

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. 9,210,362
Filing Date: February 5, 2015
Issue Date: December 8, 2015
Title: WIDEBAND TUNER ARCHITECTURE

Inter Partes Review No.: IPR2024-00434

**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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EXHIBITS

Ex. 1201:	U.S. Patent No. 9,210,362 (“the ’362 Patent”)
Ex. 1202:	Expert Declaration of David B. Lett
Ex. 1203:	Curriculum Vitae of David B. Lett
Ex. 1204:	Certified Prosecution History of the ’362 Patent
Ex. 1205:	Certified Prosecution History of U.S. Patent No. 9,100,622
Ex. 1206:	Certified Prosecution History of U.S. Patent No. 8,526,898
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:	U.S. Pub. No. 2006/0233147 (“Karabinis”)
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 February 2, 2024) for Ex Parte Reexamination No. 90/019,255
- Ex. 1223: Certified Prosecution History of U.S. Patent No. 9,100,363
- Ex. 1224: International Pub. No. 2007/145637 (“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 U.S. Pat. 9,210,362
- Ex. 1228: Reserved
- Ex. 1229: Entropic Communications, LLC v. Charter Communications, Inc., No. 2:22-cv-00125-JRG (E.D. Tex. June 26, 2023) (Claim Construction Memorandum Opinion and Order)
- Ex. 1230: U.S. Pub. No. 2006/0029170 (“Jensen ’170”)
- Ex. 1231: Reserved
- Ex. 1232: Reserved
- Ex. 1233: Excerpts of W. Ciciora, J. Farmer, D. Large, and M. Adams, “Modern Cable Television Technology: Video, Voice, and Data Communications” (2nd ed. 2004) (“Ciciora”)
- Ex. 1234: Excerpts of J. Crols and M. Steyaert, “CMOS Wireless Transceiver Design” (1997)
- Ex. 1235: U.S. Patent No. 7,340,230 (“Khoini-Poorfard”)
- Ex. 1236: U.S. Pub. No. 2003/0217362 (“Summers”)
- Ex. 1237: U.S. Pub. No. 2006/0256799 (“Eng”)
- Ex. 1238: U.S. Pub. No. 2006/008335 (“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) (“Buchanan”)
Ex. 1249:	U.S. Patent No. 7,079,528 (“Ziegler”)
Ex. 1250:	Excerpts of “Software Defined Radio: Enabling Technologies” (Walter H.W. Tuttlebee ed., 2003)
Ex. 1251-1272:	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”)

I. MANDATORY NOTICES

Real Parties in Interest (37 C.F.R. § 42.8(b)(1))

The real parties-in-interest for this petition are (i) Comcast Corporation, (ii) Comcast Cable Communications, LLC, and (iii) Comcast Cable Communications Management, LLC. No unnamed entity is funding, controlling, or directing this Petition for *inter partes* review (IPR) of U.S. Patent No. 9,210,362 (“the ’362 patent”), or otherwise has an opportunity to control or direct this Petition or Petitioner’s participation in any resulting IPR.

Related Matters (37 C.F.R. § 42.8(b)(2))

Office Proceedings

This is the third of three petitions for *inter partes* review filed by Petitioner against the ’362 Patent. Petitioner is also filing petitions for *inter partes* review against related U.S. Patent Nos. 11,381,866 and 11,399,206.

According to the Office’s records, a request for *ex parte* reexamination (Control No. 90/019,255) was filed on September 20, 2023, for claims 1 and 11 of the ’362 Patent, and an Order granting the request was issued on November 1, 2023. The requestor of the *ex parte* reexamination, Unified Patents, LLC, is not a real party-in-interest for this petition.

No other Office proceedings (e.g., *inter partes* review, post-grant review, or covered business method) have been filed against the ’362 Patent.

Litigation matters

The '362 Patent has been asserted in *Entropic Communications, LLC v. Comcast Corporation*, No. 2:23-cv-01050 (C.D. Cal. filed Feb. 10, 2023) and *Entropic Communications, LLC v. Cox Communications, Inc.*, No. 2-23-cv-01049 (C.D. Cal. filed Feb. 10, 2023) (collectively, “CA litigation”). These cases have been consolidated and remain pending. The '362 Patent was also asserted in *Entropic Communications, LLC v. Charter Communications, Inc.*, No. 2:22-cv-00125-JRG (E.D. Tex. filed Apr. 27, 2022) (“TX litigation”), which was dismissed on December 10, 2023.

Continuity

According to Office records, the '362 Patent is a continuation of U.S. Pat. App. No. 13/962,871, filed August 8, 2013 (issued as U.S. Pat. No. 9,100,622) which is a continuation of U.S. Pat. App. No. 12/762,900, filed April 19, 2010 (issued as U.S. Pat. No. 8,526,898), which claims the benefit of U.S. Provisional App. No. 61/170,526, filed April 17, 2009. The '362 Patent is part of a family that includes thirteen additional patents or applications that purport to claim priority, via a chain of continuation applications, from App. No. 12/762,900. A family tree is included as Ex. 1227.

Lead and Back-Up Counsel (37 C.F.R. § 42.8(b)(3))

Petitioner designates counsel listed below. A power of attorney for counsel is being concurrently filed.

<u>Lead Counsel</u> Frederic M. Meeker (Reg. No. 35,282) fmeeker@bannerwitcoff.com BANNER & WITCOFF, LTD. 1100 13th Street, NW Suite 1200 Washington, DC 20005 Tel: (202) 824-3000 Fax: (202) 824-3001	<u>Back-Up Counsel</u> Joshua Davenport (Reg. No. 72,756) jdavenport@bannerwitcoff.com Michael CuvIELLO (Reg. No. 59,255) mcuviello@bannerwitcoff.com Wayne Porter (Reg. No. 42,084) wporter@bannerwitcoff.com Paul Qualey (Reg. No. 45,027) pqqualey@bannerwitcoff.com BANNER & WITCOFF, LTD. 1100 13th Street, NW Suite 1200 Washington, DC 20005 Tel: (202) 824-3000 Fax: (202) 824-3001
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Please address all correspondence to counsel at the address shown above.

Petitioner consents to electronic service by email at the above email addresses and at ComcastIPRService@bannerwitcoff.com.

II. INTRODUCTION

Comcast Cable Communications, LLC (“Petitioner”) petitions for *inter partes* review and cancellation of claims 1-20 of U.S. Patent No. 9,210,362 (“the ’362 Patent”) (Ex. 1201).

III. SUMMARY OF ARGUMENT

The ’362 Patent generally claims wideband receiver systems and corresponding methods of operating such systems to select and output a plurality of television channels. The system includes a mixer module that downconverts a plurality of frequencies that include desired and undesired television channels, a wideband analog-to-digital converter (ADC) module that digitizes the plurality of frequencies, and digital circuitry that selects the desired channels from the digitized frequencies and outputs the selected channels as a digital data stream to a demodulator.

The ’362 Patent admits that its disclosure of a mixer module, an ADC module, and other elements on an analog side of wideband receiver system “is similar to conventional tuners.” Ex. 1207, p. 5; Ex. 1201, 1:5-11. But the alleged inventive concept—combining conventional tuner features with selection of desired channels from digitized frequencies and output of the selected channels as a digital data stream—was well known. These features, and additional features of the ’362 Patent

claims, are disclosed or rendered obvious by the prior art, e.g., Pugel (Ex. 1224) and other references relied on herein. Ex. 1202, ¶¶ 99-224.

Accordingly, as set forth below, claims 1-20 of the '362 Patent are unpatentable and should be cancelled.

IV. OVERVIEW OF THE '362 PATENT

A. Brief Description

The '362 Patent describes a wideband receiver system 200 “capable of receiving multiple radio frequency channels located in a broad radio frequency spectrum.” Ex. 1201, 1:15-18; Ex. 1202, ¶ 37. The system purports to group 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, 1:18-23, 2:24-27; Ex. 1202, ¶ 38. According to the '362 Patent, a receiver is “wideband” if it is “designed to concurrently receive several TV channels.” *Id.*, 1:24-27. Figure 2 is a “schematic block diagram of a wideband receiver system 200.” *Id.*, 4:16-18; Ex. 1202, ¶ 38.

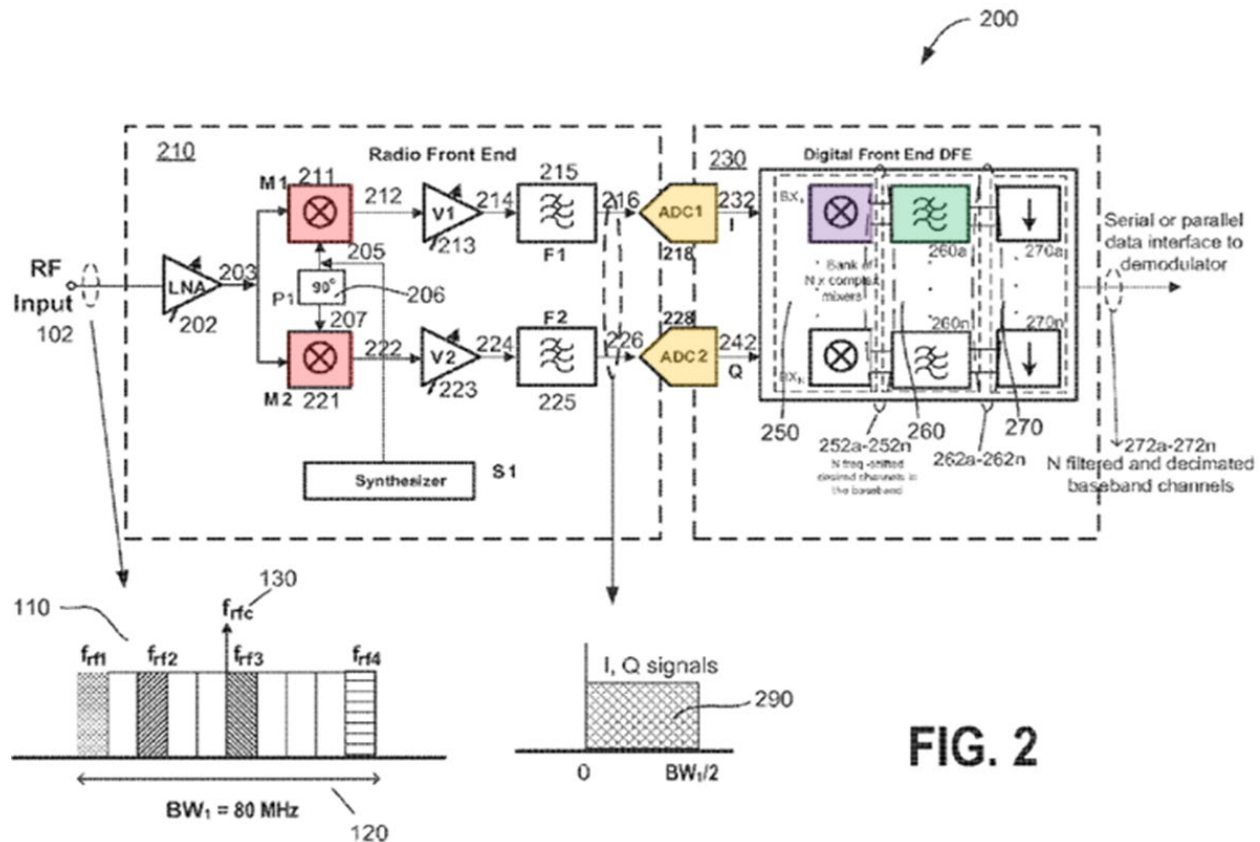


FIG. 2

Ex. 1201, Fig. 2 (annotated)

The wideband receiver system 200 receives both desired and undesired television channels as frequencies dispersed within a frequency bandwidth BW_1 . Ex. 1201, Abstract, 4:18-33; Ex. 1202, ¶ 39. Mixers “M1” and “M2” (red) “generate an in-phase signal 212 and a quadrature signal 222 that have a phase shift of 90 degrees between them” and that have been downconverted to “the baseband or low intermediate frequency (IF) band.” Ex. 1201, 4:40-46, 2:45-49; *see also* 1:60-62; . “[U]nwanted frequency components” are filtered from the in-phase signal and the quadrature signal by respective filters 215 and 225. *Id.*, 4:64-5:3. The filtered signals are then individually digitalized 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. *Id.*, 2:49-51, 5:28-31. U.S. Provisional App. No. 61/170,526 (“’526 provisional”), which the ’362 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, p. 4; Ex. 1201, 1:5-11; Ex. 1202, ¶ 39.

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, 5:31-35; Ex. 1202, ¶ 40. “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, 5:49-52; Ex. 1202, ¶ 40. An associated filter module of filters 260a-260n (one of which is shown above in **green**) filters the frequency-shifted desired channel. Ex. 1201, 5:52-54; Ex. 1202, ¶ 40.

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, 5:62-64; Ex. 1202, ¶ 41.

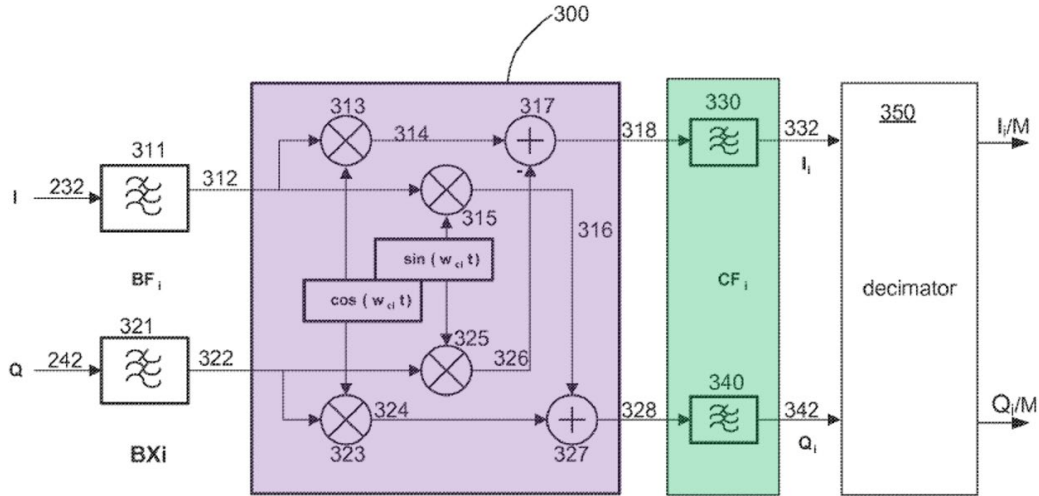


FIG. 3

Ex. 1201, Fig. 3 (annotated)

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, 6:7-17; Ex. 1202, ¶ 42. “[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 [so] 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, 6:17-34; Ex. 1202, ¶ 42. The baseband signals 318 and 328 are filtered by filters 330 and 340 (**green**) that are “one of the filters 260a-n” shown in Figure 2. Ex. 1201, 6:43-45; Ex. 1202, ¶ 42.

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, 6:55-58; Ex. 1202, ¶ 43. The ’362 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, but simply concedes that it is done “according to commonly known methods.” Ex. 1201, 6:55-58; Ex. 1202, ¶ 43.

B. Prosecution History

U.S. Application No. 14/614,543 (“the ’543 application”), which became the ’362 Patent, was filed on February 5, 2015, with 20 claims including independent claims 1 and 11. Ex. 1204, pp. 32-35; Ex. 1202, ¶ 44. An Office Action mailed on May 14, 2015, rejected all claims on the basis of nonstatutory double patenting over claims 1-27 of U.S. Patent No. 8,526,898, and Applicant filed a terminal disclaimer on May 15, 2015. Ex. 1204, pp. 75-79, 90-99; Ex. 1202, ¶ 44. A Notice of Allowance was mailed on August 7, 2015, and stated that the prior art failed to describe a wideband receiver system with “digital circuitry configured to select a plurality of desired television channels from the digitized plurality of frequencies and output said plurality of television channels to a demodulator as a digital datastream.” Ex. 1204, pp. 102-108; Ex. 1202, ¶ 44. Applicant filed a Request for Continued Examination (RCE) and an Information Disclosure Statement (IDS) on September 11, 2015. Ex. 1204, pp. 115-140; Ex. 1202, ¶ 44. A second Notice of Allowance

mailed on October 5, 2015, stated that the IDS “did not present prior art that comprise [*sic*] the inventive claimed subject matter.” Ex. 1204, pp. 141-147; Ex. 1202, ¶ 44. In an October 26, 2015, Amendment After Notice of Allowance, Applicant amended dependent claims 5-7, 10, 16-17, and 20 to “merely clarify the antecedent basis for certain claim terms.” Ex. 1204, pp. 160-165. The application issued as the ’362 Patent on December 8, 2015. Ex. 1201, pp. 1-2; Ex. 1202, ¶ 44.

None of Pugel, Crols, Chandrakasan, Karabinis, or Jensen ’170 was considered during the prosecution of the ’543 application. Ex. 1201, pp. 1-2; Ex. 1204, pp. 80-82, 153-156; Ex. 1202, ¶ 45.

In response to a request filed by third-party Unified Patents, LLC on September 20, 2023, the Office ordered reexamination (Control No. 90/019,255) of independent claims 1 and 11 of the ’362 Patent on November 1, 2023. Ex. 1222, pp. 732-743; Ex. 1202, ¶ 46. The reexamination is currently pending. Pugel has been cited in reexamination, but Crols, Chandrakasan, Karabinis, or Jensen ’170 have not. Ex. 1222, p. 412, 415-453; Ex. 1202, ¶ 46.

C. Earliest Priority Date for the Claims

The earliest possible effective filing date for the claims of the ’362 Patent is April 17, 2009, the filing date of the ’526 provisional to which the ’362 Patent claims benefit. Ex. 1202, ¶ 48. Each of the references relied on herein is prior art to that date. Ex. 1202, ¶ 48. The earliest possible priority date for claims 9 and 19 is April

19, 2010, the filing date of Application No. 12/762,900, as the '526 provisional is silent regarding a “finite impulse response filter.” Ex. 1207, pp. 3-7; Ex. 1202, ¶ 48.

V. OVERVIEW OF PRIOR ART

A. Pugel

Pugel (Ex. 1224) is a PCT Application published on December 21, 2007. Ex. 1224, p. 1. As the publication date is more than a year prior to the earliest filing date of the '362 Patent, Pugel is prior art under pre-AIA 35 U.S.C. § 102(b). Ex. 1202, ¶ 79. Pugel was not considered during the prosecution of the '362 Patent. Ex. 1201, pp. 1-2; Ex. 1202, ¶ 79.

Pugel describes a “digital television receiver capable of simultaneously receiving a plurality of channels... suitable for use with conventional cable television delivery systems.” Ex. 1224, [0008]; Ex. 1202, ¶ 80. Pugel's Figure 1 shows a multichannel receiver circuit 100 annotated with colors referenced in the discussion below. Ex. 1224, [0022]-[0028], Fig. 1; Ex. 1202, ¶ 80.

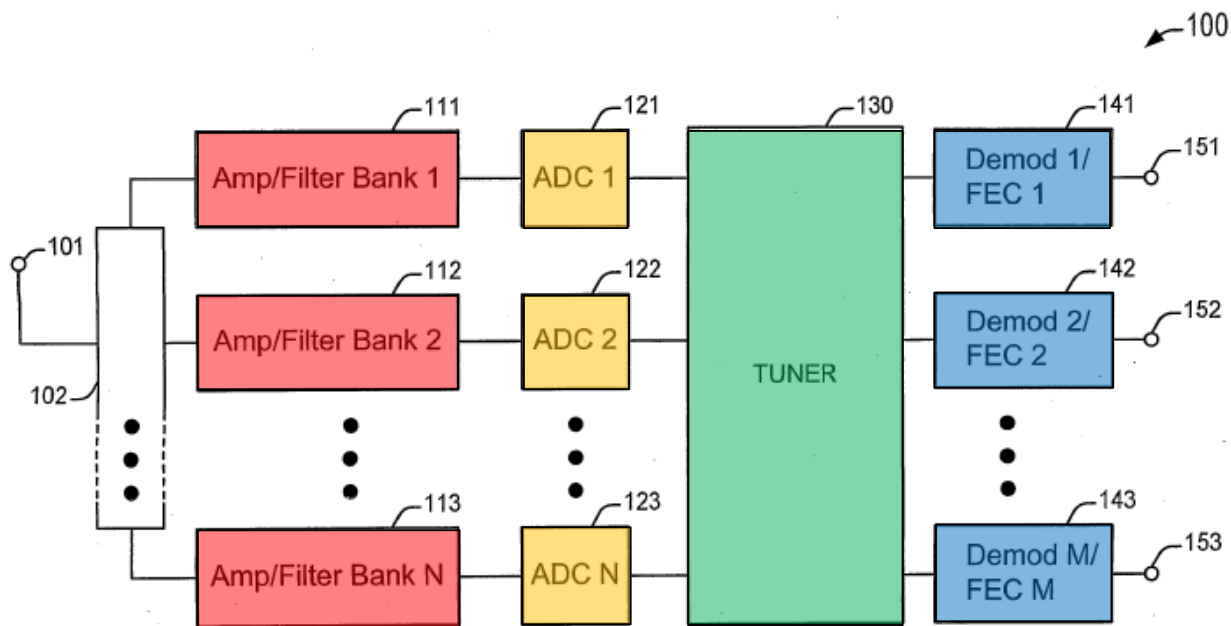


FIG. 1

Ex. 1224, Fig. 1 (annotated)

The receiver circuit 100 receives a multichannel analog RF input signal, such as a signal used in a conventional cable television delivery system, received at input coupler 101. Ex. 1224, [0008], [0024]; Ex. 1202, ¶ 81. That signal is wideband, as it may comprise multiple channels. Ex. 1224, [0009], [0020]-[0023]; Ex. 1202, ¶ 81. The signal can be optionally split. Ex. 1224, [0024]-[0025]; Ex. 1202, ¶ 81. 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]; Ex. 1202, ¶ 81.

The amplifier-filter banks (**red**) “segregate[] the multichannel analog input signal into a plurality of separate analog signals of differing frequency ranges.” Ex. 1224, [0024], [0028]-[0032], [0043]; Ex. 1202, ¶ 82. 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]; Ex. 1202, ¶ 82. Undersampling, as described in Pugel, is more economical because it reduces the need to supply ADCs supporting high-frequency sampling. Ex. 1224, [0034]; Ex. 1202, ¶ 81.

The undersampled signals are then converted to digital form in analog-to-digital converters 121-123 (**gold**) “sufficient for satisfactorily processing digital television signals and associated signals intended for end users in a conventional cable television broadcast system.” Ex. 1224, [0036], [0033]-[0037], [0044]-[0045]; Ex. 1202, ¶ 83. The digital signals are received by a digital tuner (**green**) such that “a selected set of digital cable television channels” may be demultiplexed from the digital signals. Ex. 1224, [0038], [0037]-[0039], [0045]; Ex. 1202, ¶ 83. Those demultiplexed channels may then be outputted to one or more demodulators 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]; Ex. 1202, ¶ 83.

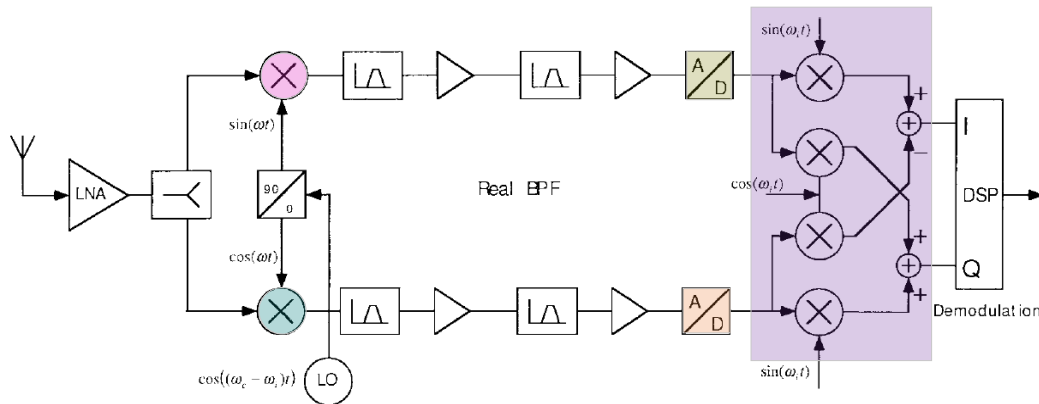
Pugel is in the same field of endeavor as the '362 Patent, and thus is analogous art. *Netflix, Inc. v. DivX, LLC*, 80 F.4th 1352, 1358 (Fed. Cir. 2023); Ex. 1202, ¶ 84. For example, the '362 Patent “relates to wideband receiver systems and methods having a wideband receiver that is capable of receiving multiple radio frequency channels located in a broad radio frequency spectrum.” Ex. 1201, 1:15-18; Ex. 1202, ¶ 84. Similarly, Pugel relates to a system and method for receiving a wideband radio frequency signal comprising multiple channels. Ex. 1224, Abstract, [0008]-[0013], [0023]-[0024]; Ex. 1202, ¶ 84. Pugel is also reasonably pertinent to problems with which the '362 is concerned, and is also analogous art on that basis. *Netflix, Inc.*, 80 F.4th at 1358; Ex. 1202, ¶ 84. Pugel describes filtering signals for input to an ADC in the same way as is described by the '362 Patent. *Compare* Ex. 1201, 4:64-5:61, Fig. 3 *with* Ex. 1224, [0029]-[0032], [0042]-[0043], Fig. 2; Ex. 1202, ¶ 84.

B. Crols

Crols (Ex. 1225) is a Non-Patent Literature published in March 1998. Crols was publicly available as of April 3, 1998. Ex. 1273, 44-50, 52. Thus, Crols is prior art under pre-AIA 35 U.S.C. § 102(b). Ex. 1202, ¶ 85. Crols was not considered during the prosecution of the '362 Patent. Ex. 1201, pp. 1-2; Ex. 1202, ¶ 85.

Crols describes various topologies for implementing intermediate frequency receivers in a telecommunication environment. Ex. 1225, p. 269; Ex. 1202, ¶ 86. Crols discusses that IF receivers may create unwanted signals (e.g., a mirror

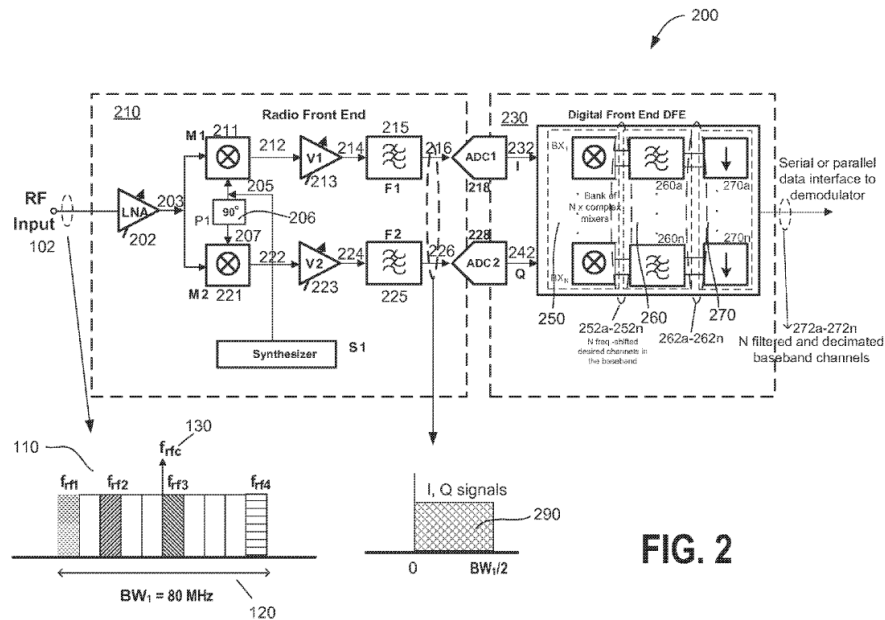
frequency) that must be suppressed in a system before use. Ex. 1225, p. 270; Ex. 1202, ¶ 86. Further, the paper analyzes techniques to perform downconversion utilizing mixers. Ex. 1225, pp. 273-274; Ex. 1202, ¶ 86.



Ex. 1225, Fig. 22 (annotated)

In particular, Crols discusses how RF receivers can avoid the mirror frequency problem during the downconversion of analog RF signals to an intermediate frequency by downconverting the signals once with a first mixer (**pink**) using a sine signal and again with a second mixer (**teal**) using a cosine signal as an input. Ex. 1225, p. 271; Ex. 1202, ¶ 87. Figure 22 of Crols (reproduced above) shows such an example RF receiver architecture. Ex. 1225, p. 281; Ex. 1202, ¶ 87. The outputs of the two mixers are digitized separately by two analog-to-digital converters (**olive** and **orange**). Ex. 1225, pp. 280-281; Ex. 1202, ¶ 87. The digitized signals 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, pp. 280-281; Ex. 1202, ¶ 87.

Crols is reasonably pertinent to problems with which the '362 Patent is concerned, and is analogous art to the '362 Patent on at least that basis. *Netflix, Inc.*, 80 F.4th at 1358; Ex. 1202, ¶ 88. For example, the '362 Patent indicates a circuit wherein an RF signal is sent through an amplifier, and then I and Q signals are mixed prior to being sent through an ADC. Ex. 1201, 4:16-5:61, Fig. 2; Ex. 1202, ¶ 88.



Ex. 1201, Fig. 2

Similarly, Crols presents circuit diagrams depicting complex bandpass filters consistent with the '362 Patent's analog circuit topologies:

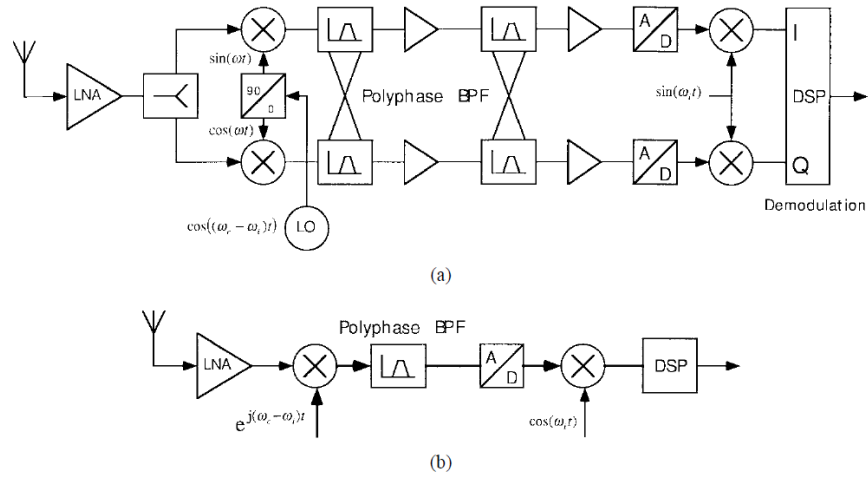


Fig. 21. The topology of a low-IF receiver which uses a complex bandpass filter in the LF part. (a) Full notation and (b) compact notation.

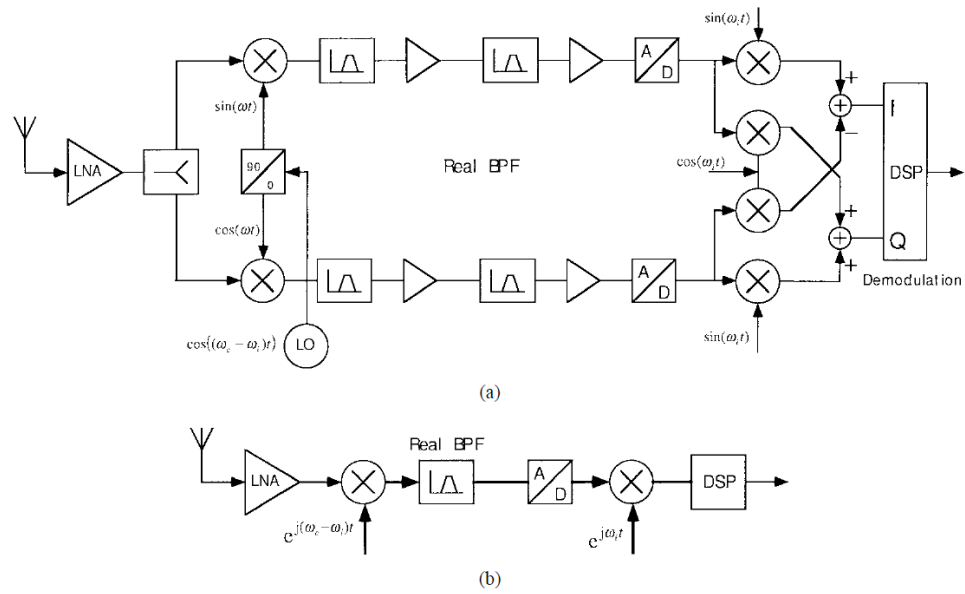


Fig. 22. The topology of a low-IF receiver which uses real filters in the LF part. (a) Full notation and (b) compact notation.

Ex. 1225, Figs. 21-22

Both techniques show ways to suppress unwanted signals as part of downconversion to IF prior to digital processing, providing example implementations for a POSITA looking to build systems in real-world applications. Ex. 1225, pp. 279-280; Ex. 1201, 4:4-5:12; Ex. 1202, ¶ 89.

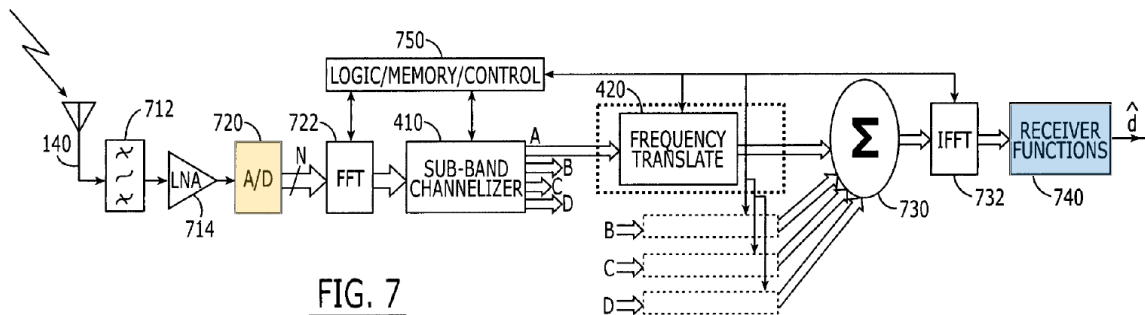
C. Chandrakasan

Chandrakasan (Ex. 1217) is a Non-Patent Literature published in January 1996. Chandrakasan was publicly available as of April 3, 1998. Ex. 1273, 35-39, 52; Ex. 1202, ¶ 90. Thus, Chandrakasan is prior art under pre-AIA 35 U.S.C. § 102(b). Ex. 1202, ¶ 90. Chandrakasan was not considered during the prosecution of the '362 Patent. Ex. 1201, pp. 1-2; Ex. 1202, ¶ 90. Chandrakasan describes the trade-offs between selecting serial time-multiplex architecture and parallel architecture to implement digital signal processing functions. Ex. 1217, pp. 354-356; Ex. 1202, ¶ 90. Parallel architectures comprise “one to one correspondence between the operations on the signal flow graph” and “requires a small or no controller.” Ex. 1217, pp. 354-355; Ex. 1202, ¶ 90. 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, p. 355; Ex. 1202, ¶ 90.

Chandrakasan is reasonably pertinent to problems with which the '362 Patent is concerned, and is analogous art to the '362 Patent on at least that basis. *Netflix, Inc.*, 80 F.4th at 1358; Ex. 1202, ¶ 91. 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, p. 352; Ex. 1201, 6:55-6:64; Ex. 1202, ¶ 91.

D. Karabinis

Karabinis (Ex. 1220) is a U.S. Published Application published on October 19, 2006, and is prior art under pre-AIA 35 U.S.C. § 102(b). Ex. 1202, ¶ 92. Karabinis was not considered during the prosecution of the '362 Patent. Ex. 1201, pp. 1-2; Ex. 1202, ¶ 92.



Ex. 1220, Fig. 7 (annotated)

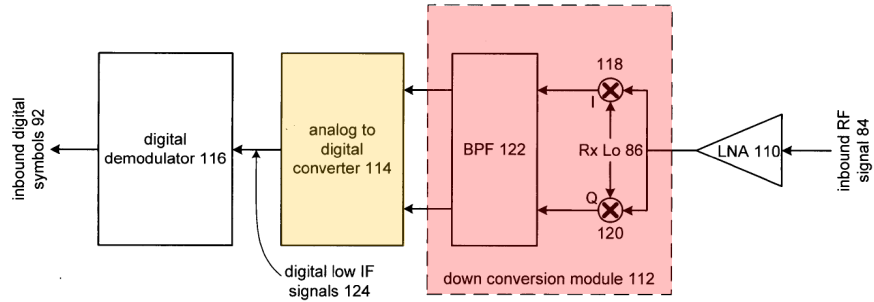
Karabinis describes sending data over a plurality of non-contiguous frequency bands that are individually too narrow to carry the data. Ex. 1220, [0010], [0037]; Ex. 1202, ¶ 93. Therefore, the receiver described in Figure 7 of Karabinis is configured to receive the non-contiguous frequency bands and selectively frequency shift the frequency bands to form a contiguous frequency band. Ex. 1220, [0017], [0042]; Ex. 1202, ¶ 93. The receiver comprises an analog-to-digital converter 720 (gold) and a Fast Fourier Transformer 722 that act as a digital (discrete-time) time-domain to frequency-domain converter. Ex. 1220, [0015], [0047]; Ex. 1202, ¶ 93. A sub-band channelizer 410 is configured to isolate the non-contiguous frequency bands, and the frequency translator 420 is configured to translate isolated bands into

a contiguous frequency band. Ex. 1220, [0017], [0049]; Ex. 1202, ¶ 93. An Inverse Fast Fourier Transformer 732 is configured to convert the contiguous frequency band back into the time domain. Ex. 1220, [0018], [0049]; Ex. 1202, ¶ 93. The receiver functions 740 (blue) include a demodulator 740 configured to demodulate the contiguous frequency band. Ex. 1220, [0017], [0049]; Ex. 1202, ¶ 93.

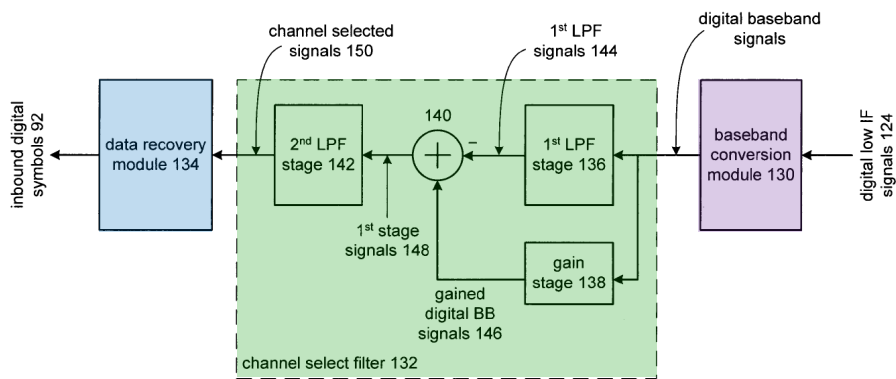
Karabinis is reasonably pertinent to problems with which the '362 is concerned, and is analogous art to the '362 Patent on at least that basis. *Netflix, Inc.*, 80 F.4th at 1358; Ex. 1202, ¶ 94. Karabinis presents known methods for handling data transmission over multiple frequency bands, similar to the '362 Patent, and a POSITA would turn to Karabinis when looking to build systems in real-world applications. Ex. 1220, [0017]-[0018], [0037]-[0038], [0042]-[0043], [0047]-[0049]; Ex. 1201, 2:31-3:50; Ex. 1202, ¶ 94.

E. Jensen '170

Jensen '170 (Ex. 1230) is a U.S. Published Application published on February 9, 2006, and is prior art under pre-AIA 35 U.S.C. § 102(b). Ex. 1202, ¶ 95. Jensen '170 was not considered during the prosecution of the '362 Patent. Ex. 1201, pp. 1-2; Ex. 1202, ¶ 95.



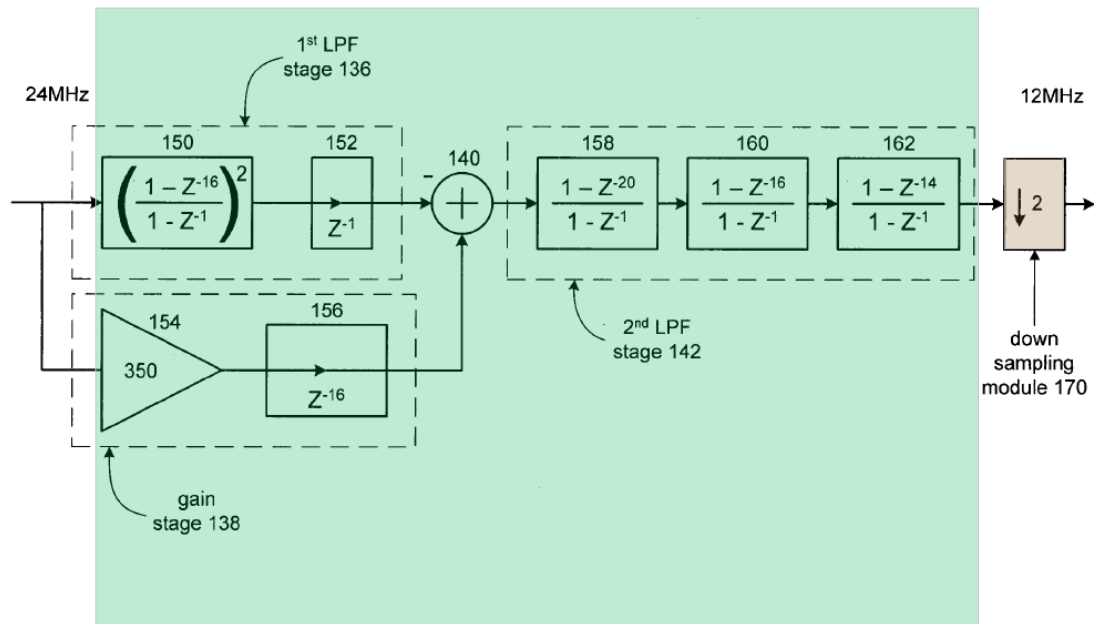
Ex. 1230, Fig. 8 (annotated)



Ex. 1230, Fig. 9 (annotated)

Jensen '170 describes a radio receiver (illustrated above) that comprises a down-conversion module 112 (**red**), an analog to digital converter 124 (**gold**), a baseband conversion module 130 (**purple**), a channel select filter 132 (**green**), and a data recovery module 134 (**blue**). Ex. 1230, [0060]-[0068], Figs. 8, 9; Ex. 1202, ¶ 96. The down-conversion module 112 includes mixers 118 and 120 that mix the inbound RF signals 84 with in-phase (I) and quadrature (Q) components of a receiver local oscillator to produce in-phase intermediate frequency (IF) mixed signals and quadrature IF mixed signals. Ex. 1230, [0060]-[0061]; Ex. 1202, ¶ 96.

The analog-to-digital converter 114 converts the in-phase IF mixed signals and quadrature IF mixed signals to digital IF signals 124. Ex. 1230, [0062]; Ex. 1202, ¶ 96. The baseband conversion module 130 converts the digital IF signals 124 into digital baseband signals. Ex. 1230, [0065]; Ex. 1202, ¶ 96. The channel-select filter 132 includes a first low pass filter stage 136, a gain stage 138, a subtraction module 140, and a second low pass filter stage 142, which in combination (green) filters channel selected signals 150 from the digital baseband signals. Ex. 1230, [0008]-[0009], [0017], [0060], [0064]-[0068]; Ex. 1202, ¶ 96. The first low pass filter stage 136 and the second low pass filter stage 138 are implemented with finite impulse filters. Ex. 1230, [0010], [0071]-[0073]; Ex. 1202, ¶ 96. The data recovery module 134 converts the channel selected signals 150 into inbound digital symbols 92. Ex. 1230, [0068]; Ex. 1202, ¶ 96.



Ex. 1230, Fig. 15 (annotated)

Jensen '170 further describes that the channel select filter 132 may further include a down-sampling module 170 (**brown**), which reduces the sampling rate of the signals of the selected channel to produce down-sampled signals for the data recovery module 134 of the RF receiver. Ex. 1230, [0074]-[0075]; Ex. 1202, ¶ 97.

Jensen '170 is reasonably pertinent to problems with which the '362 Patent is concerned, and is analogous art to the '362 Patent on at least that basis. *Netflix, Inc.*, 80 F.4th at 1358; Ex. 1202, ¶ 98. Jensen '170 presents known systems for implementing demodulators and decimators for digital channel selection, similar to the '362 Patent, and a POSITA would turn to Jensen '170 when looking to build systems in real-world applications. Ex. 1230, [0060]-[0075], [0087]-[0090]; Ex. 1201, 6:65-8:9, 9:11-10:55; Ex. 1202, ¶ 98.

VI. IDENTIFICATION OF CHALLENGE PURSUANT TO 37 C.F.R. § 42.104(b)

A. Claims for Which Review is Requested and Grounds on Which Challenge Is Based

Petitioner requests review of claims 1-20 on the following grounds.

Ground	References	Basis	Claims Challenged
A	Pugel-Crols	§103	1, 4-6, 11, 14-16

B	Pugel-Crols-Chandrakasan	§103	2, 3, 12, 13
C	Pugel-Crols-Karabinis	§103	7, 17
D	Pugel-Crols-Jensen '170	§103	8-10, 18-20

None of the prior art listed above was before the Examiner during prosecution of the '362 Patent.

A declaration of David B. Lett in support of this petition includes, e.g., a discussion of Mr. Lett's background, the '362 patent, and the prior art, as well as his opinions and an explanation of the bases for those opinions. Ex. 1202, ¶¶ 1-225. As set forth in his attached declaration, David B. Lett at least meets the level of skill of a POSITA. *Id.* ¶¶ 4-16.

B. 314(a) Discretion Does Not Apply

The Fintiv factors as set forth in the Director's June 21, 2022, Guidance Memorandum do not warrant discretionary denial.

Factor one appears neutral. Petitioner has filed IPR petitions challenging all eight patents asserted in the District Court. If trial is instituted, and the case is not dismissed, then Petitioner expects to request a stay, as decisions in Petitioner's favor would resolve the dispute in its entirety.

Factor two favors institution. Petitioner has filed a Motion to Dismiss, Patent Owner has filed an Amended Complaint, and Petitioner will renew its Motion to

Dismiss the operative complaint. No schedule beyond claim construction has been entered, and no trial date set.

Factor three favors institution. To date, the investment by the District Court has been limited to considering motions to dismiss on the pleadings.

Factor four strongly favors institution. The petition challenges all claims in the '362 patent while only claims 11 and 12 are asserted in the District Court.

Factor five does not warrant denial as Petitioner is a defendant in the District Court case.

Factor six favors institution. Petitioner presents compelling unpatentability challenges that merit institution, relying on entirely different prior art than that considered during prosecution or combinations argued in the pending *ex parte* reexamination.

C. 325(d) and 315(d) Discretion Does Not Apply

Considering the two-part framework discussed in *Advanced Bionics, LLC v. Med-El Elektromedizinische Geräte GMBH*, No. IPR2019-01469, Pap. 6, *8-9 (PTAB Feb. 13, 2020), the Board should not exercise its §§325(d) or 315(d) discretion to deny institution. The grounds raised by this Petition are not the same or substantially the same as the art and arguments raised during prosecution, and to the extent that they are, the Examiner erred in a manner material to the patentability of

the challenged claims by failing to find and consider all of the relevant prior art, including Pugel, that teaches Element [1D]. Ex. 1204 at 107.

Further, while Pugel is in consideration in reexamination, Pugel was not applied in combination with Crols or the other secondary references as presented herein, and this petition challenges 18 claims not challenged by that reexamination. Ex. 1222, pp. 2, 119-170. Petitioner intends to request a stay in that reexamination.

D. Level of Ordinary Skill

A person of ordinary skill in the art (a “POSITA”) at the time of the alleged invention 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. Additional education may substitute for professional experience, and significant work experience may substitute for formal education.

E. Claim Construction

All claim terms herein should be given their ordinary and customary meaning to a POSITA, consistent with the prosecution history, as they would be given in a civil action under 35 U.S.C. § 282(b). 37 C.F.R. § 42.100(b). Ex. 1202, ¶¶ 33-36.

1. “digitizing,” “selecting,” “outputting”

In the TX litigation, the District Court construed claim 11 as requiring that the “‘digitizing ...’ step must be performed before the ‘selecting ...’ step, and the

‘selecting ...’ step must be performed before the ‘outputting ...’ step,” but with “[n]o other order of steps” required. Ex. 1229, p. 52.

2. “wideband” and “wideband analog-to-digital converter (ADC) module”

In the TX litigation, Patent Owner agreed that “wideband analog-to-digital converter (ADC) module” should be given its plain and ordinary meaning. Ex. 1229, pp. 7-8. Consistent with its ordinary meaning, the ’362 patent defines “wideband” as a band that carries multiple channels. For example, the ’362 patent states that a receiver is “wideband” if it is “designed to concurrently receive several TV channels.” Ex. 1201, 1:24-27.¹

¹ The ’362 Patent also states that “the invention relates to wideband receiver systems that are capable of receiving multiple desired television channels that extend over multiple non-contiguous portions of the broad frequency spectrum.” Ex. 1201, 18-21. “Non-contiguous portions” is omitted from the independent claims and added only in dependent claims 7 and 17, but should they be implicitly required of a “wideband receiver,” they are obvious over Pugel in view of Crols for the reasons presented below.

3. “digital circuitry”

To the extent “digital circuitry” of claim 1 is construed to be a means-plus-function term under 35 U.S.C. 112, paragraph 6, and to the extent the ’362 patent discloses a corresponding structure for this limitation, that structure is illustrated in Figures 2 and 3, including complex mixers 250 and 300, and filters 260, 330, and 340. Ex. 1201, Figs. 2-3, 5:31-54, 6:7-58.

VII. SPECIFIC GROUNDS FOR UNPATENTABILITY

A. Ground A: Claims 1, 4-6, 11, and 14-16 are Obvious Over Pugel in View of Crols.

As set forth below, claims 1, 4-6, 11, and 14-16 are obvious over Pugel in view of Crols. Ex. 1202, ¶¶ 99-169.

1. Independent Claim 1

a. [1A] “A wideband receiver system comprising:”

While the preamble [1A]² is not limiting, Pugel teaches it. Ex. 1202, ¶¶ 101-102. The Pugel multichannel receiver circuit receives a multichannel analog RF input signal for multiple digital channels, which a POSITA would understand to be referencing a wideband signal. Ex. 1224, [0008]-[0013], [0023]-[0024]; Ex. 1202, ¶ 102; *see* Ex. 1201, 1:24-27 (describing “wideband tuners” as those receiving several

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

TV channels); Figs 2, 6-8; *see supra* Section IV.A. For example, Pugel teaches its system may process multiple signal bands ranging from 5 MHz to 900 MHz. Ex. 1224, [0028]; Ex. 1202, ¶ 102.

- b. [1B] “a mixer module configured to downconvert a plurality of frequencies that comprises a plurality of desired television channels and a plurality of undesired television channels;”**

The Pugel multichannel receiver circuit comprises a “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; Ex. 1202, ¶¶ 103-106. The bands correspond to all received television channels, including desired and undesired television channels. Ex. 1224, Abstract, [0001], [0008]-[0009], [0011], [0022], [0028], [0036]-[0044], [0048]-[0049]; Ex. 1202, ¶ 104. A channel to be selected by the digital tuner is desired, and a channel to go unselected by the digital tuner is undesired. Ex. 1202, ¶ 104. This is consistent with the use of “desired” and “undesired” in the ’362 Patent. Ex. 1201, Abstract, 1:29-34, 3:9-39, 4:19-33, 5:41-44, 5:49-61, 6:32-42, 6:55-64; Ex. 1202, ¶ 104.

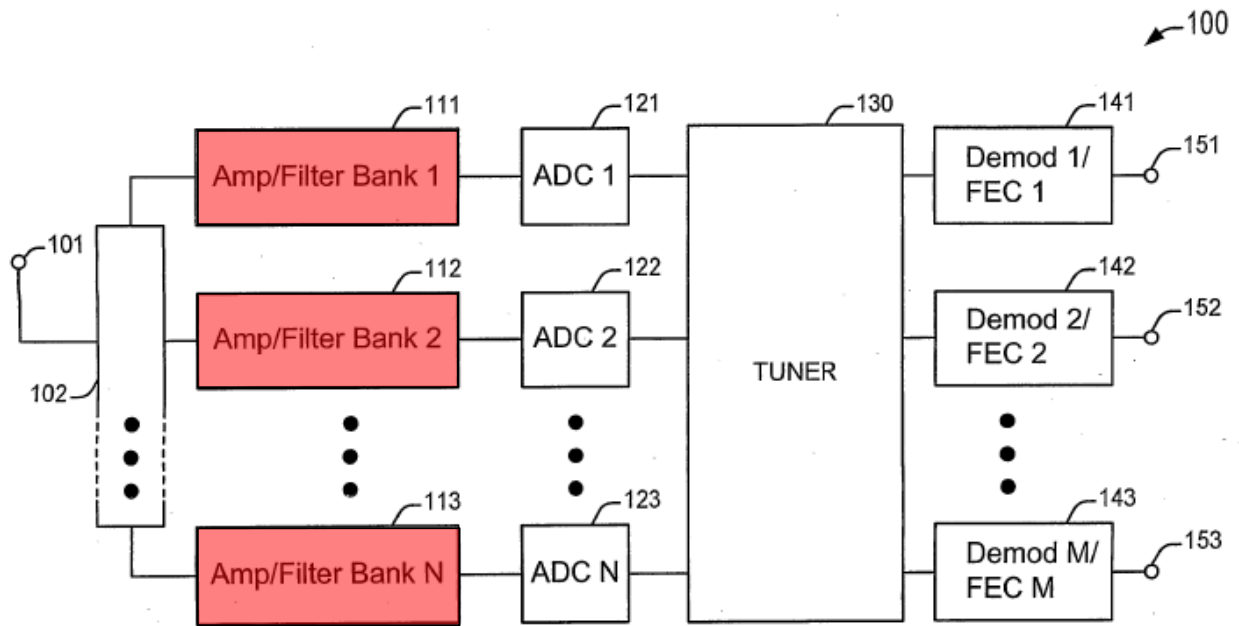


FIG. 1

Ex. 1224, Fig. 1 (annotated)

Pugel contemplates that the amplifier-filter banks may act as bandpass filters that will process limited frequency ranges for input to different ADCs. Ex. 1224, [0025]-[0032], Figs. 1, 2; Ex. 1202, ¶ 105. Further, Pugel teaches that undersampling can be performed to reduce the bands such that they have, for example, a band frequency of 300 MHz and that the Nyquist criterion can be met with a sampling frequency of 600 MHz. Ex. 1224, [0032]-[0034]; Ex. 1202, ¶¶ 105-106. Pugel states that an advantage of this system is that it *avoids* needing, for example, a sampling frequency of 1.8 GHz for sampling a band of 600 MHz to 900 MHz (the Nyquist

criterion being tied to the highest frequency in the band). Ex. 1224, [0034]; Ex. 1202, ¶¶ 105-106.

A POSITA would have understood that, in stating that a frequency band of 600 MHz to 900 MHz can be sampled at 600 MHz while satisfying the Nyquist criterion, Pugel's undersampling thus incorporates downconverting, as the signal must be downconverted from 600-900 MHz to 0-300 MHz in order for 600 MHz sampling to satisfy the Nyquist criterion, which is based on sampling at double the highest frequency in the pass-band. Ex. 1202, ¶¶ 107-108; *see* Ex. 1224, [0034], claims 14-15, 18, 20-21. To any extent Pugel does not explicitly disclose the use of downconverting to achieve this goal would be obvious or inherent to a POSITA because of the disclosure in Pugel, including recitations of downconversion in the claims. Ex. 1202, ¶¶ 107-108; Ex. 1224, claims 14-15, 18, 20-21. It would have been obvious from Pugel's express teachings (that a Nyquist criterion is met by a frequency lower than the maximum bandwidth of a band) to use well-known techniques of downconversion to implement Pugel's systems. Ex. 1202, ¶¶ 107-108. At most, this would have been nothing more than applying a known technique (downconversion) to a known device (Pugel's multichannel receiver circuit) ready for improvement to yield predictable results (the Nyquist criterion is met as taught by Pugel). Ex. 1202, ¶¶ 107-108. Further, a POSITA would have understood the use of downconversion is inherent to the disclosure, as the Nyquist criterion cannot be

mathematically satisfied as per Pugel's examples unless the maximum frequency of the pass-band is also being reduced. Ex. 1202, ¶¶ 107-108. A POSITA would have had a reasonable expectation of success, as Pugel itself says the result is possible, and downconversion was well-known in the art. Ex. 1202, ¶¶ 107-108.

To any extent that Pugel does not explicitly disclose a mixer module configured to perform downconversion, this would have been obvious in view of Crols. Ex. 1202, ¶ 109. Crols discusses numerous signal topologies, including a zero-IF receiver topology employing a quadrature downconversion mixer wherein an "RF signal is broadband filtered and then downconverted.... After low-pass filtering, the signal is ready for sampling and demodulation." Ex. 1225, pp. 279, 275; Ex. 1202, ¶ 110. Crols teaches that, in an example using a complex filter, "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, p. 279, Figs. 21, 22; Ex. 1202, ¶¶ 110-111. Crols incorporates mixer modules [red] prior to ADC conversion:

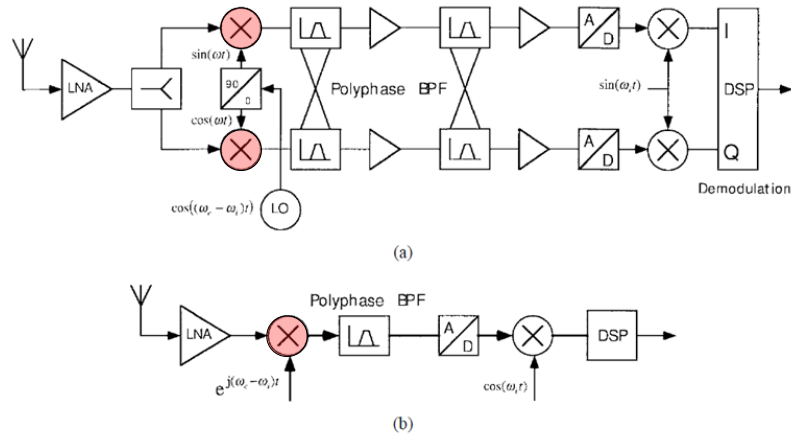


Fig. 21. The topology of a low-IF receiver which uses a complex bandpass filter in the LF part. (a) Full notation and (b) compact notation.

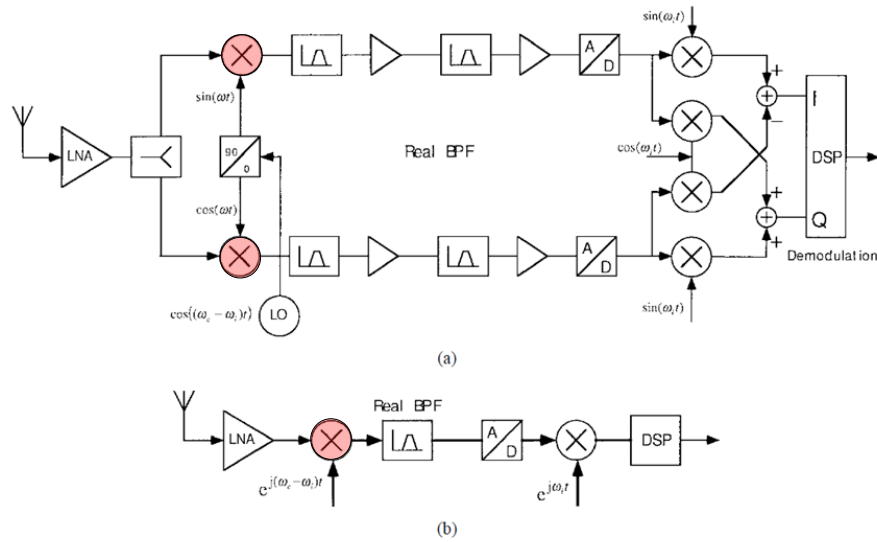


Fig. 22. The topology of a low-IF receiver which uses real filters in the LF part. (a) Full notation and (b) compact notation.

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

Crols teaches that certain topologies, such as well-known IF receiver topologies, have disadvantages in that “apart from the wanted signal, an unwanted signal (called the mirror frequency) is downconverted to the IF.” Ex. 1225, pp. 270-273; Ex. 1202, ¶ 112. The topologies shown in Crols’ Figures 21-22 suppress such mirror signals, increasing the reliability of the system. Ex. 1225, pp. 279-280; Ex. 1202, ¶¶ 112-113. Crols’ mixers described above are structurally equivalent to, and perform the

same function as, the structure described by the '362 Patent for performing the function recited in limitation [1B] (e.g., mixers 211 and 212, phase shifter 206, frequency source S1). Ex. 1201, 4:40-53; Ex. 1202, ¶ 113.

It would have been obvious to a POSITA to modify Pugel's amplifier/filter circuits to include circuit topologies as taught by Crols, because a POSITA would have been motivated to implement Pugel's system with alternative known solutions as a simple design choice. Ex. 1202, ¶ 114. 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]; Ex. 1202, ¶ 114. Further, Pugel states only 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]; Ex. 1202, ¶ 113. Crols' topologies provide exactly such additional components for that purpose, and the required traditional mixer modules and components would have been readily available. Ex. 1202, ¶ 114. A POSITA would have understood that such topologies would further provide in-phase and quadrature signals, which were commonly used in ADCs at the time. Ex. 1202, ¶ 114.

Applying Crols topologies comprising mixer modules to Pugel's receiver circuits would have been nothing more than applying a known technique (using mixer module topologies for frequency filtering and 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 segregate analog input signals for sampling in ADCs). Ex. 1202, ¶ 115. 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 operational effectiveness of its topologies, and the POSITA's own familiarity with known receiver circuit topologies in the art. Ex. 1202, ¶¶ 115-116.

- c. **[1C] “a wideband analog-to-digital converter (ADC) module configured to digitize said plurality of frequencies comprising said plurality of desired television channels and said plurality of undesired television channels;”**

Pugel's receiver circuit includes analog-to-digital converters 121-123 (gold) “sufficient for satisfactorily processing digital television signals and associated signals intended for end users in a conventional cable television broadcast system.” Ex. 1224, [0036], [0033]-[0037], [0044]-[0045], Fig. 1; Ex. 1202, ¶¶ 117-118.

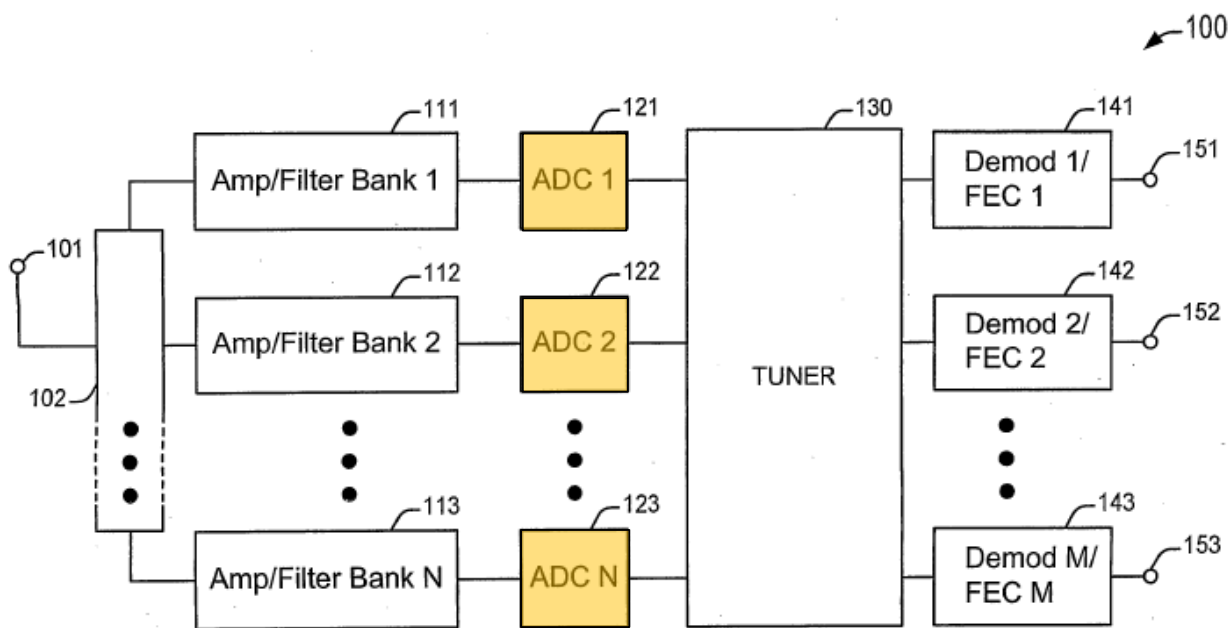


FIG. 1

Ex. 1224, Fig. 1 (annotated)

As discussed above in Section VII.A.1.b, Pugel teaches amplifier-filter circuits that generate analog signals within a particular, segregated pass-band. Ex. 1224, Abstract, [0001], [0008]-[0009], [0011], [0022], [0028], [0036]-[0044], [0048]-[0049]; Ex. 1202, ¶ 119. Those pass-bands are then outputted to a given ADC for digitization, wherein 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]; Ex. 1202, ¶ 120. Pugel’s ADC is “wideband” because it digitizes a frequency band (e.g., a 300MHz band) that a POSITA would have understood to comprise several channels within the frequency block

concurrently. *Compare* Ex. 1224, [0035]-[0036] *with* Ex. 1201, 1:24-27; Ex. 1202, ¶¶ 119, 121. Pugel discloses that the bands of frequencies may be contiguous or non-contiguous. Ex. 1224, [0043]; Ex. 1202, ¶ 121. Pugel's ADCs, as described above alone or as modified by Crols as described in Section VII.A.3, are structurally equivalent to, and perform the same function as, the structure described by the '362 Patent for performing the function recited in limitation [1C] (e.g., ADC1 218 and ADC2 228). Ex. 1201, 5:28-31; Ex. 1202, ¶ 121. Each frequency band corresponds to a particular set of television channels, including desired and undesired television channels as will be selected downstream by the digital tuner. Ex. 1224, [0026]-[0028], [0038]-[0040]; Ex. 1202, ¶¶ 119-122.

d. [1D] “digital circuitry configured to: select said plurality of desired television channels from said digitized plurality of frequencies; and”

Pugel's receiver circuit comprises a digital tuner (“digital circuitry,” green) configured to select a plurality of desired television channels from the plurality of frequencies that were digitized by the ADCs such that “a selected set of digital cable television channels” may be demultiplexed from the digital signals. Ex. 1224, [0037]-[0039], [0045], Fig. 1; Ex. 1202, ¶ 124. 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]; Ex. 1202, ¶¶ 123-124.

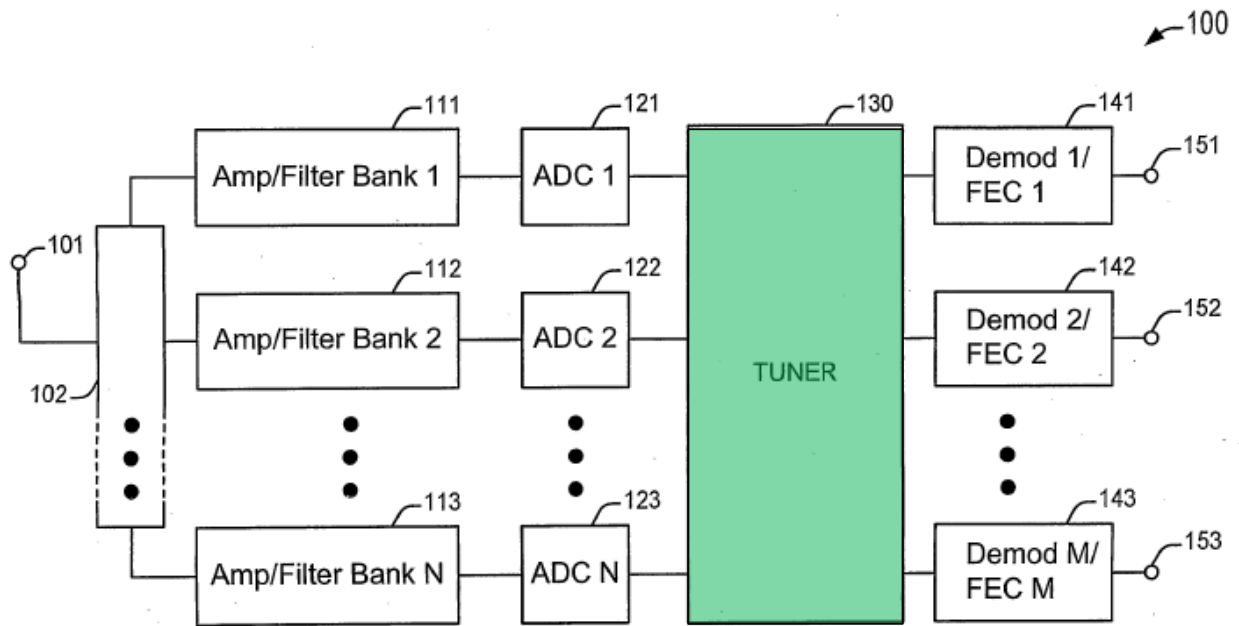


FIG. 1

Ex. 1224, Fig. 1 (annotated)

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]; Ex. 1202, ¶ 125. In such an example, the selected digital channels are the claimed “desired television channels.” Ex. 1202, ¶ 125. 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]; Ex. 1202, ¶ 125. The digital tuner 130 or demodulators may comprise “circuitry for providing additional functions, for example adaptive filters for removing multi-path

propagation effects.” Ex. 1224, [0041]. Pugel’s tuner 130, alone or as modified by Crols as described in Section VII.A.4 in connection with claim 6, is structurally equivalent to, and perform the same function as, the structure described by the ’362 Patent for performing the function recited in limitation [1D] (e.g., complex mixers 250 and filter modules 260). Ex. 1201, 5:62-6:45; Ex. 1202, ¶¶ 125-126.

e. [1E] “[digital circuitry configured to:] output said selected plurality of television channels to a demodulator as a digital datastream.”

Pugel’s tuner 130, alone or as modified by Crols as described in Sections VII.A.4 in connection with claim 6, is “digital circuitry configured to ... output said selected plurality of television channels ... as a digital datastream.” Ex. 1202, ¶¶ 129-134. As explained in Section VII.A.1.d for limitation [1D], for example, the digital tuner 130 (**green**) selects channels from the digitized signals received from the ADC. *Id.*, ¶ 129. Because claim 1 is a system claim, and because “a demodulator” is not part of the claimed system, any circuit path that outputs the “selected plurality of television channels” meets limitation [1E]. *Id.* And in this regard, Pugel’s Figure 3 depicts circuit paths (outputs from the digital tuner 130 to one or more demodulators) that are structurally equivalent to, and perform the same function as, the structure described by the ’362 Patent for performing the function recited in limitation [1E] (e.g., outputs from filter modules 260). Ex. 1201, 5:49-61; Ex. 1202, ¶ 129.

But even if the presence of “a demodulator” is required by limitation [1E], this would be satisfied by Pugel’s demodulators 141-143 (**blue**), which may perform a variety of demodulation techniques including quadrature amplitude modulation (QAM) or quadrature phase shift keying demodulation (QPSK). Ex. 1224, [0027], [0039]-[0040], [0046], Figs. 1, 3-4; Ex. 1202, ¶ 130. For example, “a first demodulator 301 may be configured to perform [QAM] demodulation of digital cable television signals.” Ex. 1224, [0040]. Ex. 1202, ¶ 130.

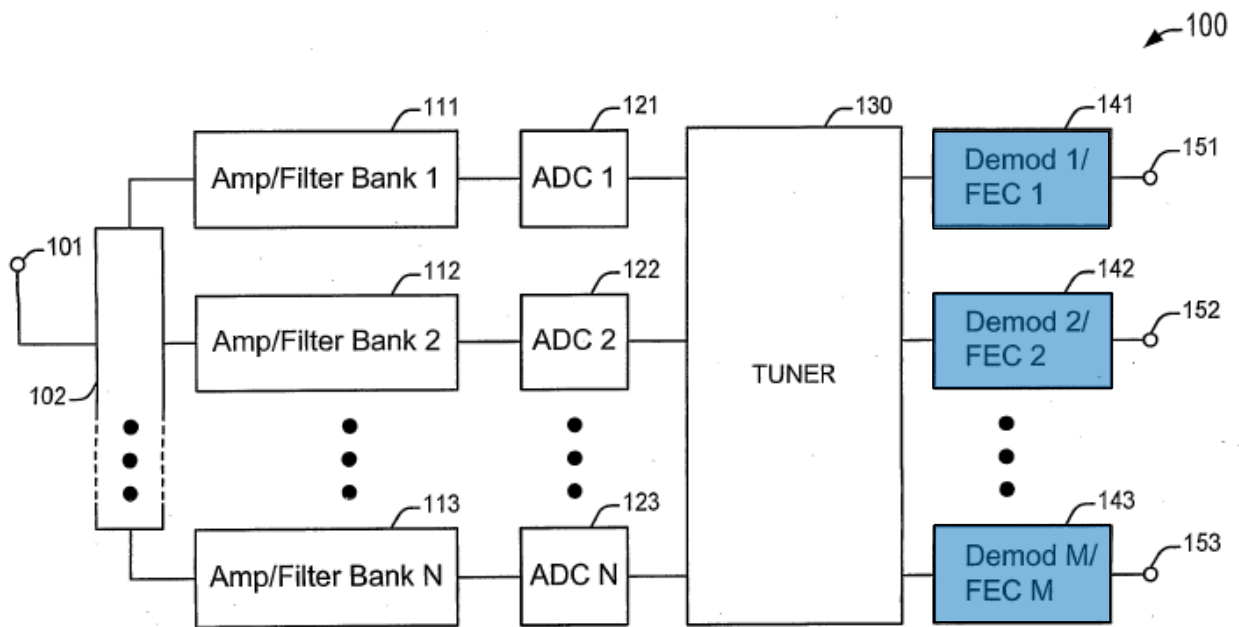


FIG. 1

Ex. 1224, Fig. 1 (annotated)

Pugel teaches that the digital tuner 130 (the “digital circuitry” of limitation [1D]) “may perform coding, decoding, scrambling, descrambling, rotating, and/or

derotating operations prior to passing the digital channel signals to demodulation circuits 141, 142, 143.” *Id.*, [0039]; Ex. 1202, ¶ 131. Thus, the digital tuner (“digital circuitry”) is configured to output digital channel signals (“said selected plurality of television channels ... as a digital datastream”) to one or more demodulators (“a demodulator”). Ex. 1202, ¶ 131.

Regarding the number of demodulators, while Figure 1 shows multiple demodulators, Pugel expressly teaches that “the present invention is not so limited and any number of ... demodulator circuits may be used in accordance with the present invention.” Ex. 1224, [0023]; Ex. 1202, ¶ 132. Moreover, Pugel expressly teaches that “the number (1 . . . M) of demodulator circuits provided is not necessarily related to the number (1 . . . N) of amplifier-filter circuits and/or analog-to-digital converters provided,” which a POSITA would have understood to teach that a single demodulator (which may itself comprise multiple demodulators) may handle multiple digital signals from a single amplifier-filter circuit, or vice-versa. Ex. 1224, [0023], [0027], [0040]; Ex. 1202, ¶ 132-133.

The ’362 Patent uses the term “demodulator” generally to refer to a device that is a single unit for demodulating a respective single channel, a device that includes multiple other devices to demodulate multiple channels, and a device that demodulates multiple channels without any specificity as to its structure. Ex. 1201, 5:44-48, 5:54-60, 6:55-58, 7:66-8:9, 9:25-27; Ex. 1202, ¶ 133. Thus, a POSITA

would have understood that either of Pugel’s embodiments—a single demodulator alone or comprising a group of demodulators —teach the claimed “demodulator.” Ex. 1202, ¶ 133.

2. Dependent Claim 4

- a. [4] “The wideband receiver system of claim 1, wherein said mixer module comprises a first mixer configured to generate an in-phase signal and a second mixer configured to generate a quadrature signal.”

As explained in Section VII.A.1.b for limitation [1B], any of the downconverters shown in Crols’ Figure 4 (red), alone or in combination, is a mixer module. *Id.*, ¶¶ 136-137.

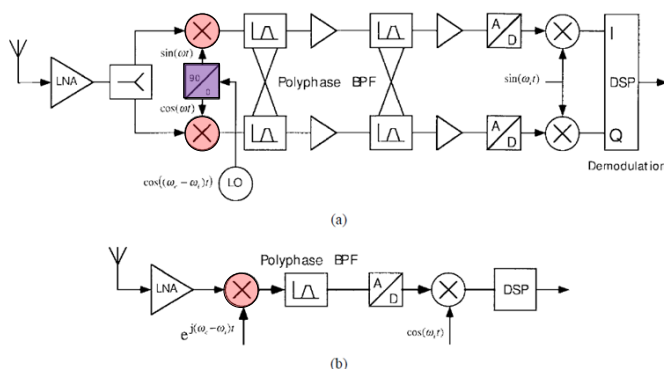


Fig. 21. The topology of a low-IF receiver which uses a complex bandpass filter in the LF part. (a) Full notation and (b) compact notation.

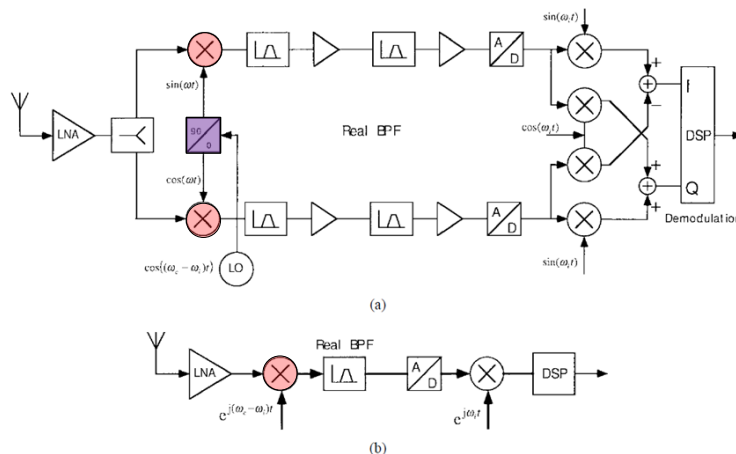


Fig. 22. The topology of a low-IF receiver which uses real filters in the LF part. (a) Full notation and (b) compact notation.

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

The downconverters use two mixers (**red**) to create an in-phase signal (the output of the lower mixer with “ $\cos(\omega t)$ ” input in Figs. 21(a) and 22(a)) and a quadrature signal (the output of the upper mixer with “ $\sin(\omega t)$ ” input in Figs. 21(a) and 22(a)) by respectively using a sine signal and a cosine signal generated by a quadrature oscillator (**purple**). Ex. 1225, pp. 277 (“Quadrature oscillators often use an RC-CR circuit to obtain the 90° phase shift. The phase shift is a result of comparing the phase shift of a pole and a zero.”), 279-282; Ex. 1234, pp. 42-43, 65-67; Ex. 1202, ¶ 137. As stated above in Section VII.A.1.b, it would have been obvious to a POSITA to modify Pugel’s receiver circuit to implement mixers, such as taught by Crols. Ex. 1202, ¶ 138. Further, in doing so, a POSITA would have understood that Pugel teaches the use of QAM or QPSK demodulation, and that in-phase and quadrature signals are used in those modulation schemes. *Id.*; Ex. 1224, [0040]; Ex. 1202, ¶ 138. Thus, applying Crols topologies comprising mixer modules to Pugel’s receiver circuits would have been nothing more than applying a known technique (generating in-phase and quadrature signals) to improve a known device (Pugel’s receiver which performs QAM or QPSK demodulation) ready for improvement to yield predictable results (the resulting implementation of Pugel-Crols would be capable of performing QAM or QPSK modulation as taught by Pugel). Ex. 1202, ¶ 138.

3. Dependent Claim 5

- a. [5] “The wideband receiver system of claim 1, wherein said wideband analog-to-digital converter comprises: a first ADC configured to generate a digital in-phase signal; and a second ADC configured to generate a digital quadrature signal.”

As explained in Section VII.A.1.c for limitation [1C], any of the individual analog-to-digital converters 121-123 (gold) is an ADC module. Ex. 1202, ¶ 141.

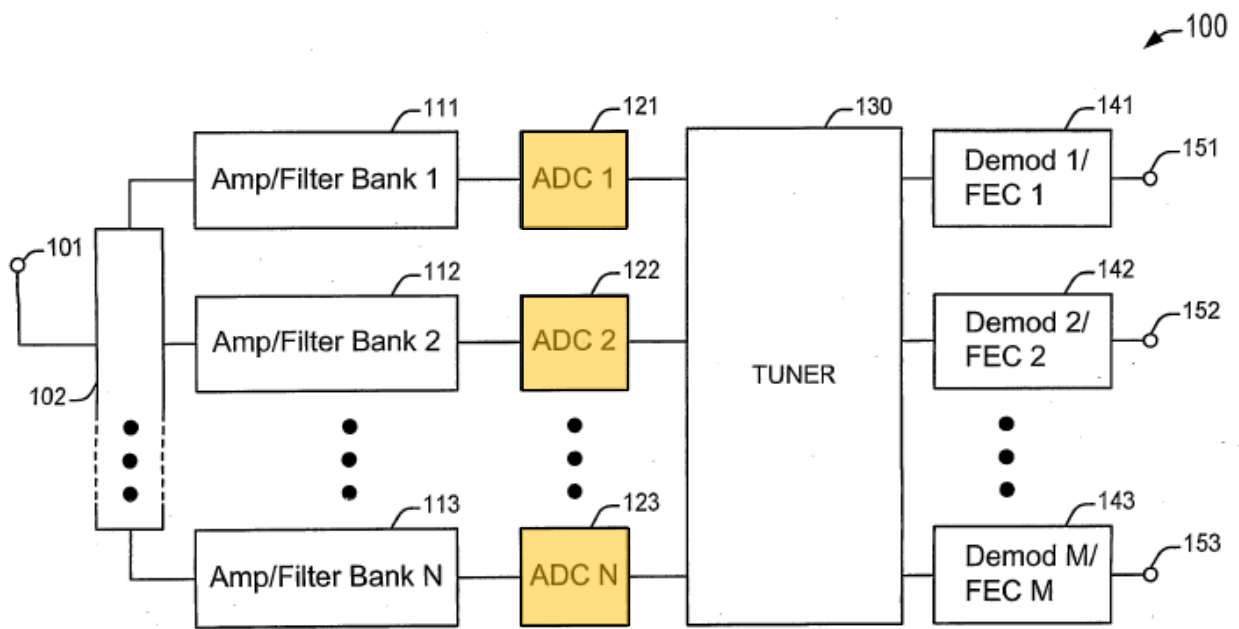
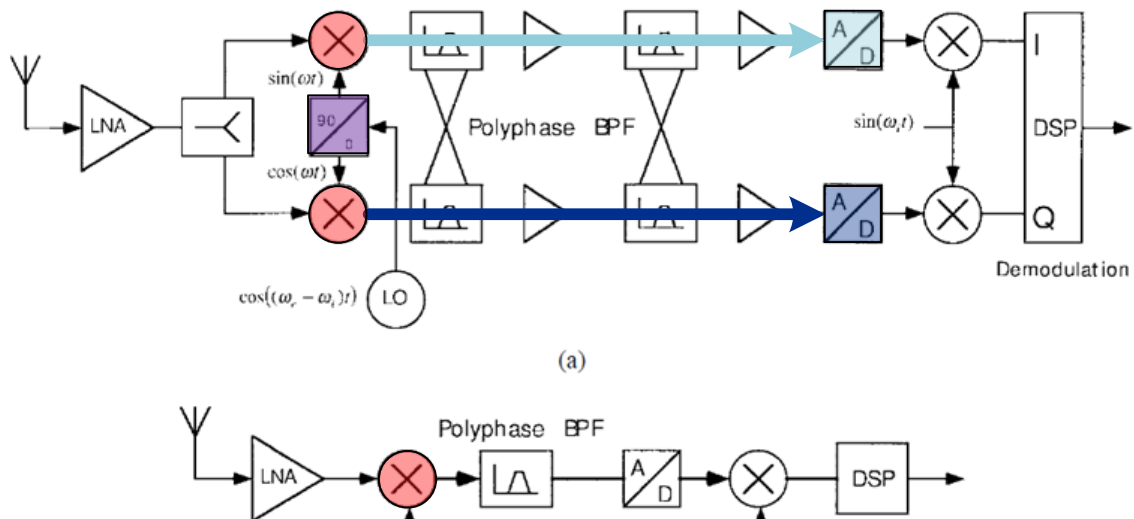


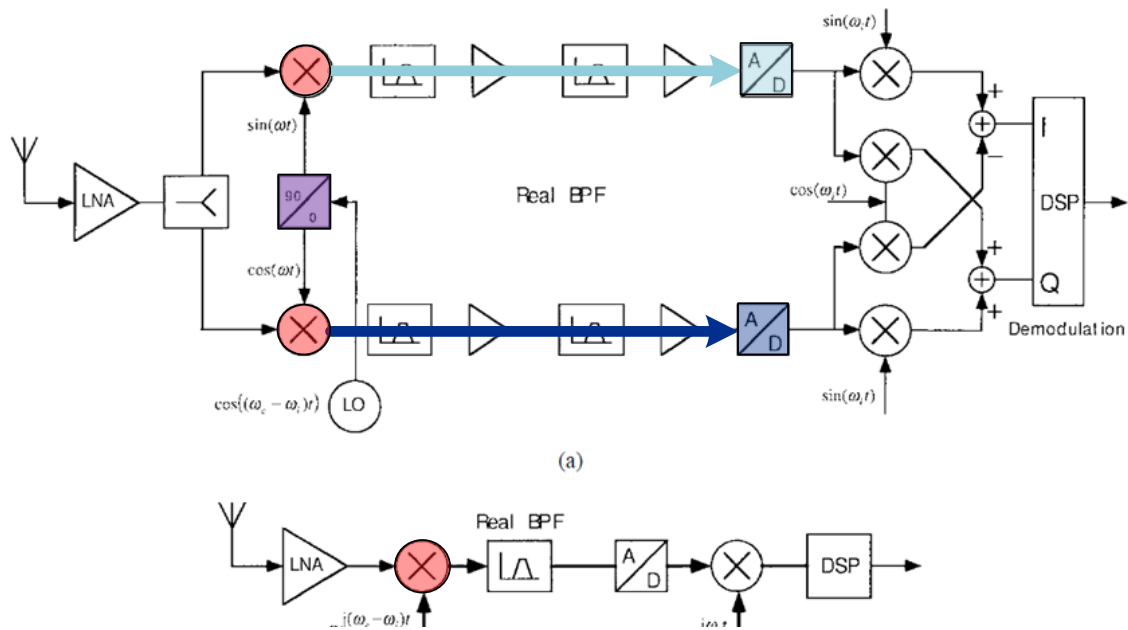
FIG. 1

Ex. 1224, Fig. 1 (annotated)

Further, as explained in Section VII.A.1.b, in the Pugel-Crols combination, the amplifier-filter banks 111-113 are implemented using complex mixer modules, as taught by Crols. Ex. 1202, ¶ 142. And as explained above in Section VII.A.2, those mixer modules (red) produce an in-phase and a quadrature signal. Ex. 1202, ¶

142. In particular, a POSITA would have understood the respective upper mixers of Figures 21-22 receive a signal with a 90-degree phase shift (denoted “90” and “ $\sin(\omega t)$ ”), causing the upper mixers to generate a quadrature signal (**light blue line**), and the respective lower mixers receive a signal with zero phase shift (denoted “0” and “ $\cos(\omega t)$ ”), causing the lower mixers to generate an in-phase signal (**dark blue line**). Ex. 1202, ¶ 142.





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

The respective ADCs digitize the signals they receive, and by receiving the in-phase and quadrature signals, they thus generate a digital quadrature signal at the first ADC (**light blue box**) and a digital sine signal at the second ADC (**dark blue box**). Ex. 1202, ¶ 143. Consistent with claim 5, the resultant combination has two ADCs, as depicted in Crols, that implement each wideband ADC as depicted in Pugel. Ex. 1202, ¶¶ 143-145.

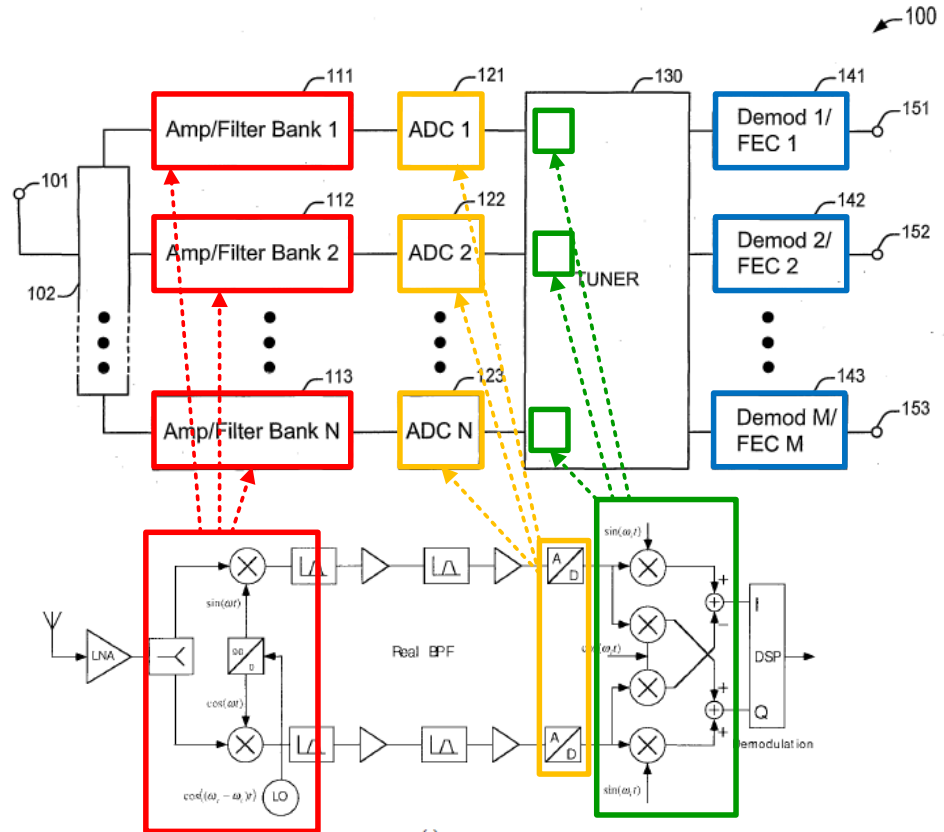
4. Dependent Claim 6

- a. [6] **“The wideband receiver system of claim 5, wherein said digital circuitry comprises a plurality of complex mixers configured to frequency shift said selected plurality of desired television channels.”**

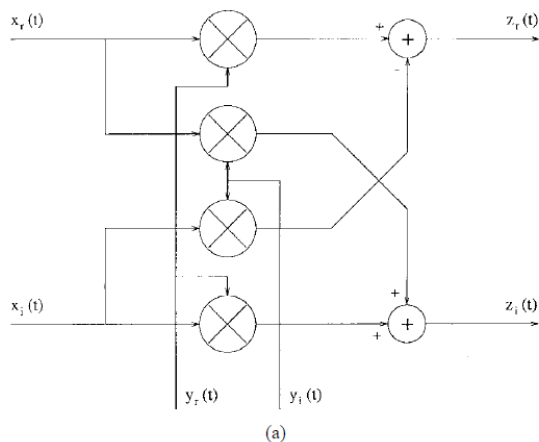
As explained in Section VII.A.1.d for limitation [1D], Pugel teaches “digital circuitry” in the form of a digital tuner 130. Pugel teaches that the digital tuner may perform a variety of other functions, including “coding, decoding, scrambling, descrambling, rotating, and/or derotating operations prior to passing the digital channel signals to demodulation circuits.” Ex. 1224, [0039]; Ex. 1202, ¶ 147. 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, claims 14-15, 18, 20-21; Ex. 1202, ¶ 147. And, as explained in Section VII.A.1.b for limitation [1B], the process of downconversion includes frequency shifting as taught by, or obvious in view of, Pugel. Ex. 1202, ¶ 147.

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. Ex. 1202, ¶ 148. Crols discloses a complex mixer for processing digital signals output by the ADC. The figures of Pugel and Crols relate as follows with the “complex mixer” of claim 6 in **green**:

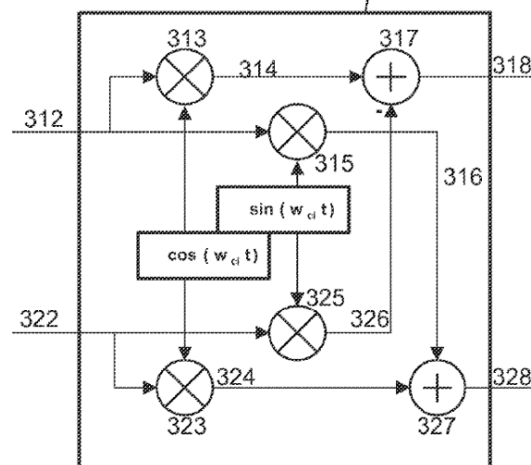
Ex. 1224, Fig. 1
(annotated)



Ex. 1202, ¶ 148. As Crols explains and illustrates, the circuitry outlined in green is a “complex mixer” that is utilized to perform downconversion. Ex. 1225, pp. 273-274, 279-280, Figs. 8(a), 21-22; Ex. 1234, pp. 46-47, Fig. 3.30; Ex. 1202, ¶ 149. Crols’s 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 ’362 Patent. Ex. 1225, pp. 273-274, 279-280, Figs. 8(a), 21-22; Ex. 1201, 6:7-25, 9:17-22, Fig. 3; Ex. 1234, p. 74; Ex. 1202, ¶ 150.



Ex. 1225, Fig. 8(a)



Ex. 1201, Fig. 3 (excerpted)

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; Ex. 1202, ¶ 151. A POSITA looking to implement downconversion would have turned to techniques known to the art, such as taught by Crols. Ex. 1202, ¶ 151. Even if not expressly taught, such an implementation would have been obvious to try, as Crols's complex mixer topology is one of a finite number of identified, predictable solutions to implement downconversion in digital circuitry, such as a digital tuner. *Id.* 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 operational effectiveness of

its topologies, and the POSITA's own familiarity with known receiver circuit topologies in the art. *Id.*

5. Independent Claim 11

Claim 11 is a method claim directed to substantially identical subject matter as system 1, and thus is rendered obvious by Pugel in view of Crols for the same reasons discussed above with respect to claim 1. *See supra* Section VII.A.1; Ex. 1224, Abstract (“A method and apparatus is presented...”); Ex. 1202, ¶¶ 153-163.

a. [11A] “A method comprising: in a wideband receiver system:”

Preamble [11A] is substantially identical to preamble [1A], and is taught by Pugel in view of Crols for the same reasons set forth in connection with preamble [1A]. *See supra* Section VII.A.1.a. Ex. 1202, ¶¶ 154-155.

b. [11B] “downconverting, by a mixer module of said wideband receiver system, a plurality of frequencies that comprises a plurality of desired television channels and a plurality of undesired television channels;”

Limitation [11B] is substantially identical to limitation [1B] and is taught by Pugel in view of Crols for the same reasons set forth in connection with limitation [1B]. *See supra* Section VII.a.1.b. In particular, limitation [11B] merely recasts the required functionality of limitation [1B] as a performed step. Ex. 1202, ¶¶ 156-157.

- c. **[11C] “digitizing, by a wideband analog-to-digital converter (ADC) module of said wideband receiver system, said plurality of frequencies comprising said plurality of desired television channels and said plurality of undesired television channels;”**

Limitation [11C] is substantially identical to limitation [1C] and is taught by Pugel in view of Crols for the same reasons set forth in connection with limitation [1C]. *See supra* Section VII.A.1.c. In particular, limitation [11C] merely recasts the required functionality of limitation [1C] as a performed step. Ex. 1202, ¶¶ 158-159.

- d. **[11D] “selecting, by digital circuitry of said wideband receiver system, said plurality of desired television channels from said digitized plurality of frequencies; and”**

Limitation [11D] is substantially identical to limitation [1D] and is taught by Pugel in view of Crols for the same reasons set forth in connection with limitation [1D]. *See supra* Section VII.A.1.d. In particular, limitation [11D] merely recasts the required functionality of limitation [1D] as a performed step. Ex. 1202, ¶¶ 160-161.

- e. **[11E] “outputting, by said digital circuitry of said wideband receiver system, said selected plurality of television channels to a demodulator as a digital datastream.”**

Limitation [11E] is substantially identical to limitation [1E] and is taught by Pugel in view of Crols for the same reasons set forth in connection with limitation [1E]. *See supra* Section VII.A.1.e. In particular, limitation [11E] merely recasts the required functionality of limitation [1E] as a performed step. Ex. 1202, ¶¶ 162-163.

6. Dependent Claim 14

- a. **[14] “The method of claim 11, comprising: generating, by a first mixer of said mixer module, an in-phase signal; and generating, by a second mixer of said mixer module, a quadrature signal.”**

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 supra* Section VII.A.2. In particular, claim 14 merely recasts the required functionality of claim 4 as a performed step. Ex. 1202, ¶¶ 164-165.

7. Dependent Claim 15

- a. **[15] “The method of claim 11, comprising: generating, via a first ADC of said wideband analog-to-digital converter, a digital in-phase signal; and generating, via a second ADC of said wideband analog-to-digital converter, a digital quadrature signal.”**

Claim 15 is substantially identical to claim 5 and is taught by Pugel in view of Crols for the same reasons set forth in connection with claim 5. *See supra* Section VII.A.3. In particular, claim 15 merely recasts the required functionality of claim 5 as a performed step. Ex. 1202, ¶¶ 166-167.

8. Dependent Claim 16

- a. **[16] “The method of claim 15, comprising frequency shifting said selected plurality of desired television channels via a plurality of complex mixers of said digital circuitry.”**

Claim 16 is substantially identical to claim 6 and is taught by Pugel in view of Crols for the same reasons set forth in connection with claim 6. *See supra* Section

VII.A.4. In particular, claim 16 merely recasts the required functionality of claim 6 as a performed step. Ex. 1202, ¶¶ 168-169.

B. Ground B: Claims 2, 3, 12, and 13 are Obvious Over Pugel in view of Crols, and Further in View of Chandrakasan.

1. Dependent Claims 2 and 3

- a. [2] “The wideband receiver system of claim 1, wherein said output of said digital datastream is via a serial interface”;
- b. [3] “The wideband receiver system of claim 1, wherein said output of said digital datastream is via a parallel interface.”

Claims 2 and 3 are similar, and only differ with regard to a type of interface via which the digital datastream of limitation [1E] is output. Claim 2 recites output “via a serial interface,” while claim 3 recites output “via a parallel interface.” But as explained below, either option would have been an obvious design choice. Ex. 1202, ¶¶ 170-182.

As explained in Sections VII.A.1.d and VII.A.1.e, Pugel teaches a digital tuner 130 as the limitation [1E] (“digital circuitry configured to output ... as a digital datastream”). Ex. 1202, ¶ 172. Pugel and Crols are silent with regard to whether its selected channels may be output via a serial interface or via a parallel interface. Ex. 1202, ¶ 173.

However, as the ’362 Patent concedes, outputting a digital data stream via serial (claim 2) and parallel (claim 3) interfaces were “commonly known methods,”

i.e., Applicant Admitted Prior Art (AAPA). Ex. 1201, 6:55-58; Ex. 1202, ¶ 174. Indeed, as explained in dictionaries, basic text books and technical papers on digital integrated circuit design at the time, a POSITA would have understood that using these two interfaces were two common options for outputting data in standard integrated circuits. Ex. 1202, ¶¶ 174-176; Ex. 1214, 30:31-42, 31:15-22; Ex. 1215, pp. 5-6, 8; Ex. 1216, pp. 79-80; Ex. 1217, pp. 354-355.

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. 1202, ¶¶ 177-178; Ex. 1216, 23-24, 27-29, 48-51. 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 circuit can either transmit the bits over multiple separate wires, one wire for each bit, which was known as a “parallel interface,” or the circuit can transmit the set of bits one at a time as sequential pulses over a single wire, according to a fixed sequence, which was known as a “serial interface.” Ex. 1202, ¶¶ 177-178; Ex. 1215, pp. 5-6, 8; Ex. 1216, pp. 79-80 (Figure 6.25).

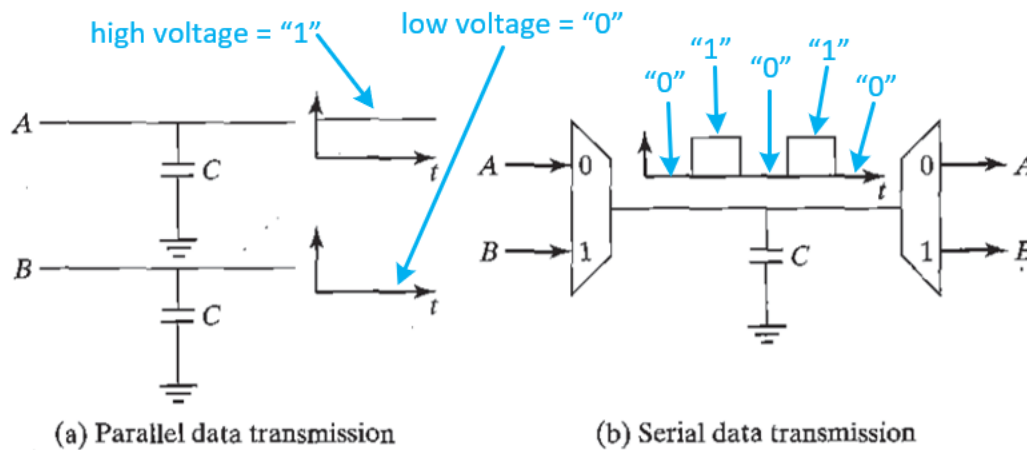


Figure 6-25 Parallel versus time-multiplexed data busses.

Ex. 1216, p. 80 (Figure 6.25) (annotated)

Implementing Pugel's data interface to a demodulator using either option would have been obvious 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. 1202, ¶ 179; Ex. 1214, 30:31-42, 31:15-22; Ex. 1215, pp. 5-6, 8; Ex. 1216, pp. 79-80; Ex. 1217, pp. 354-355. For the same reasons, implementing serial and parallel interfaces would have been well within the POSITA's skillset, and thus, a POSITA which would have had a high expectation of success, leading to a predictable result. Ex. 1202, ¶ 179.

In addition to the AAPA acknowledging that serial and parallel interfaces were commonly known, each of the background references cited above is prior art and teaches why a POSITA would apply parallel and serial interfaces to Pugel's

digital design. Ex. 1202, ¶ 179; Ex. 1214, 30:31-42, 31:15-22; Ex. 1216, pp. 79-80; Ex. 1217, pp. 354-355.

For example, Chandrakasan, an article on “Ultra Low Power 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, p. 355; Ex. 1216, pp. 79-80; Ex. 1202, ¶ 180. 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 switch activity.” Ex. 1217, p. 355; Ex. 1202, ¶ 179. Minimizing circuit area minimizes the cost of the integrated circuit, while minimizing the switching activity minimizes the power consumed by the integrated circuit. Ex. 1217, pp. 355-357; Ex. 1202, ¶ 180. 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.*

It would thus have been obvious to apply either of parallel data or serial data communication as taught by Chandrakasan to the interconnection between Pugel’s digital tuner 130 and demodulators 141-143. Ex. 1202, ¶ 181. Pugel teaches sending

a digital RF signal, and the use of parallel or serial data interfaces as taught in Chandrakasan would have enabled such transmission. Ex. 1224, [0038]-[0041], [0045]-[0046]; Ex. 1217, pp. 354-356; Ex. 1202, ¶¶ 181-182.

As such, the modification of Pugel-Crols with Chandrakasan that results in a serial interface (claim 2) or parallel interface (claim 3) between Pugel's digital tuner 130 and demodulators 141-143 is nothing more than choosing from a finite number of identified, predictable solutions (using serial or parallel communications as taught by Chandrakasan and known in the art) with a reasonable expectation of success (resulting in Pugel's system implemented with either serial or parallel communication). Ex. 1202, ¶ 182.

The resultant combinations of Pugel-Crols and Chandrakasan are predictable, and 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, pp. 355-357; Ex. 1202, ¶ 182.

2. Dependent Claim 12

- a. [12] “The method of claim 11, comprising outputting, by said digital circuitry of said wideband receiver system, said digital datastream via a serial interface.”**

Claim 12 is substantially identical to claim 2 and is taught by Pugel in view of Crols and Chandrakasan for the same reasons set forth in connection with claim 2. *See supra* Section VII.B.1. In particular, claim 12 merely recasts the required functionality of claim 2 as a performed step. Ex. 1202, ¶¶ 184-185.

3. Dependent Claim 13

- a. [13] “The method of claim 11, comprising outputting, by said digital circuitry of said wideband receiver system, said digital datastream via a parallel interface.”**

Claim 13 is substantially identical to claim 3 and is taught by Pugel in view of Crols and Chandrakasan for the same reasons set forth in connection with claim 3. *See supra* Section VII.B.1. In particular, claim 13 merely recasts the required functionality of claim 3 as a performed step. Ex. 1202, ¶¶ 184, 186.

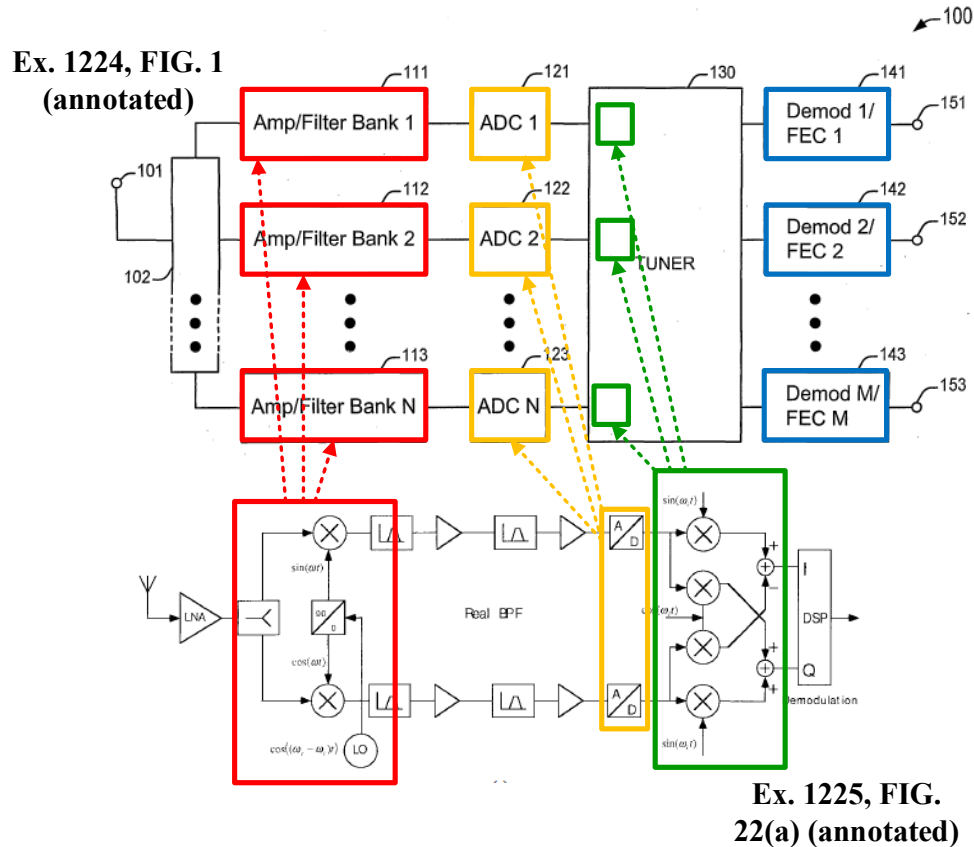
C. Ground C: Claims 7 and 17 are Obvious Over Pugel in view of Crols, and Further in View of Karabinis.

1. Dependent Claim 7

- a. [7A] “The wideband receiver system of claim 6, wherein:”**

As discussed above, Pugel, in view of Crols, discloses all of the features of claim 6, from which claim 7 depends. *See supra* Section VII.A.4; Ex. 1202, ¶ 188. In this combination, Pugel’s digital tuner 130 (see below) is modified to include a

plurality of complex mixers (as taught in Crols) (**green**) such that Pugel's digital tuner 130 is "configured to frequency shift said selected plurality of desired television channels" as recited in claim 6 of the '362 Patent. Ex. 1224, claims 14, 15, 18; Ex. 1225, pp. 273-274, 279-280; Ex. 1202, ¶ 188.



- b. [7B] “prior to said frequency shift, said selected plurality of desired television channels occupy non-contiguous portions of a frequency spectrum; and”

Pugel's digital tuner 130 (the claimed “digital circuitry”), modified with the teaching of Crols, receives, from 2xN number of analog-to-digital converters (**gold**), 2xN number of bands of digital signals, where N number of bands contain digital in-phase signals for a plurality of television channels in the frequency range of 0 to 300

MHz, while the other N components contain the Q signals for the plurality of television channels. Ex. 1224, [0009], [0011], [0026]-[0027], [0034], [0037]; Ex. 1225, pp. 279-281; Ex. 1202, ¶ 189. Pugel's modified digital tuner 130 is configured to select I and Q signals of "one or more particular digital channels desired to be recovered" from "digital signals converted by the plurality of analog-to-digital converters 121, 122, 123" and output the I and Q signals of the selected digital channels to demodulation circuits 141, 142, 143. Ex. 1224, [0037]-[0039]; Ex. 1202, ¶ 190. Pugel teaches that the first demodulator 141 can be configured to perform QAM demodulation of digital cable television signals, while the other demodulators may be configured to perform other types of demodulation of digital audio signals and high-definition television (HDTV) signals. Ex. 1224, [0040]; Ex. 1202, ¶ 190.

Pugel describes receiving "a plurality of digital cable television channels from a multichannel analog RF input signal which includes frequencies ranging from about 5 MHz to about 900 MHz." Ex. 1224, [0023], [0028]; Ex. 1202, ¶ 191. The Pugel amplifier-filter circuits 111, 112, 113 modified with Crols teachings split the multichannel analog RF input signal into multiple sets of analog bands (e.g., the first set ranging from 5-300 MHz, the second set ranging from 300-600 MHz, and the third set ranging from 600-900 MHz), where each set comprises an in-phase analog band and a quadrature analog band. *See supra* Section VII.A.4. The analog bands

are then converted to digital bands by the ADCs 121, 122, 123. Ex. 1224, [0036], [0033]-[0037]; Ex. 1202, ¶ 191.

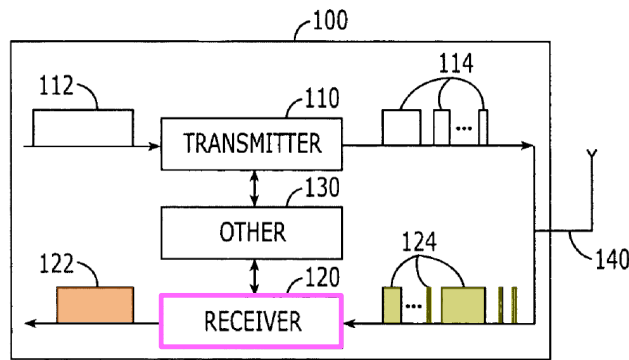
A POSITA would have the knowledge that each cable television channel occupies 6 MHz of frequency bandwidth. Ex. 1202, ¶ 192. Therefore, a POSITA would have understood that in some instances, in a single in-phase or quadrature digital band of 0 – 300 MHz, there may be signals for up to fifty channels, and, thus, signals for any two desired television channels of the fifty channels may be separated by undesired television channels. Ex. 1202, ¶ 192. After the selection of such desired television channels by the Pugel digital tuner 130, the corresponding signals may be forwarded to the same demodulator (e.g., signals of two digital cable television channels being forwarded to QAM demodulator “configured to perform quadrature amplitude modulation (QAM) demodulation of digital cable television signals”). Ex. 1224, [0038], [0040]; Ex. 1202, ¶ 193.

Thus, prior to Pugel’s digital tuner 130 processing the digital signals, the signals of the desired television channels occupy non-contiguous portions of a frequency spectrum as recited in Element [7B]. Ex. 1202, ¶¶ 189-194.

c. [7C] “after said frequency shift, said selected plurality of desired television channels occupy a contiguous frequency spectrum.”

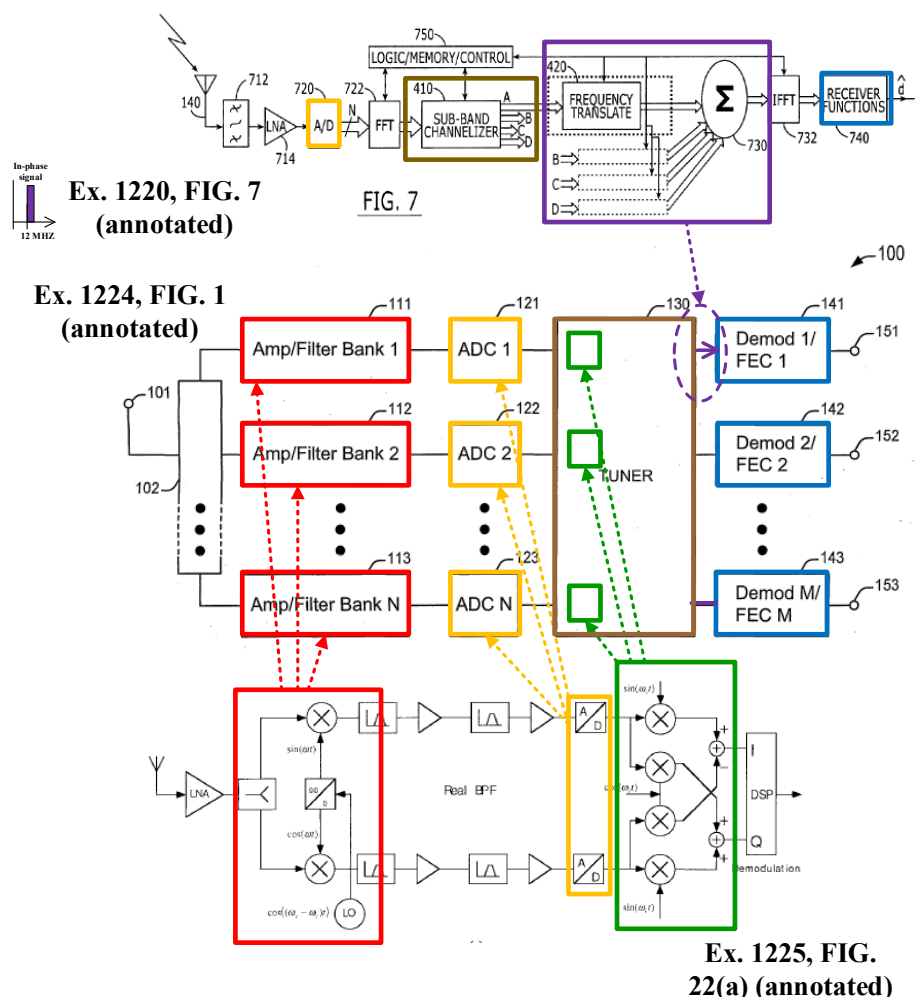
As described above with respect to claim 6, both Pugel and Crols teach downconverting digital signals produced by analog-to-digital converters. Ex. 1230, claims 14, 15, 18, 20, 21; Ex. 1225, pp. 279-280; Ex. 1202, ¶ 195. However, Pugel

and Crols do not expressly disclose a scenario where the signals of the desired television channels are in a contiguous frequency spectrum after the downconversion, as recited in Element [7C]. Ex. 1202, ¶ 195. Karabinis, however, provides such a scenario as illustrated below, in which a Karabinis receiver 120 (fuchsia) receives a plurality of signals with non-contiguous frequencies (gold), and translates the frequencies so that the signals are output within a contiguous frequency band (orange). Ex. 1220, [0017]-[0018], [0037]-[0038], [0042]-[0043], [0047]-[0049]; Ex. 1202, ¶ 195.



Ex. 1220, Fig. 1 (annotated)

Similar to the Pugel-Crols receiver, Karabinis's receiver is configured to receive signals at multiple non-contiguous frequencies and digitize the received signals using analog-to-digital converters (gold). Ex. 1220, [0010], [0031], [0037]-[0038], [0042], [0047]-[0048]; Ex. 1224, Abstract, [0009], [0011], [0023]-[0026], [0029-36], [0043]-[0044]; Ex. 1202, ¶ 196.



Karabinis also includes digital circuitry—e.g., sub-band channelizer 410 (**brown**)—that performs the same function as Pugel’s digital tuner 130, which is to isolate the plurality of the non-contiguous frequencies (digital in-phase and quadrature signals of desired cable television channels as taught by Pugel-Crols) from the digitized signals and output them for demodulation. Ex. 1220, [0042], [0044], [0047], [0049], Figs. 4-5, 7; Ex. 1202, ¶ 197.

In Pugel, signals of desired cable television channels are provided by the digital tuner 130 to the QAM demodulator 141. Ex. 1224, [0027], [0040], [0046];

Ex. 1202, ¶¶ 195, 198. While Pugel is silent regarding how the signals of the desired cable television channels are provided to the QAM demodulator 141, Karabinis provides a method of outputting the signals of Pugel-Crols' desired television channels to the QAM demodulator 141 by shifting the frequencies of signals of the desired cable television channels into a contiguous frequency band (the claimed "continuous frequency spectrum") using the Karabinis frequency translator 420 (illustrated in Figure 7 of Karabinis reproduced above), and summing the shifted television channels with Karabinis's summer 730. Ex. 1220, [0017], [0042]-[0044], [0049]; Ex. 1220, ¶ 198. The summed contiguous frequency band is then provided to the QAM demodulator 141 to extract the modulated data of the selected cable television channels. Ex. 1224, [0027], [0040], [0046]; Ex. 1202, ¶ 198.

It would have been obvious to a POSITA to modify Pugel's digital tuner 130 to include Karabinis's frequency translator 420 and summer 730, because a POSITA would have been motivated to implement Pugel's system with known solutions such that Pugel's digital tuner 130 can output signals of desired cable television channels to Pugel's QAM demodulator 141. Ex. 1202, ¶ 199. Doing so would have permitted Pugel's QAM demodulator 141 to receive signals of all of the desired cable television channels simultaneously over a single bus. Ex. 1202, ¶ 199. A POSITA would have been motivated to turn to other known topologies, such as Karabinis, in view of Pugel's express teaching that Pugel's digital tuner 130 may include "a

multitude of components configured as is well known in the art to recover a plurality of digital channel signals substantially simultaneously.” Ex. 1224, [0037]; Ex. 1202, ¶ 199.

Implementing Karabinis’s frequency translator 420 and summer 730 in Pugel’s digital tuner 130 would have been nothing more than applying a known technique (providing signals of desired channels in a “contiguous frequency spectrum”) to improve a known device (Pugel-Crols’s receiver circuits comprising the digital tuner 130 and the QAM demodulator 141) ready for improvement to yield predictable results (Pugel’s digital tuner 130 sending in-phase and quadrature signals of desired cable television channels in a single bus to Pugel’s QAM demodulator 141). Ex. 1202, ¶ 200. A POSITA would have had a reasonable expectation of success given the express teachings in Pugel to turn to other systems, Karabinis’ detailed descriptions of the operational effectiveness of its topologies, and the POSITA’s own familiarity with known receiver circuit topologies in the art. Ex. 1202, ¶ 200.

Accordingly, Element [7C], and the entirety of claim 7, is obvious over the combination of Pugel, Crols, and Karabinis. Ex. 1202, ¶¶ 188-201.

2. Dependent Claim 17

- a. [17A] **“The method of claim 16, wherein:”**
- b. [17B] **“prior to said frequency shifting, said selected plurality of desired television channels occupy non-contiguous portions of a frequency spectrum; and”**
- c. [17C] **“after said frequency shifting, said selected plurality of desired television channels occupy a contiguous frequency spectrum.”**

Claim 17 is directed to substantially identical subject matter as claim 7 and is taught by Pugel in view of Crols and further in view of Karabinis, for the same reasons set forth in connection with claim 7. *See supra* Section VII.C.1; Ex. 1202, ¶ 202.

D. Ground D: Claims 8, 9, 10, 18, 19, and 20 are Obvious Over Pugel In View of Crols and Further in View of Jensen ’170.

1. Dependent Claims 8 and 9

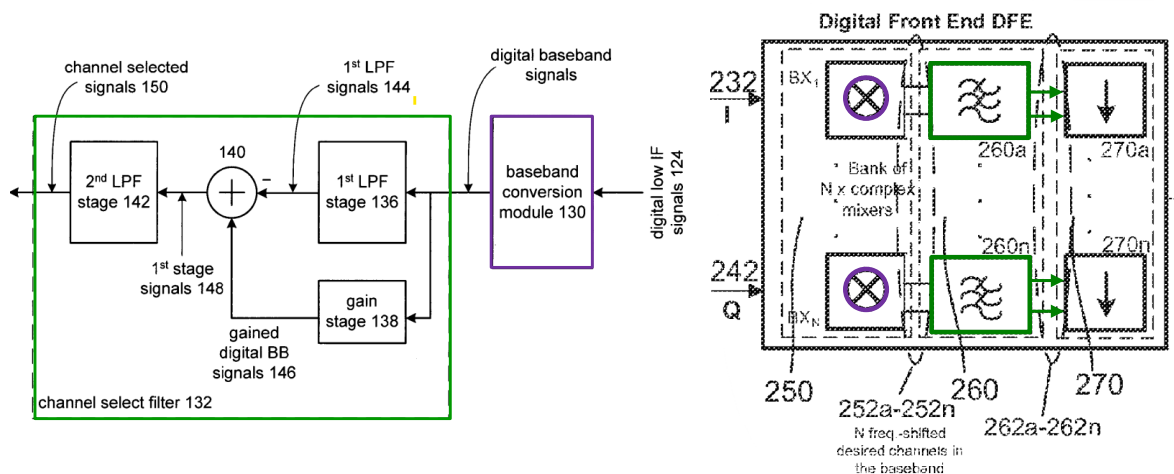
- a. [8] **“The wideband receiver system of claim 1, wherein said digital circuitry comprises a plurality of channel filters configured to perform said selection of said plurality of desired television channels.”**
- b. [9] **“The wideband receiver system of claim 8, wherein each one of said plurality of channel filters is a finite impulse response filter.”**

As discussed above, Pugel’s digital tuner 130 (the claimed “digital circuitry”) is configured to select signals of “one or more particular digital channels desired to be recovered” from “digital signals converted by the plurality of analog-to-digital converters 121, 122, 123” and output the selected digital channels to demodulation

circuits 141, 142, 143. Ex. 1224, [0037]-[0039]; Ex. 1202, ¶¶ 204-205. Before the selection process, the digital signals are downconverted by the digital tuner 130. Ex. 1224, [0037], claims 14-15, 18, 20-21; *see supra* Section VII.A.4; Ex. 1202, ¶ 206. The selection is performed by the digital tuner 130 by “demultiplex[ing] only the digital channel signals corresponding to those digital cable television channels” selected via the channel selector 315. Ex. 1224, [0038]; Ex. 1202, ¶ 205. While Pugel does not expressly disclose in detail the components inside the digital tuner 130 that perform the downconversion and the selection, Pugel suggests that the digital tuner may include “a multitude of components configured as is well known in the art to recover a plurality of digital channel signals substantially simultaneously using a plurality of separate digital processors or a single digital processor.” Ex. 1224, [0037]; Ex. 1202, ¶ 207.

To any extent that Pugel does not explicitly disclose the components of the digital tuner 130 configured to perform the downconversion and the selection, Jensen ’170 describes using a baseband conversion module 130 to downconvert digital signals and low pass filters (LPFs) to build a “channel select” filter 132 that, like the filters 260 in the ’362 Patent, perform the claimed selection by allowing only selected signals to pass through the filters and blocking the undesired signals. *Compare* Ex. 1230, Fig. 9 (channel select filter 132), [0009], [0016]-[0017], [0064], [0066]-[0067] *with* Ex. 1201, Fig. 2 (filters 260), 5:49-58, 6:43-54; Ex. 1202, ¶ 208.

Specifically, a portion of Jensen '170's digital demodulator 116 (below left), which is the same as each of the I path 232 and Q path 243 of the '362 Patent's digital front end 230 (below right), includes a baseband conversion module 130 (purple) followed by a channel select filter 132 (green). Ex. 1230, [0064]-[0066]; Ex. 1202, ¶¶ 209-210. The channel-select filter 132 includes a first low pass filter stage 136 and a second low pass filter stage 142, which are implemented with finite impulse response (FIR) filters. Ex. 1230, [0010], [0064]-[0066], [0071]-[0073]; Ex. 1202, ¶¶ 209-210.

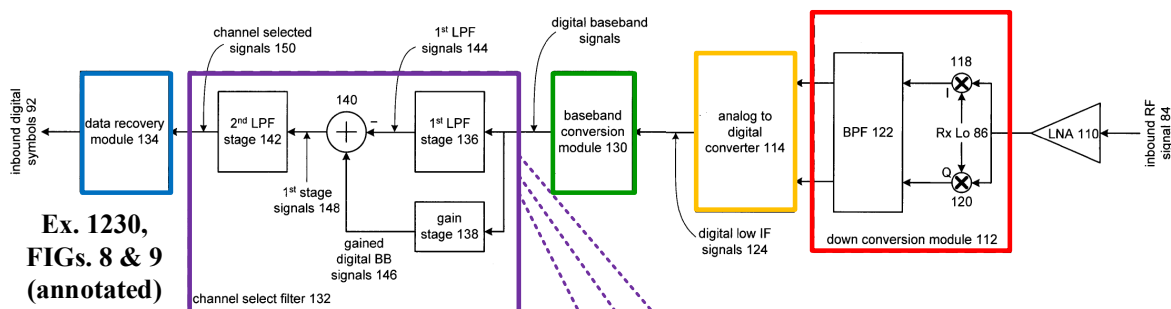


Ex. 1230, Fig. 9 (annotated, excerpted); Ex. 1201, Fig. 2 (annotated, excerpted)

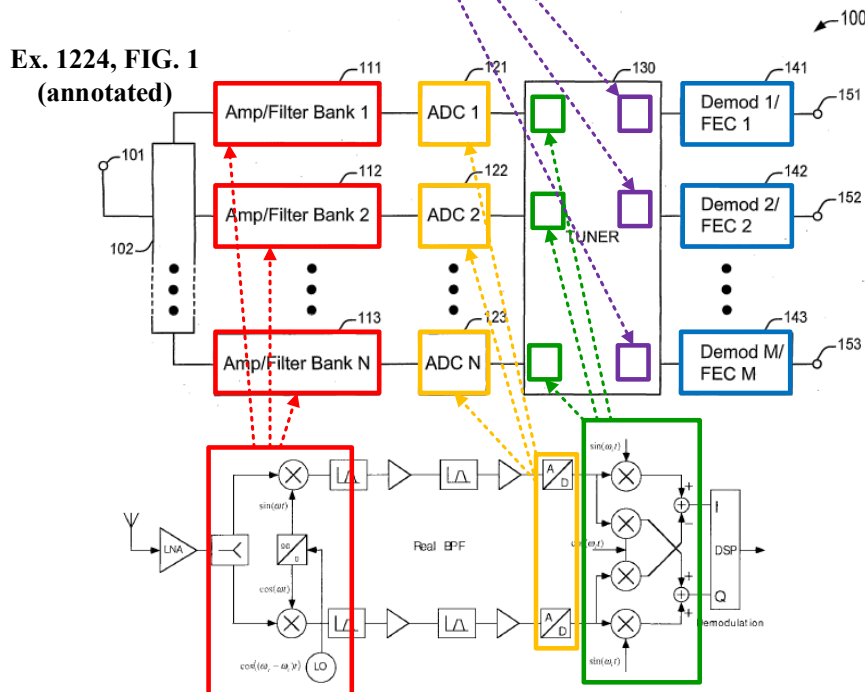
Digital low IF signals 124 enter the baseband conversion module 130 in Jensen '170, where the baseband conversion module 130 shifts the frequency of the desired channel to baseband. Ex. 1230, [0064]-[0065]; Ex. 1202, ¶¶ 208-209. The channel select filter 132 then selects the desired channels, while filtering out the remaining channels. Ex. 1230, [0007], [0009]-[0010], [0012], [0067]-[0068]; Ex.

1202, ¶ 208. Pugel in view of Crols and further in view of Jensen '170 thus teaches claims 8 and 9. Ex. 1202, ¶¶ 209-210.

As explained by Jensen '170, finite impulse response (FIR) filters were “[a] popular class of filters for channel-select filtering ... because of their inherent linear phase response.” Ex. 1230, [0010]; Ex. 1202, ¶ 211. A POSITA would have selected FIR filters for use as the low pass filters 136, 142 in the channel select filter 132 to take advantage of their linear phase response, which avoids distorting the received signal, and would have known to do so because of the popularity of such filters. Ex. 1230, [0009]-[0010]; Ex. 1202, ¶ 211.



**Ex. 1230,
FIGS. 8 & 9
(annotated)**



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

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

It would have been obvious to a POSITA to modify Pugel's digital tuner 130 (see above) to include circuit topologies of the channel select filter 132 as taught by Jensen '170, because a POSITA would have been motivated to implement Pugel's digital tuner 130 with known solutions, in view of Pugel's express teaching that digital tuner 130 could be implemented with "a multitude of components configured as is well known in the art to recover a plurality of digital channel signals." Ex. 1224, [0037]; Ex. 1202, ¶¶ 212-213.

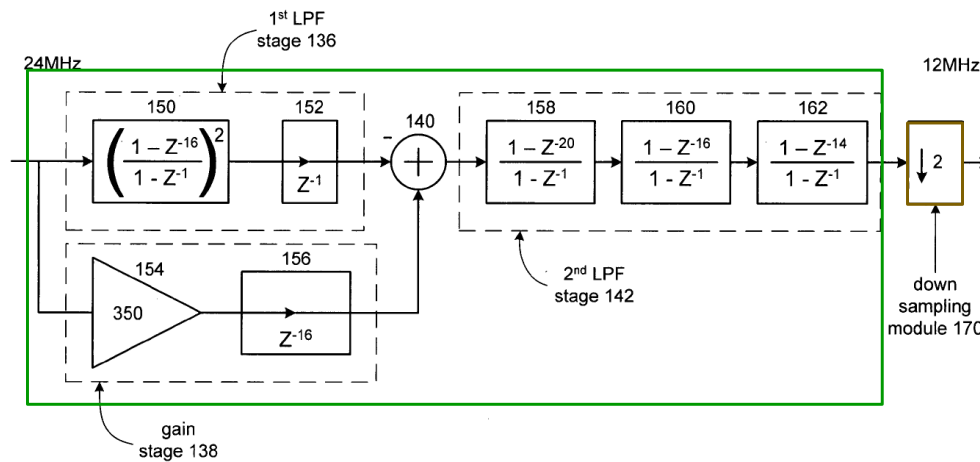
Applying Jensen '170 channel select filter 132 comprising FIR-based low pass filters to Pugel's digital tuner 130 would have been nothing more than applying a known technique (using channel select filters to filter signals of desired channels as taught by Jensen '170) to improve a known device (Pugel's digital tuner 130) to yield predictable results (Pugel's digital tuner 130 filtering signals of desired television channels using Jensen '170's channel select filters). Ex. 1202, ¶ 213. A POSITA would have had a reasonable expectation of success given the express teachings in Pugel to turn to other systems, such as Jensen '170's detailed descriptions of using channel select filters implemented using FIR architecture, and the POSITA's own familiarity with known receiver circuit topologies in the art. Ex. 1202, ¶ 213.

2. Dependent Claim 10

- a. [10] “The wideband receiver system of claim 1, wherein said digital circuitry comprises a decimator circuit configured to decimate one or more of said selected plurality of television channels prior to said output of said selected plurality of desired television channels.”**

Pugel is silent with regard to whether digital tuner 130 (the claimed “digital circuitry”) comprises a decimator circuit. As explained by Jensen '170, however, decimation was commonly performed to reduce the sampling rate of a digital signal, as ADCs were typically high sampling rate devices, and reducing the sampling rate would reduce power consumption and complexity in subsequent processing. Ex.

1230, [0074]-[0076], [0087-90], Figs. 15, 23, 24, 26, 28; Ex. 1202, ¶ 216. Jensen '170 further describes that the channel select filter 132 (**green**) may further include a down-sampling module 170 (**brown**), which reduces the sampling rate of the signals of the selected channel to produce down-sampled signals for the data recovery module 134 of the RF receiver. Ex. 1230, [0074]-[0075], Fig. 15; Ex. 1202, ¶ 217.



Ex. 1230, Fig. 15 (annotated)

This issue of sampling rates described in Jensen '170 is precisely the situation in Pugel's design, where the rate of Pugel's ADCs for sampling the wideband RF source signals is much higher (e.g., 600MHz) than the rate for demodulating individual television channels (e.g., a 6 MHz channel requiring a sampling rate of 12 MHz). Ex. 1224, [0034]; Ex. 1202, ¶ 218.

Following Jensen '170, a POSITA would have included a decimator circuit in the Pugel digital tuner 130 to reduce the sampling rate of digital signals and thereby

reduce power consumption and/or complexity in subsequent processing (e.g., in data recovery module 134). Ex. 1230, [0074]-[0075], Fig. 15; Ex. 1202, ¶ 218. Such a combination of Pugel with Jensen '170 would have been nothing more than the use of a known technique (Jensen '170's decimator following a channel select filter) to improve a similar device (Pugel's receiver with similar architecture) in the same way that Jensen '170 describes. Ex. 1202, ¶ 219.

As disclosed by Jensen '170, the use of decimation modules or of channel-select decimation filters (which combined a FIR filter with decimation) was common (and thus well-known), and the result of including decimation in the Pugel digital tuner 130 would thus have been predictable to a POSITA. Ex. 1230, [0074]-[0075]; Ex. 1202, ¶ 219.

3. Dependent Claims 18 and 19

- a. [18] “The method of claim 11, wherein said digital circuitry comprises a plurality of channel filters configured to perform said selecting.”**
- b. [19] “The method of claim 18, wherein each one of said plurality of channel filters is a finite impulse response filter.”**

Claims 18 and 19 are directed to substantially identical subject matter as claims 8 and 9, respectively, and are taught by Pugel in view of Crols and further in view of Jensen '170, for the same reasons set forth in connection with claims 8 and 9. *See supra* Section VII.D.1; Ex. 1202, ¶¶ 221-223.

4. Dependent Claim 20

- a. [20] “The method of claim 11, comprising decimating, by said digital circuitry, one or more of said selected plurality of desired television channels prior to said outputting of said selected plurality of television channels.”

Claim 20 is substantially identical to claim 10 and is taught by Pugel in view of Crols and further in view of Jensen '170, for the same reasons set forth in connection with claim 10. *See supra* Section VII.D.2; Ex. 1202, ¶ 221. In particular, claim 20 merely recasts the required functionality of claim 10 as a performed step. 1202, ¶ 224.

VIII. GROUNDS FOR STANDING & FEE PAYMENT

Petitioner hereby certifies that the '362 Patent is available for, and Petitioner is not barred or estopped from requesting, *inter partes* review challenging claims 1-20.

Pursuant to 37 C.F.R. § 42.103, the undersigned authorizes the charge of any required fees to Deposit Account No. 19-0733.

IX. CONCLUSION

Inter partes review should be instituted and claims 1-20 canceled.

Dated: February 16, 2024

By: /Frederic M. Meeker/

Frederic M. Meeker
Reg. No. 35,282
Banner & Witcoff, Ltd.
1100 13th Street, NW
Suite 1200
Washington, DC 20005
(202) 824-3000
fmeeker@bannerwitcoff.com

CERTIFICATION UNDER 37 CFR § 42.24(d)

Under the provisions of 37 CFR § 42.24(d), the undersigned hereby certifies that the word count for the foregoing Petition for Inter Partes Review totals 12,752, which is less than the 14,000 allowed under 37 CFR § 42.24(a)(1)(i). This total includes 12,697 words as counted by the Word Count feature of Microsoft Word and 55 words used in annotations.

Pursuant to 37 C.F.R. § 42.24(a)(1), this count does not include the table of contents, the table of authorities, mandatory notices under § 42.8, the certificate of service, this certification of word count, the claims listing appendix, or appendix of exhibits.

BANNER & WITCOFF, LTD

Dated: February 16, 2024

By: /Frederic M. Meeker/

Frederic M. Meeker
Reg. No. 35,282
Banner & Witcoff, Ltd.
1100 13th Street, NW
Suite 1200
Washington, DC 20005
(202) 824-3000
fmeeker@bannerwitcoff.com

CERTIFICATE OF SERVICE

Pursuant to 37 C.F.R. § 42.105, I hereby certify that I caused a true and correct copy of this Petition for *Inter Partes* Review in connection with U.S. Patent No. 9,210,362 and supporting evidence to be served via FedEx Priority Overnight on February 16, 2024, on the following:

23446 - MCANDREWS HELD & MALLOY, LTD
500 WEST MADISON STREET
SUITE 3400
CHICAGO, IL 60661
UNITED STATES

Dated: February 16, 2024

By: /Frederic M. Meeker/

Frederic M. Meeker
Reg. No. 35,282

CLAIM LISTING APPENDIX

U.S. Pat. No. 9,210,362

Designation	Claim Language
Claim 1	
[1A]	A wideband receiver system comprising:
[1B]	a mixer module configured to downconvert a plurality of frequencies that comprises a plurality of desired television channels and a plurality of undesired television channels;
[1C]	a wideband analog-to-digital converter (ADC) module configured to digitize said plurality of frequencies comprising said plurality of desired television channels and said plurality of undesired television channels;
[1D]	digital circuitry configured to: select said plurality of desired television channels from said digitized plurality of frequencies; and
[1E]	[digital circuitry configured to:] output said selected plurality of television channels to a demodulator as a digital datastream.
Claim 2	
2	The wideband receiver system of claim 1, wherein said output of said digital datastream is via a serial interface.
Claim 3	
3	The wideband receiver system of claim 1, wherein said output of said digital datastream is via a parallel interface.
Claim 4	
4	The wideband receiver system of claim 1, wherein said mixer module comprises a first mixer configured to generate an in-phase signal and a second mixer configured to generate a quadrature signal.
Claim 5	
5	The wideband receiver system of claim 1, wherein said wideband analog-to-digital converter comprises: a first ADC configured to generate a digital in-phase signal; and a second ADC configured to generate a digital quadrature signal.

Designation	Claim Language
Claim 6	
6	The wideband receiver system of claim 5, wherein said digital circuitry comprises a plurality of complex mixers configured to frequency shift said selected plurality of desired television channels.
Claim 7	
[7A]	The wideband receiver system of claim 6, wherein:
[7B]	prior to said frequency shift, said selected plurality of desired television channels occupy non-contiguous portions of a frequency spectrum; and
[7C]	after said frequency shift, said selected plurality of desired television channels occupy a contiguous frequency spectrum.
Claim 8	
8	The wideband receiver system of claim 1, wherein said digital circuitry comprises a plurality of channel filters configured to perform said selection of said plurality of desired television channels.
Claim 9	
9	The wideband receiver system of claim 8, wherein each one of said plurality of channel filters is a finite impulse response filter.
Claim 10	
10	The wideband receiver system of claim 1, wherein said digital circuitry comprises a decimator circuit configured to decimate one or more of said selected plurality of television channels prior to said output of said selected plurality of desired television channels.
Claim 11	
[11A]	A method comprising: in a wideband receiver system:
[11B]	downconverting, by a mixer module of said wideband receiver system, a plurality of frequencies that comprises a plurality of desired television channels and a plurality of undesired television channels;
[11C]	digitizing, by a wideband analog-to-digital converter (ADC) module of said wideband receiver system, said plurality of frequencies comprising said plurality of desired television channels and said plurality of undesired television channels;

Designation	Claim Language
[11D]	selecting, by digital circuitry of said wideband receiver system, said plurality of desired television channels from said digitized plurality of frequencies; and
[11E]	outputting, by said digital circuitry of said wideband receiver system, said selected plurality of television channels to a demodulator as a digital datastream.
Claim 12	
12	The method of claim 11, comprising outputting, by said digital circuitry of said wideband receiver system, said digital datastream via a serial interface.
Claim 13	
13	The method of claim 11, comprising outputting, by said digital circuitry of said wideband receiver system, said digital datastream via a parallel interface.
Claim 14	
[14A]	The method of claim 11, comprising:
[14B]	generating, by a first mixer of said mixer module, an in-phase signal; and
[14C]	generating, by a second mixer of said mixer module, a quadrature signal.
Claim 15	
15	The method of claim 11, comprising: generating, via a first ADC of said wideband analog-to-digital converter, a digital in-phase signal; and generating, via a second ADC of said wideband analog-to-digital converter, a digital quadrature signal.
Claim 16	
16	The method of claim 15, comprising frequency shifting said selected plurality of desired television channels via a plurality of complex mixers of said digital circuitry.
Claim 17	
[17A]	The method of claim 16, wherein:
[17B]	prior to said frequency shifting, said selected plurality of desired television channels occupy non-contiguous portions of a frequency spectrum; and
[17C]	after said frequency shifting, said selected plurality of desired television channels occupy a contiguous frequency spectrum.
Claim 18	

Designation	Claim Language
18	The method of claim 11, wherein said digital circuitry comprises a plurality of channel filters configured to perform said selecting.
Claim 19	
19	The method of claim 18, wherein each one of said plurality of channel filters is a finite impulse response filter.
Claim 20	
20	The method of claim 11, comprising decimating, by said digital circuitry, one or more of said selected plurality of desired television channels prior to said outputting of said selected plurality of television channels.