

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. 11,785,275
Filing Date: September 30, 2022
Issue Date: October 10, 2023
Title: SYSTEM AND METHOD FOR RECEIVING A TELEVISION SIGNAL

Inter Partes Review No.: IPR2025-00182

DECLARATION OF DAVID B. LETT

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

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1. 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

2. 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.

3. I have been asked to provide a declaration regarding certain matters pertaining to U.S. Patent No. 11,785,275 (“the ’275 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) systems, and content delivery systems provides me with an understanding of the subject matter described and claimed in the ’275 patent.

4. 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

5. 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.

6. 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.

7. 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.

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

9. 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.

10. In 1990, I returned to Scientific Atlanta, which was acquired by Cisco in 2006. I worked as Engineering Manager running the set top box engineering group, where I was promoted to Director and Vice President during my tenure until 2011. I led the design of many cable set top boxes and systems through the evolution of analog video, addressability, downloadable software, electronic program guides, digital video, VOD, software applications, high-definition TV, DVR, DOCSIS, full spectrum tuners, and multiroom DVR. These systems implemented various technologies, including DOCSIS 1/2/3 and hybrid gateways, 802.11, IPTV, DVR, cable modems, ADSL, VDSL, DVB-T/C/S, bootloaders, factory diagnostics, application frameworks, Nagra, DRMs, conditional access, secure microprocessors, device management, Android, Adobe Flash, Linux, DVD play/record, MPEG-4, MPEG-2, H.264, NTSC, PAL, DAVIC, MoCA, high-performance CPUs, cablecards, network processors, HDMI, multiple video/audio display interfaces, 2D/3D graphics, multiple RF tuners, and full spectrum tuners.

11. 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.

12. 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.

13. 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.

14. 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.

15. I am a named inventor on at least 117 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”

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

17. 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 '275 patent, which I (as I discuss below) understand is early 2009 or early 2010.

3. MATERIALS CONSIDERED

18. In formulating my opinion, I reviewed and considered the '275 patent (U.S. Pat. No. 11,785,275 to Reddy, et al.) (Ex. 1201), as to which I am offering my opinion regarding the validity of certain claims, as discussed herein.

19. In preparing this declaration, I also reviewed and considered the Petition and the file history of the '275 patent (included in Ex. 1204) as well as the

following references:

- Ex. 1201: U.S. Patent No. 11,785,275 (“the ’275 patent”)
- Ex. 1203: Curriculum Vitae of David B. Lett
- Ex. 1204: Certified Prosecution History of the ’275 patent
- Ex. 1205: Certified Prosecution History of U.S. Patent No. 11,490,152 (“the parent”)
- Ex. 1206: Reserved
- Ex. 1207: Certified Prosecution History of U.S. Provisional App. No. 61/170,526 (“’526 provisional”)
- Ex. 1208-1213: Reserved
- 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. 1220: Reserved
- Ex. 1221: “Data-Over-Cable Service Interface Specifications: Radio Frequency Interface Specification CM-SP-RFiv2.0-I11-060602,” DOCSIS, June 2006

Ex. 1222:	File History (as of December 3, 2024) for Ex Parte Reexamination No. 90/019,255
Ex. 1223:	Reserved
Ex. 1224:	International Pub. No. 2007/145,637 (“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. 1226:	Reserved
Ex. 1227:	U.S. Patents and Patent Applications Family Tree for the ’275 patent
Ex. 1228-1232:	Reserved
Ex. 1233:	Excerpts of W. Ciciora, J. Farmer, D. Large, and M. Adams, “Modern Cable Television Technology: Video, Voice, and Data Communications” (2 nd 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. 2006/008335 (“Seendripu”)
Ex. 1239:	Excerpts of Chris Bowick, “RF Circuit Design” (2 nd ed. 2008)
Ex. 1240:	Reserved
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 (“Kelley”)

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. 1247: Reserved

Ex. 1248: Excerpts of William Buchanan, “Computer Busses” (2000)

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. 1253-1272: Reserved

Ex. 1273: Expert Declaration of Dr. Sylvia Hall-Ellis

Ex. 1274: Reserved

Ex. 1275: U.S. Patent No. 6,791,995 (“Azenkot”)

Ex. 1276: U.S. Patent No. 6,542,203 (“Shadwell”)

Ex. 1277-1278: Reserved

Ex. 1279: U.S. Patent No. 3,968,444 (“Tenny”)

Ex. 1280-1284: Reserved

4. UNDERSTANDING OF APPLICABLE LEGAL STANDARDS

20. 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 '275 patent based on the following grounds:

- Ground A: Claims 1, 5-11, and 15-20 as anticipated under pre-AIA § 102(b) based on Pugel.
- Ground B: Claims 1, 5-11, and 15-20 as obvious under pre-AIA § 103(a) based on Pugel.
- Ground C: Claims 1, 4-11, and 14-20 as obvious under pre-AIA § 103(a) based on Pugel in view of Crols.
- Ground D: Claims 2-3 and 12-13 as obvious under pre-AIA § 103(a) based on Pugel in view of Chandrakasan.
- Ground E: Claims 2-3 and 12-13 as obvious under pre-AIA § 103(a) based on Pugel in view of Crols and in further view of Chandrakasan.

21. 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.

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

23. 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.

24. 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.

25. 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.

26. 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.

27. 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.

28. It is my understanding that the prior art references themselves may provide a suggestion, motivation, or reason to combine, but at 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.

29. 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.

30. 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

31. 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 ’275 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, 1:36-39. 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.

32. I believe that a person of ordinary skill in the art of the ’275 patent, at the time of the alleged invention of the ’275 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 ’275 patent, and thus, I am familiar with the knowledge that such persons had at the time (*i.e.*, early 2009 or early 2010). At that time, I had a skill level that was at least as high as the skill level I described

above for a person of ordinary skill in the art of the '275 patent.

33. 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 in early 2009 to early 2010, before the earliest claimed priority date of the '275 patent.

6. CLAIM CONSTRUCTION

34. I understand that my analysis requires an understanding of the scope of the claims of the '275 patent. I understand that claim terms subject to *inter partes review*, absent some other definition provided in the patent, are given their ordinary meaning to a person of ordinary skill in the art in light of the patent specification. Therefore, in my analyses given below, I have assumed that all claim terms are given their ordinary interpretation as would have been understood by a POSITA reading the patent specification as of the priority date. I further understand that certain claim terms may be means plus function limitations. In particular, I understand that a “means plus function” limitation should be interpreted to cover only the corresponding structure described in the specification that performs the recited function, and equivalents thereof. I also understand that a limitation will be presumed to be a means plus function limitation if (a) the claim limitation uses the phrase “means for”; (b) the “means for” is modified by functional language; and (c) the phrase “means for” is not modified by sufficient structure for achieving the

specified function. I understand that a structure will be considered structurally equivalent to the corresponding structure identified in the specification only if the differences between them are insubstantial. For example, a structure may be deemed to be a structural equivalent to the corresponding structure where the structure performs the same function in substantially the same way to achieve substantially the same result.

35. Though no claims in the '275 patent include “means for” language, I have been asked to consider a potential construction of “radio front end” in claim 11 as a means-plus-function limitation. Should this term be construed as such, the corresponding structure that performs the recited function for this limitation (which is the function of “process the input signal” recited in claim 11) is the radio front end 210 illustrated in Figure 2 or the radio front end 410 illustrated in Figure 4. Ex. 1201, Figs. 2, 4. I note that the internal components of the radio front end 210 and the radio front end 410 are the same. Specifically, each includes a low noise amplifier (LNA) (e.g., LNA 202 in Figure 2 and LNA1 in Figure 4), two mixers (e.g., mixers 211 and 221 in Figure 2 and mixers 411 and 421 in Figure 4), two more amplifiers (e.g., amplifiers 213 and 223 in Figure 2 and amplifiers 413 and 423 in Figure 4) and two filters (e.g., filters 215 and 225 in Figure 2 and filters 415 and 425 in Figure 4). Ex. 1201, 4:43-5:47, 7:31-46, Figs. 2, 4. A POSITA would have understood that any one of these components processes the RF input signal that is input to the radio front end 210 or radio front end 410. Lastly, as I discuss in my

detail analysis below, the prior art discloses the “radio front end” limitation, whether or not it is construed as a means-plus-function limitation.

36. I have also been asked to consider a potential construction of the “digital frontend (DFE)” in claims 11, 12, and 13 as a means-plus-function limitation. Should this term be construed as such, the corresponding structure that performs the recited functions for this limitation (which are the functions of “select the plurality of desired channels from the digitized signal and output the selected plurality of desired channels to at least one demodulator as a digital datastream” recited in Elements [11E]-[11F], “output the digital datastream via a serial interface” recited in claim 12, and “output the digital datastream via a parallel interface” recited in claim 13) is the digital front end 230 illustrated in Figure 2, the digital front end 430 illustrated in Figure 4, the digital front ends 630 and 740 illustrated in Figure 6, or the digital front end 930 illustrated in Figure 9. Ex. 1201, 5:56-6:13, 6:33-7:20, 7:49-58, 9:43-67, 10:27-39, 10:65-11:11, 11:40-43, Figs. 2-4, 6-7, 9. I note that: (i) the digital front end 230 in Figure 2 includes the circuit in Figure 3, (ii) the digital front ends 630 and 740 in Figure 6 include the circuit in Figure 7, and (iii) the digital front end 930 in Figure 9 is a combination of the digital front ends 630 and 740 from Figure 6. I also note that the internal components of the different digital front ends are similar but not necessarily the same. The digital front end 230 in Figure 2, for example, shows a bank of N complex mixers 250, a bank of filters 260, and a bank of decimators 270. Ex. 1201, 5:56-6:20, Fig. 2. One of the paths through the digital

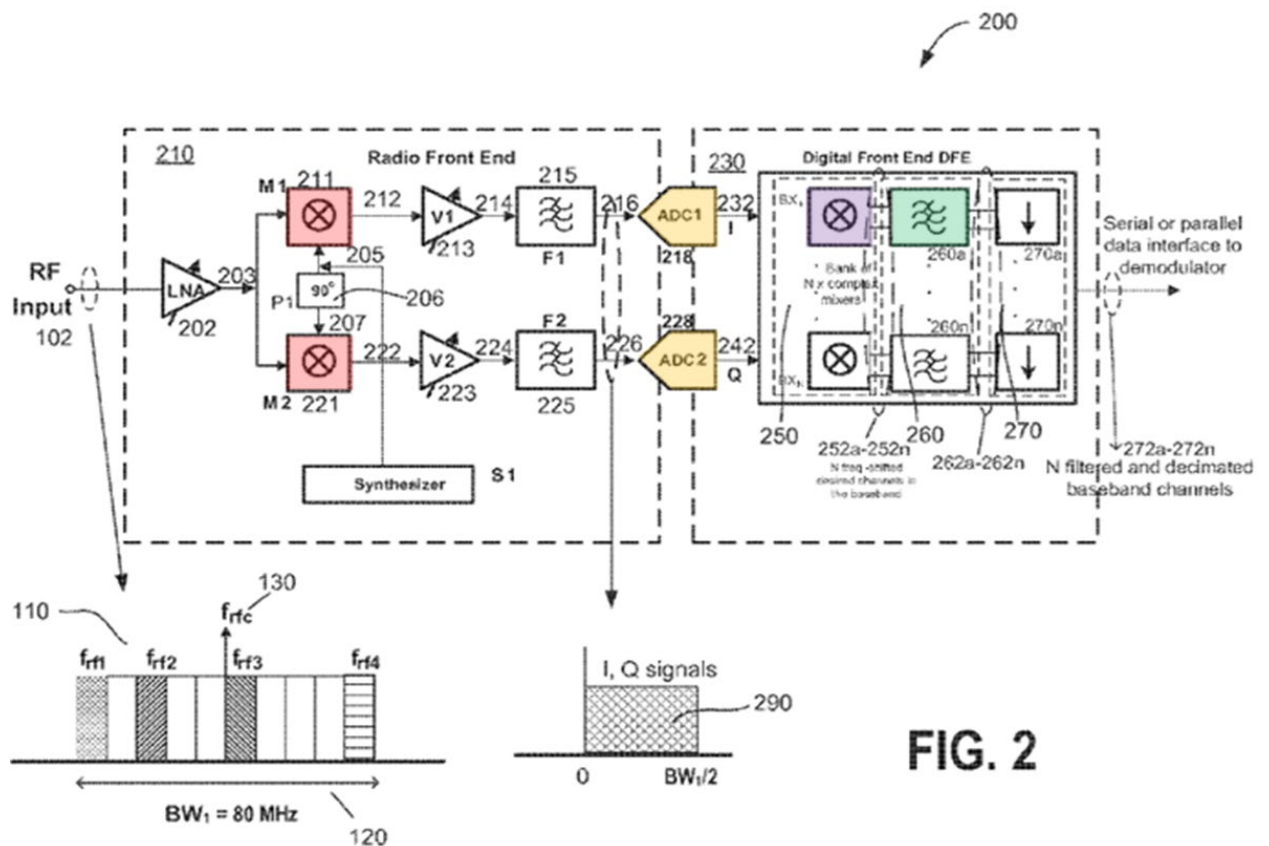
front end 230 is shown in more detail in Figure 3. Ex. 1201, 6:21-23. Therefore, Figure 3 shows that the digital front end 230 from Figure 2 includes a mixer 300 that includes four multipliers 313, 315, 323, and 325 and two adders 317 and 327. Ex. 1201, 6:21-7:2. The '275 patent also discloses that the multipliers receive the $\cos(\omega_{ci}t)$ and $\sin(\omega_{ci}t)$ signals from numerically controlled oscillators (NCOs). Ex. 1201, 6:35-7:2. Figure 3 also shows that the two outputs of the mixer 300 are then filtered by filters 330 and 340 and decimated by decimator 350. Ex. 1201, 7:3-15. I note that the '275 patent indicates that decimators are optional. Ex. 1201, 3:8-10, 6:17-19. Indeed, a POSITA would have understood that the recited functions of the claims (identified above) do not require decimating and could be performed by the mixers/multipliers and filters alone. Lastly, as I discuss in my detailed analysis below, the prior art discloses the “digital frontend (DFE)” limitation, whether or not it is construed as a means-plus-function limitation.

7. OVERVIEW OF THE '275 PATENT

37. The '275 patent describes a wideband receiver system 200 that is “capable of receiving multiple radio frequency channels located in a broad radio frequency spectrum.” Ex. 1201, 1:33-35.

38. The '275 patent states that the system groups the desired channels that extend over non-contiguous portions of the frequency spectrum “into a contiguous, or substantially-contiguous, frequency spectrum” to “increase the dynamic range

without requiring expensive data conversion, filtering, and channel selection at the demodulator.” Ex. 1201, 1:35-40, 2:44-46. According to the ’275 patent, a receiver is “wideband” if it is “designed to concurrently receive several TV channels.” *Id.*, 1:42-43. Figure 2 is a “schematic block diagram of a wideband receiver system 200.” *Id.*, 4:40-41.



Ex. 1201, Fig. 2 (annotated)

39. The wideband receiver system 200 receives both desired and undesired television channels as frequencies dispersed within a frequency bandwidth BW_1 . Ex. 1201, Abstract, 1:35-40. Mixers “M1” and “M2,” which are shown in **red** above,

“generate an in-phase signal 212 and a quadrature signal 222 that have a phase shift of 90 degree between them” and that have been downconverted to “the baseband or low intermediate frequency (IF) band.” Ex. 1201, 2:64-3:1, 4:65-5:4, *see also* 2:10-12. “[U]nwanted frequency components” are filtered from the in-phase signal and the quadrature signal by respective filters 215 and 225. Ex. 1201, 5:22-29. The filtered signals are then individually digitized by wideband analog-to-digital converters ADC1 and ADC2 (gold) to generate a digital in-phase (I) signal 232 and a digital quadrature (Q) signal 242. Ex. 1201, 3:1-3, 5:53-56. U.S. Provisional App. No. 61/170,526 (“the ’526 provisional”), which the ’275 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 5; Ex. 1201, 1:6-28.

40. The digital I and Q signals 232 and 242 are input to a bank of N complex mixers 250 (one of which is shown above in purple) in a digital front end 230, where “N is an integer value corresponding to the number of desired RF channels.” Ex. 1201, 5:56-60. “Each of the N complex mixers ... extract[s] a different one of the desired channels” from the I and Q signals 232 and 242 and “frequency-shifts the extracted signals to the baseband frequency.” Ex. 1201, 6:8-11. An associated filter module of filters 260a-260n (one of which is shown above in green) filters the frequency-shifted desired channel. Ex. 1201, 6:11-13.

41. Figure 3 “is a simplified circuit diagram of one of the signal paths 272a to 272n of digital front end 230” and shows elements in one of the rows of digital

front end 230 in Figure 2. Ex. 1201, 6:21-23.

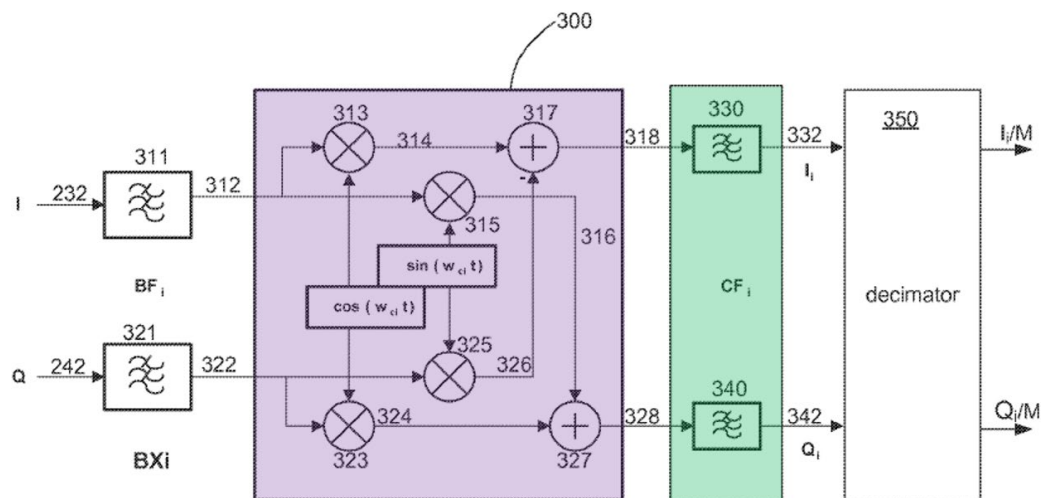


FIG. 3

Ex. 1201, Fig. 3 (annotated)

42. Mixer 300 (**purple**) represents one of the complex mixers 250 and has multipliers 313, 315, 323, and 325 and adders 317 and 327. Ex. 1201, 6:33-43. “[C]omplex mixer 300 causes a frequency shift of the filtered components 312 and 322 to respective baseband signals 318 and 328 in the digital domain” by using a frequency ω_{ci} that is chosen such that “each one of the desired channels embedded in the digital signals I 232 and Q 242 will be downshifted to the baseband.” Ex. 1201, 6:43-62. The baseband signals 318 and 328 are filtered by filters 330 and 340 (**green**) that are “one of the filters 260a-n in Fig 2.” Ex. 1201, 7:3-5.

43. After decimation, “the N desired baseband channels 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.” Ex. 1201, 7:16-20. The ’275

patent does not provide any details of how $N \times 2$ signals (N channels, with an I and a Q signal for each channel) might be manipulated, combined, and/or otherwise processed between the decimators 270 and a demodulator. Rather, the '275 patent admits that this is performed “according to commonly known methods.” *Id.*

7.1. Prosecution History

44. The '275 patent claims priority to a number of applications. In particular, it is a direct continuation of U.S. Application No. 17/862,946 (“the parent”), which has very similar claims. The main difference is that the '275 patent claims add the feature that “the plurality of desired channels are non-contiguous.” Thus, below I have addressed the prosecution history of the parent and then the prosecution history of the '275 patent.

7.1.1. Prosecution History of the Parent

45. The parent was filed on July 12, 2022, with original claims 1-18 and a preliminary amendment removing the original claims and adding new claims 19-38. Ex. 1205 at 2, 5-8. In a first office action issued on September 7, 2022, the examiner only examined the original claims 1-18 by mistake and provided double patenting and 35 U.S.C. § 112 rejections. Ex. 1205 at 119-123. The applicant requested the examination on the new claims 19-38 on September 12, 2022. Ex. 1205 at 143-148. The examiner allowed claims 19-38 on September 28, 2022, based on the prior art not teaching “selecting, by a digital frontend (DFE) coupled to the ADC, *a plurality*

of desired channels from the digitized signal and outputting by the DFE, the selected plurality of desired channels to at least one demodulator as a digital datastream.” Ex. 1205 at 153-159. None of the prior art that I rely on herein (e.g., Pugel, Crols, or Chandrakasan) was cited or considered during the prosecution of the parent.

7.1.2. Prosecution History of the ’275 Patent

46. It is my understanding that U.S. Application No. 17/956,889 (“’889 application”), which issued as the ’275 patent, was filed on September 30, 2022. Ex. 1204 at 44. The ’889 application was filed with 18 claims, including independent claims 1 and 10. Ex. 1204 at 91-95. On November 17, 2022, the applicant filed a preliminary amendment to remove the original 18 claims and to add new claims 19-38. Ex. 1204 at 110-117. The main difference from the parent’s claims is that the ’275 patent claims add “the plurality of desired channels are non-contiguous.” *Compare* Ex. 1204 at 91-95, 113-116, 3385-3387 *with* Ex. 1201, claims 1-20.

47. Along with the preliminary amendment, Applicant also filed an Information Disclosure Statement (IDS) comprising an invalidity chart citing Pugel for claims 11 and 12 of U.S. Patent No. 9,210,362. Ex. 1204 at 125-130, 576-594. This claim chart was included among over 2000 pages of non-patent literature submitted with the IDS, without any additional context from the Applicant to indicate its relevance. *See* Ex. 1204 at 125-2282. While the Examiner indicated consideration of the claim chart, the Examiner did not indicate that Pugel itself was

ever considered as a reference for the '275 patent. Ex. 1201, cover; *see also* Ex. 1204 at 3359-3382. Furthermore, while the claim chart citing Pugel was of record in prosecution, that chart did not apply Pugel in combination with Crols or Chandrakasan as presented herein. Ex. 1204 at 576-594.

48. The first Office Action, issued on May 1, 2023, rejected all claims on the basis of nonstatutory double patenting over claims 1-20 of U.S. Patent No. 11,490,152. Ex. 1204 at 3352-3357. Applicant then filed a terminal disclaimer on July 25, 2023. Ex. 1204 at 3390-3393. On August 14, 2023, a Notice of Allowance was mailed that stated that the prior art failed to teach “selecting, by a digital frontend (DFE) coupled to the ADC, a plurality of desired channels from the digitized signal and outputting by the DFE, the selected plurality of desired channels to at least one demodulator as a digital datastream.” Ex. 1204 at 3400-3406. This was the same statement as the reasons for allowance in the parent. *Compare* Ex. 1204 at 3405 *with* Ex. 1205 at 158. The examiner never specifically discussed the Pugel reference in the Notice of Allowance that was sent on August 14, 2023. Ex. 1204 at 3400-3406.

49. Instead of paying the issue fee, Applicant filed a Request for Continued Examination (RCE) and an Information Disclosure Statement (IDS) on August 16, 2023. Ex. 1204 at 3415-3421. The Examiner issued a second Notice of Allowance on August 28, 2023. Ex. 1204 at 3404-3406. Then, the Examiner simply repeated the same reason for allowance given in the previous notice of allowance and in the

parent and did not address the Pugel patent. Ex. 1204 at 3005. The application issued as the '275 patent on October 10, 2023. Ex. 1204 at 4857-4858.

50. It is my opinion that, if the Examiner had seriously considered Pugel, the Examiner should have seen that Pugel clearly describes “selecting, by a digital frontend (DFE) coupled to the ADC, a plurality of desired channels from the digitized signal and outputting by the DFE, the selected plurality of desired channels to at least one demodulator as a digital datastream,” which is what the Examiner stated was missing from the prior art made of record. Ex. 1204 at 4830. I have shown how Pugel clearly describes these features in my analysis below regarding Elements [1E] and [1F], which explains how Pugel’s digital tuner 130 performs the selecting and outputting steps. *See* Sections 9.1.1.e-f below. It also appears that neither Crols nor Chandrakasan was considered during the prosecution of the '889 application. Ex. 1201, cover.

7.2. Earliest Priority Date for the Claims

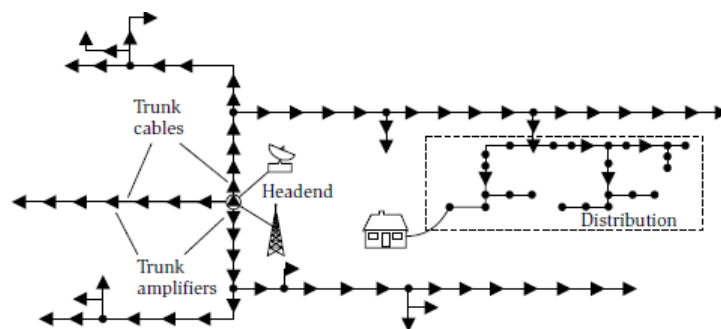
51. I understand that Application No. 17/956,889 (“the '889 application”), which eventually became the '275 patent, was filed on September 30, 2022. It is further my understanding that the '889 Application claims priority to a chain of applications that claim priority to the '526 provisional filed on April 17, 2009. It is my understanding that the '275 patent asserts to be entitled to a priority date of the filing date of the earliest application from which the '275 patent claims priority, *i.e.*,

April 17, 2009, which is the filing date of the '526 provisional. Thus, the earliest possible effective filing date for the claims of the '275 patent is April 17, 2009. I understand that all of the references that I rely on in this Declaration were published or filed before April 17, 2009, and are prior art to that date.

8. OVERVIEW OF THE PRIOR ART

8.1. Cable and Satellite Television Networks

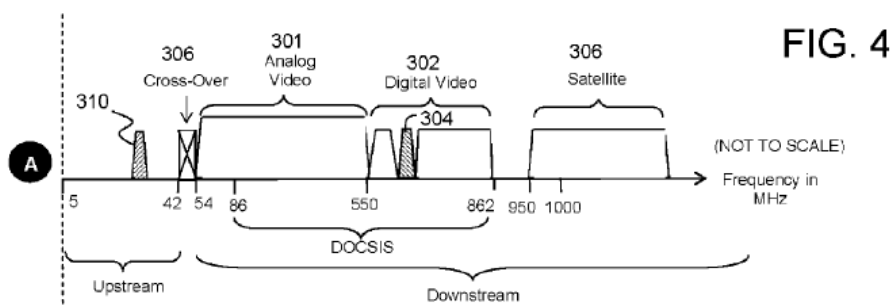
52. The origins of the cable and satellite television networks long predate the earliest claimed priority date (April 17, 2009) of the '275 patent. Cable television networks are entertainment distribution systems that allow consumers to access and enjoy various television channels. Ex. 1233 at 22. The 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. Ex. 1215 at 9. 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.

53. 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)

54. 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.

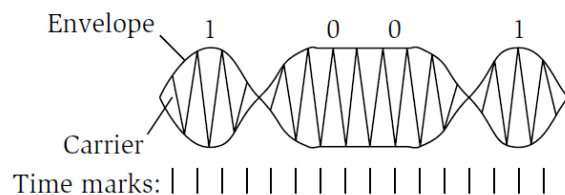
55. Television channels from satellite networks occupy various bands in frequencies greater than 950 MHz. Ex. 1235, 1:37-48; Ex. 1237, [0079]-[0080]. Signals in satellite bands are sent to a satellite receiver or set-top box, with the satellite bands carrying multiple transponder channels and each transponder channel carrying a number of different television channels. Ex. 1235, 1:37-48.

8.2. Modulated RF Signals

56. 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 '275 patent, multiple modulation techniques facilitating high spectral efficiencies were known to a POSITA by the earliest claimed priority date of the '275 patent.

8.2.1. Biphase Shift Keying



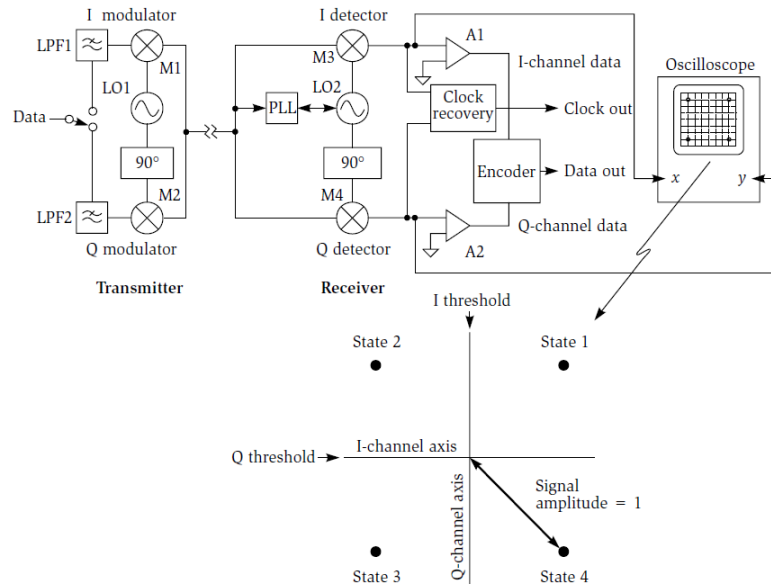
Ex. 1233, Fig. 4.3 (Excerpted) (page 161)

57. 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)

58. 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 “10”), 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.



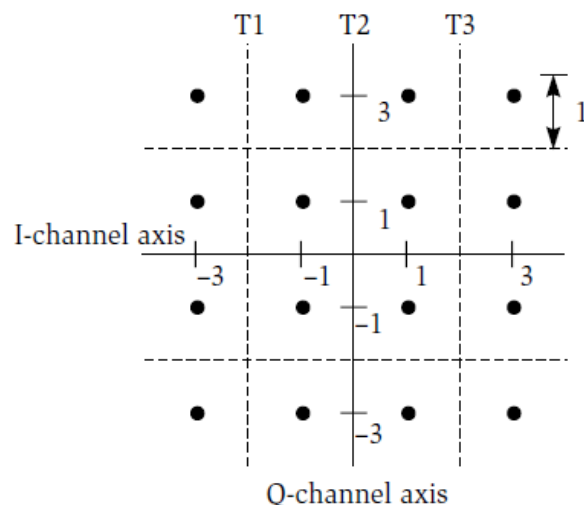
Ex. 1233, Fig. 4.4 (page 164)

59. 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.

60. 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

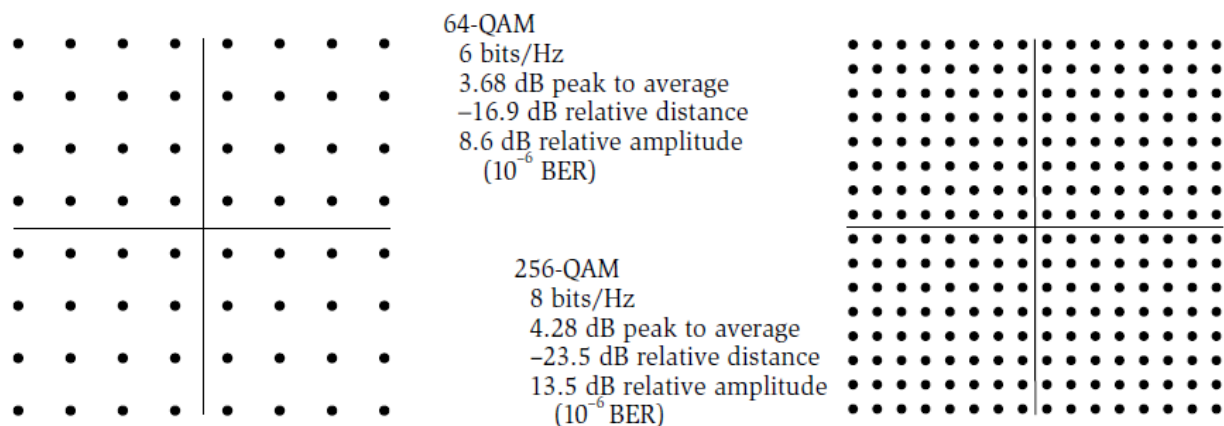
amplitude changes to communicate information. Ex. 1233 at 280. QPSK modulation met this requirement of satellite transponders. *Id.*

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



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

61. 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.* at 166-167. 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)

62. 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.*

63. 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

64. 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, 1:49-52; Ex. 1236, [0018], [0020]-[0021].

65. Cable television RF receivers concurrently receive RF signals for multiple digital television channels allocated in the RF frequency spectrum of 550 to 864 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].

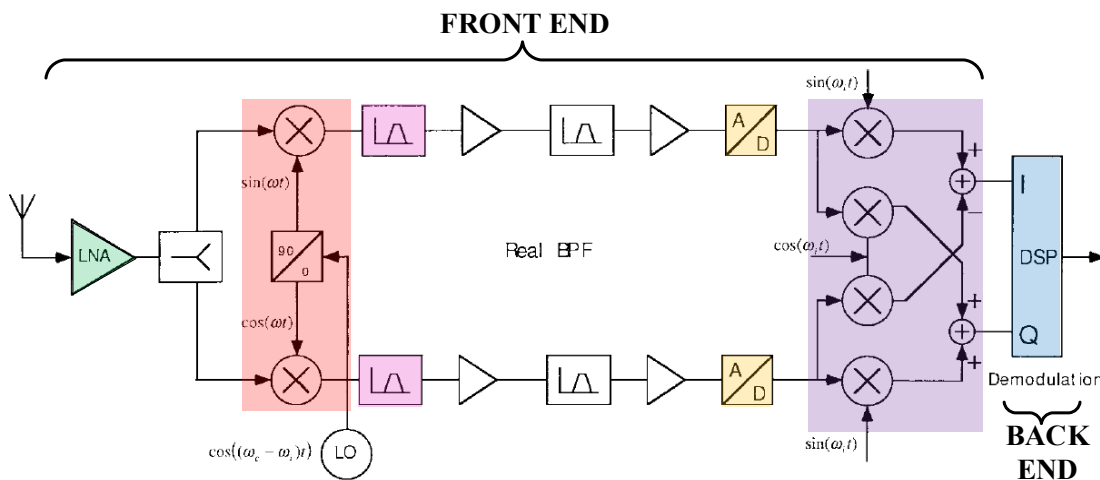
Furthermore, the POSITA was aware that cable and satellite television radio receivers could tune (i.e., select and extract) signals for certain desired television channels (e.g., channels selected for viewing by a consumer) from the received RF frequency spectrum. Ex. 1233 at 299; Ex. 1236, [0020]-[0021]; Ex. 1242, 4:10-36; Ex. 1244, 1:51-58.

66. 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 '275 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 '275 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].

67. 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. 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) (page 281)

68. 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.

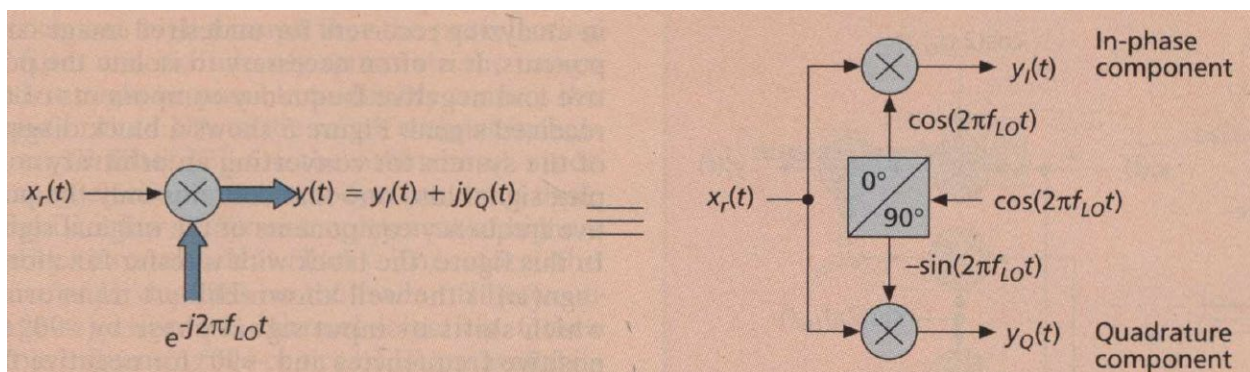
69. Still referring to Figure 22(a) of Ex. 1225 (reproduced and annotated above), in the front end of a low-IF receiver, the incoming RF signals are first amplified by a front-end low noise amplifier (LNA) (**green**) to provide enough gain to boost the received RF signal levels to an acceptable level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

70. 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.

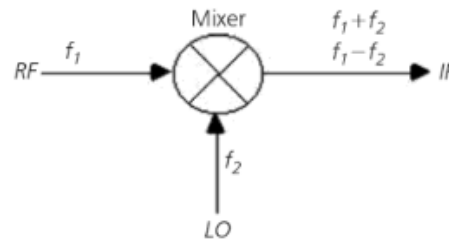
Ex. 1218 at 134 (emphasis added).



Ex. 1218, Fig. 2 (page 133)

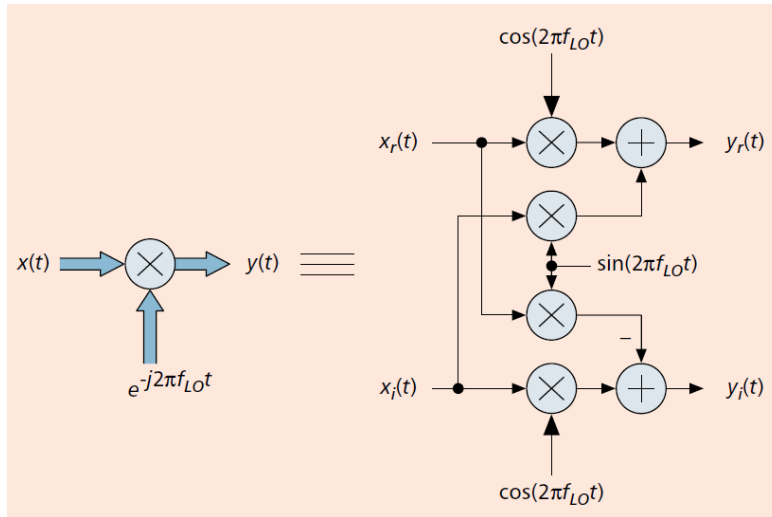
The term “mixer” and “multiplier” are often used interchangeably to refer to an analog or digital electrical circuit (represented by the symbol $\otimes$) that multiplies a

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.



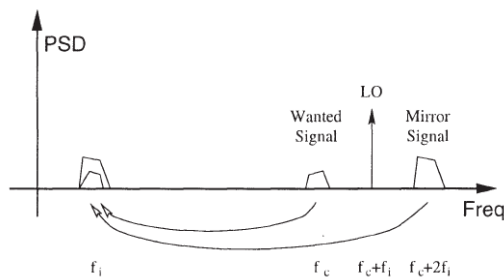
Ex. 1239, Fig. 8-9 (page 12)

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.

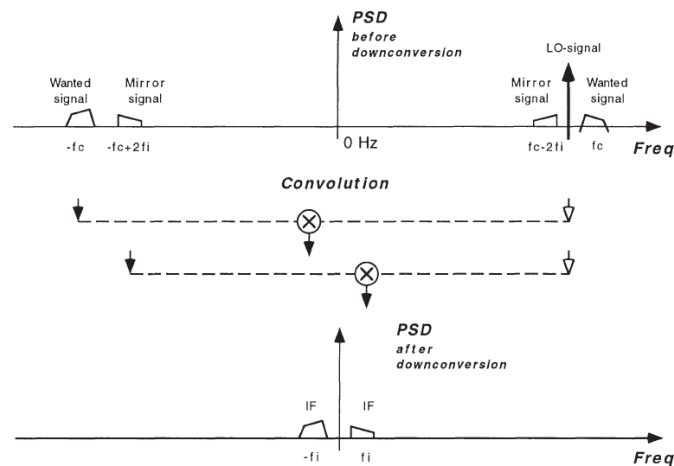


Ex. 1218, Fig. 3 (Excerpted) (page 134)

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)

71. 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 can be used after the first stage of downconversion to filter out unwanted mirror signals. *Id.* at 28; Ex. 1239 at 17.

72. 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 bondings 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 18. 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; Ex. 1234 at 74, 76.

73. Analog-to-digital converters (ADCs) 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

74. 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.

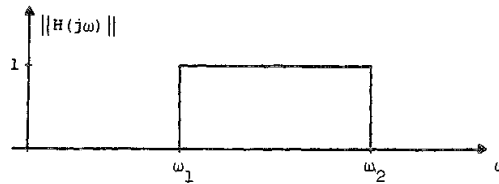


Fig. 1.27. Ideal BP filter.

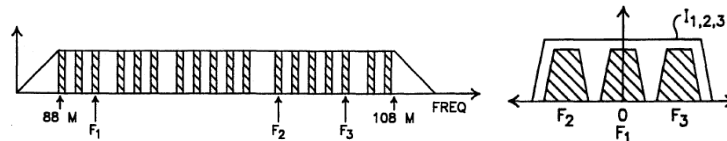
Ex. 1241, Fig. 1.27 (page 21)

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.

75. 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

76. 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

77. 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; Ex. 1246, 2:51-57.

8.3.5. Demodulation of Multiple Channels

78. 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, 7:53-66. 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. 1275, 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**).

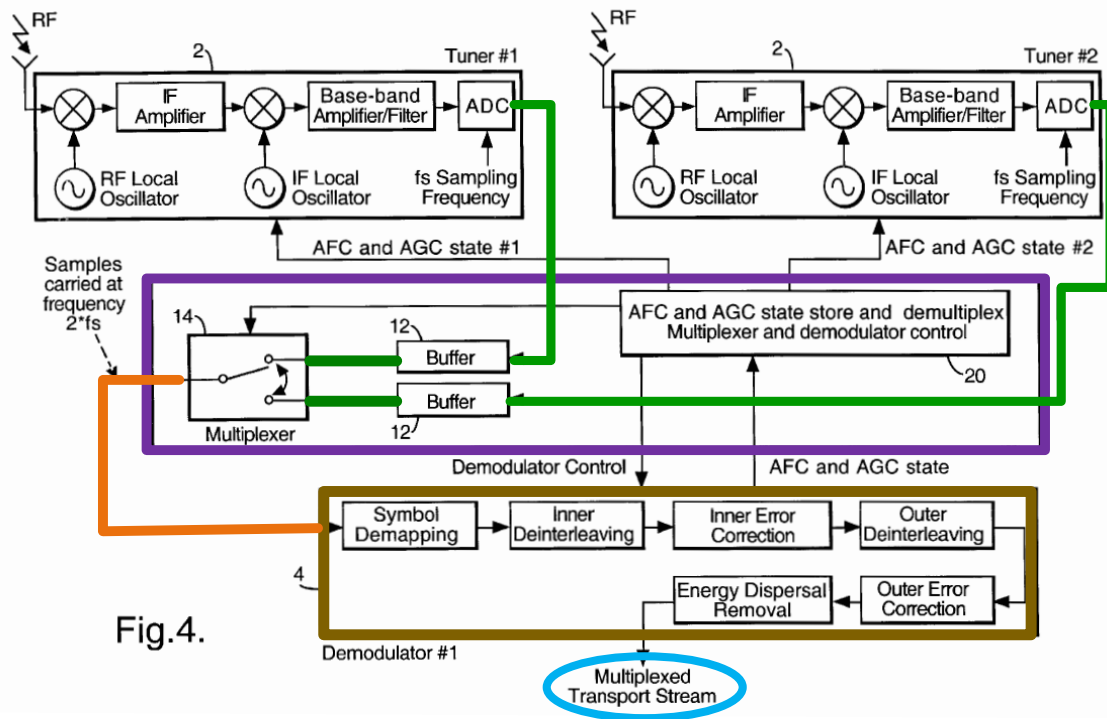


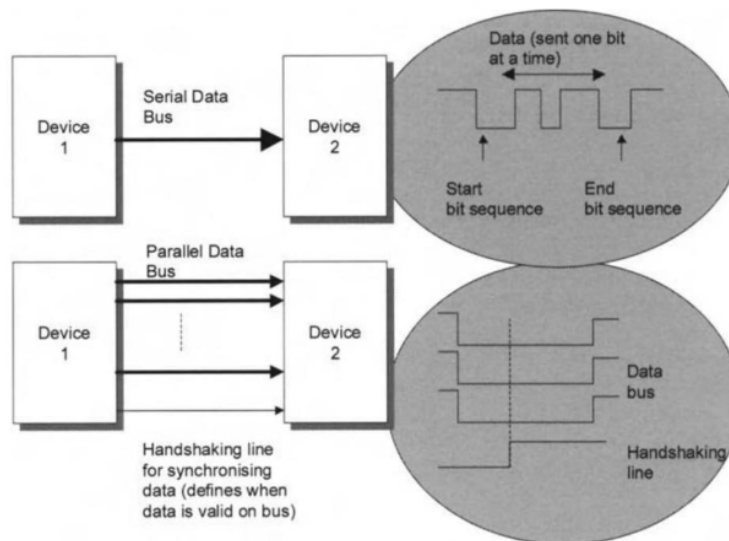
Fig.4.

Ex. 1276, Fig. 4 (annotated).

A POSITA would have been well aware that single demodulator at the time, such as those disclosed in Carson, Azenkot, and Shadwell, were capable of demodulating multiple selected channels. Ex. 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. Kelly (Ex. 1244) illustrates an RF receiver that demodulates two channels separately with two demodulators. Ex. 1244, 7:53-57.

8.4. Serial vs. Parallel Data Communication

79. As described throughout Subsection 8.3.1 above, the different components of an IF receiver, including a low-IF receiver, were known to a POSITA prior to the '275 patent. It was also known to the POSITA by the earliest claimed priority date (April 17, 2009) of the '275 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)

80. 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.*

81. Therefore, it was well known before the claimed priority date of the '275 patent to use technologies such as those described above in Sections 8.1-8.3 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. Pugel (Ex. 1224)

82. Pugel (Ex. 1224) is a PCT Application published on December 21, 2007. As the publication date is more than a year prior to the earliest filing date of the '275 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 '275 patent, even though a claim chart citing Pugel was considered. Ex. 1201,

cover.

83. Pugel describes a “digital television receiver capable of simultaneously receiving a plurality of channels ... suitable for use with conventional cable television delivery systems” and “other types of radio-frequency communications systems as well, including the reception of digital television channels via satellite and terrestrial television transmission systems.” Ex. 1224, [0008], [0022]. Pugel’s Figure 1 shows a multichannel receiver circuit 100 annotated with colors referenced in the discussion below. Ex. 1224, [0022]-[0028], Fig. 1.

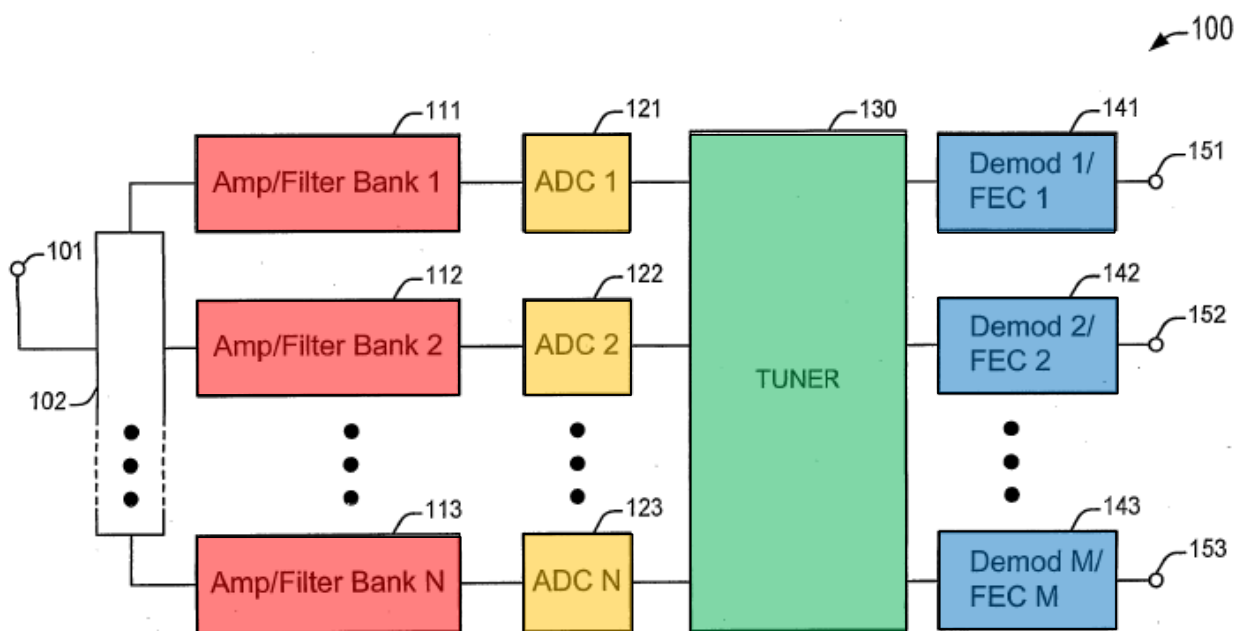


FIG. 1

Ex. 1224, Fig. 1 (annotated)

84. At input coupler 101, the receiver circuit 100 receives a multichannel analog RF input signal, such as a signal used in a conventional cable television

delivery system. 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 at splitter 102. Ex. 1224, [0024]-[0025]. Regardless of whether a splitter 102 is used, 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].

85. The amplifier-filter banks (**red**) “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 economical because it reduces the need to supply ADCs supporting high-frequency sampling. Ex. 1224, [0034].

86. 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, [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, [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].

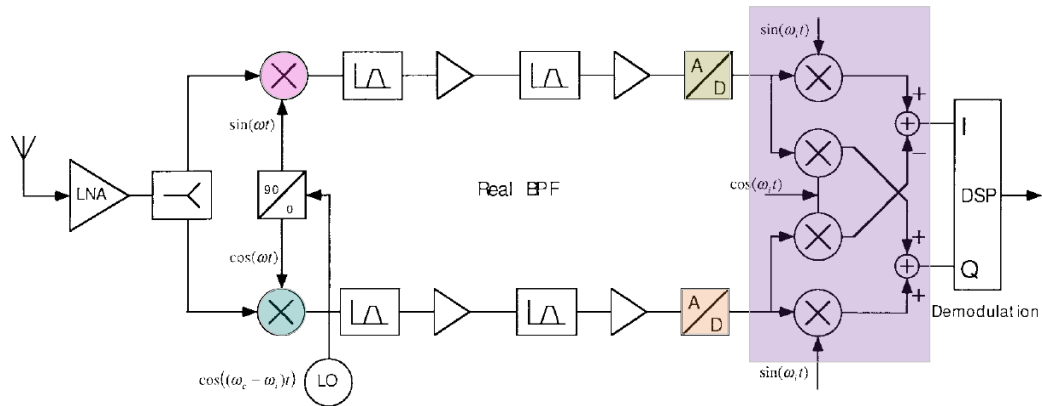
87. It is my opinion that Pugel is in the same field of endeavor as the '275 patent and thus is analogous art. For example, the '275 patent “relates to wideband receiver systems and methods having a wideband receiver that is capable of receiving multiple radio frequency channels located in a broad radio frequency spectrum.” Ex. 1201, 1:32-35. Similarly, Pugel relates to a “multichannel 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 '275 patent is concerned, and is also analogous art on that basis. Pugel describes filtering signals for input to an ADC in the same way as is described by the '275 patent. *Compare* Ex. 1201, 5:22-37, Fig. 3 *with* Ex. 1224, [0029]-[0032], [0042]-[0043], Fig. 2. As another example, the '275 patent describes that “in certain applications such as DVR and picture-in-picture, the receiver system may have to concurrently receive several desired channels” and “an 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, 1:55-57, 2:50-53. 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, suggests “a digital television receiver capable of simultaneously receiving a plurality of channels” Ex. 1224, [0005], [0008].

8.6. Crols (Ex. 1225)

88. Crols (Ex. 1225) is a Non-Patent Literature published in March 1998. Crols was publicly available as of April 3, 1998. Ex. 1273, ¶¶ 86-93, 96. 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 '275 patent. Ex. 1201, cover.

89. Crols describes various topologies for implementing intermediate frequency (IF) receivers (a type of RF receiver) 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. Further, the paper analyzes techniques to perform downconversion using mixers. Ex. 1225 at 273-274.

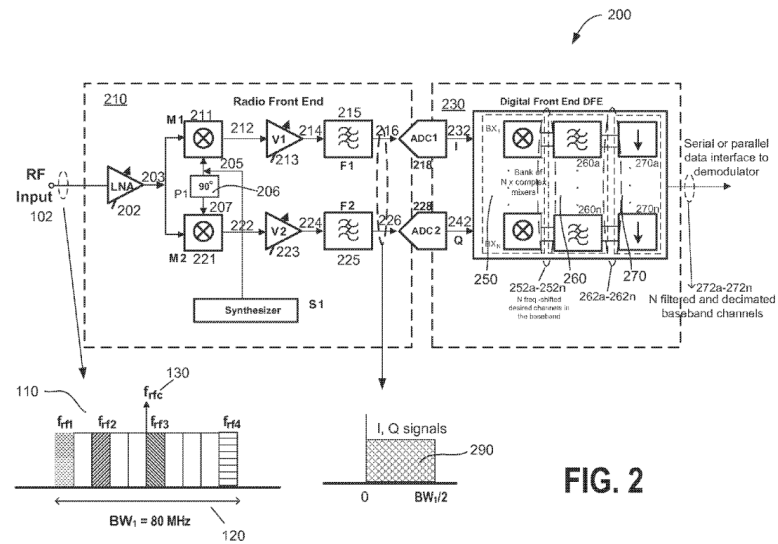


Ex. 1225, Fig. 22(a) (annotated) (page 281)

90. 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.

91. It is my opinion that Crols is reasonably pertinent to problems with which the '275 patent is concerned, and is analogous art to the '275 patent on at least that basis. For example, the '275 patent indicates a circuit wherein an RF signal is

sent through an amplifier, and then split into I and Q components before being sent through an ADC. Ex. 1201, 4:65-6:20, Fig. 2.



Ex. 1201, Fig. 2

92. Similarly, Crols presents circuit diagrams depicting complex bandpass filters that are similar to the '275 patent's circuit topologies:

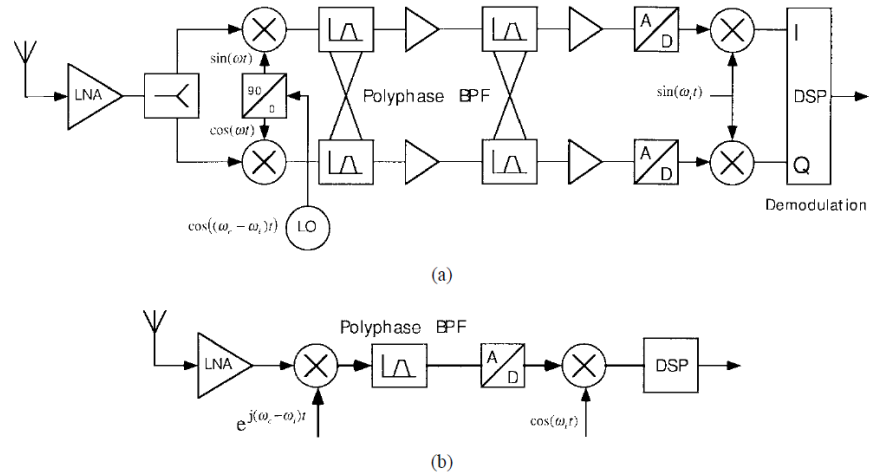


Fig. 21. The topology of a low-IF receiver which uses a complex bandpass filter in the LF part. (a) Full notation and (b) compact notation.

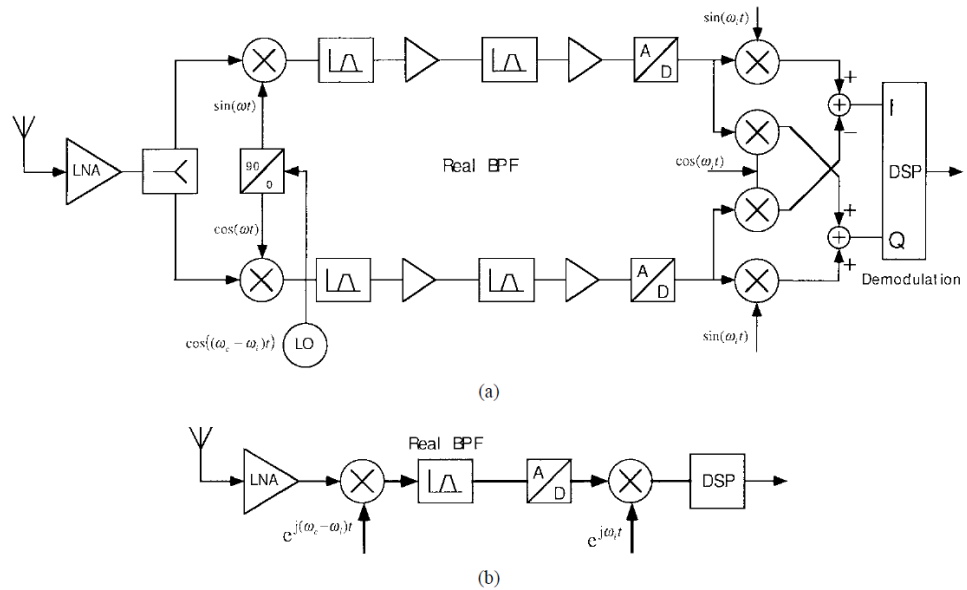


Fig. 22. The topology of a low-IF receiver which uses real filters in the LF part. (a) Full notation and (b) compact notation.

Ex. 1225, Figs. 21-22 (page 281)

Both references provide techniques for suppressing unwanted signals as part of downconversion to IF prior to digital processing, and provide example implementations for a POSITA looking to build systems in real-world applications. Ex. 1225 at 279-280; Ex. 1201, 4:65-5:37.

8.7. Chandrakasan (Ex. 1217)

93. Chandrakasan (Ex. 1217) is a Non-Patent Literature published in 1996. Chandrakasan was publicly available as of April 3, 1998. Ex. 1273, ¶¶ 71-77, 96. Thus, it is my opinion that Chandrakasan is prior art under pre-AIA 35 U.S.C. 102(b). Chandrakasan was not considered during the prosecution of the '275 patent. Ex. 1201, cover.

94. Chandrakasan describes the trade-offs between using serial interfaces (serial time-multiplex architecture) and parallel interfaces when implementing 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.

95. Chandrakasan is reasonably pertinent to problems with which the '275 patent is concerned, and is analogous art to the '275 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, 7:16-20.

9. OPINIONS WITH RESPECT TO THE '275 PATENT

9.1. Pugel Anticipates or Renders Obvious Claims 1, 5-11, and 15-20 (Grounds A and B)

96. In the following, I provide an element-by-element analysis showing how Pugel anticipates or renders obvious claims 1, 5-11, and 15-20. 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 1

97. The elements of claim 1 appear in the Claims Listing Appendix, labeled as Elements [1A]-[1F]. For the following reasons, it is my opinion that claim 1 is anticipated or rendered obvious by Pugel.

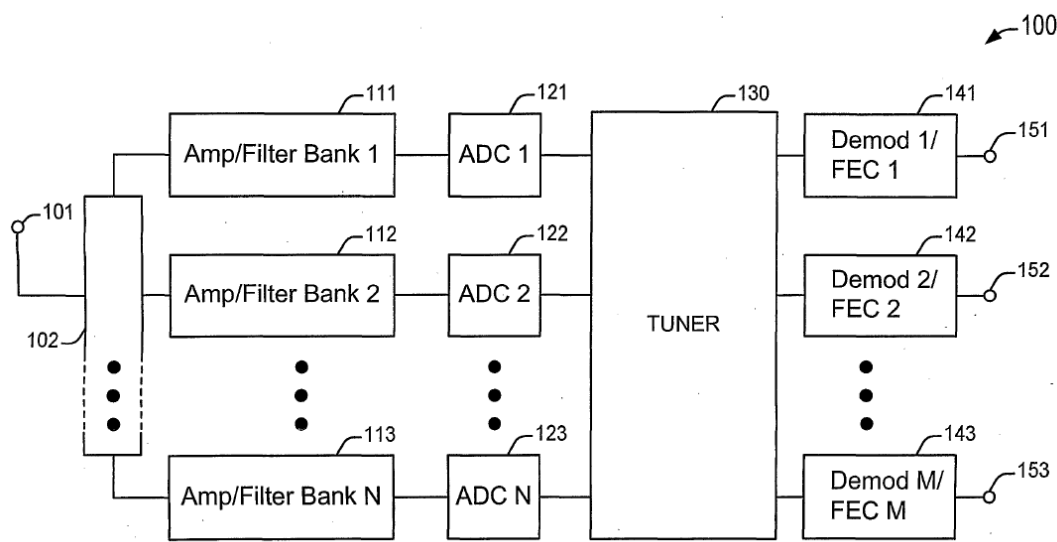
a. [1A] “A method for operating a television receiver, comprising:”

98. To the extent the preamble is limiting, it is my opinion that Pugel discloses “[a] method for operating a television receiver, comprising:” as claimed.

99. Pugel teaches methods performed by a multichannel receiver circuit 100 (illustrated by Figure 1 of Pugel reproduced below) that is capable of “simultaneous reception of a plurality of digital television channels” and “recovering a wide variety of digital content,” such that devices such as “a television display device, a PVR device, a videocassette recorder device, or any other appropriate signal receiving device” may receive those recovered digital content. Ex. 1224, [0008]-[0009], [0048]-[0049]. Pugel describes that its multichannel receiver circuit is “sufficient for satisfactorily processing digital television signals and associated signals intended for end users in a conventional cable television broadcast system”

and “the invention may be used in other types of radio-frequency communications systems as well, including reception of digital television channels via satellite and terrestrial television transmission systems.” Ex. 1224, [0022], [0033]-[0037]. Pugel provides an example where Pugel’s multichannel receiver circuit receives a multichannel analog RF input signal comprising “frequencies ranging from about 5 MHz to about 900 MHz.” Ex. 1224, [0008]-[0013], [0023]-[0024], [0028].

100. Thus, it is my opinion that Pugel teaches Element [1A].



Ex. 1224, Fig. 1

b. [1B] “receiving, by an input terminal, an input signal comprising broadcast channels, the broadcast channels comprising a plurality of desired channels and a plurality of undesired channels, wherein the plurality of desired channels are non-contiguous;”

101. It is my opinion that Pugel discloses the “receiving, by an input terminal, an input signal comprising broadcast channels, the broadcast channels comprising a plurality of desired channels and a plurality of undesired channels,

wherein the plurality of desired channels are non-contiguous,” as recited in claim 1.

102. As discussed in Section 9.1.1.a, Pugel teaches a multichannel receiver circuit (illustrated by Figure 1 of Pugel reproduced below) that is capable of “simultaneous reception of a plurality of digital television channels” from cable, satellite, and/or terrestrial television transmission systems. Ex. 1224, [0008]-[0009], [0022], [0033]-[0037]. Pugel provides an example where Pugel’s multichannel receiver circuit receives a multichannel analog RF input signal comprising “frequencies ranging from about 5 MHz to about 900 MHz.” Ex. 1224, [0008]-[0013], [0023]-[0024], [0028]. A POSITA would have the knowledge that each cable television channel occupies 6 MHz of frequency bandwidth and that Pugel’s multichannel analog RF input signal comprises data for multiple digital television channels. Ex. 1221 at 1, 23-24; Ex. 1233 at 45, 413, 515-520.

103. Pugel’s multichannel receiver circuit comprises an input coupler 101 (**green**, the claimed “input terminal”) that receives 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.

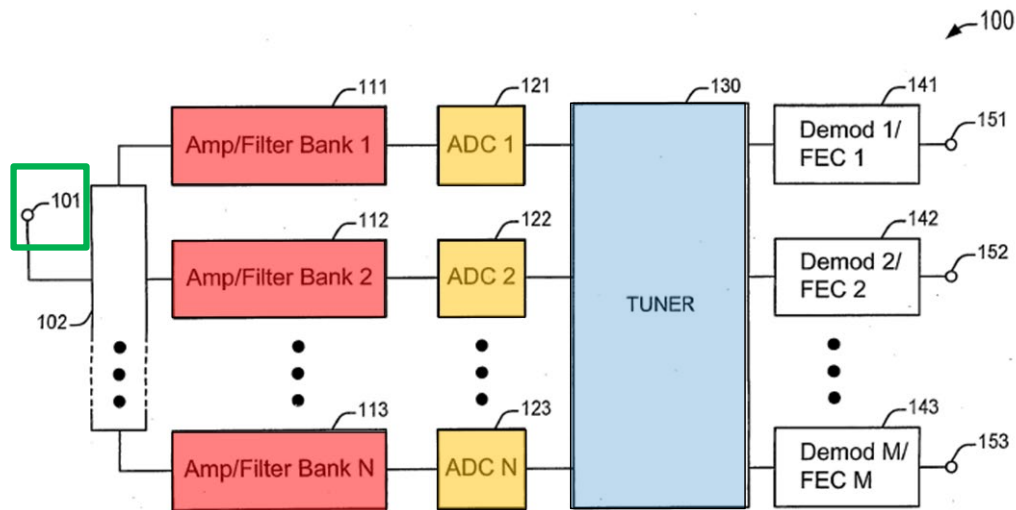
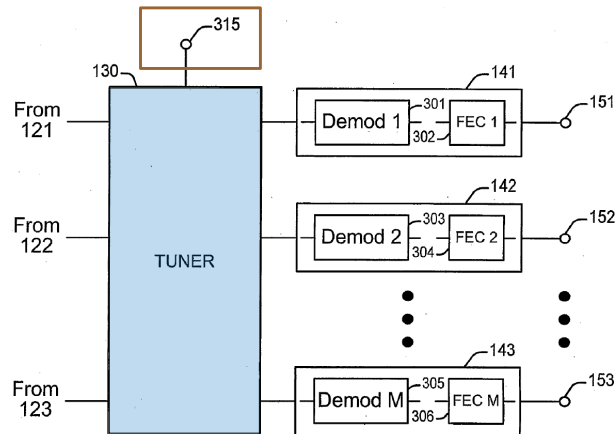


FIG. 1

Ex. 1224, Fig. 1 (annotated)

104. Pugel describes that the “plurality of amplifier-filter banks or circuits 111, 112, 113 (**red**) is configured to process frequencies within a specified band.” Ex. 1224, [0028], Figs. 1, 2. For example, Pugel describes that “the plurality of amplifier-filter circuits 111, 112, 113 then segregates the multichannel analog input signal into a plurality of separate analog signals of differing frequency ranges, or ‘bands.’” Ex. 1224, [0024]. For a multichannel analog RF input signal ranging from about 5 MHz to about 900 MHz, the first amplifier-filter bank 111 may process a first band comprising a first frequency range of 5 to 300 MHz, the second amplifier-filter bank 112 may process a second band comprising a second frequency range of 300 to 600 MHz, and the third amplifier-filter bank 113 may process a third band comprising a third frequency range of 600 to 900 MHz. Ex. 1224, [0024]-[0025], [0028].



Ex. 1224, Fig. 3 (annotated)

105. The digital tuner 130 (**blue**) in Pugel’s multichannel receiver circuit includes a channel selector 315 (**brown**) (illustrated by Figure 3 of Pugel reproduced above) 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 selected digital television channels. Ex. 1224, Abstract, [0001], [0008]-[0009], [0011], [0022], [0028], [0036]-[0044], [0048]-[0049]. Pugel’s “digital tuner 130 may include one or more digital multiplexers or demultiplexers capable of generating a plurality of digital channel signals from the converted digital band signals” and “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 single digital processor.” Ex. 1224, Abstract, [0037]. I would understand that the selected digital television channels are “desired” by the users. Additionally, it was well-known before the earliest claimed

priority date of the '275 patent that television channels were each allocated 6 MHz of frequency bandwidth in the RF frequency spectrum, and a POSITA would have understood that the example multichannel analog RF input signal described in Pugel (ranging from about 5 MHz to about 900 MHz, the claimed “input signal comprising broadcast channels, the broadcast channels comprising a plurality of desired channels and a plurality of undesired channels”) 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. Ex. 1221 at 1, 23-24; *see* Section 8.1, *supra* (citing Ex. 1233 at 45, 413, 515-520). Therefore, a POSITA would have understood that Pugel’s multichannel analog RF input signal comprises all received television channels, including desired and undesired television channels. Ex. 1224, Abstract, [0001], [0008]-[0009], [0011], [0022], [0028], [0036]-[0044], [0048]-[0049]. My understanding of “desired” and “undesired” digital television channels in Pugel is consistent with the use of “desired” and “undesired” in the '275 patent. Ex. 1201, Abstract, 1:46-51, 3:29-59, 4:43-58, 5:66-6:7, 6:59-7:2, 7:16-25.

106. It is also my opinion that Pugel discloses the claimed “wherein the plurality of desired channels are non-contiguous” because Pugel discloses that the bands of frequencies processed by each of the ADCs “may not necessarily be contiguous.” Ex. 1224, [0043] (input signal may be separated into “first, second, and third bands of frequencies [that] may not necessarily be contiguous”). Pugel’s

desired digital television channels would have been selected from the non-contiguous band of frequencies, and therefore, the desired digital television channels (the claimed “plurality of desired channels”) would have also been non-contiguous. Ex. 1224, [0036]-[0045], [0048]-[0049], Fig. 4. If every one of the desired digital channels is selected from different non-contiguous bands of frequencies, then the desired digital television channels are necessarily non-contiguous as well.

107. Additionally, there is nothing in Pugel that would tell a POSITA that the desired digital television channels have to be contiguous. Rather, a POSITA would have understood that a first desired digital television channel is simply a digital television channel within the first band of frequencies that the Pugel digital tuner 130 is targeting, and a second desired digital television channel is another digital television channel within the second band of frequencies that the Pugel digital tuner 130 is also targeting. Since the first and the second band of frequencies would have been non-contiguous in at least some cases, the first and the second desired digital television channels would have also been non-contiguous in some cases. Additionally, it is my opinion that for a multichannel analog RF input signal ranging from 5 – 950 MHz, there may be signals for up to one hundred and forty-nine channels, and, thus, signals for any two desired television channels of the one hundred and forty-nine channels may be separated by undesired television channels. In other words, a POSITA would have understood that Pugel’s desired television channels “are non-contiguous” in Pugel’s 5 – 950 MHz range multichannel analog

RF input signal. Pugel discloses that at least two desired digital channels would have been selected in some cases. Ex. 1224, [0045]-[0046]. If these two desired digital channels are necessarily non-contiguous, then these two desired digital channels alone would also meet the limitation in Element [1B] that the “plurality of desired channels are non-contiguous” because the two alone make a plurality. Thus, it is my opinion that Pugel discloses all of Element [1B], including the non-contiguous part of the claim.

108. If the Patent Owner argues that Pugel does not expressly disclose that the selected desired digital television channels (which I rely on for the claimed “plurality of desired channels”) are non-contiguous, a POSITA would have found this condition obvious from Pugel alone. A POSITA would have recognized this condition as being taught by Pugel because Pugel discloses that the received multi-channel RF signal is one of a variety of formats, including cable signals, satellite signals, or terrestrial signals. Ex. 1224, [0022]. A POSITA would have understood that the RF signals used in any of the above referenced systems would include RF channels in different frequency bands that have a gap between them in at least some implementations or situations. *See* Section 8.1, *supra*. Moreover, a POSITA would have understood that subscribers (such as the end users who are watching content such as television shows) select content channels according to their individual desires and regardless of the underlying frequencies used to carry the content channels. In other words, a human user selecting programs would normally not be

aware of the channel on which those programs were carried. Thus, a POSITA would have expected that, inevitably, a user would select content channels within non-contiguous RF channels. Indeed, the '275 patent recognizes that it was known that, inevitably, users would select (i.e., “desire”) channels that are non-contiguous in a received RF bandwidth. Ex. 1201, 1:44-48, 1:55-58, 2:16-18. Thus, a POSITA would have expected Pugel’s subscriber to select content channels within non-contiguous RF channels. In other words, Pugel’s subscriber does not have to only select channels that are next to each other. In fact, a POSITA would appreciate that, given the large number of channels already available at the time of Pugel, it would be statistically unlikely that all the channels selected by a user would be contiguous. If that were the case, it would be merely a coincidence and not the result of the design of Pugel’s system. Rather, based on Pugel’s system of using a “digital tuner 130 may include one or more digital multiplexers or demultiplexers” and a “channel selector 315 to permit selection of one or more particular digital channels desired to be recovered,” a POSITA would have expected that the desired digital channels are not contiguous. Ex. 1224, [0037]-[0038]. Accordingly, in at least some (if not most) instances of operating Pugel’s system, the desired digital channels (which are the channels Pugel’s digital tuner 130 targets to capture the subscriber’s desired content channels) would have been non-contiguous. Ex. 1224, [0038].

109. It is also my opinion that a POSITA would have been motivated to implement Pugel’s system so that the desired digital channels are non-contiguous

because it improves the system's flexibility to access content. A POSITA would not have wanted to be limited to target desired digital channels within a single frequency band because content would have been (in at least some instances) broadcast in separate frequency bands on non-contiguous RF channels. Ex. 1224, [0044]; Ex. 1279, 1:5-50, 2:6-12, 4:34-58, Figure 1 (which shows that it was known for TV channels to be transmitted in non-contiguous frequency bands); Ex. 1201, 2:33-39 (even the '275 patent acknowledges that it was known for desired TV channels to be carried in RF channels that are broadcast in non-contiguous bands). A POSITA would have wanted to improve the system so it would have the flexibility to receive content channels that are available in multiple, separated bands in some cases. For example, if 100 content channels (10 RF channels with 10 content channels in each = 100) are in a first frequency band and 30 content channels (5 RF channels with 6 content channels in each = 30) are in a second frequency band, a POSITA would have implemented Pugel such that the desired channels are selected from both bands to increase the total number of accessible content channels. Ex. 1224, [0037]-[0038], [0046]. At least some POSITAs would have been working for, or building products for a television service provider, and such POSITAs would have wanted to increase the number of accessible content channels to attract subscribers and increase revenue.

110. A POSITA would have had a reasonable expectation of success in implementing Pugel such that the desired digital channels are non-contiguous

because doing so does not involve any structural change to Pugel's system (e.g., no new circuitry needs to be added for the desired digital channels to be non-contiguous) or any additional steps. Pugel's system already receives a multi-channel RF signal comprising the desired digital channels and unwanted channels. Ex. 1224, [0028]. The condition that the desired digital channels are non-contiguous is merely the result of setting the target frequency of the digital multiplexers or demultiplexers in Pugel's digital tuner 130 to frequencies for non-contiguous channels. Ex. 1224, [0037]. More specifically, the desired digital channels are selected by setting target frequencies for Pugel's digital tuner (more particularly, setting one target frequency for digital multiplexers or demultiplexers) via the channel selector 315. Ex. 1224, [0037]-[0038]. The target frequencies correspond to the characteristic frequencies of the desired RF channels (which are within the multi-channel RF signal), and the desired RF channels are determined based on the choices of a subscriber (e.g., a selection of a content channel by the subscriber) that are not influenced by Pugel's system. Ex. 1224, [0038]. A POSITA would have understood that Pugel's system is designed in such a way that it is indifferent as to whether the desired digital channels are contiguous or not. Ex. 1224, [0023]-[0039], Figs. 1-3. A POSITA would have also understood that Pugel's system is able to select non-contiguous RF channels just as easily as it is able to select contiguous channels. *Id.* A POSITA would have seen that there is no impediment in Pugel's system to set the target frequencies of

the digital multiplexers or demultiplexers in Pugel's digital tuner 130 so that the desired digital channels are non-contiguous. *Id.*

111. Thus, it is my opinion that Pugel discloses or teaches Element [1B] in multiple ways. In sum, Pugel discloses or teaches receiving, by the input terminal, the RF signal comprising broadcast RF channels, the broadcast RF channels comprising desired digital television channels and undesired digital television channels, wherein the desired channels are non-contiguous.

c. [1C] “processing, by a radio front end coupled to the input terminal, the input signal to generate a processed input signal;”

112. It is my opinion that Pugel discloses “processing, by a radio front end coupled to the input terminal, the input signal to generate a processed input signal,” as claimed.

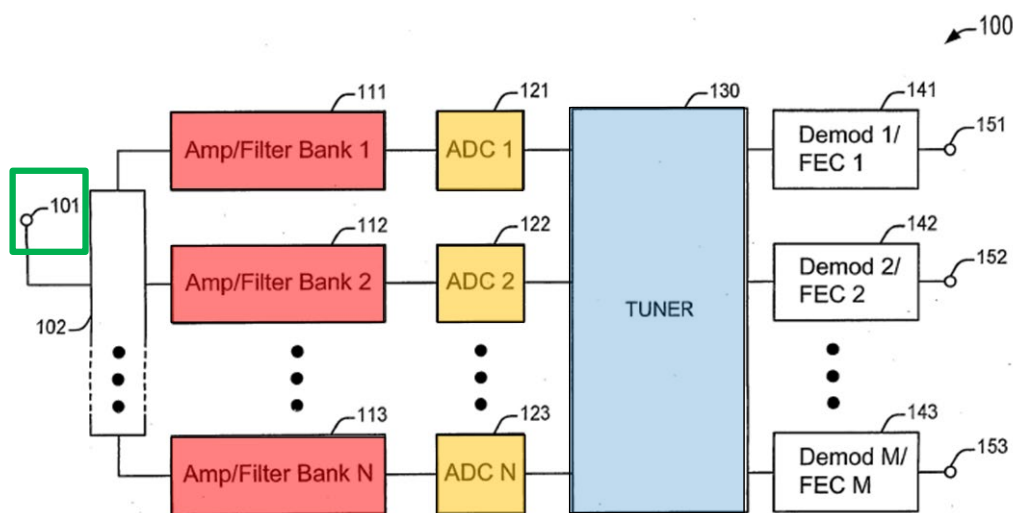


FIG. 1

Ex. 1224, Fig. 1 (annotated)

113. The Pugel multichannel receiver circuit comprises a “plurality of amplifier-filter banks or circuits 111, 112, 113” (“red,” collectively the claimed “radio front end”) where “the respective inputs of the amplifier/filter banks 111, 112, 113 are mutually directly connected to the input coupler 101” (the claimed “input terminal”). Ex. 1224, [0024]-[0025], Fig. 1. Pugel’s “plurality of amplifier-filter banks or circuits 111, 112, 113 ... configured to process frequencies within a specified band.” Ex. 1224, [0028], Figs. 1-2. Pugel contemplates that the amplifier-filter banks may act as bandpass filters that will process bands of limited frequency ranges for input to different analog-to-digital converters (ADCs). Ex. 1224, [0025]-[0032], Figs. 1-2. For example, Pugel describes splitting the multichannel analog RF input signal, ranging from about 5 MHz to about 900 MHz and comprising both desired and undesired television channels, into three analog bands by using the amplifier-filter circuits 111, 112, 113; the amplifier-filter circuit 111 processes the first analog band ranging from 5 to 300 MHz, the amplifier-filter circuit 112 processes the second analog band ranging from 300 to 600 MHz, and the amplifier-filter circuit 113 processes the third analog band ranging from 600 to 900 MHz. Ex. 1224, [0024]-[0026], [0028], [0034].

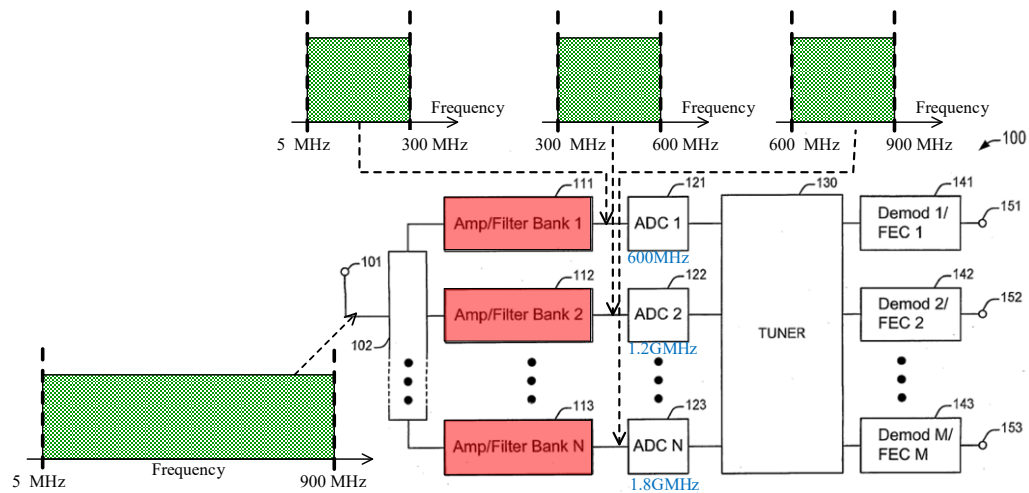


FIG. 1

Ex. 1224, Fig. 1 (annotated, example without Pugel's undersampling)

114. The analog signals in the analog bands processed by the amplifier-filter circuits 111, 112, 113 are converted to digital signals by the ADCs 121, 122, 123. Ex. 1224, [0024]. It is well known that ADCs convert incoming analog RF signals to digital signals by sampling the analog RF signals at a rate that is at least twice the highest frequency contained in the analog signals. *See* Section 8.3.4, *supra* (citing Ex. 1245 at 70; Ex. 1233 at 98-101). Therefore, the first band of 5 MHz to 300 MHz needs to be sampled with a sampling rate of 600 MHz, the second band of 300 MHz to 600 MHz needs to be sampled with a sampling rate of 1.2 GHz, and the third band of 600 MHz to 900 MHz needs to be sampled with a sampling rate of 1.8 GHz. Ex. 1224, [0033]-[0034]. Pugel recognizes the problem that three different clock devices are required to produce the different sampling rates and that some of the sampling rates are quite high (e.g., 1.8 GHz for the third analog band). Ex. 1224, [0033]-[0034].

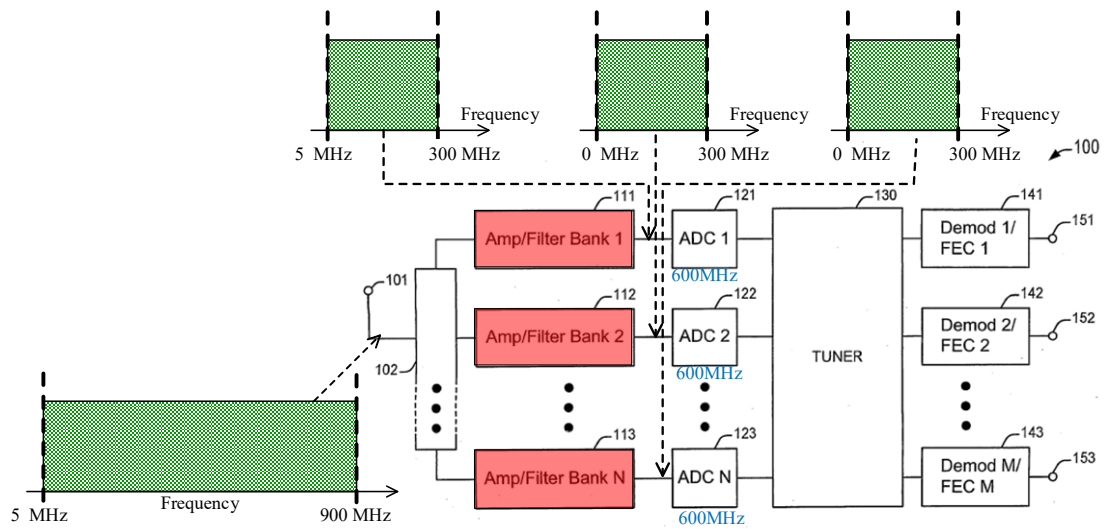
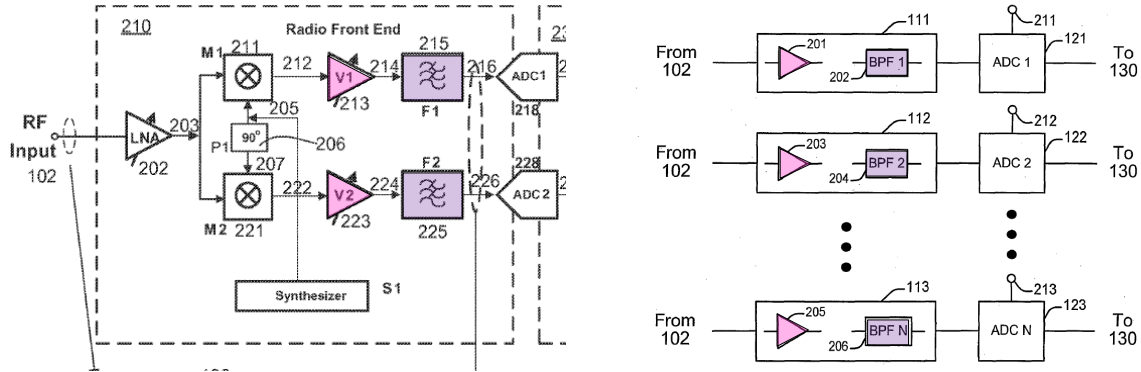


FIG. 1

Ex. 1224, Fig. 1 (annotated, example with Pugel's undersampling)

115. To resolve the problem, Pugel applies the undersampling technique that allows the ADCs to behave like mixers or down converters according to the Nyquist-Shannon sampling theorem, which says the sampling frequency needs to be at least twice the signal bandwidth. Ex. 1224, [0042], [0044]. Specifically, Pugel teaches that undersampling shifts the three analog bands with ~ 300 MHz bandwidth using analog-to-digital converters 121, 122, 123 using the same undersampling frequency of 600 MHz, at least twice the signal bandwidth of 300 MHz, satisfying the Nyquist-Shannon sampling theorem. Ex. 1224, [0032]-[0034]. Furthermore, Pugel describes that a single clock device (600 MHz in this example) can provide the requisite clock signal for all of the analog-to-digital converters 121, 122, 123. *Id.*



Ex. 1201, Fig. 2 (annotated, excerpted) Ex. 1224, Fig. 2 (annotated)

116. Furthermore, Pugel’s amplifier-filter banks 111, 112, 113 (including amplifiers 201, 203, 205 (pink) and filters 202, 204, 206 (purple)) comprise the claimed “radio frontend” because they first receive and process the multichannel RF signal before the multichannel RF signal is digitized by the analog-to-digital converters 121, 122, 123. It is my opinion that the functionalities of Pugel’s amplifier-filter banks 111, 112, 113 are similar to the ’275 patent’s radio frontend 210 that uses filters 215/225 (purple) and amplifiers 213/223 (pink) to receive and process the RF input signal 102 before the RF input signal is digitized. *Compare* Ex. 1224, [0025]-[0032], Fig. 2 *with* Ex. 1201, 4:42-6:19, Fig. 2.

117. Thus, it is my opinion that Pugel teaches Element [1C].

d. [1D] “digitizing, by an analog-to-digital converter (ADC) coupled to the radio front end, the processed input signal to generate a digitized signal;”

118. It is my opinion that Pugel discloses “digitizing, by an analog-to-digital converter (ADC) coupled to the radio front end, the processed input signal to

generate a digitized signal,” as claimed.

119. Pugel’s receiver circuit 100 includes analog-to-digital converters (ADCs) 121, 122, 123 (**gold**, collectively the claimed “analog-to-digital converter (ADC)”) coupled to the amplifier-filter banks or circuits 111, 112, 113 (**red**, collectively the claimed “radio front end”). Ex. 1224, [0023]-[0024], Fig. 1. Pugel describes that the ADCs 121, 122, 123 are “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], Fig. 1.

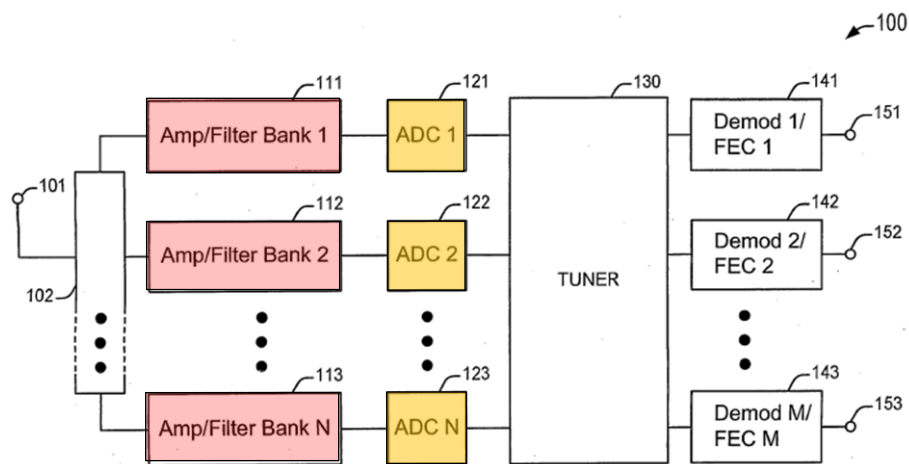
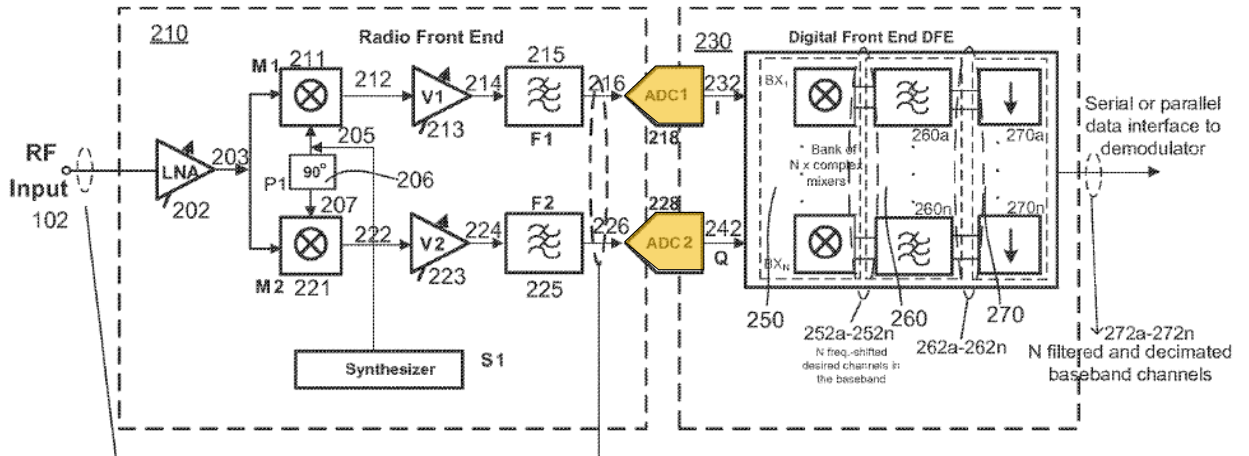


FIG. 1

Ex. 1224, Fig. 1 (annotated)



Ex. 1201, Fig. 2 (annotated)

120. 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]. 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].

121. 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 (the claimed feature of “generat[ing] a digitized signal”), 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].

122. Further, a POSITA would have understood each of Pugel's ADCs as a "wideband" ADC as it is digitizing a wideband signal (i.e., an analog band that has a width of a 300MHz band and comprises multiple channels). *Compare* Ex. 1224, [0035]-[0036] *with* Ex. 1201, 1:41-48. Pugel discloses that the bands of frequencies may be contiguous or non-contiguous. Ex. 1224, [0043].

123. Thus, it is my opinion that Pugel teaches Element [1D].

e. [1E] "selecting, by a digital frontend (DFE) coupled to the ADC, the plurality of desired channels from the digitized signal; and"

124. It is my opinion that Pugel in view of Crols discloses "selecting, by a digital frontend (DFE) coupled to the ADC, the plurality of desired channels from the digitized signal," as claimed.

125. Pugel's receiver circuit comprises a digital tuner (**green**, the claimed "digital front end (DFE),") coupled to the ADCs 121, 122, 123 (**gold**, the claimed "ADC") and configured to 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, [0037]-[0039], [0045], Fig. 1. 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." Ex. 1224, [0037].

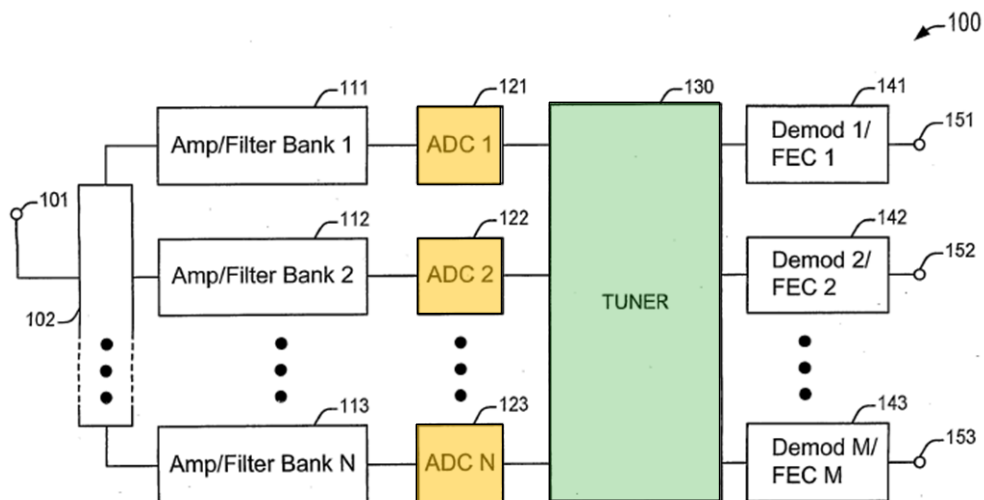


FIG. 1

Ex. 1224, Fig. 1 (annotated)

126. For example, Pugel teaches that the digital tuner may select and only demultiplex digital channels corresponding to certain pay-per-view selections or may demultiplex all channels. Ex. 1224, [0038]. 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 selected digital television channels. Ex. 1224, Abstract, [0001], [0008]-[0009], [0011], [0022], [0028], [0036]-[0044], [0048]-[0049]. In such an example, the selected digital channels are the claimed “desired television 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]. The digital tuner 130 may also comprise other circuitry,

such as “circuitry for providing additional functions, for example adaptive filters for removing multi-path propagation effects.” Ex. 1224, [0041].

127. Thus, the digital tuner 130 is “a digital frontend” because it processes digital signals—specifically the digital channels received from the ADCs—before demodulation, just as the ’275 patent’s digital frontend processes digital signals before demodulation. *Compare* Ex. 1224, [0037]-[0039], [0041], [0045], Fig. 1 with Ex. 1201, 5:56-6:19, Fig. 2.

128. Thus, it is my opinion that Pugel discloses the features of Element [1E].

- f. [1F] “outputting, by the DFE, the selected plurality of desired channels to at least one demodulator as a digital datastream, wherein the demodulator extracts information encoded in the digital datastream.”

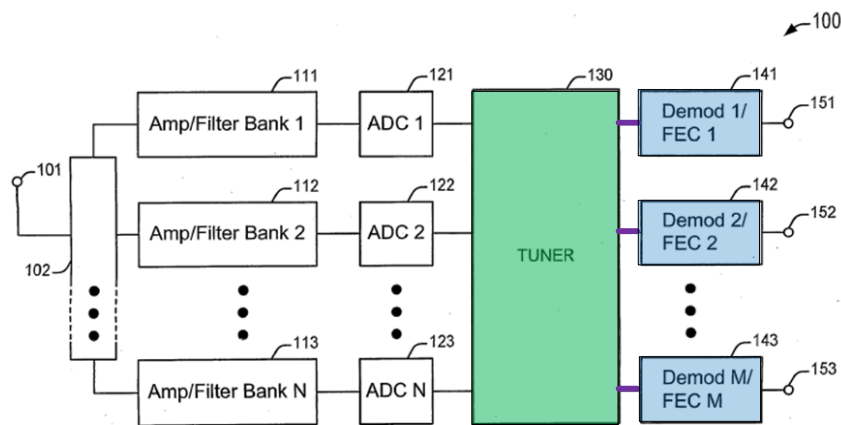


FIG. 1

Ex. 1224, Fig. 1 (annotated)

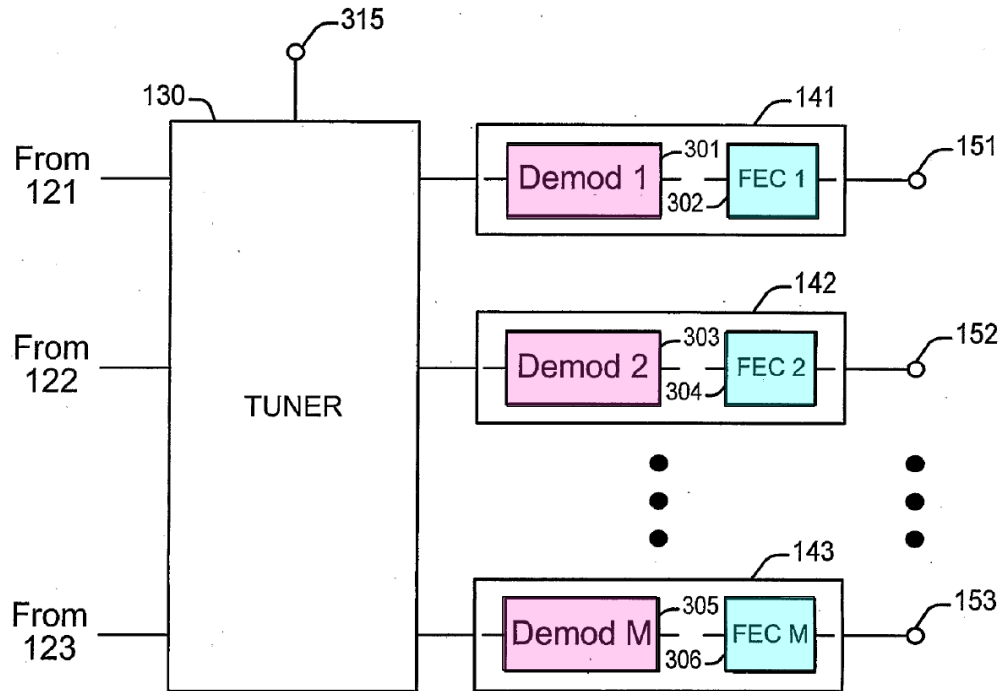
129. It is my opinion that Pugel discloses “outputting, by the DFE, the selected plurality of desired channels to at least one demodulator as a digital

datastream, wherein the demodulator extracts information encoded in the digital datastream,” as claimed.

130. As I explained in Section 9.1.1.e for Element [1E], Pugel’s digital tuner 130 (**green**) selects signals of cable television channels from the digitized bands of signals received from the ADCs 121, 122, 123. Ex. 1224, [0038]. Pugel’s Figure 3 depicts circuit paths (**purple**) that transfer outputs from the digital tuner 130 to one or more demodulators 141, 142, 143. These circuit paths from the digital tuner 130 to the demodulator circuits 141, 142, 143 are consistent with the description of the ’275 patent. Ex. 1201, Fig. 2.

131. Furthermore, Pugel teaches that the digital tuner 130 (the “DFE” of Elements [1E] and [1F]) “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]. Thus, the digital tuner 130 (the claimed “DFE”) is configured to pass digital channel signals selected by Pugel’s digital tuner 130 (“the selected plurality of desired channels ... as a digital datastream”) to one or more of Pugel’s demodulators (“at least one demodulator”).

132. Pugel’s demodulator circuits 141-143 (**blue**), perform a variety of demodulation techniques including quadrature amplitude modulation (QAM), quadrature phase shift keying demodulation (QPSK), vestigial sideband demodulation (VSB) on signals outputted by the digital tuner 130. Ex. 1224, [0027], [0039]-[0040], [0046], Figs. 1, 3-4.



Ex. 1224, Fig. 3 (annotated)

133. It is also my opinion that Pugel discloses “wherein the demodulator extracts information encoded in the digital datastream,” as claimed. Pugel teaches that “[e]ach of the demodulation circuits 141, 142, 143 may include demodulators 301, 303, 305 [pink] configured to perform a particular demodulation function or set of functions corresponding to the type of digital content expected to be found within a corresponding digital channel signal.” Ex. 1224, [0040]. Any number of demodulators may handle signals from any number of ADCs. Ex. 1224, [0023], [0027], [0040]. For example, “a first demodulator 301 may be configured to perform quadrature amplitude modulation (QAM) demodulation of digital cable television signals; a second demodulator 303 may be configured to perform quadrature phase shift keying (QPSK) demodulation of digital audio signals; and a third demodulator

305 may be configured to perform vestigial sideband (VSB) demodulation of high-definition television (HDTV) signals.” *Id.*

134. Further, to any extent it is argued that Pugel does not explicitly disclose extracting the information, this would have been obvious to a POSITA in view of Pugel’s disclosure. A POSITA would have understood a demodulator to be a device that extracts data from a digital signal. Ex. 1215, 6-7 (defining demodulation as “[t]he reconversion of a modulated signal back into its original form by extracting the data from the modulated carrier.”); Ex. 1219, 1:12-28 (demodulation refers to a process whereby “receivers use digital demodulators to recover data from a received signal.”). A POSITA would have thus understood that a typical demodulator known in the art operates by extracting the data being communicated from a transmitted RF signal. For example, a POSITA would have the knowledge that modulation is a technique where digital data of television channels (e.g., digital data comprising of bits “1” and “0”) are encoded into RF carrier signals by varying the amplitudes, frequencies, and/or phases of the RF carrier signals. Ex. 1233 at 155; *see* Section 8.2, *supra*. In Pugel, the modulated RF carrier signals are transmitted from the headends of cable television networks to subscriber locations where Pugel’s multichannel receiver circuit may be used. Ex. 1224, [0008]-[0009]; Ex. 1233 at 155, 408-411; *see* Sections 8.2-3, *supra*. The POSITA would have understood that the demodulator circuits 141, 142, 143 in Pugel’s multichannel receiver circuit would apply demodulation techniques to the received RF carrier signals to extract the

digital data encoded in the RF carrier signals. Ex. 1224, [0040], [0046]; Ex. 1233 at 408-411; *see* Section 8.3, *supra*. This is consistent with Pugel’s disclosure that “demodulators 301, 303, 305 configured to perform a particular demodulation function or set of functions corresponding to the type of digital content expected to be found within a corresponding digital channel signal.” Ex. 1224, [0040]. A POSITA reading this disclosure would have understood that, in order to effectively perform functions on content for a desired cable television channel within a signal, the system would first extract the content from the signal. As an example relevant to Pugel’s disclosure, as I explained above in Section 8.2.3, the DOCSIS standards DOCSIS, DOCSIS 1.1, and DOCSIS 2.0 all mandated 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; Ex. 1221 at 100-101, 172; *compare* Ex. 1224, [0041]. Standards by Society of Cable Telecommunications Engineers (SCTE) and national standard by American National Standards Institute (ANSI) also mandate the use of 64-QAM and 256-QAM. Ex. 1233 at 211. Therefore, a POSITA would have known that signals of Pugel’s selected cable television channels were demodulated by a QAM demodulator in order to extract the data encoded in the signals. Thus, it would have been obvious to a POSITA implementing Pugel’s teachings to have extracted information encoded in the digital datastream during the demodulation performed by Pugel’s demodulators, in view of Pugel’s express teachings. Ex. 1224, [0040]. It is my opinion that a POSITA would have had a reasonable expectation of

success, as extracting information in a signal by demodulation was well-known and within the capabilities of a POSITA at the time.

135. Furthermore, Pugel discloses that the demodulator circuits 141, 142, 143 comprise “[f]orward-error-correction (FEC) circuits 302, 304, 306 [cyan] [that] may include one or more components configured for coding or decoding” and “providing additional functions, for example adaptive filters for removing multi-path propagation effects, co-channel interference, and other types of radio frequency interference (RFI) well known in the art.” Ex. 1224, [0041], [0046]. These functions are performed on “digital content expected to be found within a corresponding digital channel signal,” and so a POSITA reading Pugel’s disclosure would have understood the data for the selected cable television channel extracted by the demodulators 301, 303, 305 are further processed by the FEC circuits 302, 304, 306. Ex. 1224, [0040], [0041]. Pugel thus discloses the claimed feature of “the demodulator extract[ing] information encoded in the digital datastream.”

136. Thus, it is my opinion that Pugel teaches Element [1F] and as Pugel teaches Elements [1A] through [1F], claim 1 is anticipated or rendered obvious by Pugel.

9.1.2. Dependent Claim 5

- a. [5] “The method of claim 1, wherein the extracted information is stored for use in a digital video recorder (DVR).”**

137. It is my opinion that Pugel discloses “[t]he method of claim 1, wherein

the extracted information is stored for use in a digital video recorder (DVR),” as claimed. As explained above in Sections 9.1.1.a-f, Pugel discloses Elements [1A]-[1F] of claim 1.

138. Pugel also discloses that “one of skill in the art will appreciate that the invention ... allows a single device to receive a modulated signal at an input and produce a plurality of video signals, or other information signals, related to the modulated signal” and “[t]his plurality of video signals may then be received at respective devices such as, for example ... a PVR device.” 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)”). Pugel discloses 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” and “[t]he information on the recorded channels is then available for later playback or other processing.” Ex. 1224, [0005]. A POSITA would have understood that the recorded channels as being available for later playback would entail that the recorded channels are stored at the PVR or some other device for later playback by the PVR. Thus, it is my opinion that Pugel teaches the claimed feature of “extracted information [that] is stored for use

in a digital video recorder (DVR).”

139. Thus, it is my opinion that Pugel anticipates or renders obvious claim 5.

9.1.3. Dependent Claim 6

a. [6] “The method of claim 1, wherein the extracted information is output for a picture-in-picture display.”

140. It is my opinion that Pugel discloses “[t]he method of claim 1, wherein the extracted information is output for a picture-in-picture display,” as claimed. As explained above in Sections 9.1.1.a-f, Pugel discloses Elements [1A]-[1F] of claim 1.

141. 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 teaches that PiP demands support for the simultaneous reception of multiple television channels. *Id.* And 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]. To any extent not explicitly disclosed by Pugel, 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 had 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.

142. As such, it is my opinion that claim 6 is anticipated and rendered obvious based on Pugel.

9.1.4. Dependent Claims 7, 8, and 10

- a. [7] “The method of claim 1, wherein the plurality of desired channels comprises at least one television channel.”**
- b. [8] “The method of claim 1, wherein the plurality of undesired channels comprises at least one television channel.”**
- c. [10] “The method of claim 1, wherein the broadcast channels comprise cable broadcast channels.”**

143. It is my opinion that Pugel discloses the features of claims 7, 8, and 10.

144. 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 (“[t]his 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 teaches tuning desired channels comprising one or more cable broadcast channels. Ex. 1224, [0037]-[0039], [0045].

145. As I discuss in Section 9.1.1.b, Pugel’s multichannel receiver circuit permits users to select one or more digital television channels “desired to be recovered” by the users from the multichannel analog RF input signal received by the multichannel receiver circuit and demodulates the selected digital television channels. Ex. 1224, Abstract, [0001], [0008]-[0011], [0022], [0028], [0036]-[0044], [0048]-[0049]. The selected digital television channels are the claimed “plurality of desired channels” by the users, while the digital television channels not selected by the users can be understood as the claimed “plurality of undesired channels” in the multichannel analog RF input signal. Ex. 1221 at 1, 23-24; *see* Section 9.1.1.b, *supra*; Section 8.1, *supra* (citing Ex. 1233 at 45, 413, 515-520). Therefore, a POSITA would have understood that Pugel’s multichannel analog RF input signal comprises all received television channels, including desired and undesired television channels. Ex. 1224, Abstract, [0001], [0008]-[0011], [0022], [0028], [0036]-[0044], [0048]-[0049].

146. Thus, it is my opinion that claims 7-8 and 10 are anticipated and rendered obvious by Pugel.

9.1.5. Dependent claim 9

a. [9] “The method of claim 1, wherein the broadcast channels comprise satellite broadcast channels.”

147. It is my opinion that Pugel discloses “[t]he method of claim 1, wherein the broadcast channels comprise satellite broadcast channels,” as claimed.

148. Pugel discloses that its multichannel receiver circuit can also be used for “other types of radio-frequency communications systems as well, including reception of digital television channels via satellite and terrestrial television transmission systems.” Ex. 1224, [0022]. It is my opinion that such digital television channels from satellite television transmission systems disclose the claimed “satellite broadcast channels.”

149. To any extent that the Patent Owner argues that this disclosure does not explicitly disclose the use of Pugel’s systems for satellite broadcast channels, it is my opinion that a POSITA would have understood that satellite television channels could be received and processed in the same manner as cable television channels in view of Pugel’s express teachings. As I discuss in Section 8.1, digital cable television channels from cable television networks occupy the RF spectrum from 550 to 864 MHz, while satellite television channels from satellite networks occupy various bands in frequencies greater than 950 MHz. Ex. 1233 at 413, 503; Ex. 1235, 1:37-48; Ex. 1237, [0079]-[0080]. I also discussed in Section 8.3 that the same type of RF receivers, such as low-IF receivers, could be used for receiving RF signals both from

cable television networks and satellite television networks because even though the signals of cable television channels and satellite cable television channels occupy different portions of the RF spectrum, such signals are processed and demodulated by RF receivers in substantially similar fashion. Ex. 1235, 1:49-61; Ex. 1238, [0022]-[0023], [0029]-[0030], [0042].

150. Furthermore, the '275 patent references satellite broadcasting only twice, first to note that tuners could be used for “digital video broadcasting (DVB) via satellite (DVB-S), via cable (DVB-C), or terrestrial digital video broadcasting (DVB-T),” and second to note that “a tuner designed for a terrestrial broadcast digital TV can be used together with a tuner dedicated to receiving a cable signal and/or a tuner for receiving a satellite broadcast signal.” Ex. 1201, 9:8-10, 10:55-58. These passages reinforce that digital video broadcasting via satellite and via cable are very closely related, with the primary difference being that they operate in different frequency bands. Ex. 1201, 9:2-15. A POSITA would have understood this relationship and would have been well-equipped to make any minor modifications necessary to adapt Pugel’s teachings regarding cable broadcast channel delivery to systems employing satellite broadcast channels.

151. Additionally, as I explain in Section 8.2.2, a POSITA would have been well aware that satellite television networks primarily used QPSK modulation. Ex. 1233 at 280; Ex. 1236, [0071], [0075]. And Pugel’s multichannel receiver circuit already comprises a “demodulator 303 ... [that is] configured to perform quadrature

phase shift keying (QPSK) demodulation.” Ex. 1224, [0040].

152. Therefore, it is my opinion that a POSITA would have thus found it obvious to apply Pugel’s teachings regarding cable broadcast channels to satellite broadcast channels in view of Pugel’s express teachings. Further, this modification would have been nothing more than applying a known technique (processing television channels in a satellite frequency range) to a known device (Pugel’s multichannel receiver circuit comprising a QPSK demodulator) ready for improvement to yield predictable results (satellite signal frequency ranges are processed rather than cable broadcast frequency ranges). A POSITA would have a reasonable expectation of success, as Pugel’s multichannel receiver circuit is designed to process signals at a wide range of frequencies, and any necessary modification would have been well within the skill of a POSITA. Ex. 1224, [0035]-[0036].

153. Thus, it is my opinion that claim 9 is anticipated and rendered obvious by Pugel.

9.1.6. Independent Claim 11

154. The elements of claim 11 appear in the Claims Listing Appendix, labeled as Elements [11A]-[11F]. Claim 11 recites a television receiver device with the same components and functions thereof that were recited in method claim 1, and thus is anticipated or rendered obvious by Pugel for the same reasons discussed

above with respect to claim 1. See my explanation above in Sections 9.1.1.a-f. *See also* Ex. 1224, Abstract (“A method and apparatus is presented...”).

a. [11A] “A television receiver device, comprising:”

155. It is my opinion that Pugel discloses “[a] television receiver device, comprising:” as claimed.

156. The preamble [11A] is substantially identical to the preamble [1A], and is taught by Pugel for the same reasons set forth in connection with the preamble [1A]. *See* Section 9.1.1.a, *supra*.

b. [11B] “an input terminal operable to receive an input signal comprising broadcast channels, the broadcast channels comprising a plurality of desired channels and a plurality of undesired channels, wherein the plurality of desired channels are non-contiguous;”

157. It is my opinion that Pugel discloses “an input terminal operable to receive an input signal comprising broadcast channels, the broadcast channels comprising a plurality of desired channels and a plurality of undesired channels, wherein the plurality of desired channels are non-contiguous,” as claimed.

158. Element [11B] is substantially identical to Element [1B] and is taught by Pugel for the same reasons set forth in connection with Element [1B]. See my explanation in Section 9.1.1.b. In particular, Element [11B] merely recasts the “input terminal” of Element [1B] as a portion of the “television receiver device” of Element [11A].

c. [11C] “a radio front end, coupled to the input terminal, operable to process the input signal;”

159. It is my opinion that Pugel discloses “a radio front end, coupled to the input terminal, operable to process the input signal,” as claimed.

160. Element [11C] is substantially identical to Element [1C] and is taught by Pugel for the same reasons set forth in connection with Element [1C]. See my explanation in Section 9.1.1.c. In particular, Element [11C] merely recasts the “radio front end” of Element [1C] as a portion of the “television receiver device” of Element [11A].

d. [11D] “an analog-to-digital converter (ADC), coupled to the radio front end, operable to digitize the processed input signal to generate a digitized signal; and”

161. It is my opinion that Pugel discloses “an analog-to-digital converter (ADC), coupled to the radio front end, operable to digitize the processed input signal to generate a digitized signal,” as claimed.

162. Element [11D] is substantially identical to Element [1D] and is taught by Pugel for the same reasons set forth in connection with Element [1D]. See my explanation in Section 9.1.1.d. In particular, Element [11D] merely recasts the “analog-to-digital converter (ADC)” of Element [1D] as a portion of the “television receiver device” of Element [11A].

e. [11E] “a digital frontend (DFE), coupled to the ADC, operable to select the plurality of desired channels from the digitized signal and”

- f. [11F] “output the selected plurality of desired channels to at least one demodulator as a digital datastream, wherein the demodulator is operable to extract information encoded in the digital datastream.”**

163. It is my opinion that Pugel discloses “a digital frontend (DFE), coupled to the ADC, operable to select the plurality of desired channels from the digitized signal and output the selected plurality of desired channels to at least one demodulator as a digital datastream, wherein the demodulator is operable to extract information encoded in the digital datastream,” as claimed.

164. Elements [11E] and [11F] are substantially identical to Elements [1E] and [1F], respectively, and are taught by Pugel for the same reasons set forth in connection with Elements [1E] and [1F]. See my explanation in Sections 9.1.1.e-f. In particular, Elements [11E] and [11F] merely recast the “radio front end” of Elements [1E] and [1F] as a portion of the “television receiver device” of Element [11A].

165. Thus, it is my opinion that Pugel teaches Elements [11A] through [11F], and claim 11 is anticipated or rendered obvious by Pugel.

9.1.7. Dependent Claim 15

- a. [15] “The television receiver device of claim 11, wherein the extracted information is stored for use in a digital video recorder (DVR).”**

166. It is my opinion that for the same reasons set forth for claim 5 in Section 9.1.2, claim 15 is anticipated or rendered obvious by Pugel.

9.1.8. Dependent Claim 16

- a. [16] “The television receiver device of claim 11, wherein the extracted information is output for a picture-in-picture display.”**

167. It is my opinion that for the same reasons set forth for claim 6 in Section 9.1.3, claim 16 is anticipated or rendered obvious by Pugel.

9.1.9. Dependent Claims 17, 18, and 20

- a. [17] “The television receiver device of claim 11, wherein the plurality of desired channels comprises at least one television channel.”**
- b. [18] “The television receiver device of claim 11, wherein the plurality of undesired channels comprises at least one television channel.”**
- c. [20] “The television receiver device of claim 11, wherein the broadcast channels comprise cable broadcast channels.”**

168. It is my opinion that for the same reasons set forth for claims 7, 8, and 10 in Section 9.1.4, claims 17, 18, and 20 are anticipated or rendered obvious by Pugel.

9.1.10. Dependent Claim 19

- a. [19] “The television receiver device of claim 11, wherein the broadcast channels comprise satellite broadcast channels.”**

169. It is my opinion that for the same reasons set forth for claim 9 in Section 9.1.5, claim 19 is anticipated or rendered obvious by Pugel.

9.2. Pugel in view of Crols Renders Obvious Claims 1, 4-11, and 14-20 (Ground C)

9.2.1. Independent claim 1

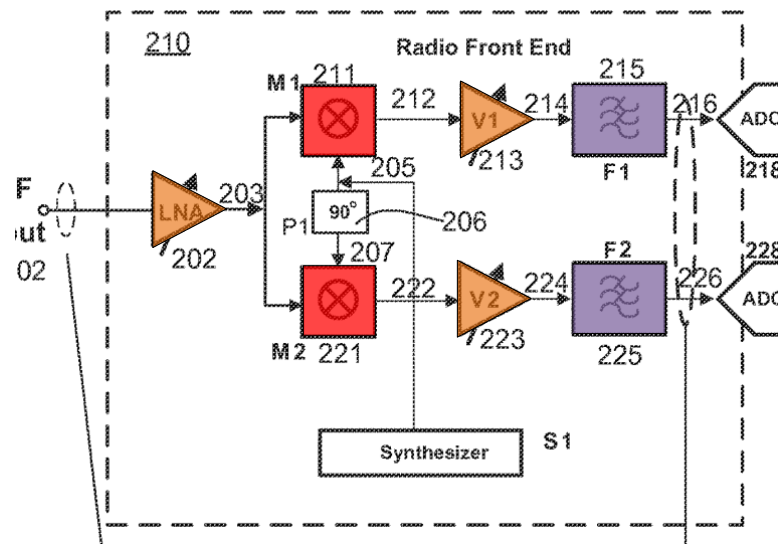
- a. [1A] “A method for operating a television receiver, comprising:”
- b. [1B] “receiving by an input terminal, an input signal comprising broadcast channels, the broadcast channels comprising a plurality of desired channels and a plurality of undesired channels, wherein the plurality of desired channels are non-contiguous;”
- c. [1C] “processing, by a radio front end coupled to the input terminal, the input signal to generate a processed input signal;”
- d. [1D] “digitizing, by an analog-to-digital converter (ADC) coupled to the radio front end, the processed input signal to generate a digitized signal;”
- e. [1E] “selecting, by a digital frontend (DFE) coupled to the ADC, the plurality of desired channels from the digitized signal; and”
- f. [1F] “outputting, by the DFE, the selected plurality of desired channels to at least one demodulator as a digital datastream, wherein the demodulator extracts information encoded in the digital datastream.”

170. As I discuss in Sections 9.1.1.a-f, Pugel discloses Elements [1C] of claim 1. However, to any extent that means-plus-function constructions of “radio frontend” and “digital frontend” apply, it is my opinion that Pugel in view of Crols teaches the claimed “radio frontend” and “digital frontend.”

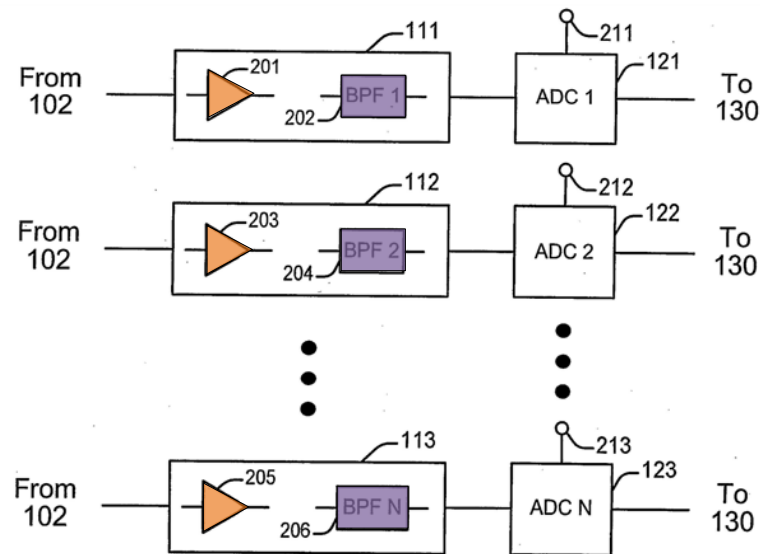
“Radio Frontend” in Elements [1C]

171. As I discuss in Section 9.1.1.c, Pugel’s amplifier-filter banks disclose the claimed “radio front end.” But to any extent that a means-plus-function construction of “radio front end” applies, and Pugel’s amplifier/filter circuits 111, 112, 113 allegedly are not structurally equivalent to, or perform the same function as, the structure described by the ’275 patent for performing the function recited in

Element [1C], this would have been obvious in view of Crols. Ex. 1201, 4:40-5:37; Ex. 1225 at 269, 271-274, 279-282. The '275 patent discloses a “radio front end” comprising amplifiers (**orange**, 202, 213, and 223), filters (**purple**, 215 and 225), and mixers (**red**, 211 and 221). While Pugel discloses amplifiers (**orange**, 201, 203, and 205) and filters (**purple**, 202, 204, and 206) consistent with the structure of the '275 patent, it does not explicitly show mixers. *Compare* Ex. 1224, [0025]-[0032], Fig. 2 *with* Ex. 1201, 4:42-6:19, Fig. 2.



Ex. 1201, Fig. 2 (annotated, excerpted)



Ex. 1224, Fig. 2 (annotated, excerpted)

172. Crols discusses numerous topologies for signal processing, including zero-IF and low-IF receiver topologies. Ex. 1225 at 269, 271-274, 279-282, Figs. 5-6, 21-22. In zero-IF and low-IF receiver topologies, an incoming RF analog signal is first downconverted, and the downconverted analog signal is converted to a digital signal, which is then sent to a demodulator. *Id.* Both the zero-IF and low-IF receiver topologies employ a complex mixer for the downconversion of the incoming RF analog signal. Ex. 1225 at 275, 279, Figs. 5-6, 21-22. Crols teaches that “[c]omplex operators [in IF receivers] are made with pairs of real operators, amplifiers, mixers, and filters.” Ex. 1225 at 275.

173. In low-IF receiver topologies, Crols suggests that “downconversion of the IF signal can be done in two ways, both are shown in the full and compact notation in Figs. 21 and 22.” Ex. 1225 at 279, Figs. 21-22 (reproduced below). The first downconversion is performed on analog RF signals before ADCs digitize the

signals, while the second downconversion is performed on digital signals before the digital signals are provided to the demodulators. Ex. 1225 at 279; *See* Section 8.3.1, *supra*. Low-IF receivers in Crols incorporate a mixer module (**red**) to downconvert incoming RF signals to IF, and the downconverted IF signals are digitized by the ADCs (see below). Ex. 1225 at 272, 279.

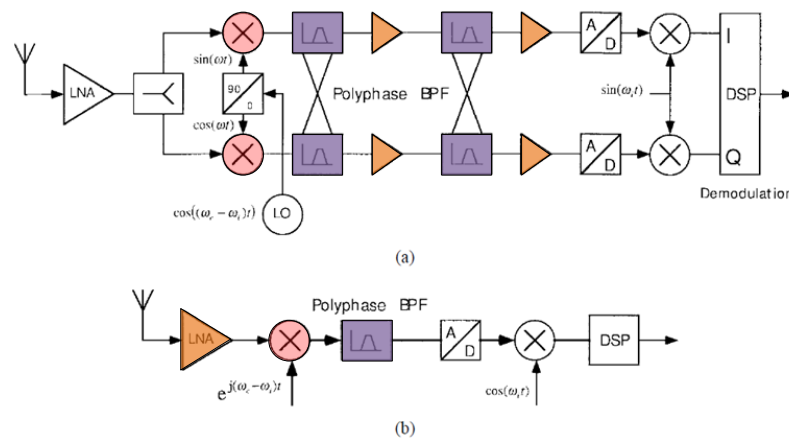


Fig. 21. The topology of a low-IF receiver which uses a complex bandpass filter in the LF part. (a) Full notation and (b) compact notation.

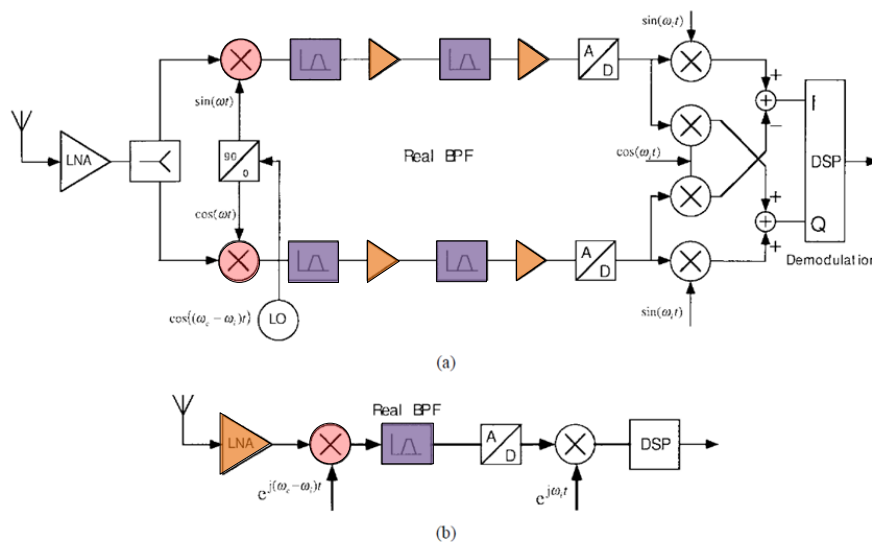
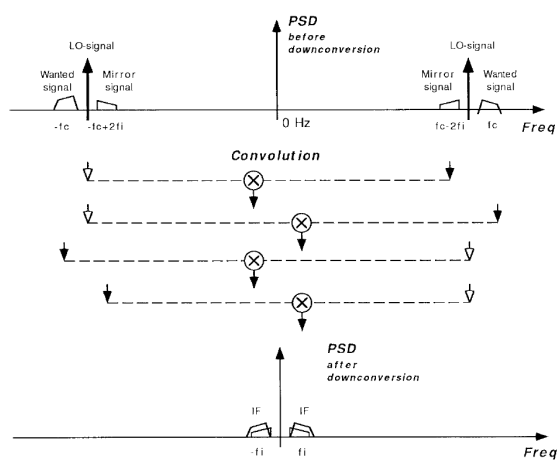


Fig. 22. The topology of a low-IF receiver which uses real filters in the LF part. (a) Full notation and (b) compact notation.

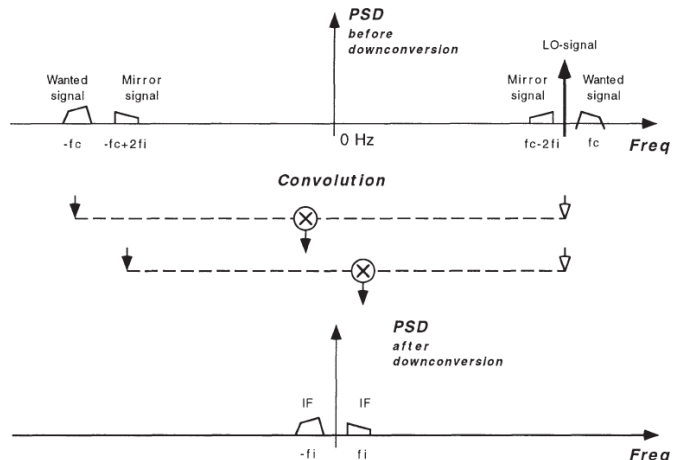
Ex. 1225, Figs. 21-22 (annotated) (page 281)

174. In the first downconversion step in Crols, the incoming RF signals are

split and then down-converted by a quadrature downconverter (**red**) comprising two mixers to produce in-phase (I) and quadrature (Q) components of the signals in IF. Ex. 1225 at 271; *see also* Ex. 1234 at 65. The RF signals could also be downconverted using a single mixer and a sinusoidal signal (as shown by Figure 2 of Ex. 1225, 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. 1225 at 270-273, Fig. 2; *see also* Ex. 1234 at 24, 46.



Ex. 1225, Fig. 2 (page 270)

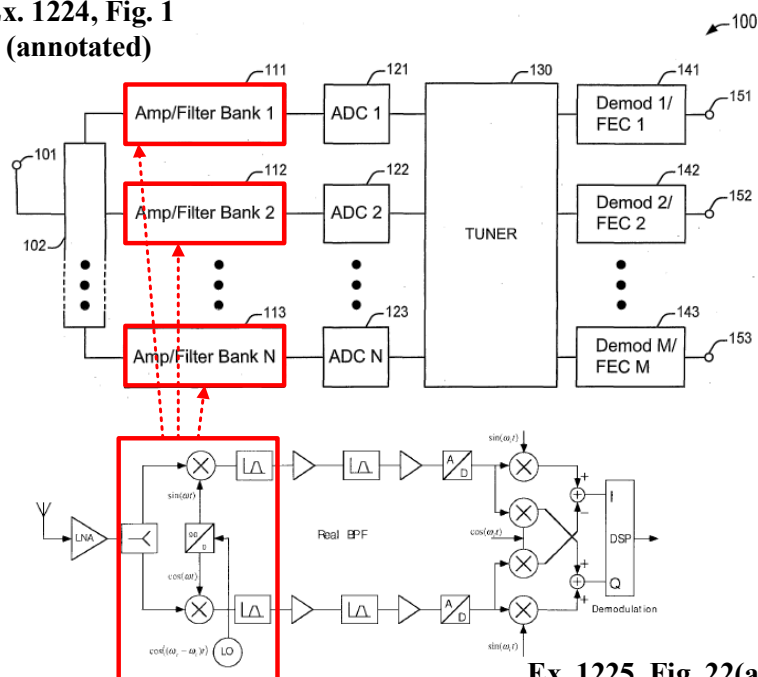


Ex. 1225, Fig. 19 (page 280)

175. It was known that the mirror signal problem could be avoided by mixing the incoming RF signals with a complex signal comprising a sine signal and a cosine signal. Ex. 1225 at 279-280; *see also* Ex. 1234 at 28, 43; Ex. 1239 at 13. Mixing with such a complex signal shifts a wanted RF signal at frequency f_c to f_i while the unwanted mirror (or image) frequency signal at $f_c + 2f_i$ is shifted to f_i . Filters

can be used after the first stage of downconversion to filter out unwanted mirror signals. Ex. 1225 at 271-272. It is my opinion that Crols' complex mixer (**red**) described above is structurally equivalent to, and performs the same function as the mixers 211 and 212 in the '275 patent. Ex. 1201, 4:65-5:37.

**Ex. 1224, Fig. 1
(annotated)**



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

176. It is my opinion that it would have been obvious to a POSITA to modify Pugel's amplifier/filter circuits 111, 112, 113 to include complex mixer topologies as taught by Crols (as illustrated above) because a POSITA would have been motivated to implement Pugel's system with alternative known solutions as a simple design choice. A POSITA would have been motivated to turn to other known topologies, such as Crols, in view of Pugel's express teaching that "any number of amplifier-filter circuits, analog-to-digital converters, and/or demodulator circuits

may be used in accordance with the present invention.” Ex. 1224, [0023]. Further, Pugel states that each amplifier-filter circuit comprises “at least an amplifier... and a filter,” and that the amplifier-filter circuits “may include one or more additional components (not shown) for accomplishing segregation of the analog input signal as described above.” Ex. 1224, [0029]-[0030]. Crols’ complex mixer topologies provide exactly such additional components for that purpose, and the required traditional mixer modules and components would have been readily available.

177. It is my opinion that applying Crols’ topologies comprising mixer modules to Pugel’s receiver circuits would have been nothing more than applying a known technique (using complex mixer topologies for mirror signal suppression as taught by Crols) to improve a known device (Pugel’s receiver circuits comprising amplifier-filter circuits) ready for improvement to yield predictable results (Pugel’s amplifier-filter circuits would more effectively downconvert analog input signals such that Pugel’s ADCs can use the same low sampling rate). 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 complex mixer topologies, and the POSITA’s own familiarity with known receiver circuit topologies in the art.

178. Additionally, it is also my opinion that a POSITA would have understood that Crols’ complex mixers would further provide in-phase and quadrature components of signals, which are commonly used in the modulation and

demodulation of cable and/or satellite television channels. *See* Sections 8.1, 8.2.3, *supra*. For example, in both QPSK modulation and QAM modulation, digital data is split into two components, an I (in-phase) component and a Q (quadrature) component. Ex. 1233 at 163-164, 166. The same RF carrier signal is used for each component, but the noninterfering phases of the two signals in the two components are 90° apart. *Id.* After the two RF carrier signals for 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 one or more complex mixers, such as the complex mixer in Crols. *Id.*; Ex. 1225 at 271. The separation back into I/Q components allows the demodulators inside the receiver to map the two components onto the QPSK or QAM I/Q constellation and interpret the digital data encoded in the I/Q components. Ex. 1233 at 164. A POSITA was also aware that at the receiver's end, the received RF signals would have to be processed in such a way that a demodulator could demodulate the RF signals to recover the digital data encoded in the RF signals, and such processing would require splitting the incoming RF signals into I/Q components again. Ex. 1233 at 408-411, Fig. 22.1; Ex. 1234 at 23; Ex. 1235, 1:35-37, 1:49-52; Ex. 1236, [0018], [0020]-[0021];

179. A POSITA would have been well aware that cable television networks primarily used QAM modulation, while satellite television networks primarily used QPSK modulation. Ex. 1233 at 156, 280; Ex. 1236, [0071]. Pugel's multichannel

receiver circuit is capable of receiving RF signals from cable and satellite. Ex. 1224, [0008]-[0009], [0022], [0033]-[0037]. Therefore, the POSITA would have understood that the received RF signals would have been modulated using either QPSK or QAM modulation, and the Pugel's multichannel receiver circuit would have to be capable of spitting the received Pugel's multichannel RF signals into I and Q components such that Pugel's demodulator could decode the digital data from the I and Q components. Ex. 1224, [0008], [0022], [0040]. A POSITA would have understood that Crols' mixers may be used to create I and Q components. Ex. 1225 at 277 ("Quadrature oscillators often use an RC-CR circuit to obtain the 90° phase shift."), 279-282; Ex. 1234 at 42-43, 65-67. In my opinion, it would have been obvious to a POSITA to modify Pugel's receiver circuit to implement mixers, such as taught by Crols, in order to support QAM and QPSK modulation as taught by Pugel. Thus, applying Crols' topologies comprising mixer modules to Pugel's receiver circuits would have been nothing more than applying a known technique (generating I and Q components of RF 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). It is also my opinion that 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.

180. The resultant system of Pugel-Crols thus comprises amplifiers and filters as taught by Pugel, with the addition of mixers as taught by Crols. It is my opinion that the resultant system of Pugel-Crols is thus structurally equivalent to, and performs the same function as, the structure described by the '275 patent for performing the function recited in limitation [1C] of “process[ing] the input signal.” Ex. 1201, 4:65-5:37.

“Digital Frontend” in Elements [1E] and [1F]

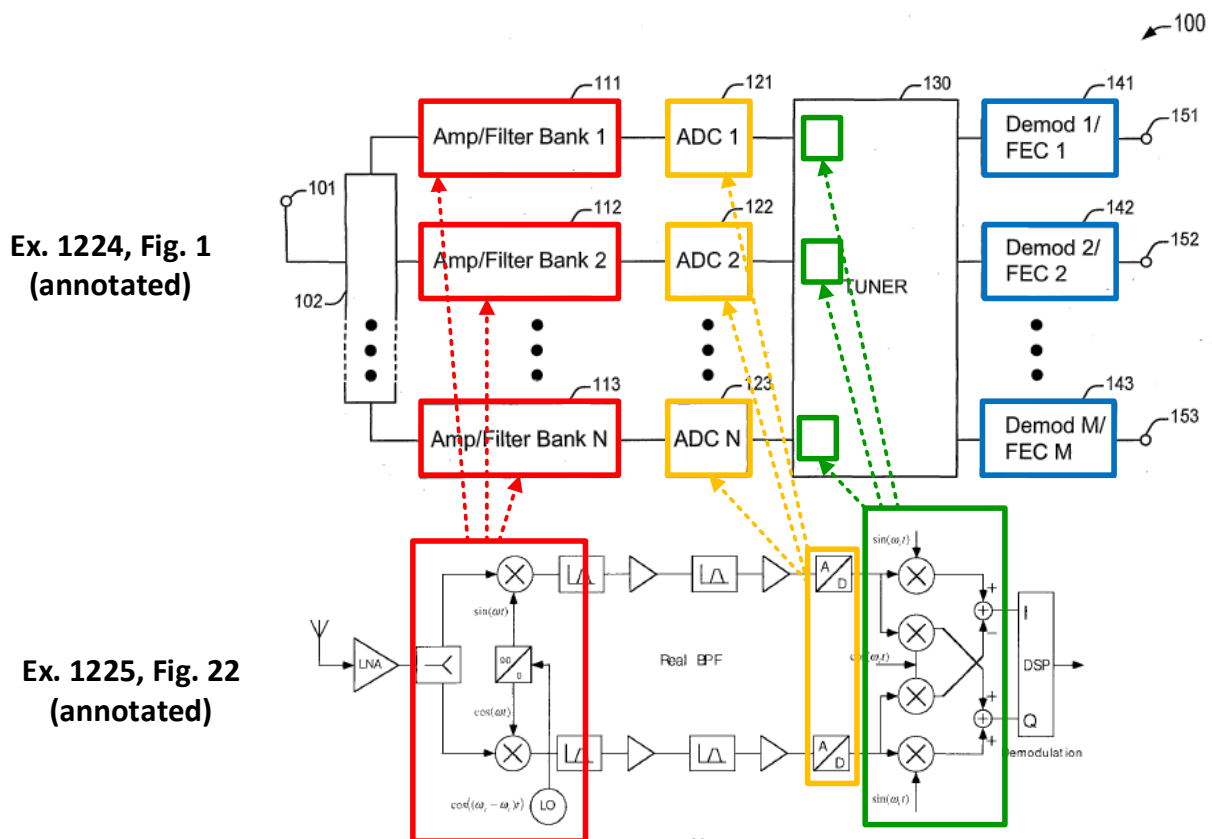
181. Additionally, to any extent that a means-plus-function construction of “digital frontend” applies, and Pugel’s tuner 130 allegedly is not structurally equivalent to, or performs the same function as, the structure described by the '275 patent for performing the function recited in limitations [1E]-[1F], (e.g., complex mixers 250 and filter modules 260), this would have been obvious in view of Crols. Ex. 1201, 6:21-7:25; *see also* Sections 6.1, 6.3, *supra*. As I explained in Section 9.1.1.e for limitation [1E], Pugel teaches a digital tuner 130 (the claimed “digital frontend”) that demultiplexes only the digital channel signals of cable television channels selected by a user. Ex. 1224, [0038]. Pugel multichannel receiver circuit also comprises one or more demodulator circuits, such as the demodulator circuits 141, 142, 143. *See also* Section 9.1.1.f. The digital tuner 130 performs “coding, decoding, scrambling, descrambling, rotating, and/or derotating operations prior to passing the digital channel signals to demodulation circuits.” Ex. 1224, [0039]. It is

my opinion that a POSITA would have understood this to include downconversion or have found it obvious, because the claims of Pugel provide an express teaching that the digital tuner 130 may itself perform downconverting of digital signals. Ex. 1224, claim 14 (reciting “[t]he apparatus (100) of claim 12 where said digital processor (130) multiplexes said first, second, and third digital signals, downconverts said multiplexed signal and extracts desired information to be coupled to said first and second demodulator circuits.”), claim 15 (reciting “[t]he apparatus (100) of claim 12 where said digital processor (130) downconverts and extracts desired information to be coupled to said first and second demodulator circuits (141, 142) from each of said first, second, and third digital signals individually.”), claim 18 (reciting “[a] method (400) processing signals comprising the steps of ... downconverting said first digital signal and said second signal”), claim 20 (reciting “multiplexing said first digital signal and said second digital signal after said digitizing steps and before said downconverting step,” claim 21(reciting “downconverting step comprises downconverting each of said first and second set of signals individually”).

182. 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

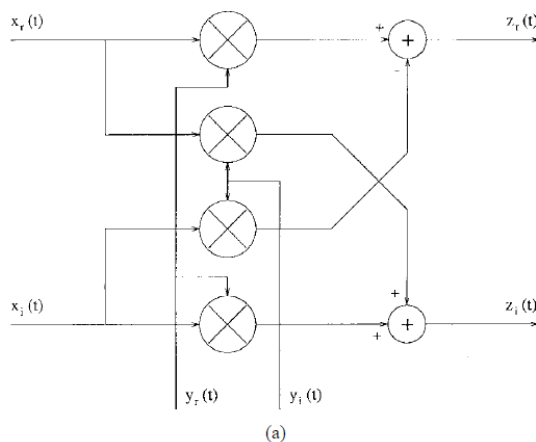
baseband and then applying a low pass filter function to isolate the signals of the desired television channel. *Id.*

183. It is my opinion that to any extent that Pugel does not teach or suggest implementation details regarding using a complex mixer to perform downconverting at the digital tuner, this would have been obvious to a POSITA in view of Crols because 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**:

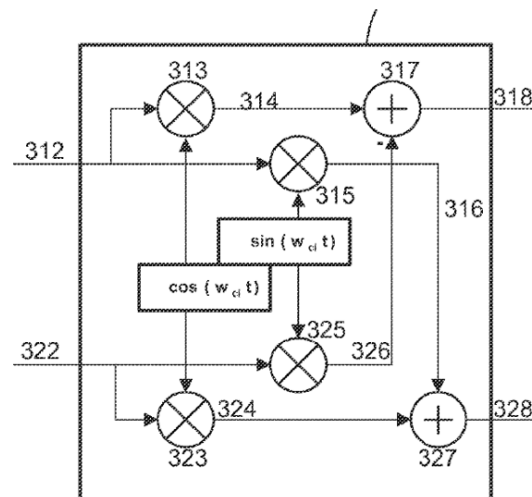


As Crols explains and illustrates, the circuitry outlined in green is a “complex mixer” that is utilized to perform downconversion. Ex. 1225 at 273-274, 279-

280, Figs. 8(a), 21-22; Ex. 1234 at 46-47, Fig. 3.3. Crols further teaches that once a signal is received from an ADC in a low-IF topology, “it has to be filtered further on in order to extract the wanted signal from its neighbors.” Ex. 1225 at 270-271, Figs. 3, 5. Crols’ complex mixer has the identical structure and performs the identical downconversion (i.e., shifting the frequency of in-phase and quadrature components of the digital complex input signal) as mixer 300 shown in Figure 3 of the ’275 patent. Ex. 1225 at 273-274, 279-280, Figs. 8(a), 21-22; Ex. 1201, 6:33-7:25, 11:15-24, Fig. 3; Ex. 1234 at 63.



Ex. 1225, Fig. 8(a) (page 273)



Ex 1201, Fig. 3 (excerpted)

184. Therefore, 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 because of Pugel’s express teachings that its digital tuner 130 employs downconversion. Ex. 1224, [0039], claims 14-15, 18, 20-21. 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. 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.

185. Therefore, it is my opinion that Pugel in view of Crols renders obvious claim 1.

9.2.2. Independent Claim 11

- a. [11A] “A television receiver device, comprising:”**
- b. [11B] “an input terminal operable to receive an input signal comprising broadcast channels, the broadcast channels comprising a plurality of desired channels and a plurality of undesired channels, wherein the plurality of desired channels are non-contiguous;”**
- c. [11C] “a radio front end, coupled to the input terminal, operable to process the input signal;”**
- d. [11D] “an analog-to-digital converter (ADC), coupled to the radio front end, operable to digitize the processed input signal to generate a digitized signal; and”**
- e. [11E] “a digital frontend (DFE), coupled to the ADC, operable to select the plurality of desired channels from the digitized signal and”**
- f. [11F] “output the selected plurality of desired channels to at least one demodulator as a digital datastream, wherein the demodulator is operable to extract information encoded in the**

digital datastream.”

186. Elements [11A] through [11F] of claim 11 are substantially identical to Elements [1A] through [1F] of claim 1, respectively, and are taught by Pugel in view of Crols for the same reasons set forth in connection with Elements [1E] and [1F] in Section 9.2.1. Thus, it is my opinion that claim 11 is rendered obvious by Pugel in view of Crols.

9.2.3. Dependent Claim 4

- a. [4A] “The method of claim 1, wherein the ADC comprises:”**
- b. [4B] “a first ADC configured to generate a digital in-phase signal; and”**
- c. [4C] “a second ADC configured to generate a digital quadrature signal.”**

187. It is my opinion that Pugel in view of Crols discloses the features of claim 4.

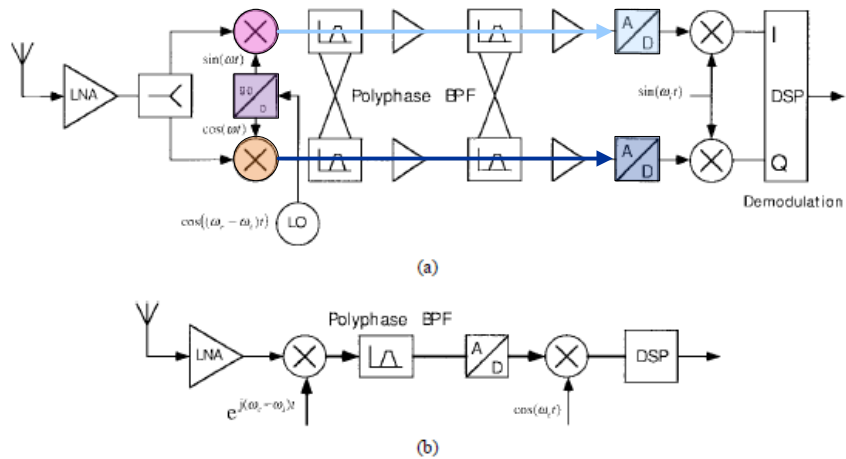


Fig. 21. The topology of a low-IF receiver which uses a complex bandpass filter in the LF part. (a) Full notation and (b) compact notation.

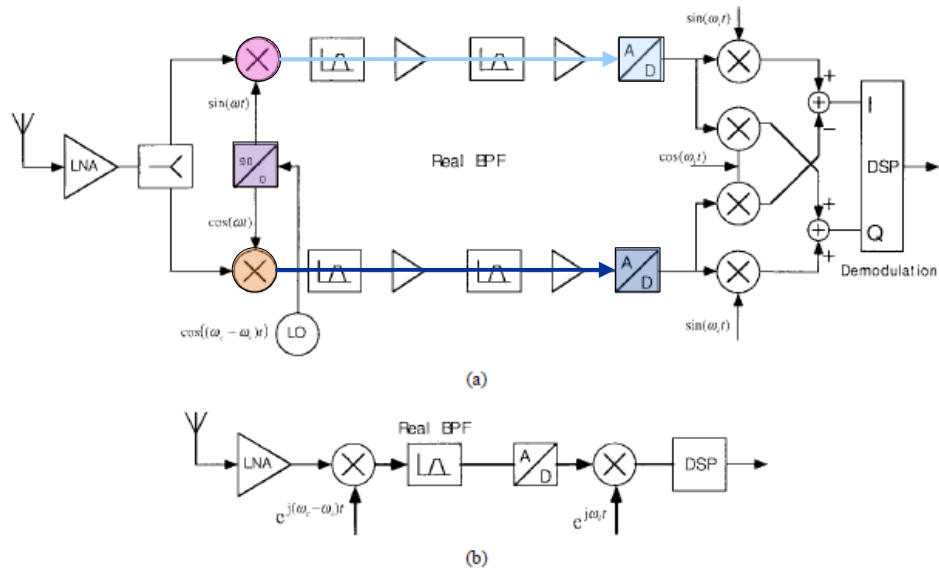
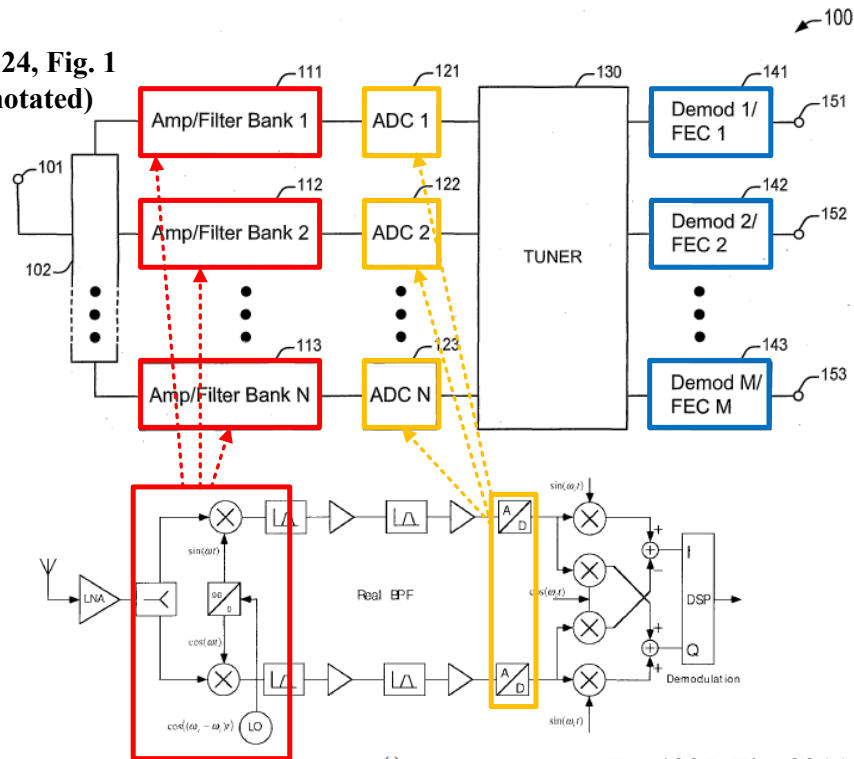


Fig. 22. The topology of a low-IF receiver which uses real filters in the LF part. (a) Full notation and (b) compact notation.

Ex. 1225, Figs. 21-22 (annotated) (page 281)

188. Crols illustrates a first ADC (**dark blue box**, the claimed “first ADC”) that receives the in-phase component (**dark blue line**, the claimed “in-phase signal”) from the first mixer (**orange**) to digitize the in-phase component and a second ADC (**light blue box**, the claimed “second ADC”) that receives the quadrature component (**light blue line**, the claimed “quadrature signal”) from the second analog mixer (**pink**) to digitize the quadrature component. Ex. 1225, Figs. 21, 22; Ex. 1234 at 31.

Ex. 1224, Fig. 1
(annotated)



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

189. It is my opinion that a POSITA would have modified each of Pugel's ADCs 121, 122, 123 to incorporate two ADCs as depicted in Crols as illustrated above. It would have been obvious to a POSITA to modify Pugel's ADCs to implement Crols' double ADCs (as illustrated above) because a POSITA would have understood that the double ADCs are needed to digitize the in-phase and quadrature components. Thus, applying Crols' ADC topologies to Pugel's receiver circuits would have been nothing more than applying a known technique (having an ADC each for in-phase and quadrature signals) to improve a known device (Pugel's receiver that performs QAM or QPSK demodulation and requires in-phase and quadrature components for the demodulation) ready for improvement to yield predictable results (the resulting implementation of Pugel-Crols would be capable

of digitizing both in-phase and quadrature components).

190. Thus, it is my opinion that Pugel in view of Crols discloses the features of claim 4.

9.2.4. Dependent Claim 14

- a. [14A] “The television receiver device of claim 11, wherein the ADC comprises:”**
- b. [14B] “a first ADC configured to generate a digital in-phase signal; and”**
- c. [14C] “a second ADC configured to generate a digital quadrature signal.”**

191. It is my opinion that Pugel in view of Crols discloses Elements [14A], [14B], and [14C] of claim 14.

192. Claim 14 is substantially identical to claim 4 and is taught by Pugel in view of Crols, for the same reasons set forth in connection with claim 4. See my explanation in Section 9.2.3. Thus, it is my opinion that Pugel in view of Crols renders obvious claim 14.

9.2.5. Dependent Claims 5-10 and 15-20

- a. [5] “The method of claim 1, wherein the extracted information is stored for use in a digital video recorder (DVR).”**
- b. [6] “The method of claim 1, wherein the extracted information is output for a picture-in-picture display.”**
- c. [7] “The method of claim 1, wherein the plurality of desired channels comprises at least one television channel.”**
- d. [8] “The method of claim 1, wherein the plurality of undesired**

channels comprises at least one television channel.”

- e. [9] “The method of claim 1, wherein the broadcast channels comprise satellite broadcast channels.”**
- f. [10] “The method of claim 1, wherein the broadcast channels comprise cable broadcast channels.”**
- g. [15] “The television receiver device of claim 11, wherein the extracted information is stored for use in a digital video recorder (DVR).”**
- h. [16] “The television receiver device of claim 11, wherein the extracted information is output for a picture-in-picture display.”**
- i. [17] “The television receiver device of claim 11, wherein the plurality of desired channels comprises at least one television channel.”**
- j. [18] “The television receiver device of claim 11, wherein the plurality of undesired channels comprises at least one television channel.”**
- k. [19] “The television receiver device of claim 11, wherein the broadcast channels comprise satellite broadcast channels.”**
- l. [20] “The television receiver device of claim 11, wherein the broadcast channels comprise cable broadcast channels.”**

193. As I discuss in Sections 9.2.1 and 9.2.2, Pugel in view of Crols discloses Elements [1A]-[1F] of base claim 1 and Elements [11A]-[11F] of base claim 11. Pugel, alone or in combination with Crols, teaches the additional features of claims 5-10 and 15-20. *See* Sections 9.1.2-9.1.10, *supra*.

194. Therefore, it is my opinion that Pugel in view of Crols renders obvious claims 5-10 and 15-20.

9.3. Pugel in view of Chandrakasan Renders Claims 2, 3, 12, and 13 Obvious (Ground D).

9.3.1. Dependent Claims 2 and 3

- a. [2] “The method of claim 1, wherein the DFE outputs the digital datastream via a serial interface.”**
- b. [3] “The method of claim 1, wherein the DFE outputs the digital datastream via a parallel interface.”**

195. It is my opinion that Pugel in view of Chandrakasan describes “[t]he method of claim 1, wherein the DFE outputs the digital datastream via a serial interface,” as recited in claim 2, and “[t]he method of claim 1, wherein the DFE outputs the digital datastream via a parallel interface,” as recited in claim 3.

196. Claims 2 and 3 are similar and only differ with regard to the type of interface via which the digital datastream is outputted. Ex. 1201, 7:16-20. Claim 2 recites output “via a serial interface,” while claim 3 recites output “via a parallel interface.” *Id.* But as I explain below, either option would have been an obvious design choice.

197. As explained in Sections 9.1.1.e and 9.1.1.f, Pugel teaches a digital tuner 130 (the claimed “DFE”). Pugel is silent about whether the digital data of the selected channels may be output via a serial interface or parallel interface from the digital tuner 130.

198. However, as the ’275 patent concedes, outputting a digital datastream via serial (claim 2) and parallel (claim 3) interfaces were “commonly known methods,” which I have been informed is Applicant Admitted Prior Art (AAPA).

Ex. 1201, 7:16-20; *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 the 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.

199. For example, the 7th edition of the Authoritative Dictionary of IEEE Standards Terms (“IEEE”) teaches 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, 10. 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.

200. Basic textbooks also teach “serial interface” and “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, *see also* 23, 28-29, 49-51, 79-80 (Figure 6.25).

201. 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 (Figure 6.25).

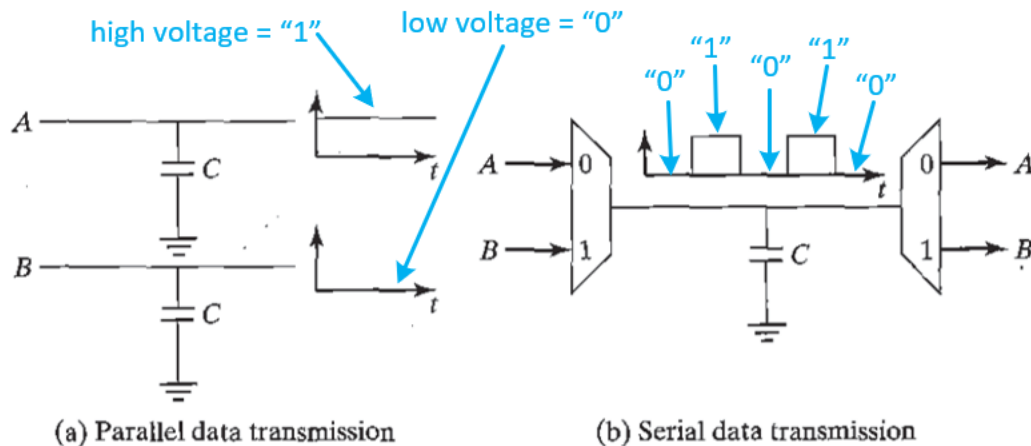


Figure 6-25 Parallel versus time-multiplexed data busses.

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

202. 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, *see also* 17, 27-28, 49-51. Pugel teaches that its ADCs output digital signals at varying resolutions with differing numbers of bits. Ex. 1224, [0036]. To output multiple bits (i.e., 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 (Figure 6.25).

203. Implementing Pugel’s data interface to a demodulator using either option would have been obvious as one of two design choices, because both were

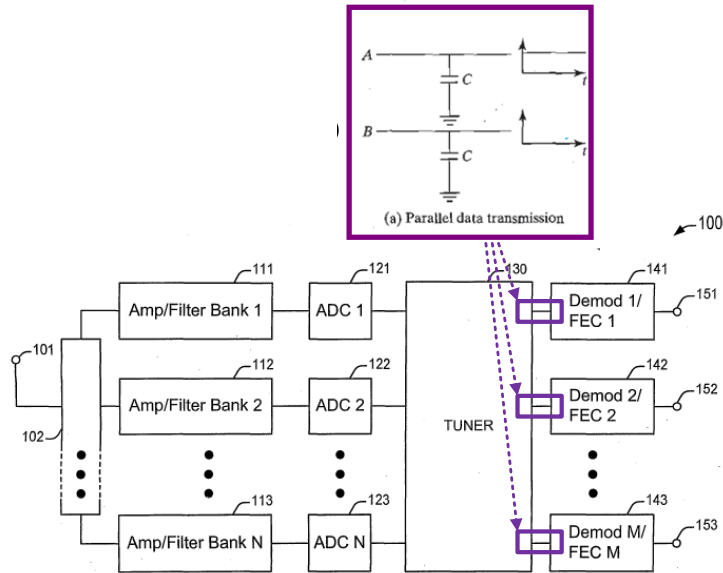
“commonly known methods,” as Applicant admits and as shown in the background art that demonstrates such interfaces were known and used by POSITAs in integrated circuit designs at the time. Ex. 1201, 7:16-20; Ex. 1214, 30:31-42, 31:15-22; Ex. 1215 at 5-6, 8; Ex. 1216 at 79-80; Ex. 1217 at 354-355; Ex. 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.

204. As another example, Chandrakasan, an article on “Ultra Low Power Digital Signal Processing,” teaches 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 teaches that time-multiplexing (i.e., 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 teaches selecting between serial and parallel interfaces for transmitting digital data between two points, both of which have advantages over each other, depending upon area and power constraints and the temporal correlation

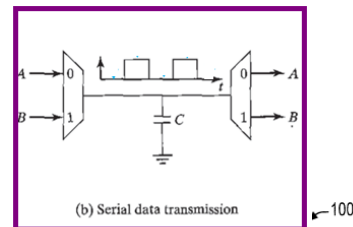
between the signals. *Id.*

205. It is my opinion that it would thus have been obvious to a POSITA to apply either parallel data or serial data communication as taught by Chandrakasan to the interconnection between Pugel's digital tuner 130 and demodulator circuits 141-143. Ex. 1224, [0038]-[0041], [0045]-[0046]; Ex. 1217 at 354-356.

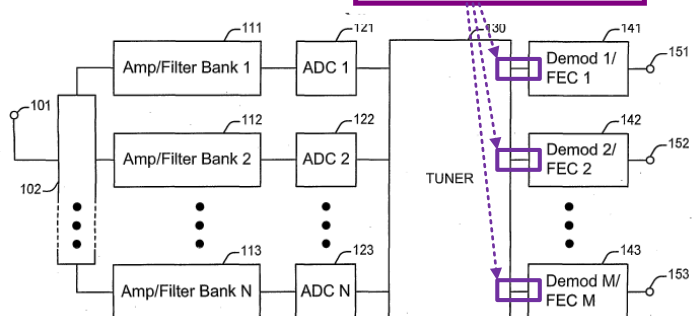
206. As such, the modification of Pugel with Chandrakasan (illustrated below) that results in a serial interface (claim 2) or parallel interface (claim 3) between Pugel's digital tuner 130 and demodulator circuits 141-143 is nothing more than choosing from a finite number of identified and predictable 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 teaches 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.



Ex. 1216, Fig. 6.25(b)
(annotated)



Ex. 1224, Fig. 1
(annotated)



207. Thus, it is my opinion that the combination of Pugel and Chandrakasan discloses claims 2 and 3.

9.3.2. Dependent Claims 12 and 13

- a. [12] “The television receiver device of claim 11, wherein the DFE is operable to output the digital datastream via a serial interface.”
- b. [13] “The television receiver device of claim 11, wherein the DFE is operable to output the digital datastream via a parallel interface.”

208. It is my opinion that the combination of Pugel and Crols discloses “[t]he television receiver device of claim 11, wherein the DFE is operable to output the digital datastream via a serial interface,” as recited in claim 12, and “[t]he television receiver device of claim 11, wherein the DFE is operable to output the digital datastream via a parallel interface,” as recited in claim 13.

209. Claim 12 is substantially identical to claim 2 and is taught by the combination of Pugel and Chandrakasan for the same reasons set forth in connection with claim 2. *See* Section 9.3.1, *supra*. In particular, claim 12 merely recasts the performed step of claim 2 as the required functionality of the claimed “DFE.”

210. Claim 13 is substantially identical to claim 3 and is taught by the combination of Pugel and Chandrakasan for the same reasons set forth in connection with claim 3. *See* Section 9.3.1, *supra*. In particular, claim 13 merely recasts the performed step of claim 3 as the required functionality of the claimed “DFE.”

9.4. Pugel in view of Crols and Chandrakasan Renders Claims 2, 3, 12, and 13 Obvious (Ground E)

[2] “The method of claim 1, wherein the DFE outputs the digital datastream via a serial interface.”

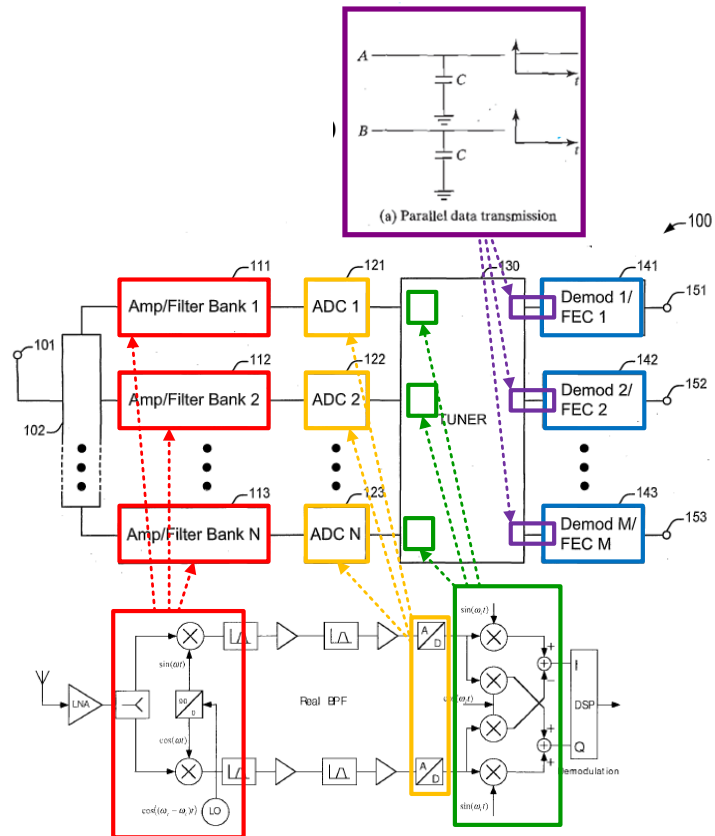
[3] “The method of claim 1, wherein the DFE outputs the digital datastream via a parallel interface.”

[12] “The television receiver device of claim 11, wherein the DFE is operable to output the digital datastream via a parallel interface.”

[13] “The television receiver device of claim 11, wherein the DFE is operable to output the digital datastream via a parallel interface.”

211. As I explain above in Section 9.2, Pugel in view of Crols teaches the base claims 1 and 11 from which claims 2, 3, 12, and 13 depend. And it is my opinion that for the same reasons set forth above in Section 9.3, Chandrakasan teaches the additional features of claims 2, 3, 12, and 13.

212. As discussed above in Section 9.2, modifying Pugel in view of Crols would have been obvious to a POSITA. It is my opinion that modifying the Pugel-Crols combination further in view of Chandrakasan would have also been obvious to a POSITA for the same rationales as discussed above in Section 9.3. For example, a POSITA would have understood that any one of the serial and parallel interfaces described by Chandrakasan that could have been implemented in the Pugel multichannel receiver circuit could also be implemented in the Pugel multichannel receiver circuit modified with the teachings of Crols (as illustrated below). Chandrakasan would modify the connections (**purple**) between Pugel’s digital tuner 130 and Pugel’s demodulator 141, 142, 143, and the POSITA would have understood that the additional modification based on Chandrakasan’s teachings would have presented no additional difficulties for Pugel’s multichannel receiver circuit or to the modification to Pugel’s multichannel receiver circuit based on Crols’ teachings.



213. Therefore, in my opinion, claims 2, 3, 12, and 13 are rendered obvious based on the combination of Pugel, Crols, and Chandrakasan.

10. CONCLUSION

214. 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: 12/3/2024

By: David B. Lett
David B. Lett

CLAIMS LISTING APPENDIX

U.S. Pat. No. 11,785,275

Designation	Claim Language
Claim 1	
[1A]	A method for operating a television receiver, comprising:
[1B]	receiving, by an input terminal, an input signal comprising broadcast channels, the broadcast channels comprising a plurality of desired channels and a plurality of undesired channels, wherein the plurality of desired channels are non-contiguous;
[1C]	processing, by a radio front end coupled to the input terminal, the input signal to generate a processed input signal;
[1D]	digitizing, by an analog-to-digital converter (ADC) coupled to the radio front end, the processed input signal to generate a digitized signal;
[1E]	selecting, by a digital frontend (DFE) coupled to the ADC, the plurality of desired channels from the digitized signal; and
[1F]	outputting, by the DFE, the selected plurality of desired channels to at least one demodulator as a digital datastream, wherein the demodulator extracts information encoded in the digital datastream.
Claim 2	
2	The method of claim 1, wherein the DFE outputs the digital datastream via a serial interface.
Claim 3	
3	The method of claim 1, wherein the DFE outputs the digital datastream via a parallel interface.
Claim 4	
[4A]	The method of claim 1, wherein the ADC comprises:
[4B]	a first ADC configured to generate a digital in-phase signal; and
[4C]	a second ADC configured to generate a digital quadrature signal.
Claim 5	
5	The method of claim 1, wherein the extracted information is stored for use in a digital video recorder (DVR).

Designation	Claim Language
Claim 6	
6	The method of claim 1, wherein the extracted information is output for a picture-in-picture display.
Claim 7	
7	The method of claim 1, wherein the plurality of desired channels comprises at least one television channel.
Claim 8	
8	The method of claim 1, wherein the plurality of undesired channels comprises at least one television channel.
Claim 9	
9	The method of claim 1, wherein the broadcast channels comprise satellite broadcast channels.
Claim 10	
10	The method of claim 1, wherein the broadcast channels comprise cable broadcast channels.
Claim 11	
[11A]	A television receiver device, comprising:
[11B]	an input terminal operable to receive an input signal comprising broadcast channels, the broadcast channels comprising a plurality of desired channels and a plurality of undesired channels, wherein the plurality of desired channels are non-contiguous;
[11C]	a radio front end, coupled to the input terminal, operable to process the input signal;
[11D]	an analog-to-digital converter (ADC), coupled to the radio front end, operable to digitize the processed input signal to generate a digitized signal; and
[11E]	a digital frontend (DFE), coupled to the ADC, operable to select the plurality of desired channels from the digitized signal and
[11F]	output the selected plurality of desired channels to at least one demodulator as a digital datastream, wherein the demodulator is operable to extract information encoded in the digital datastream.
Claim 12	
12	The television receiver device of claim 11, wherein the DFE is operable to output the digital datastream via a serial interface.
Claim 13	

Designation	Claim Language
13	The television receiver device of claim 11, wherein the DFE is operable to output the digital datastream via a parallel interface.
Claim 14	
[14A]	The television receiver device of claim 11, wherein the ADC comprises:
[14B]	a first ADC configured to generate a digital in-phase signal; and
[14C]	a second ADC configured to generate a digital quadrature signal.
Claim 15	
15	The television receiver device of claim 11, wherein the extracted information is stored for use in a digital video recorder (DVR).
Claim 16	
16	The television receiver device of claim 11, wherein the extracted information is output for a picture-in-picture display.
Claim 17	
17	The television receiver device of claim 11, wherein the plurality of desired channels comprises at least one television channel.
Claim 18	
18	The television receiver device of claim 11, wherein the plurality of undesired channels comprises at least one television channel.
Claim 19	
19	The television receiver device of claim 11, wherein the broadcast channels comprise satellite broadcast channels.
Claim 20	
20	The television receiver device of claim 11, wherein the broadcast channels comprise cable broadcast channels.