

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

COMCAST CABLE COMMUNICATIONS, LLC,
Petitioner,

v.

ENTROPIC COMMUNICATIONS, LLC.,
Patent Owner.

Patent No. 11,381,866
Filing Date: January 28, 2022
Issue Date: July 5, 2022
Title: CABLE TELEVISION DEVICE

Inter Partes Review No.: IPR2024-00437

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

TABLE OF CONTENTS

I.	MANDATORY NOTICES	viii
A.	Real Parties in Interest (37 C.F.R. § 42.8(b)(1)).....	viii
B.	Related Matters (37 C.F.R. § 42.8(b)(2)).....	viii
C.	Lead and Back-Up Counsel (37 C.F.R. § 42.8(b)(3)).....	x
II.	INTRODUCTION	1
III.	SUMMARY OF ARGUMENT.....	1
IV.	OVERVIEW OF THE '866 PATENT	1
A.	Brief Description	1
B.	Prosecution History	3
C.	Earliest Priority Date for the Claims	4
V.	OVERVIEW OF PRIOR ART.....	5
A.	Pugel.....	5
B.	Crols	8
C.	Chandrakasan	12
D.	Jensen '170	13
E.	Zaltsman	15
VI.	IDENTIFICATION OF CHALLENGE PURSUANT TO 37 C.F.R. § 42.104(b)	16
A.	Claims for Which Review is Requested and Grounds on Which Challenge Is Based	16
B.	Summary of the Grounds and Comparison of Claim Limitations	18
C.	314(a) Discretion Does Not Apply.....	19
D.	325(d) Discretion Does Not Apply	20
E.	Level of Ordinary Skill	21
F.	Claim Construction.....	21
1.	“Wideband”	21
2.	“Digital Down Converter”/“Digital Front End”	22
VII.	SPECIFIC GROUNDS FOR UNPATENTABILITY	24

A.	Grounds A0 and A1: Pugel	24
1.	Independent Claim 27	25
2.	Independent Claim 41	31
3.	Independent Claim 55	33
4.	Independent Claim 69	35
5.	Dependent Claims 28, 42, 56, and 70	36
6.	Dependent Claims 33, 47, 61, and 75	38
7.	Dependent Claims 37, 51, 65, and 79	41
8.	Dependent Claims 39, 53, 67, and 81	41
9.	Dependent Claims 40, 54, 68, and 82	42
B.	Ground B: Pugel in view of Crols.....	43
1.	Claims 27-28, 33, 37, 39-42, 47, 51, 53-56, 61, 65, 67-70, 75, 79, and 81-82.....	43
2.	Dependent Claims 29, 43, 57, and 71	46
3.	Dependent Claims 30, 44, 58, and 72	49
4.	Dependent Claims 32, 46, 60, and 74	50
C.	Ground C: Pugel in view of Zaltsman.....	52
1.	Dependent Claims 38, 52, 66, and 80	52
D.	Ground D: Pugel in view of Crols and Zaltsman and further in view of Jensen '170	53
1.	Dependent Claims 31, 45, 59, and 73	53
E.	Ground E: Pugel in view of Chandrakasan	58
1.	Independent Claim 1	58
2.	Independent Claim 14	62
3.	Dependent Claims 2 and 15	63
4.	Dependent Claims 7 and 20	64
5.	Dependent Claims 8, 21, 34, 48, 62, and 76	64
6.	Dependent Claims 9 and 22	67
7.	Dependent Claims 11 and 24	68
8.	Dependent Claims 12 and 25	68

9.	Dependent Claims 13 and 26	68
10.	Dependent Claims 35, 36, 49, 50, 63, 64, 77 and 78	69
F.	Ground F: Pugel in view of Chandrakasan and further in view of Crols	69
1.	Dependent claims 3 and 16	69
2.	Dependent claims 4 and 17	70
3.	Dependent claims 6 and 19	70
G.	Ground G: Pugel in view of Chandrakasan and further in view of Zaltsman	71
1.	Dependent Claims 10 and 23	71
H.	Ground H: Pugel in view of Chandrakasan and further in view of Crols, Zaltsman, and Jensen '170	72
1.	Dependent Claims 5 and 18	72
VIII.	GROUNDS FOR STANDING & FEE PAYMENT	73
IX.	CONCLUSION	73
	CERTIFICATION UNDER 37 CFR § 42.24(d)	74
	CERTIFICATE OF SERVICE	75
	CLAIM LISTING APPENDIX	76

EXHIBITS

Ex. 1201:	U.S. Patent No. 11,381,866 (“the ’866 Patent”)
Ex. 1202:	Expert Declaration of David B. Lett
Ex. 1203:	Curriculum Vitae of David B. Lett
Ex. 1204:	Certified Prosecution History of the ’866 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:	Reserved
Ex. 1209:	Reserved
Ex. 1210:	Reserved
Ex. 1211:	Reserved
Ex. 1212:	Reserved
Ex. 1213:	Reserved
Ex. 1214:	U.S. Patent No. 7,237,214 (“Pandey”)
Ex. 1215:	Excerpts of “IEEE Std 100-2000, The Authoritative Dictionary of IEEE Standards Terms, Seventh Edition” (IEEE Press. 2000) (“IEEE Std 100”)
Ex. 1216:	Excerpts of Jan M Rabaey, “Digital Integrated Circuits: A Design Perspective” (Pearson, 2nd ed. 2002) (“Rabaey”)
Ex. 1217:	A. P. Chandrakasan, “Ultra Low Power Digital Signal Processing” Proceedings of 9th International Conference on VLSI Design, Bangalore, India, 1996, pp. 352-357 (“Chandrakasan”)

- Ex. 1218: S. Mirabbasi and K. Martin, “Classical and Modern Receiver Architectures,” IEEE Communications Magazine, vol. 38, no. 11, pp. 132-139, November 2000 (“Mirabbasi”)
- Ex. 1219: U.S. Patent No. 6,061,406 (“Carson”)
- Ex. 1220: Reserved
- Ex. 1221: “Data-Over-Cable Service Interface Specifications: Radio Frequency Interface Specification CM-SP-RFiv2.0-I11-060602,” DOCSIS, June 2006
- Ex. 1222: Reserved
- Ex. 1223: Reserved
- 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. Patent No. 11,381,866
- Ex. 1228: Reserved
- Ex. 1229: Reserved
- 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” (2nd 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: U.S. Pub. No. 2005/0183015 (“Dunton”)
- Ex. 1252: U.S. Pub. No. 2003/0229900 (“Reisman”)
- Exs. 1253-1272: Reserved
- Ex. 1273: Expert Declaration of Dr. Sylvia Hall-Ellis
- Ex. 1274: U.S. Pub. No. 2008/0120667 (“Zaltsman”)
- Ex. 1275: U.S. Patent No. 6,791,995 (“Azenkot”)
- Ex. 1276: U.S. Patent No. 6,542,203 (“Shadwell”)

I. MANDATORY NOTICES

A. 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. 11,381,866 (“the ’866 Patent”), or otherwise has an opportunity to control or direct this Petition or Petitioner’s participation in any resulting IPR.

B. 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 ’866 Patent. Petitioner is also filing petitions for *inter partes* review against related U.S. Patent Nos. 11,399,206 and 9,210,362.

No other Office proceedings (e.g., *inter partes* review, post-grant review, or covered business method) have been filed against the ’866.

Litigation matters

The ’866 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 ’866 Patent was also asserted in *Entropic*

Communications, LLC v. Charter Communications, Inc., No. 2:22-cv-00052-JRG (E.D. Tex. filed Apr. 27, 2022) (“TX litigation”), which case was dismissed on December 10, 2023.

Continuity

According to Office records, the ’866 Patent is a continuation of U.S. Pat. App. No. 17/217,244, filed March 30, 2021 (abandoned), which is a continuation of U.S. Pat. App. No. 16/430,506, filed June 4, 2019 (issued as U.S. Pat. No. 10,972,781), which is a continuation of U.S. Pat. App. No. 15/792,318, filed October 24, 2017 (issued as U.S. Pat. No. 10,313,733), which is a continuation of U.S. Pat. App. No. 14/948,881, filed November 23, 2015 (issued as U.S. Pat. No. 9,819,992), which is a continuation of U.S. Pat. App. No. 14/617,973, filed February 10, 2015 (issued as U.S. Pat. No. 9,210,363), which 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 ’866 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.

C. 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.

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II. INTRODUCTION

Comcast Cable Communications, LLC (“Petitioner”) petitions for *inter partes* review and cancellation of claims 1-82 of U.S. Patent No. 11,381,866 (“the ’866 Patent”) (Ex. 1201).

III. SUMMARY OF ARGUMENT

The ’866 Patent generally claims a cable television (TV) device for digitizing and demodulating a plurality of television channels. The system includes a wideband analog-to-digital converter (ADC) that digitizes a plurality of frequencies, and a digital front end and digital down converters that select the desired channels from the digitized frequencies, and output the selected channels.

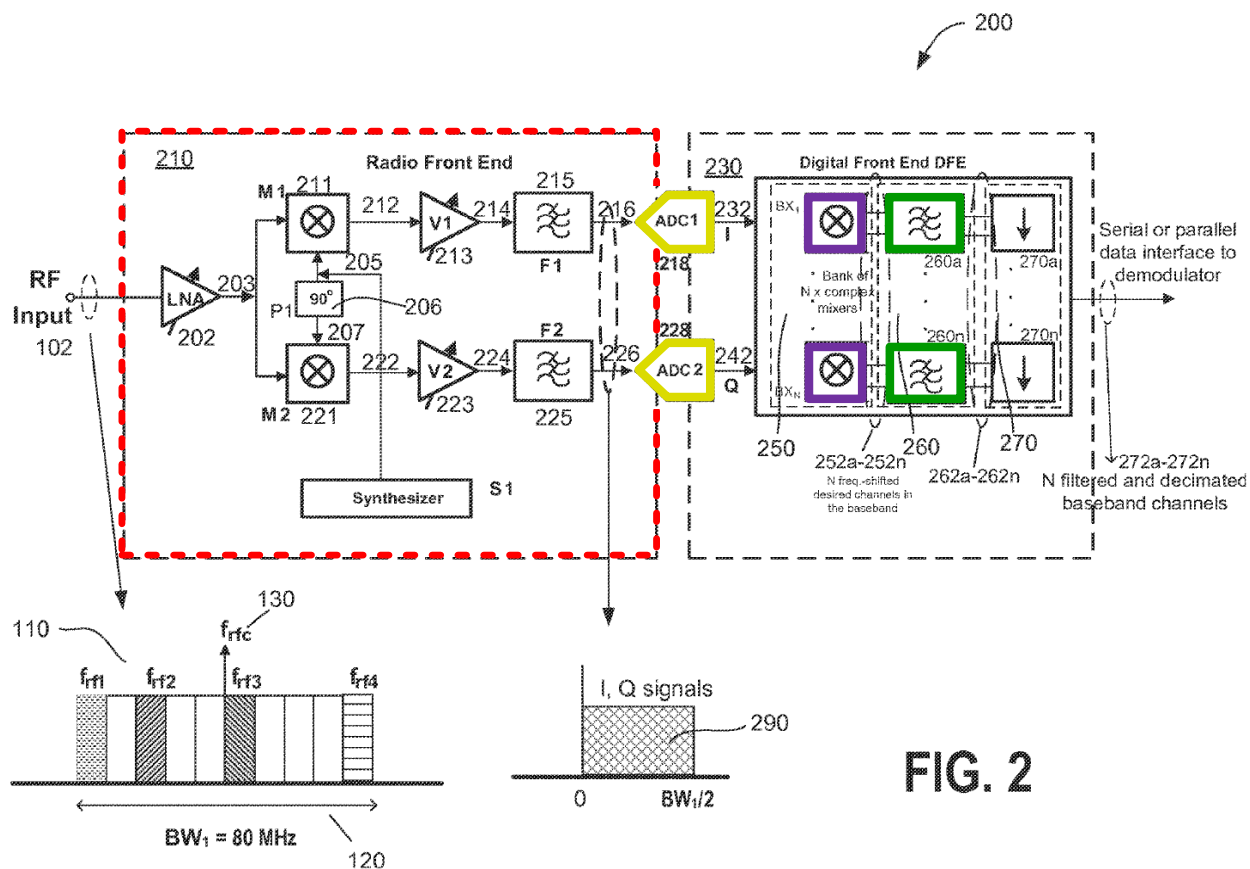
These features and additional features of the ’866 Patent claims are disclosed or rendered obvious by the prior art, e.g., Pugel (Ex. 1224), Crols (Ex. 1225), and other references relied on herein. Accordingly, as set forth below, claims 1-82 of the ’866 Patent are unpatentable and should be cancelled.

IV. OVERVIEW OF THE ’866 PATENT

A. Brief Description

The ’866 Patent describes a wideband receiver system 200 illustrated below “capable of receiving multiple radio frequency channels located in a broad radio frequency spectrum.” Ex. 1201, 1:26-29, 4:35-37; Ex. 1202, ¶ 40. According to the

'866 Patent, a receiver is “wideband” if it is “designed to concurrently receive several TV channels.” *Id.*, 1:35-38; Ex. 1202, ¶ 40.



Ex. 1201, Fig. 2 (annotated)

The system 200 receives desired and undesired television channels as frequencies dispersed within a frequency bandwidth BW_1 . Ex. 1201, 4:38-50. A radio frontend 210 (red) downconverts the bandwidth of channels as in-phase and quadrature signals 212 and 222 at an intermediate frequency (IF), which are digitized by wideband analog-to-digital converters ADC1/ADC2 (gold). *Id.*, 2:59-65, 4:61-24, 5:48-51; Ex. 1202, ¶ 41. U.S. Provisional App. No. 61/170,526 (“526 provisional”), which the '866 Patent incorporates by reference, admits that the left

side of Figure 2 (up to and including ADC1/ADC2) “is similar to conventional tuners.” Ex. 1207, p. 5; Ex. 1201, 1:6-22; Ex. 1202, ¶ 41.

The digital I and Q signals 232 and 242 from ADC1/ADC2 are input to a bank of N complex mixers 250 (**purple**) in a digital front end 230. Ex. 1201, 5:51-55. “Each of the N complex mixers ... extract[s] a different one of the desired channels” from the I and Q signals and “frequency-shifts the extracted signals to the baseband frequency.” *Id.*, 6:2-6; Ex. 1202, ¶ 42. Filters 260a-260n (**green**) filter each frequency-shifted desired channel. Ex. 1201, 6:6-8. After (optional) decimation, baseband channels from multiple rows of digital front end 230 “will be sent as a serial or parallel digital data stream to a demodulator using a serial or parallel data interface according to commonly known methods.” Ex. 1201, 7:10-14; Ex. 1202, ¶ 42.

B. Prosecution History

U.S. Application No. 17/587,415, which became the '866 patent, was filed on January 28, 2022, with a preliminary amendment cancelling claims 1-18 and adding new claims 19-48 claims. Ex. 1204, pp. 2-109. The Office rejected claims 19-27, 29-30, 33-42, 44-45, and 48 as obvious over U.S. Patent No. 6,760,342 (Skones et al.) in view of International Publication No. WO 02/087230 (Uskali et al.). *Id.*, pp. 119-132. The Office action indicated that dependent claims 28 and 43 (providing

channels “via a serial interface”), claims 31 and 46 (“DVR”), and claims 32 and 47 (“picture-in-picture display”) contained allowable subject matter. *Id.*, p. 131.

Applicant received a Notice of Allowance after adding: the limitations of claim 28 to claim 19 (issued claim 1), the limitations of claim 43 to claim 34 (issued claim 14), new independent claim 49 (issued claim 27) based on original claims 19 and 31, new independent claim 63 (issued claim 41) based on original claims 34 and 46, new independent claim 77 (issued claim 55) based on original claims 19 and 32, new independent claim 91 (issued claim 69) based on original claims 34 and 47, and multiple sets of new dependent claims that paralleled existing dependent claims. *Id.*, pp. 148-175; Ex. 1202, ¶¶ 43-46.

C. Earliest Priority Date for the Claims

The earliest possible priority date for the claims 1-9, 13-22, and 26 of the '866 Patent is April 17, 2009, the filing date of the '526 provisional. Each of the references relied on herein is prior art to that date. The earliest possible priority date for the remaining claims is April 19, 2010, the filing date of Application No. 12/762,900, as the '526 provisional is silent regarding a “channel delivered via ... DOCSIS[] protocol,” “DVR,” or “picture-in-picture display.” Ex. 1207, *passim*; Ex. 1202, ¶ 47.

V. OVERVIEW OF PRIOR ART

A. Pugel

Pugel (Ex. 1224) is a PCT Application published December 21, 2007. Ex. 1224, p. 1. As the publication date is more than a year prior to the earliest filing date of the '866 Patent, Pugel is prior art under pre-AIA 35 U.S.C. § 102(b). Pugel was not considered during the prosecution of the '866 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 description below. Ex. 1224, [0022]-[0028], Fig. 1; Ex. 1202, ¶ 80.

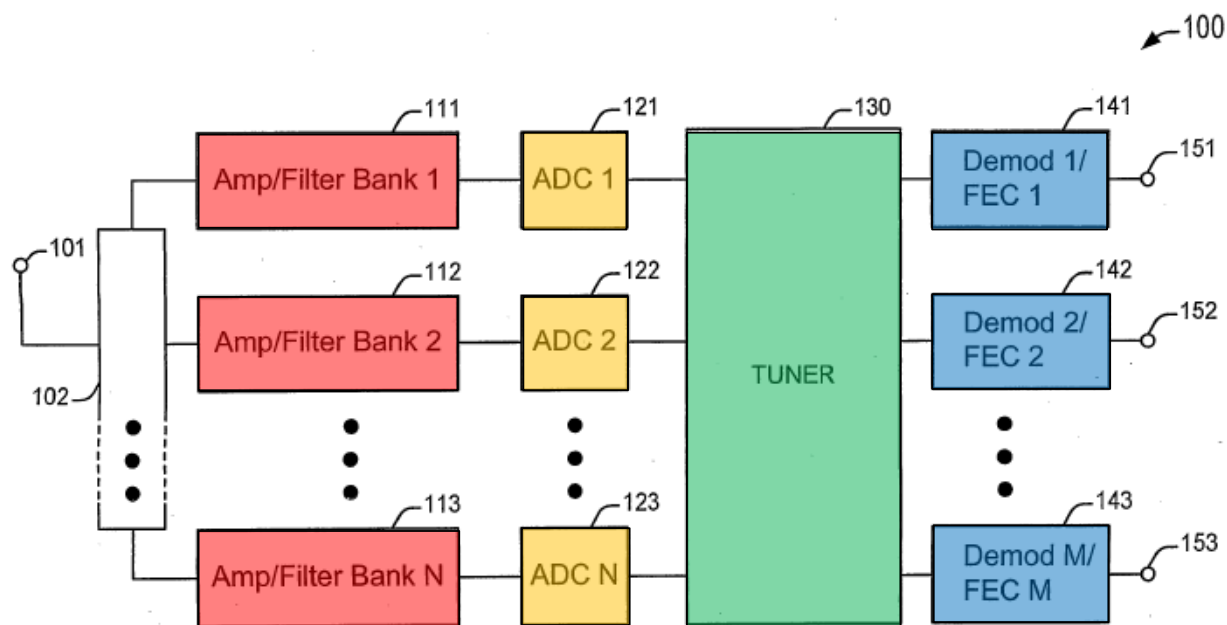


FIG. 1

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.

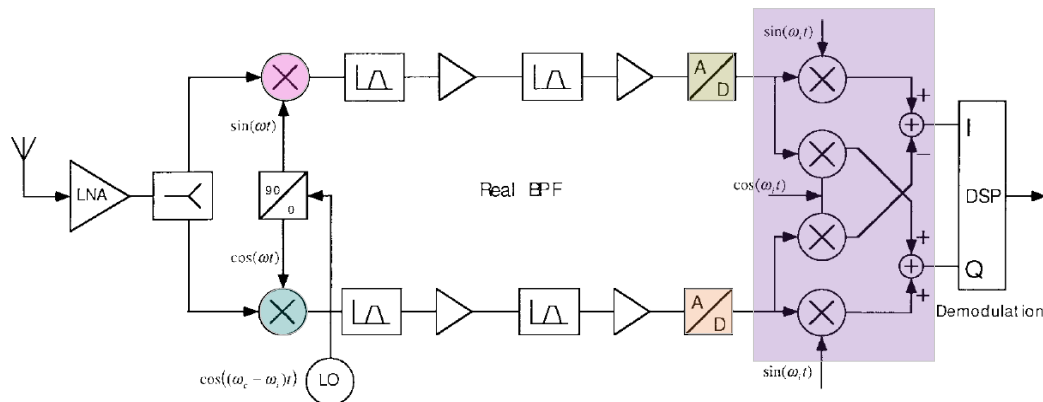
The amplifier-filter banks 111-113 (**red**) “segregate[] the multichannel analog input signal into a plurality of separate analog signals of differing frequency ranges.” Ex. 1224, [0024], [0028]-[0032], [0043]; Ex. 1202, ¶ 82. The plurality of separate signals are undersampled, such that the sampling 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, ¶ 82.

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 130 (**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 '866 Patent, and thus is analogous art. Ex. 1202, ¶ 84. Like the '866 Patent, Pugel relates to a system and method for receiving a wideband radio frequency signal comprising multiple channels. Ex. 1201, 1:26-29; Ex. 1224, Abstract, [0008]-[0013], [0023]-[0024]; Ex. 1202, ¶ 84. Pugel is also reasonably pertinent to problems with which the '866 is concerned, and is also analogous art on that basis. Ex. 1202, ¶ 84. For example, Pugel describes filtering signals for input to an ADC in the same way as is described by the '866 Patent. Compare Ex. 1201, 4:35-6:27, Figs. 2, 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. 1225, p. 448; Ex. 1273, 44-50, 52. Thus, Crols is prior art under pre-AIA 35 U.S.C. § 102(b). Crols was not considered during the prosecution of the '866 Patent. Ex. 1201, pp. 1-2; Ex. 1202, ¶ 85.



Ex. 1225, Fig. 22 (annotated)

Crols describes 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. 271-272; 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 '866 Patent is concerned, and is analogous art to the '866 Patent on at least that basis. Ex. 1202, ¶ 88. For example, the '866 Patent indicates a circuit wherein an RF signal is amplified, and the downconverted I and Q signals are generated, prior to digitization by an ADC. Ex. 1201, 4:35-6:15, Fig. 2; Ex. 1202, ¶ 88.

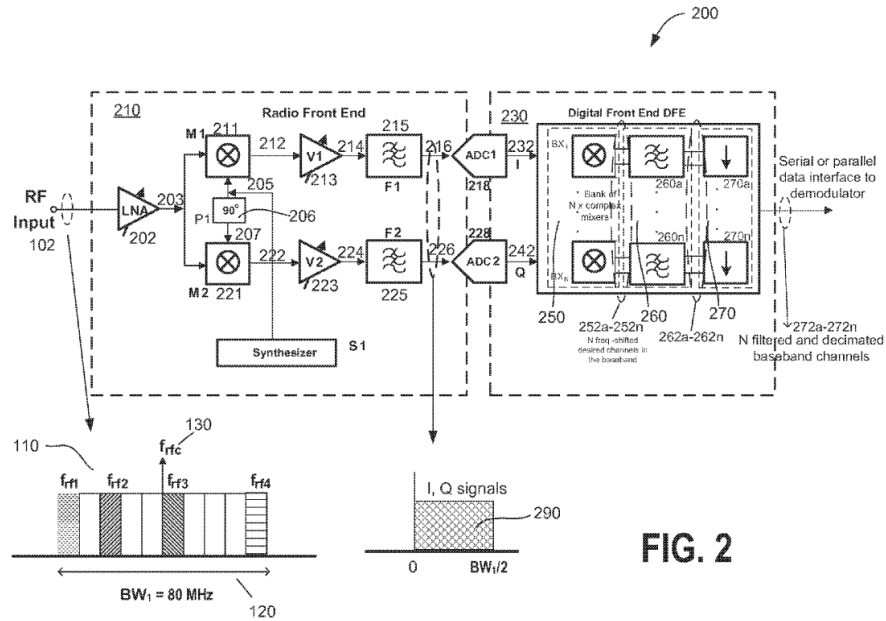


FIG. 2

Ex. 1201, Fig. 2

Similarly, Crols presents circuit diagrams depicting complex bandpass filters consistent with the '866 Patent's analog circuit topologies:

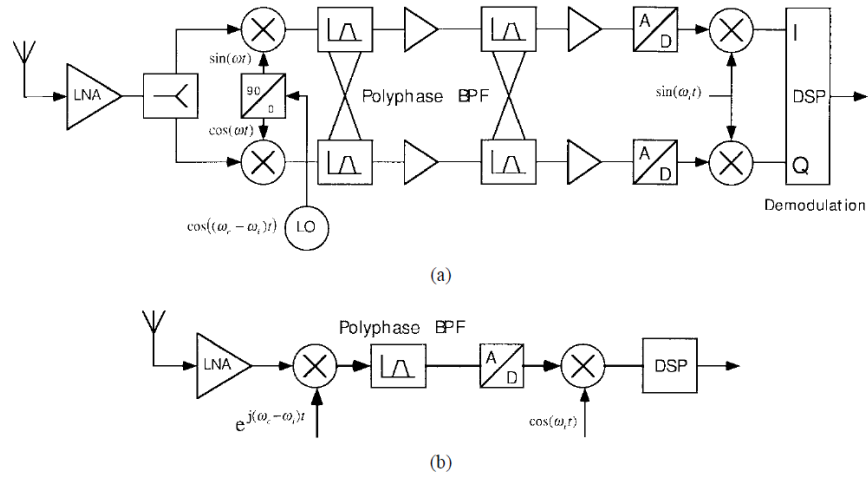


Fig. 21. The topology of a low-IF receiver which uses a complex bandpass filter in the LF part. (a) Full notation and (b) compact notation.

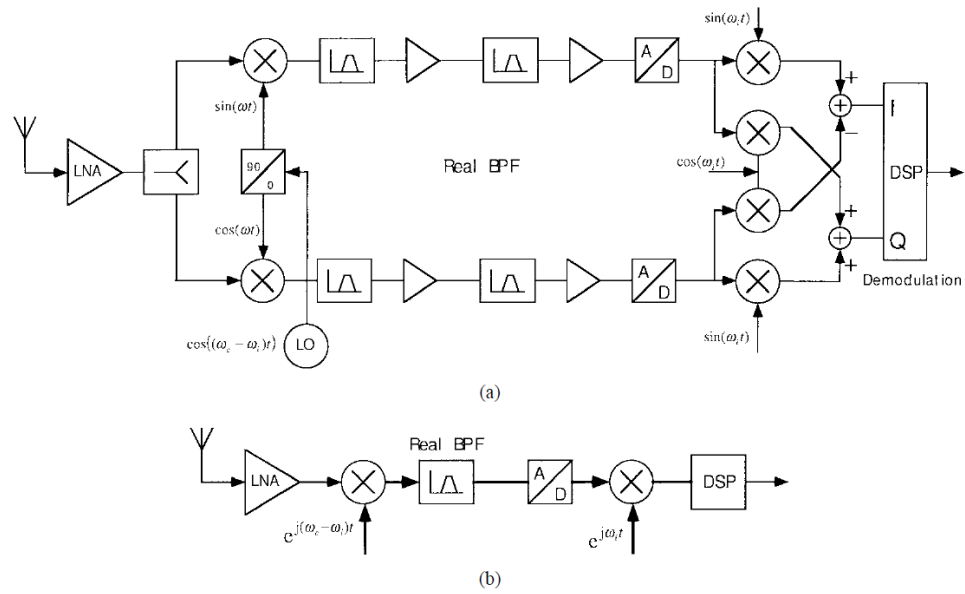


Fig. 22. The topology of a low-IF receiver which uses real filters in the LF part. (a) Full notation and (b) compact notation.

Ex. 1225, Figs. 21-22

Both techniques show ways to suppress unwanted signals as part of downconversion to a baseband 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, 5:17-32; Ex. 1202, ¶ 89.

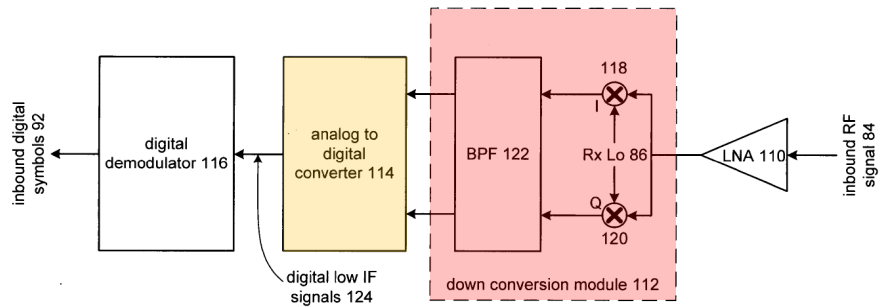
C. Chandrakasan

Chandrakasan (Ex. 1217) is a Non-Patent Literature published in January 1996. Ex. 1217, cover. Chandrakasan was publicly available as of April 23, 1996. Ex. 1273, 35-39, 52. Thus, Chandrakasan is prior art under pre-AIA 35 U.S.C. § 102(b). Chandrakasan was not considered during the prosecution of the '866 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 “require 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.

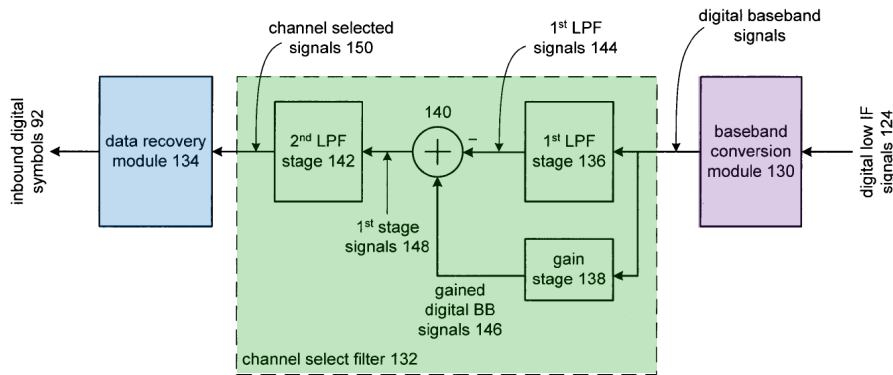
Chandrakasan is reasonably pertinent to problems with which the '866 Patent is concerned, and is analogous art to the '866 Patent on at least that basis. Both techniques represent well-known approaches to signal transmissions in digital systems, providing example implementations for a POSITA looking to build systems in real-world applications. Ex. 1217, p. 352; Ex. 1201, 7:10-19; Ex. 1202, ¶ 91.

D. 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). Jensen '170 was not considered during the prosecution of the '866 Patent. Ex. 1201, pp. 1-2; Ex. 1202, ¶ 92.



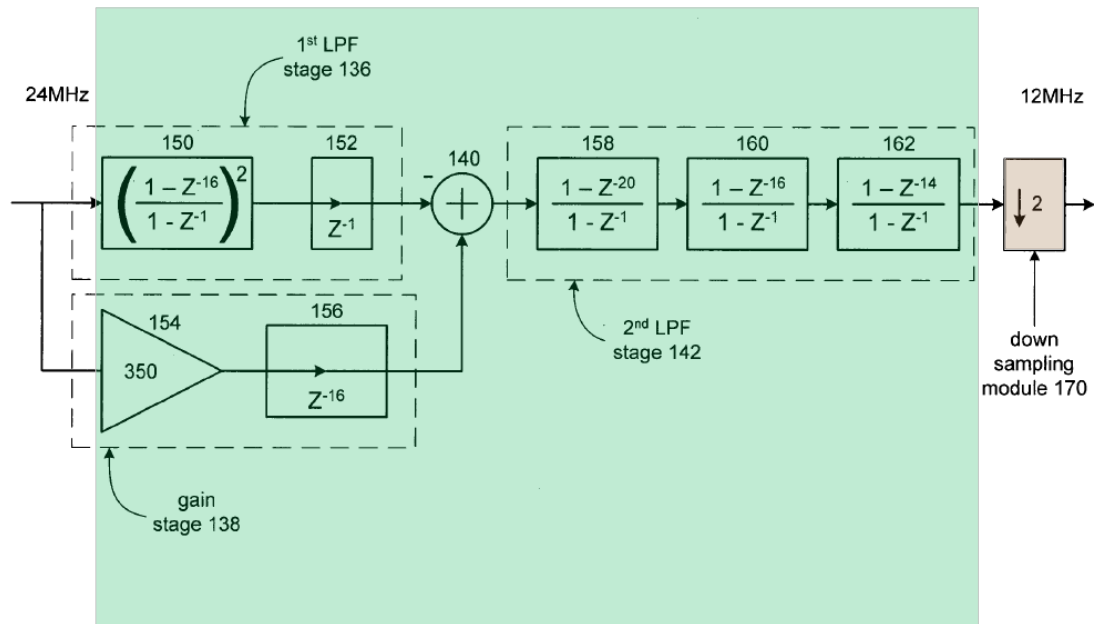
Ex. 1230, Fig. 8 (annotated)



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, ¶

93. 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. Ex. 1230, [0060]-[0061]; Ex. 1202, ¶ 93. 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, ¶ 93. 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, ¶ 93. 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. Ex. 1230, [0074]-[0075]; Ex. 1202, ¶ 94.



Ex. 1226, Fig. 15 (annotated)

Jensen '170 is reasonably pertinent to problems with which the '866 Patent is concerned, and is analogous art to the '866 Patent on at least that basis. Ex. 1202, ¶ 95. Jensen '170 presents known systems for implementing demodulators and decimators for digital channel selection, similar to the '866 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, 7:20-8:34, 9:35-11:7; Ex. 1202, ¶ 95.

E. Zaltsman

Zaltsman (Ex. 1274) is a U.S. Patent Application Publication published May 22, 2008. As the publication date is more than a year prior to the earliest priority date of the '866 Patent claims against which it is asserted herein, Zaltsman is prior art under pre-AIA 35 U.S.C. § 102(b). Further, in view of its October 29, 2007, filing date, Zaltsman is prior art under pre-AIA 35 U.S.C. § 102(e) as to all claims. Zaltsman was not considered during the prosecution of the '866 Patent. Ex. 1201, pp. 1-2; Ex. 1202, ¶ 96.

Zaltsman discloses a cable gateway system and architecture incorporating a hybrid digital video transceiver. Ex. 1274, Abstract, [0003]-[0023]; Ex. 1202, ¶ 97. Zaltsman provides a detailed background section discussing known technology as of 2007, particularly regarding the use of digital television standards including

DOCSIS in wideband television transmission to a set top receiver. Ex. 1274, [0003]-[0023]; Ex. 1202, ¶ 97. In particular, Zaltsman states that, in the latest DOCSIS standard of the day, multiple television channels were bonded together, typically using a 6 MHz frequency band. Ex. 1274, [0012]-[0013]; Ex. 1202, ¶ 97.

Zaltsman is reasonably pertinent to problems with which the '866 Patent is concerned, and is analogous art to the '866 Patent on at least that basis. Ex. 1202, ¶ 98. Zaltsman describes cable systems for transmitting digital data signals using RF signals and QAM, similar to the '866 Patent, and a POSITA would turn to Zaltsman when looking for technical details known in the art for such systems. Ex. 1274, Abstract, [0003]-[0023]; Ex. 1201, 1:26-56, 2:45-3:67, 8:54-9:8; 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 1-82 under the following grounds.

Ground	References	Basis	Claims Challenged
A0	Pugel	§102	27 , 28, 33, 37, 39, 40, 41 , 42, 47, 51, 53, 54, 55 , 56, 61, 65, 67, 68, 69 , 70, 75, 79, 81, 82
A1	Pugel	§103	27 , 28, 33, 37, 39, 40, 41 , 42, 47, 51, 53, 54, 55 , 56, 61, 65, 67, 68, 69 , 70, 75, 79, 81, 82

B	Pugel-Crols	§103	27 -30, 32-33, 37, 39-40, 41 , 42-44, 46-47, 51, 53-54, 55 , 56-58, 60-61, 65, 67-68, 69 , 70-72, 74-75, 79, 81-82
C	Pugel-Zaltsman	§103	38, 52, 66, 80
D	Pugel-Crols-Zaltsman- Jensen '170	§103	31, 45, 59, 73,
E	Pugel-Chandrakasan	§103	1 , 2, 7, 8, 9, 11, 12, 13, 14 , 15, 20, 21, 22, 24, 25, 26, 34, 35 36, 48, 49, 50, 62, 63, 64, 76, 77, 78
F	Pugel-Chandrakasan-Crols	§103	3, 4, 6, 16, 17, 19
G	Pugel-Chandrakasan- Zaltsman	§103	10, 23
H	Pugel-Chandrakasan-Crols- Zaltsman-Jensen '170	§103	5, 18

None of the prior art listed in the table above was before the examiner during prosecution of the '866 Patent.

A declaration of David B. Lett in support of this petition includes, e.g., a discussion of Mr. Lett's background, the '866 patent, and the prior art, as well his opinions and an explanation of the bases for those opinions. Ex. 1202, ¶¶ 1-224. As

set forth in his attached declaration, David B. Lett at least meets the level of skill of a POSITA. *Id.* ¶¶ 4-16.

B. Summary of the Grounds and Comparison of Claim Limitations

The '866 Patent has 6 independent claims (1, 14, 27, 41, 55, and 68) with 12-13 dependent claims each for a total of 82 claims. All of the claims are directed to a wideband receiver system, for example, as illustrated in Figure 2 of the '866 Patent. The independent claims differ in two primary ways. First, independent claims 1, 27, and 55 recite a “digital front end,” whereas independent claims 14, 41, and 69 recite “a plurality of digital down converters.” As shown in the detailed analysis below, both limitations are directed to the same structure illustrated, for example, as element 230 in Figure 2 of the '866 Patent. Second, every two independent claims include a different well-known ancillary feature—claims 1 and 14 recite a “serial interface,” claims 27 and 41 recite a “digital video recorder,” and claims 55 and 69 recite “picture-in-picture.”

Pugel, the primary reference, discloses every feature of independent claims 27, 41, 55, and 69, and thus anticipates these claims as well as multiple dependent claims (Ground A0). To the extent Patent Owner argues that Pugel does not expressly disclose certain features, Pugel also renders claims 27, 41, 55, and 69 obvious (Ground A1).

Additional grounds add Crols (Ground B) for teaching certain analog components and features of a complex mixer, Zaltsman (Ground C) for teaching standard cable television transmission techniques and standards, and Chandrakasan (Ground E) for teaching serial and parallel interfaces. Grounds D, F, G, and H represent permutations of the above, wherein various subfeatures are independently stacked onto one another without otherwise adding additional technical complexity.

C. 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 '866 patent while only claims 27, 28, 33, 36, 37, 41, 42, 47, 50, and 51 is 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 different prior art than was considered during prosecution.

D. 325(d) Discretion Does Not Apply

Considering the two-part framework discussed in *Advanced Bionics, LLC v. Med-El Elektromedizinische Geräte GMBH*, No. IPR2019-01469, Paper 6 at 8-9 (PTAB Feb. 13, 2020), the Board should not exercise its §325(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, 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.

E. 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. Ex. 1202, ¶¶ 31-33.

F. 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, ¶¶ 34-39.

1. “Wideband”

This is consistent with its ordinary meaning, the ’866 Patent defines “wideband” as a band that carries multiple channels. For example, the ’866 Patent states that a receiver is “wideband” if it is “designed to concurrently receive several TV channels.” Ex. 1201, 1:36-39; Ex. 1202, ¶ 36.¹

¹ The ’866 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,

2. “Digital Down Converter”/“Digital Front End”

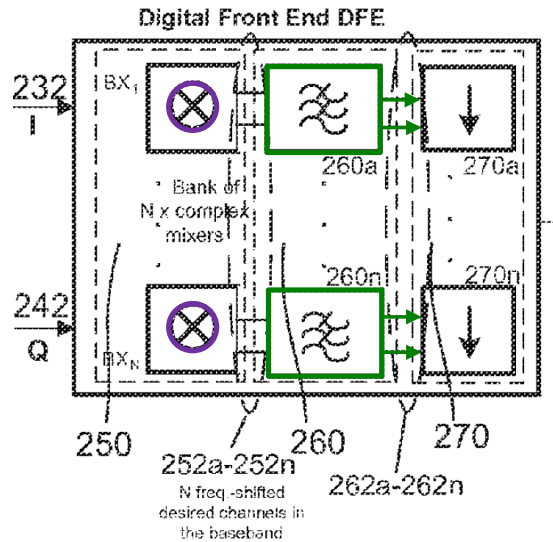
Independent claims 14, 41, and 69 recite “digital down converter[s]” “operable to generate a digital channel output corresponding to each desired channel.” A digital down converter, as the term states, is digital circuitry that downconverts a digital signal. Ex. 1202, ¶ 37. The ’866 Patent omits the term “digital down converter”, but describes a “Digital Front End (DFE)” that downconverts digital signals. Ex. 1202, ¶ 37. Instead of digital down converters, independent claims 1, 27 and 55 recite a DFE that is, similar to the digital down converters of claims 14, 41, and 69, “configured to concurrently select and provide each of the plurality of desired channels,” but with the further limitation “without providing any of the plurality of undesired channels.”

The example DFE from Figure 2 of the ’866 Patent includes a plurality of signal paths, with each path including a complex mixer 250, a low pass filter 260,

1:28-33. This does not change the ordinary meaning above for “wideband,” and in any event the claims only recite a “wideband analog-to-digital converter,” not a “wideband receiver system.”

and optionally a demodulator or a serial or parallel interface to a demodulator.² Ex. 1201, 5:33-7:9, 9:50-60, Figs. 2-3; Ex. 1202, ¶ 38. Each of these signal paths performs the function claims 14, 41, and 69 ascribe to a digital down converter—generating a digital channel output corresponding to a desired channel. Ex. 1201, 5:51-7:9, 9:50-60, Figs. 2-3; Ex. 1202, ¶ 38. Each of these signal paths performs the function claims 14, 41, and 69 ascribe to a digital down converter—generating a digital channel output corresponding to a desired channel. Ex. 1201, 5:51-7:9, 9:50-60, Figs. 2-3; Ex. 1202, ¶ 38. That this structure is the digital down converter in the '866 Patent is consistent with the dependent claims, which further require that the digital down converter(s) have, e.g., a digital mixer, filter, demodulator, and a serial or parallel interface. Ex. 1201, claims 16, 18-21, 40, 43-50, 68, 71-76. The complex mixer in each path performs “down-converting,” which the '866 Patent describes as shifting of the frequency of a signal to a lower frequency (also termed “down shift” and “frequency shift”). Ex. 1201, 1:38-40, 2:2-6, 2:13-28, 2:59-63, 2:65-3:2, 4:60-66, 6:3-6, 6:7-56, 7:47-55, 9:17-26; Ex. 1202, ¶ 38.

² The '866 Patent alternatively refers to the boxes following the filters in Figures 2 and 3 as decimators and/or demodulators, and also discloses the DFE as having outputs to a demodulator. Ex. 1201, 6:8-14, 7:4-9, 9:50-60, Figs. 2-3.



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

Neither “digital down converter” nor “digital front end” is a means-plus-function term. But if either term is so construed, the corresponding structure for “digital down converter” includes the components in one signal path in the DFE, i.e., a complex mixer 250 and a filter 260, and the corresponding structure for a “digital front end” include two such signal paths. Ex. 1201, 5:51-7:9, 9:50-60, Figs. 2-3; Ex. 1202, ¶ 39.

VII. SPECIFIC GROUNDS FOR UNPATENTABILITY

A. Grounds A0 and A1: Pugel

As set forth below, Pugel alone anticipates and renders obvious claims 27-28, 33, 37, 39-42, 47, 51, 53-56, 61, 65, 67-70, 75, 79, and 81-82. Ex. 1202, ¶¶ 99-154.

1. Independent Claim 27

Elements [27A]-[27D] are disclosed and rendered obvious by Pugel. Ex. 1202, ¶¶ 100-120.

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

While the preamble [27A]³ is not limiting, Pugel teaches it. Ex. 1202, ¶¶ 101-104. Pugel teaches a multichannel receiver circuit for processing multiple digital television channels, such that devices such as “television receivers, PVR's, or other devices” may receive those signals. Ex. 1224, [0001]-[0013], [0048]; Ex. 1202, ¶ 102. A POSITA would thus have understood that Pugel’s multichannel receiver circuit, combined with a DVR as discussed below in Section VII.A.1.d,⁴ is a “cable television (TV) device” as recited in Element [1A]. Ex. 1202, ¶¶ 102-103.

³ The limitations of the claims appear and are labelled in the Claims Listing Appendix.

⁴ As explained below regarding Element [27D], for claims reciting a DVR the “cable TV device” incorporates both the multichannel receiver circuit and a DVR based on Pugel’s teachings. Claims that do not recite a DVR are anticipated or obvious in view of the receiver circuit alone.

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

Pugel teaches Element [27B]. Ex. 1202, ¶¶ 105-111. Pugel’s receiver circuit includes analog-to-digital converters 121-123 (“wideband ...ADC”, gold) “sufficient for satisfactorily processing digital television signals and associated signals intended for end users in a conventional cable television broadcast system.” Ex. 1224, [0036], [0033]-[0037], [0044]-[0045], Fig. 1; Ex. 1202, ¶ 106.

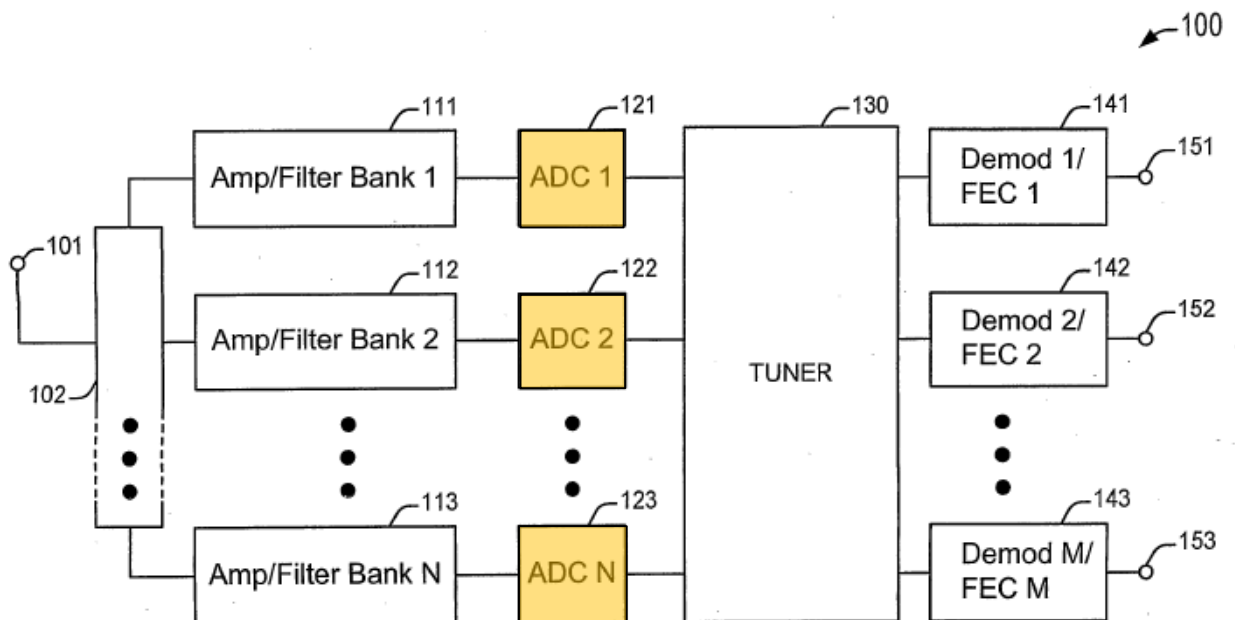


FIG. 1

Ex. 1224, Fig. 1 (annotated)

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]. 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, ¶ 106. 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, ¶ 106. This is consistent with the use of “desired” and “undesired” in the ’866 Patent. Ex. 1201, Abstract, 1:40-45, 3:25-56, 4:38-53, 5:56-65, 6:3-15, 6:53-63, 7:10-19; Ex. 1202, ¶ 106.

The pass-bands from the amplifier-filter circuits are received by 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, ¶¶ 107-108. Pugel’s ADC is “wideband” because it digitizes a “contiguous” 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, 1:35-38; Ex. 1202, ¶¶ 109-110. Pugel discloses that the bands of frequencies may be contiguous or non-contiguous. Ex. 1224, [0043]; Ex. 1202, ¶ 110. Pugel’s ADCs are structurally equivalent to, and perform the same function as, structure described by the ’866 Patent for performing the function recited in limitation 1C (e.g., ADC1 218 and ADC2 228). Ex. 1201, 5:48-51; Ex. 1202, ¶ 110. Each contiguous frequency band

processed by each ADC corresponds to a particular set of television channels, including a plurality of desired and undesired television channels as will be selected downstream by the digital tuner. Ex. 1224, [0026]-[0028], [0038]-[0040]; Ex. 1202, ¶¶ 109-110.

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

Pugel teaches Element [27C]. Ex. 1202, ¶¶ 112-115. Pugel’s receiver circuit comprises a digital tuner (**green**) that is “capable of generating a plurality of digital channels” and integrates a channel selector 315 such that “a selected set of digital channels may be communicated.” Ex. 1224, [0037]-[0038]; Ex. 1202, ¶ 113. The digital tuner configured to select a plurality of desired television channels from the plurality of frequencies that were digitized by the ADCs is “configured to concurrently select and provide each of the plurality of desired channels without providing any of the plurality of undesired channels.” Ex. 1224, [0038], [0037]-[0039], [0045], Fig. 1; Ex. 1202, ¶ 113. 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, ¶ 113.

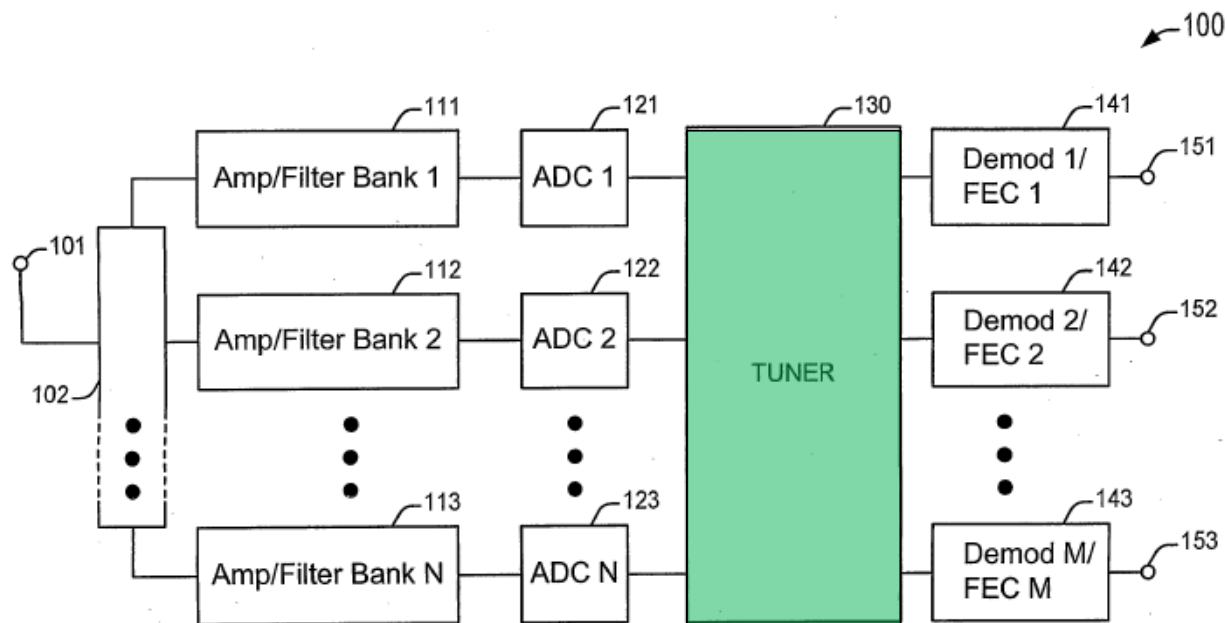


FIG. 1

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, ¶ 114. In such an example, the selected digital channels are the claimed “desired television channels.” Ex. 1202, ¶ 114. The digital tuner may also 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, ¶ 114.

d. [27D] “wherein the cable TV device comprises a digital video recorder (DVR).”⁵

Pugel teaches Element [27D]. Ex. 1202, ¶¶ 116-120. Pugel teaches that its system may comprise “a PVR device” for receiving the digital video signals. Ex. 1224, [0048]-[0049]; Ex. 1202, ¶¶ 116-120. This refers to a personal video recorder, which a POSITA would have understood to be another term for a DVR. Ex. 1224, [0005]; Ex. 1202, ¶ 117.

To any extent that Pugel does not explicitly disclose that Pugel’s multichannel receiver circuit may comprise a DVR, it would have been obvious to a POSITA to co-locate the television receiver circuit and a DVR into the same device (collectively, a “cable TV device”) because it would allow for a more feature-filled device and would be more cost-efficient. Ex. 1202, ¶ 118. Pugel provides an express teaching that “[m]any PVR's include the ability to tune one or more channels for viewing, while simultaneously tuning one or more additional channels for recording to a recording medium.” Ex. 1224, [0005]. It would have been obvious to a POSITA that a DVR for tuning and recording multiple channels, as taught by Pugel, could be

⁵ While Petitioner alleges this feature is taught by Pugel, Petitioner notes that the '866 Patent itself only mentions in its Background section that it was known for a DVR to receive multiple signals, and Petitioner does not concede the '866 Patent provides support for this limitation. Ex. 1201, 1:46-56.

implemented using the multichannel receiver circuit including a tuner as also taught by Pugel. Ex. 1202, ¶ 119. Nothing in Pugel forecloses that a DVR and receiver circuit could be co-located. Ex. 1202, ¶¶ 118-119. And co-locating the bundled receiver circuit / DVR device would still be consistent with Pugel's other teachings, as the device could then send additional tuned signals to other devices (e.g., receivers or other DVRs) throughout the home. *See* Ex. 1224, [0049]; Ex. 1202, ¶¶ 118-119. This may have the benefit of being more cost-efficient for the consumer, as the consumer could buy a bundled receiver circuit / DVR device to start, and they may purchase further devices in their home compatible with the receiver circuit later. Ex. 1202, ¶¶ 118-119.

This would be nothing more than applying a known technique (incorporating a tuner into a DVR, as taught by Pugel) to a known device (Pugel's receiver circuit) ready for improvement to yield predictable results (a single device with DVR and multichannel tuning functionality, as taught by Pugel). Ex. 1202, ¶¶ 118-119. A POSITA would have a reasonable expectation of success, as Pugel expressly teaches DVRs incorporating tuners, and co-locating both elements into a single device would have been well within the skill of a POSITA. Ex. 1202, ¶¶ 118-119.

2. Independent Claim 41

[41A] “A cable TV device comprising:”

[41B] “a wideband analog-to-digital converter (ADC) configured

to digitize an input signal, wherein the input signal comprises a plurality of desired channels and a plurality of undesired channels; and”

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

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

Elements [41A]-[41D] recite similar elements as Elements [27A]-[27D], except, for example, that [27B] recites “digitize a contiguous band of frequencies”, and [27C] recites a “DFE” rather than a “plurality of digital down converters.” Ex. 1202, ¶¶ 120-122. To the extent there is any difference between “configured to digitize a contiguous band of frequencies in an input signal,” and “configured to digitize an input signal,” both limitations are taught for the same rationale discussed above. Ex. 1202, ¶ 123; *see* Section VII.A.1.b, *supra*. Regarding the “plurality of digital down converters,” this is just another name for the structure called a “DFE” in limitation [27C]. Ex. 1202, ¶ 124; *see* Section VI.A.1.c. Pugel teaches the digital tuner 130 “multiplexes said first, second, and third digital signals, downconverts said multiplexed signal and extracts desired information to be coupled to said first and second demodulator circuits.” Ex. 1202, ¶¶ 125-126; Ex. 1224, claims 14-15, 18, 20-21. A POSITA would understand the digital tuner 130, which performs downconversion, to be a digital down converter, but to any extent that Pugel does

not explicitly disclose that the digital tuner comprises digital down converters, it would have been obvious to a POSITA in view of Pugel's express teachings that digital tuner 130 performs digital downconversion that the digital tuner 130 would therefore comprise digital down converters for performing that task. Ex. 1202, ¶ 127.

Moreover, to the extent "digital down converter" (which is not recited in the '866 Patent specification and figures) is construed to be a means-plus-function term, Pugel's structure performs the (1) identical function, (2) in substantially the same way (3) with substantially the same result, as the disclosed structure in the '866 Patent. Ex. 1202, ¶ 128. As described above, Pugel's ADC and digital tuner structure (alone or as modified in view of Crols or Jensen '170 herein) corresponds with the '866 Patent's DFE, with each operating in the same way (filtering wideband analog channels before digitally converting and multiplexing them) to produce the same digital channel outputs. Ex. 1202, ¶ 128; *see* Sections VII.B, VII.D, *infra*.

Elements [41A]-[41D] are thus disclosed and taught as obvious by Pugel for the same reasons discussed above with respect to Elements [27A]-[27D]. Ex. 1202, ¶¶ 121-129; *see* Section VII.A.1.a-d, *supra*.

3. Independent Claim 55

[55A] "A cable television (TV) device comprising:"

[55B] "a wideband analog-to-digital converter (ADC) configured to digitize a contiguous band of frequencies in an input signal,

wherein the contiguous band of frequencies comprises a plurality of desired channels and a plurality of undesired channels; and”

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

[55D] “wherein the cable TV device is operable to configure at least some of the plurality of desired channels as an output for a picture-in-picture display.”⁶

Elements [55A]-[55C] recite similar elements as Elements [27A]-[27C]. Ex. 1202, ¶ 131. Elements [55A]-[55C] are thus disclosed and taught as obvious by Pugel for the same reasons discussed above with respect to Elements [27A]-[27C]. Ex. 1202, ¶¶ 130-133; *see* Section VII.A.1.a-c, *supra*.

Regarding Element [55D], Pugel teaches that its system is designed to support a television displaying multiple channels on the same television using a picture-in-picture (PiP) display. Ex. 1224, [0005], [0048]-[0049]; Ex. 1202, ¶ 132. Pugel teaches that PiP demands support for simultaneous reception of multiple television channels. *Id.* And a POSITA would have understood that an advantage of Pugel’s

⁶ While Petitioner alleges this feature is taught by Pugel, Petitioner notes that the ’866 Patent itself only mentions that it was known for a receiver with picture-in-picture to receive multiple signals in its Background section, and Petitioner does not concede the patent provides support for this limitation. Ex. 1201, 1:46-56.

multichannel receiver is that it supports the output of multiple television channels to support such a PiP system when “traditional solutions lack the flexibility required.” Ex. 1224, [0005]; Ex. 1202, ¶ 132 To any extent not explicitly disclosed by Pugel, it would have been obvious to a POSITA in view of Pugel’s express teachings that a device, such as Pugel’s multichannel receiver circuit, would be configured to output a plurality of desired channels for use in a PiP display in the home. Ex. 1202, ¶ 132. A POSITA would understand the benefits of such a configuration because it would support the display of PiP material from the tuner, as taught by Pugel. Ex. 1202, ¶ 132. This would have been nothing more than applying a known technique (generation of multiple data streams for PiP display) to a known device (Pugel’s receiver circuit) ready for improvement to yield predictable result (the output of the receiver circuit could be used for PiP display). Ex. 1202, ¶ 132. A POSITA would have a reasonable expectation of success, as Pugel’s multichannel receiver circuit is designed to output a plurality of desired channels, and any necessary modification would have been well within the skill of a POSITA. Ex. 1202, ¶ 132.

4. Independent Claim 69

[69A] “A cable TV device comprising:”

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

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

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

Elements [69A]-[69C] recite similar elements as Elements [27A]-[27C]. Ex. 1202, ¶ 135. Elements [69A]-[69C] are thus disclosed and taught as obvious by Pugel for the same reasons discussed above with respect to Elements [27A]-[27C]. Ex. 1202, ¶¶ 134-136; *see* Section VII.A.1.a-c, *supra*. Element [69D] is identical to Element [55D], and is thus disclosed and taught as obvious by Pugel for the same reasons discussed above with respect to Element [55D]. Ex. 1202, ¶¶ 135-136; *see* Section VII.A.3, *supra*.

5. Dependent Claims 28, 42, 56, and 70

**[28/42/56/70] “The cable TV device of claim [27/41/55/69], wherein:
the cable TV device comprises a cable network connector, and
the input signal is operably communicated from the cable network connector to the wideband ADC via at least one of an analog amplifier and an analog filter.”**

Pugel teaches the features described in claims 28, 42, 56, and 70. Ex. 1202, ¶¶ 137-139. Pugel teaches “a cable network connector” comprising an input coupler 101 for a multichannel analog RF input signal, and optionally a splitter 102, that connects the input signal to a plurality of amplifier-filter circuits (**red**), which in turn

connect to a plurality of ADCs (gold). Ex. 1224, [0025]-[0026], [0042]-[0044], Figs. 1-2; Ex. 1202, ¶ 138. The amplifier-filter circuits comprise at least one analog amplifier (e.g., amplifier 201) and analog filter (e.g., bandpass filter 202). Ex. 1202, ¶ 138. The contents of Pugel's Amp/Filter Bank in Figure 1 are shown in Pugel's Figure 2.

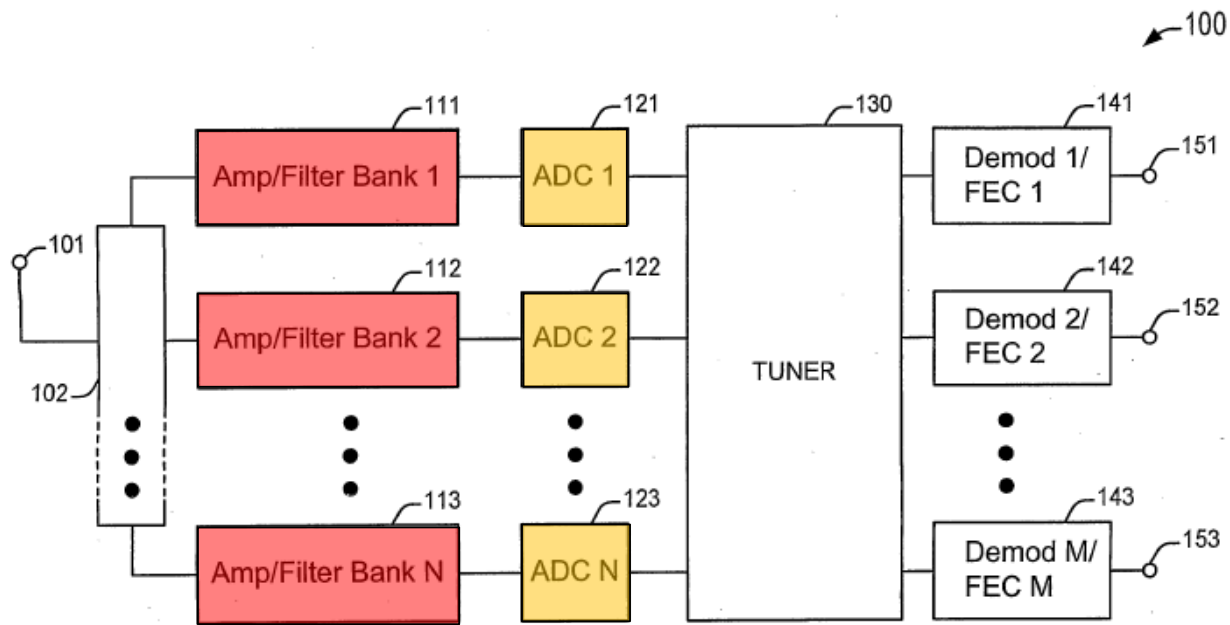


FIG. 1

Ex. 1224, Fig. 1 (annotated)

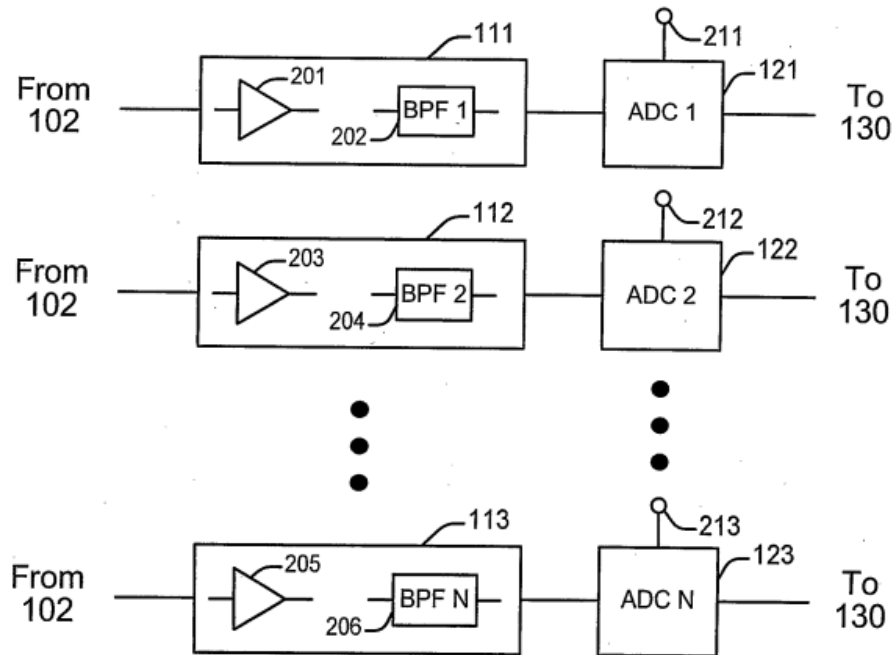


FIG. 2

Ex. 1224, Fig. 2

6. Dependent Claims 33, 47, 61, and 75

[33/61] “The cable TV device of claim [27/55], wherein: the DFE comprises a plurality of digital demodulators, and each digital demodulator, of the plurality of digital demodulators, is operable to demodulate a desired channel, of the plurality of desired channels.”

[47/75] “The cable TV device of claim [41/69], wherein: each digital down converter comprises a digital demodulator operable to demodulate a desired channel, of the plurality of desired channels, to provide a demodulated channel as the digital channel output.”

Pugel teaches the features described in claims 33, 47, 61, and 75. Ex. 1202,

¶¶ 140-147. The input to Pugel’s multichannel receiver circuit 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], Fig. 3; Ex. 1202, ¶ 141. Pugel teaches the digital tuner 130 comprising a channel selector 315 for selecting channels to be demultiplexed, wherein a channel selected by the digital tuner is desired, and a channel unselected by the digital tuner is undesired. *Id.* This is consistent with the use of “desired” and “undesired” in the ’866 Patent. Ex. 1201, Abstract, 1:40-45, 3:25-56, 4:38-53, 5:56-65, 6:3-15, 6:53-63, 7:10-19; Ex. 1202, ¶ 141. Pugel teaches outputting the selected, demultiplexed channels output from digital tuner 130 which are then received by one or more 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, ¶ 143. For example, “a first demodulator 301 may be configured to perform [QAM] demodulation of digital cable television signals.” Ex. 1224, [0040].

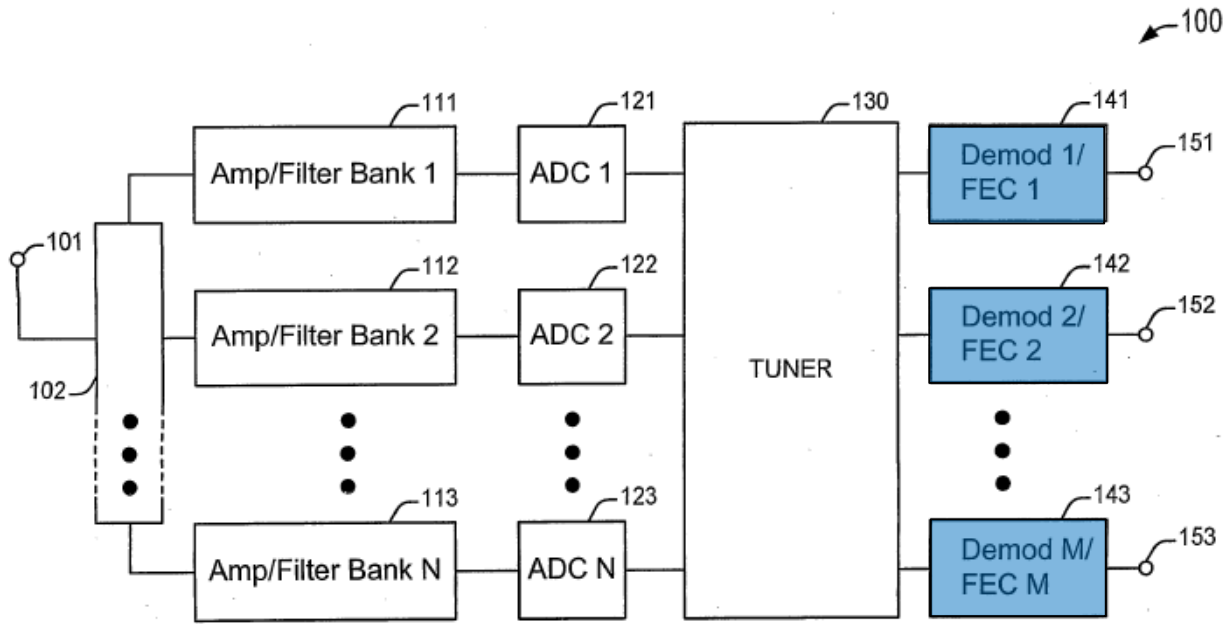


FIG. 1

Ex. 1224, Fig. 1 (annotated)

Pugel teaches that the digital tuner 130 “may perform coding, decoding, scrambling, descrambling, rotating, and/or derotating operations prior to passing the digital channel signals to demodulation circuits 141, 142, 143.” Ex. 1224, [0039]; Ex. 1202, ¶ 144. Thus, the digital tuner outputs desired digital channel signals to one or more demodulators operable to demodulate the desired channels. Ex. 1202, ¶ 144. The demodulated signal is then provided as a digital channel output at one or more output couplers 151-153. Ex. 1224, [0010]-[0012], [0027], [0039]-[0041], [0046], Figs. 3-4.

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, ¶ 145. 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.” Ex. 1224, [0023], [0027], [0040]; Ex. 1202, ¶¶ 142, 145-147.

7. Dependent Claims 37, 51, 65, and 79

[37/51/65/79] “The cable TV device of claim [27/41/55/69], wherein: the plurality of desired channels comprises at least one cable broadcast channel.”

Pugel teaches the features described in claims 37, 51, 65, and 79. Ex. 1202, ¶¶ 148-149. Pugel’s system is “sufficient for satisfactorily processing digital television signals and associated signals intended for end users in a conventional cable television broadcast system.” Ex. 1224, [0036], [0033]-[0037], [0044]-[0045]. This includes tuning desired channels comprising of one or more cable broadcast channels. Ex. 1224, [0037]-[0039], [0045]; Ex. 1202, ¶¶ 148-149.

8. Dependent Claims 39, 53, 67, and 81

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

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

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

Claims 39 and 53 recite the identical, or substantially similar, limitations as in Element [55D], and claims 67 and 81 recite the identical limitation as in Element [27D]. Ex. 1202, ¶ 160. As discussed above, Pugel discloses or teaches these limitations. See Sections VII.A.1.d, VII.A.3, *supra*; Ex. 1202, ¶¶ 150-151.

9. Dependent Claims 40, 54, 68, and 82

[40/68] “The cable TV device of claim [27/55], wherein: the contiguous band of frequencies comprises a portion of a frequency spectrum of the input signal.”

[54/82] “The cable TV device of claim [41/69], wherein: the plurality of desired channels and the plurality of undesired channels comprise a portion of a frequency spectrum of the input signal.”

Pugel teaches the features described in claims 40, 54, 68, and 82. Ex. 1202, ¶¶ 152-154. Pugel teaches that the “plurality of amplifier-filter banks or circuits 111, 112, 113 is configured to process frequencies within a specified band.” Ex. 1224, [0028], Figs. 1-2. Pugel teaches that the amplifier-filter banks process frequencies by using bandpass filters to provide limited frequency ranges for input to different ADCs. Ex. 1224, [0025]-[0032], Figs. 1-2; Ex. 1202, ¶¶ 153-154. That limited

frequency range is a “portion of a frequency spectrum of the input signal.” Ex. 1202, ¶¶ 152-154.

B. Ground B: Pugel in view of Crols

1. Claims 27-28, 33, 37, 39-42, 47, 51, 53-56, 61, 65, 67-70, 75, 79, and 81-82

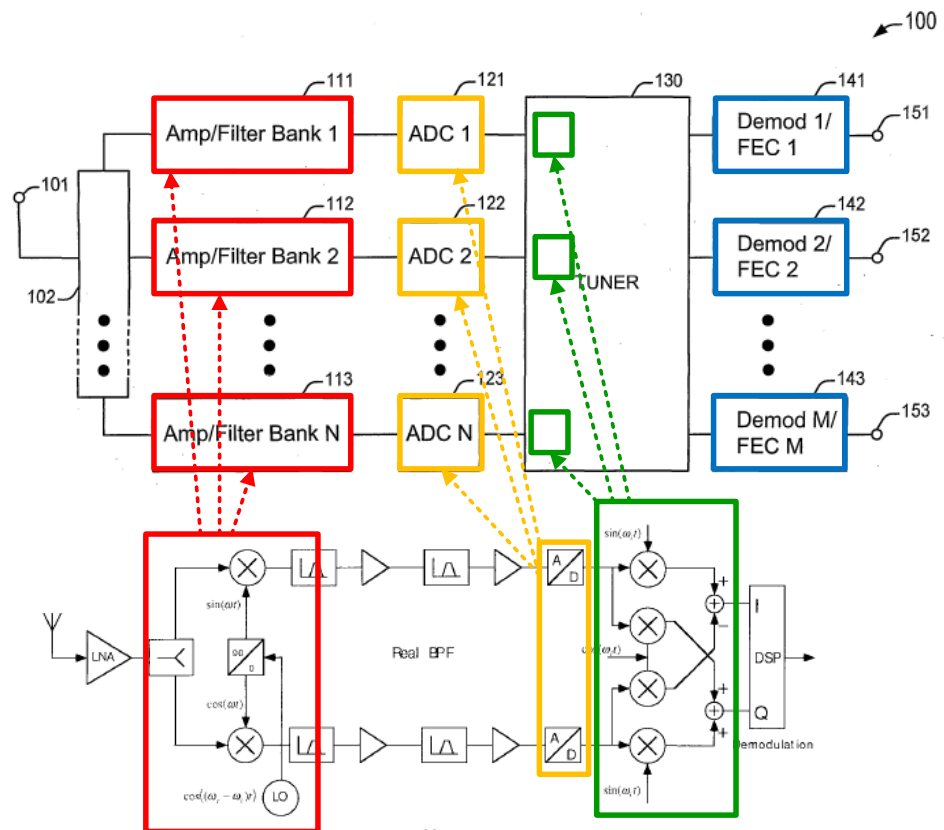
Pugel teaches the limitations of these claims for the reasons set forth above in Section VII.A. But to any extent that a means-plus-function construction of “digital down converter” applies, and Pugel’s tuner 130 is not structurally equivalent to, or perform the same function as, the structure described by the ’866 Patent for performing the function recited in limitations [27C], [41C], [55C], or [69C], (e.g., complex mixers 250 and filter modules 260), this would be obvious in view of Crols. Ex. 1201, 6:16-7:19; Ex. 1202, ¶¶ 155-156. As explained in Section VII.A.1.c for limitation [27C], Pugel teaches a DFE or digital down converter comprising a digital tuner 130. Ex. 1202, ¶ 165; *see also* Section VII.A.2. Pugel also teaches that the DFE or digital down converter comprises one or more modulators. Ex. 1202, ¶ 156; *see also* Section VII.A.6. The digital tuner 130 or demodulators may comprise “circuitry for providing additional functions, for example adaptive filters for removing multipath propagation effects.” Ex. 1224, [0041]. Pugel teaches that the additional functions include “coding, decoding, scrambling, descrambling, rotating, and/or derotating operations prior to passing the digital channel signals to demodulation

circuits.” Ex. 1224, [0039]. A POSITA would have understood this to 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, ¶ 156.

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, ¶¶ 157-158. Crols discloses a complex mixer for processing digital signals output by the ADC. The figures of Pugel and Crols relate as follows, with the corresponding mixer in **green**:

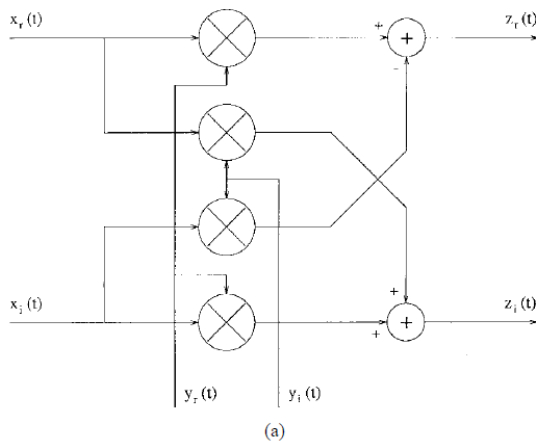
Ex. 1224, FIG. 1
(annotated)

Ex. 1225, FIG. 22
(annotated)

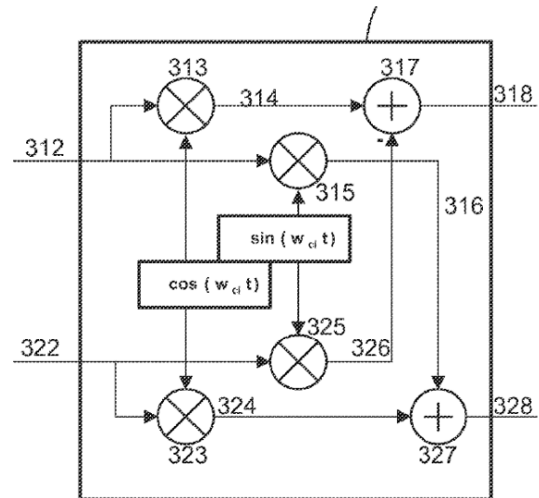


Ex. 1202, ¶ 157. As Crols explains and illustrates, the circuitry outlined in green is

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, 75, Fig. 3.30; Ex. 1202, ¶ 157. 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 ’866 Patent. Ex. 1225, pp. 273-274, 279-280, Figs. 8(a), 21-22; Ex. 1201, 6:28-47, 9:42-47, Fig. 3; *see also* Ex. 1234, p. 63; Ex. 1202, ¶ 157.



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, ¶ 158. A POSITA looking to implement downconversion would have turned to techniques known to the art, such

as taught by Crols. Ex. 1202, ¶ 158. 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’s detailed descriptions of operational effectiveness of its topologies, and the POSITA’s own familiarity with known receiver circuit topologies in the art. *Id.* Thus, Pugel in view of Crols teaches the limitations of claims 27-28, 33, 37, 39-42, 47, 51, 53-56, 61, 65, 67-70, 75, 79, and 81-82. *Id.*, ¶¶ 155-158.

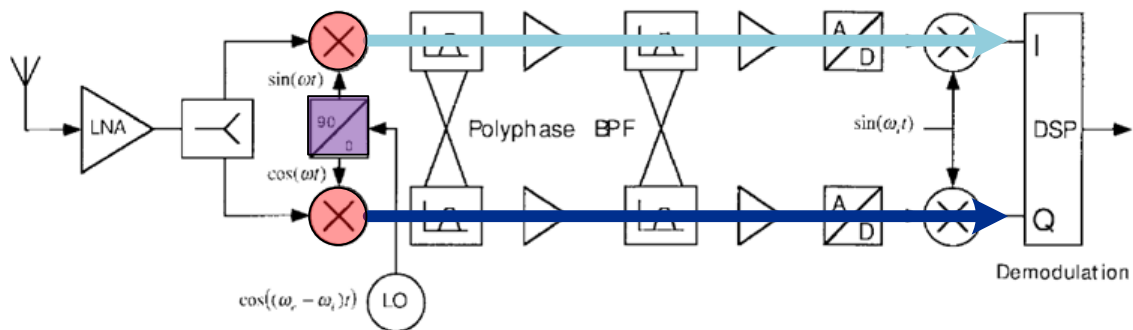
2. Dependent Claims 29, 43, 57, and 71

**[29/57] “The cable TV device of claim [27/55], wherein:
the DFE comprises a plurality of mixers, and
each mixer, of the plurality of mixers, is operable to generate a
corresponding complex signal comprising an in-phase (I) component and
a quadrature (Q) component.”**

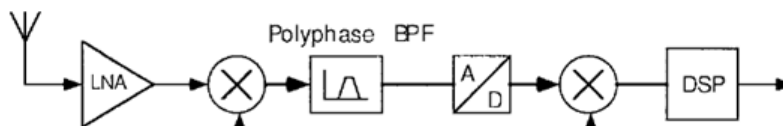
**[43/71] “The cable TV device of claim [41/69], wherein:
each digital down converter comprises a digital mixer operable to
generate a corresponding complex signal comprising an in-phase (I)
component and a quadrature (Q) component.”**

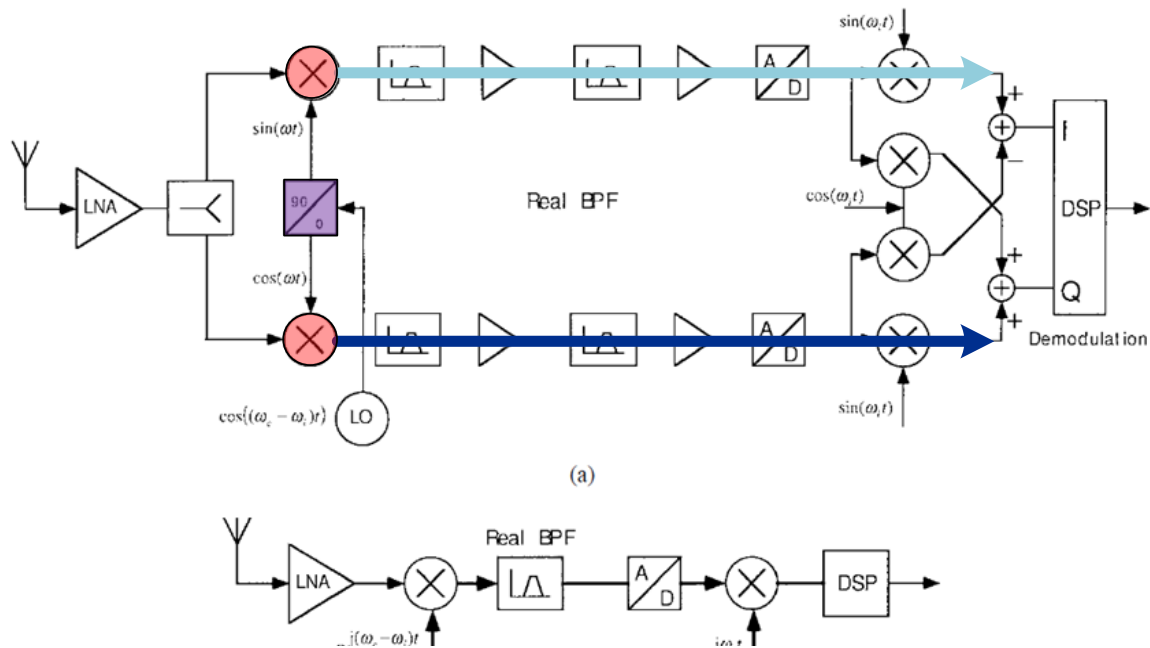
Pugel in view of Crols teaches the features described in claims 33, 47, 61, and 75. Pugel-Crols teaches a DFE or digital down converter comprising a plurality of mixers for the reasons discussed above in Section VII.B.1. Further, the resultant

mixers of Pugel-Crols produce in-phase and quadrature signals. Ex. 1202, ¶¶ 159-166. Crols teaches using two mixers (**red**) to create an in-phase signal (the output of the lower mixer with “ $\cos(\omega t)$ ” input in Figures 21(a) and 22(a), (**dark blue**)) and a quadrature signal (the output of the upper mixer with “ $\sin(\omega t)$ ” input in Figures 21(a) and 22(a), (**light blue**)) by respectively using a sine signal and a cosine signal generated by a quadrature oscillator (**purple**). Ex. 1225, 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.



(a)





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

As stated above, it would have been obvious to a POSITA to modify Pugel's receiver circuit to implement mixers, such as taught by Crols, because, 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. Ex. 1202, ¶ 165; Ex. 1224, [0040]. 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 perform 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, ¶ 165. A POSITA would have had a reasonable expectation of success given the express teachings in Pugel to turn to other systems, Crols's detailed descriptions of operational effectiveness of its topologies, and the POSITA's own familiarity with known receiver circuit topologies in the art. *Id.*

3. Dependent Claims 30, 44, 58, and 72

[30/44/58/72] The cable TV device of claim [29/43/57/71], wherein: the I and Q components of each corresponding complex signal are at baseband.

Pugel in view of Crols teaches the features described in claims 30, 44, 58, and 72. Ex. 1202, ¶¶ 167-174. Pugel-Crols discusses generating a corresponding complex signal comprising an I component and a Q component for the reasons discussed above in Section VII.B.2. Ex. 1202, ¶¶ 168-171. Crols further teaches that the resulting I and Q components of Pugel-Crols are at baseband. Ex. 1202, ¶ 172. Crols states that “[i]t will be presumed that the demodulation is preferably done with a DSP at baseband.” Ex. 1225, p. 269. For example, concerning Crols's Figures 21-22, Crols teaches that “[t]he final downconversion of the wanted signal to the baseband can then be done by multiplication with a sine.” Ex. 1225, p. 279; Ex. 1202, ¶ 172.

To any extent that Pugel-Crols does not explicitly disclose I and Q components of each complex signal at baseband, this would have been obvious. To

any extent not explicitly disclosed, downconverting a signal to baseband would be obvious to a POSITA because of the disclosures in Pugel-Crols, including recitations of downconversion in the claims of Pugel, and Crols's disclosure of converting to baseband. Ex. 1202, ¶ 173; Ex. 1224, claims 14-15, 18, 20-21; Ex. 1225, pp. 269, 279-280. It would have been obvious from Pugel's and Crols's express teachings (regarding downconversion in Pugel, and that a signals should be at baseband for demodulation in Crols) to use well-known techniques of downconversion to baseband to implement the system of Pugel-Crols. Ex. 1202, ¶ 173. At most, this would have been nothing more than applying a known technique (downconversion to baseband as taught by Pugel and Crols) to a known device (Pugel's multichannel receiver circuit) ready for improvement to yield predictable results (a signal at baseband as taught by Crols). Ex. 1202, ¶ 173. A POSITA would have had a reasonable expectation of success, as downconversion was well-known in the art as evidenced by Pugel and Crols. Ex. 1202, ¶ 173.

4. Dependent Claims 32, 46, 60, and 74

**[32/60] “The cable TV device of claim [29/55], wherein:
the DFE comprises a plurality of digital demodulators, and
each digital demodulator, of the plurality of digital demodulators,
is operable to demodulate the corresponding complex signal.”**

[46/74] “The cable TV device of claim [43/71], wherein: each digital down converter comprises a digital demodulator operable to demodulate the corresponding complex signal to provide a demodulated channel as the digital channel output.”

Pugel teaches demodulators for demodulating a plurality of desired channels, as discussed above in Section VII.A.6 regarding claims 33, 47, 61, and 75. Ex. 1202, ¶¶ 175-176. Further, Pugel-Crols teaches generating a complex signal comprising an in-phase and a quadrature component, as discussed in Section VII.B.2 regarding claims 29, 43, 57, and 71. Ex. 1202, ¶ 176. The resulting modification of Pugel-Crols thus creates a complex signal that is then demodulated by the demodulators. Ex. 1202, ¶ 176. A POSITA would have understood that Pugel's demodulators would have been designed for such signals, as, for example, Pugel discloses that the demodulators may perform QAM demodulation of digital cable television signals, and QAM demodulation utilizes complex signals comprising in-phase and quadrature components. Ex. 1224, [0040]; Ex. 1202, ¶ 176. To any extent this is not explicitly disclosed, it would have been obvious for Pugel's demodulators to receive a complex signal to enable performance of QAM demodulation based on Pugel's express teachings. Ex. 1202, ¶ 176. Applying Crols topologies comprising complex signals to Pugel's receiver circuits would have been nothing more than applying a known technique (generating in-phase and quadrature signals) to improve a known device (Pugel's receiver which performs QAM or QPSK demodulation) ready for improvement to yield predictable results (the resulting implementation of Pugel-Crols would be capable of performing QAM or QPSK modulation as taught by

Pugel). *Id.* Thus Pugel in view of Crols teaches the features described in claims 32, 46, 60, and 74.

C. Ground C: Pugel in view of Zaltsman

1. Dependent Claims 38, 52, 66, and 80

[38/52/66/80] “The cable TV device of claim [27/41/55/69], wherein: the plurality of desired channels comprises at least one channel delivered via a Data Over Cable Service Interface Specification (DOCSIS) protocol.”

Pugel teaches transmission of digital cable television signals using well-known methods, including by sending using QAM, QPSK, VSB, and/or HDTV signals. Ex. 1224, [0040]. DOCSIS was the predominant standard at the time of the alleged invention for sending digital cable transmissions, and it would have been obvious to any POSITA to have turned to the standard to deliver cable television channels as taught by Pugel. Ex. 1202, ¶¶ 177-178.

To any extent that Pugel does not explicitly teach the DOCSIS protocol, use of the protocol would have been obvious in view of Zaltsman because it would support transmission in consumer networks using the most common standard of the day. Ex. 1202, ¶ 179. Zaltsman provides a detailed background section discussing known technology as of 2007, particularly regarding the use of digital television standards including DOCSIS in wideband television transmission to a set top receiver. Ex. 1274, [0003]-[0023]. In particular, Zaltsman states that, in the latest DOCSIS standard of the day, multiple television channels were bonded together,

typically using a 6 MHz frequency band. Ex. 1274, [0012]-[0013]. Modifying Pugel to use the DOCSIS standard as taught by Zaltsman would have been nothing more than applying a known technique (DOCSIS standardized transmission) to a known device (Pugel's receiver circuit for digital cable television transmission) ready for improvement to yield a predictable result (signals from Pugel's receiver circuit are transmitted according to the known DOCSIS standard). Ex. 1202, ¶ 179. A POSITA would have had a reasonable expectation of success, as the standard was well-documented and implementing it was well within the skill of the art. Ex. 1202, ¶ 179; *see* Ex. 1221. Pugel in view of Zaltsman thus teaches the features described in claims 38, 52, 66, and 80.

D. Ground D: Pugel in view of Crols and Zaltsman and further in view of Jensen '170

1. Dependent Claims 31, 45, 59, and 73

[31/59] “The cable TV device of claim [29/57], wherein: the DFE comprises a plurality of filters, and each filter, of the plurality of filters, is operable to filter the corresponding complex signal comprising a 6 MHz channel.”

[45/73] “The cable TV device of claim [43/71], wherein: each digital down converter comprises a filter operable to select the corresponding complex signal comprising a 6 MHz channel.

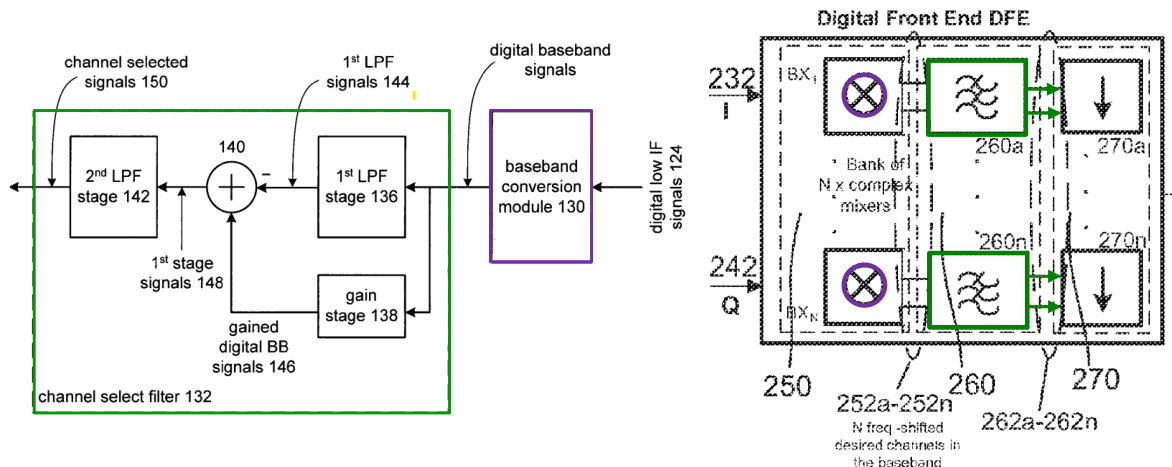
Pugel in view of Crols and Zaltsman and further in view of Jensen '170 teaches the features of claims 31, 45, 59, and 73. Ex. 1202, ¶¶ 180-190. As discussed above, Pugel's digital tuner 130 is configured to select signals of “one or more

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, ¶ 181; *see* Section VII.A.1.c. Before the selection process, the digital signals are downconverted by the digital tuner 130. Ex. 1224, [0037], claims 14-15, 18, 20-21; *see* Section VII.B.1. 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, ¶¶ 181-182. 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, ¶ 183.

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 ’866 Patent, perform the claimed selection by allowing only selected signals to pass through the filters and blocking the undesired signals. *Compare* Ex. 1224, Fig. 9 (channel select filter 132), [0009],

[0016]-[0017], [0064], [0066]-[0067] *with* Ex. 1201, Fig. 2 (filters 260), 6:3-12, 6:64-7:9; Ex. 1202, ¶ 184.

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 '866 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, ¶¶ 185-186. 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, ¶ 186.

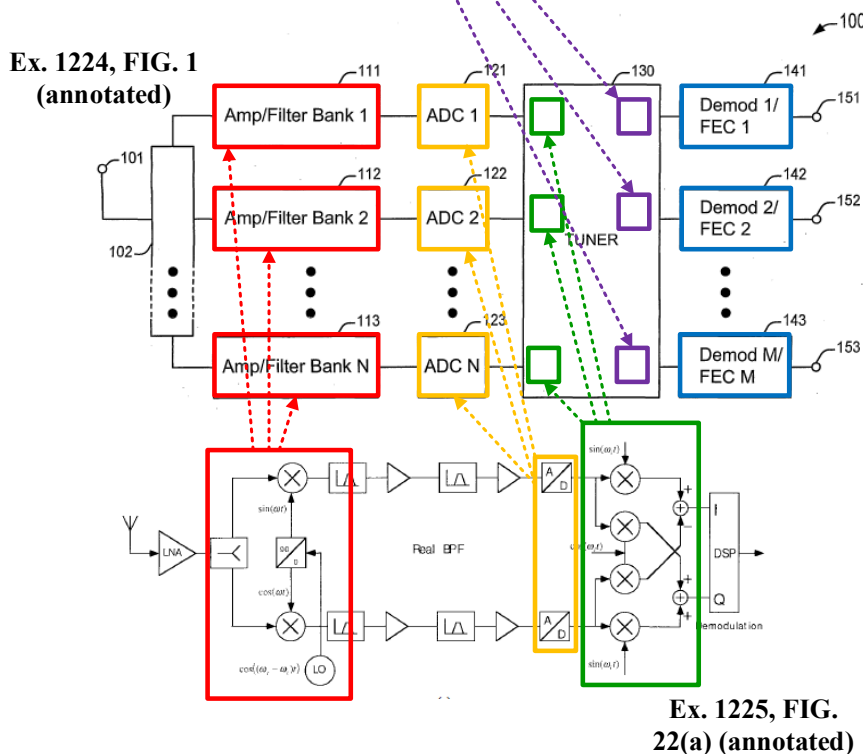
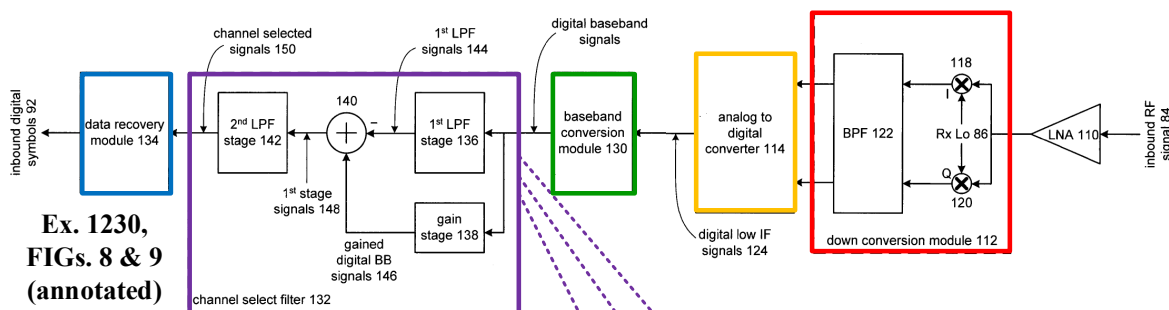


Ex. 1230, Fig. 9 (annotated, excerpted) Ex. 1201, Fig. 2 (annotated, excerpted)

Digital low IF signals enter the baseband conversion module 130 in Jensen '170, where the baseband conversion module 130 shifts the frequency of the desired channel to baseband. Ex. 1230, [0064]-[0065]; Ex. 1202, ¶ 187. 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, ¶ 187.

Pugel in view of Crols and further in view of Jensen '170 thus teach claims 31, 45, 59, and 73. Ex. 1202, ¶ 187.



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, ¶¶ 188-189.

Applying Jensen ’170’s 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, ¶ 189. 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, ¶ 189.

And, as further described in Section VII.C, it would have been obvious to modify Pugel in view of Zaltsman to use the DOCSIS standard, which employs 6 MHz channels. Ex. 1202, ¶ 190. Modifying Pugel in view of Crols and Jensen ’170 would have been obvious for the same rationale, and the additional references would have presented no additional difficulties for the combination to a POSITA. Ex. 1202, ¶ 190.

E. Ground E: Pugel in view of Chandrakasan

1. Independent Claim 1

**[1A/1B] “A cable television (TV) device comprising:
a wideband analog-to-digital converter (ADC) configured to digitize a
contiguous band of frequencies in an input signal, wherein the contiguous
band of frequencies comprises a plurality of desired channels and a
plurality of undesired channels; and”**

Elements [1A]-[1B] are identical to Elements [27A]-[27B]. Ex. 1202, ¶¶ 191-192. Elements [1A]-[1B] are thus disclosed and taught as obvious by Pugel for the same reasons discussed above with respect to Elements [27A]-[27B]. Ex. 1202, ¶¶ 191-192; *see* Section VII.A.1.a-b, *supra*.

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

Element [1C] is identical to Element [27C], save the recitation of “via a serial interface.” Ex. 1202, ¶ 193. Save that element, [1C] is thus disclosed and taught as obvious by Pugel for the same reasons discussed above with respect to Element [27C]. *See* Section VII.A.1.c, *supra*. As explained above, Pugel teaches a DFE or digital down converter comprising a digital tuner 130 and one or more demodulators 141-143. *See* Sections VII.A.1.c, VII.A.6. But Pugel is silent with regard to whether its selected channels may be output from the demodulators via a serial interface or via a parallel interface.

However, as the '866 Patent concedes, outputting a digital data stream via serial and parallel interfaces were “commonly known methods,” i.e., Applicant Admitted Prior Art (AAPA). Ex. 1201, 7:10-13; Ex. 1202, ¶ 194. 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, ¶¶ 194-197.

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, ¶ 198; Ex. 1216, pp. 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, ¶ 198; Ex. 1215, pp. 5-6, 8; Ex. 1216, pp. 79-80 (Fig. 6-25).

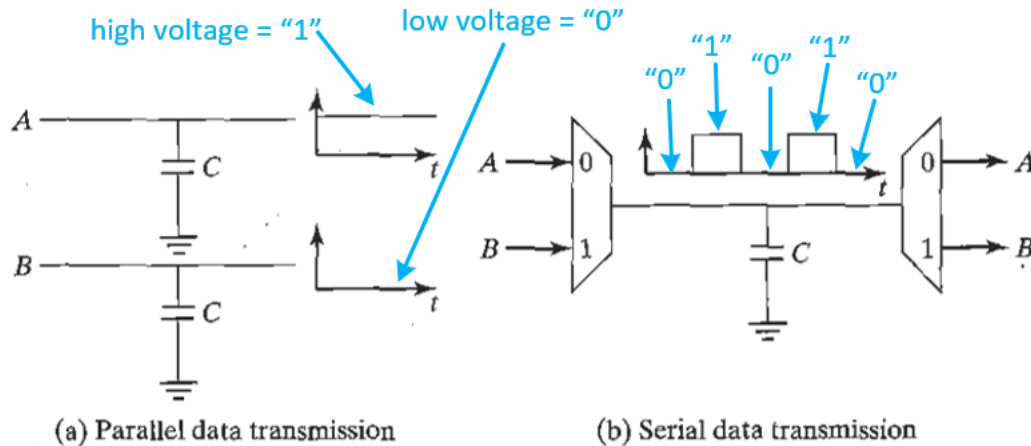


Figure 6-25 Parallel versus time-multiplexed data busses.

Ex. 1216, p. 80 (Fig. 6-25) (annotated)

Implementing Pugel's data interface as an output from a demodulator using either option would have been obvious as design choices, because both were "commonly known methods" as Applicant admits and as shown in the background art that demonstrates such interfaces where known and used by POSITAs in integrated circuit designs at time. Ex. 1202, ¶ 199; 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, ¶ 199.

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, ¶¶ 194-199; 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 Digital Signal Processing,” teaches that both serial (referred to in Chandrakasan as “time-multiplexed”) and parallel interfaces such as those illustrated in Figure 6-25 above were used in integrated circuits. Ex. 1217, p. 355; Ex. 1216, pp. 79-80 (Fig. 6-25); Ex. 1202, ¶ 200. Specifically, Chandrakasan teaches that time-multiplexing (i.e., a serial interface) is often used “due to area constraints or if very high-throughput is not the goal,” but that “[g]iven that there is a choice between time-multiplexed and fully-parallel architectures... an important question which arises is what architecture will result in the lowest switching activity.” Ex. 1217, p. 355; Ex. 1202, ¶ 200. 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, ¶ 200. 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, ¶ 201. 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, ¶ 201.

As such, the modification of Pugel with Chandrakasan that results in a serial interface or parallel interface as an interconnection between Pugel's digital tuner 130 and demodulators 141-143 is nothing more 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, ¶ 202.

The resultant combinations of Pugel 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, ¶ 202.

Thus, Pugel in view of Chandrakasan teaches Element [1C], and claim 1 is obvious in its entirety. Ex. 1202, ¶¶ 191-203.

2. Independent Claim 14

[14A/14B/14C] "A cable TV device comprising:

a wideband analog-to-digital converter (ADC) configured to digitize an input signal, wherein the input signal comprises a plurality of desired channels and a plurality of undesired channels; and

a plurality of digital down converters coupled to the wideband ADC, wherein each digital down converter, of the plurality of digital down converters, is operable to generate a digital channel output corresponding to each desired channel, of the plurality of desired channels, and”

Elements [14A]-[14C] are identical to Elements [41A]-[41C]. Ex. 1202, ¶ 213. Elements [14A]-[14C] are thus disclosed and taught as obvious by Pugel for the same reasons discussed above with respect to Elements [41A]-[41C]. Ex. 1202, ¶ 204; *see* Section VII.A.2, *supra*.

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

Element [14D] is taught by Pugel in view of Chandrakasan for the same reason as “via a serial interface” is taught as to Element [1C], above. Ex. 1202, ¶¶ 205-206; *see* Section VII.E.1, *supra*.

3. Dependent Claims 2 and 15

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

For the same reasons set forth for claim 28 in Section VII.A.5, *supra*, Pugel teaches the additional limitations of claims 2 and 15. Ex. 1202, ¶ 207.

4. Dependent Claims 7 and 20

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

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

For the same reasons set forth for claims 33 and 47 in Section VII.A.6, *supra*, Pugel teaches the additional limitations of claims 7 and 20. Ex. 1202, ¶ 208.

5. Dependent Claims 8, 21, 34, 48, 62, and 76

[8/34/62] “The cable TV device of claim [7/33/61], wherein: the DFE is operable to provide a plurality of demodulated desired channels via a parallel interface.”

[21/48/76] “The cable TV device of claim [20/47/75], wherein: the plurality of digital down converters is operable to provide a plurality of demodulated desired channels via a parallel interface.”

As explained above, Pugel teaches a digital tuner 130 in communication with one or more demodulators 141-143. *See* Sections VII.A.6, VII.E.1, and VII.E.4; Ex. 1202, ¶ 209. And as further discussed above with respect to Element [1C], Pugel in view of Chandrakasan teaches that it would have been obvious to provide the plurality of channels as an *input* to demodulators 141-143 via a parallel or serial interface. *See* Section VII.E.1, *supra*; Ex. 1202, ¶ 209. For similar rationale, it would

have been obvious that the *output* of the demodulators 141-143 could be provided via a parallel interface. Ex. 1202, ¶ 209.

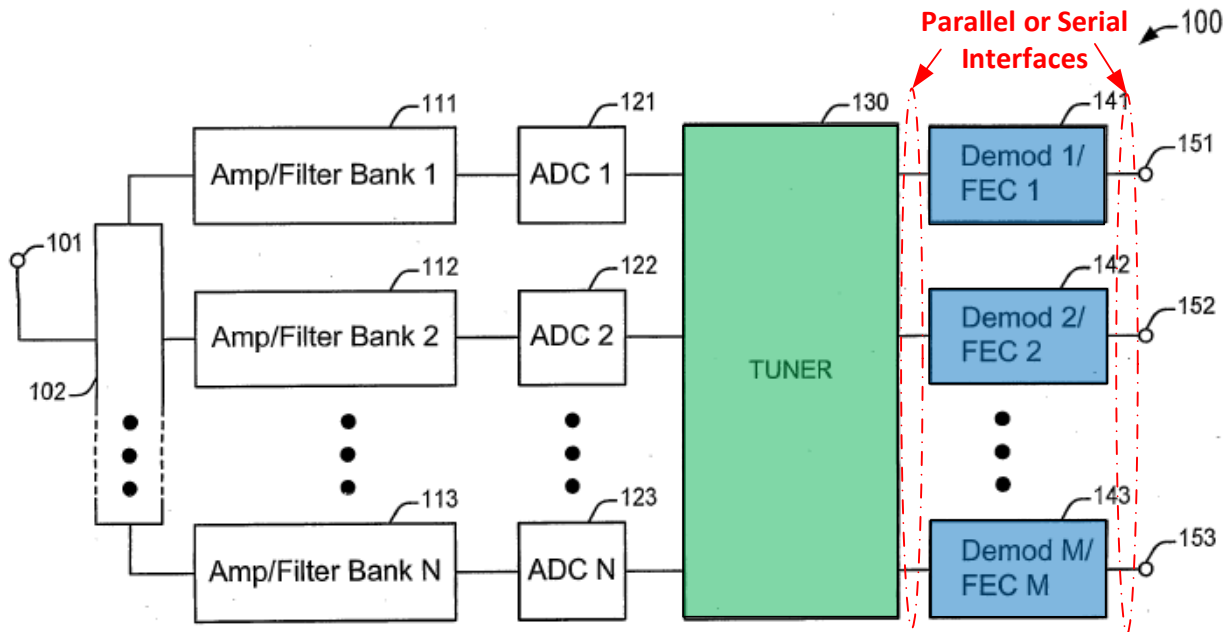


FIG. 1

Ex. 1224, Fig. 1 (annotated)

Implementing Pugel’s data interface as an output from a demodulator using either option would have been obvious as design choices, because both were “commonly known methods” as Applicant admits and as shown in the background art that demonstrates such interfaces where known and used by POSITAs in integrated circuit designs at time. Ex. 1202, ¶¶ 210-211; Ex. 1214, 30:31-42, 31:15-22; Ex. 1215, pp. 5-6, 8; Ex. 1216, pp. 79-80, Fig. 6-25; 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, ¶ 211.

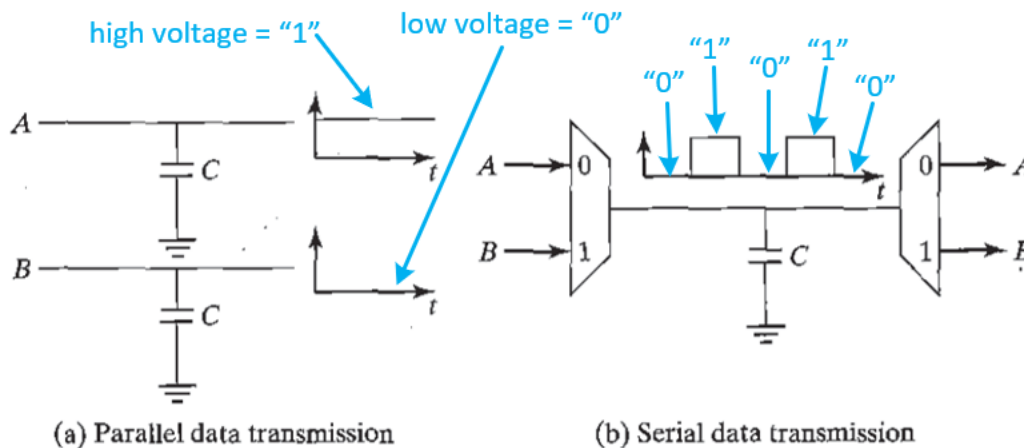


Figure 6-25 Parallel versus time-multiplexed data busses.

Ex. 1216, p. 80 (Fig 6-25) (annotated)

Further, Chandrakasan 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, ¶ 212.

It would thus have been obvious to apply either of parallel data or serial data communication as taught by Chandrakasan to the output from Pugel's demodulators 141-143. Ex. 1202, ¶ 213. 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, ¶ 213.

As such, the modification of Pugel with Chandrakasan that results in a parallel interface as an output from demodulators 141-143 is nothing more than choosing from a finite number of identified, predictable solutions (using serial or parallel communications as taught by Chandrakasan and known in the art) with a reasonable expectation of success (resulting in Pugel's system implemented with either serial or parallel communication). Ex. 1202, ¶ 213.

The resultant combinations of Pugel 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, ¶ 213.

Thus, the combination of Pugel and Chandrakasan teaches claims 8, 21, 34, 48, 62, and 78, for the same reasons discussed above with respect to their base claims 1, 14, 27, 41, 55, and 69, and further based on the additional teachings of Chandrakasan as discussed above. Ex. 1202, ¶ 214.

6. Dependent Claims 9 and 22

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

For the same reasons set forth for claims 37 in Section VII.A.7, *supra*, Pugel teaches the additional limitations of claims 9 and 22. Ex. 1202, ¶ 215.

7. Dependent Claims 11 and 24

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

For the same reasons set forth for [27D] in Section VII.A.1.d, *supra*, Pugel teaches the additional limitations of claims 11 and 24. Ex. 1202, ¶ 216.

8. Dependent Claims 12 and 25

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

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

For the same reasons set forth for [55D] in Section VII.A.3, *supra*, Pugel teaches the additional limitations of claims 12 and 25. Ex. 1202, ¶ 217.

9. Dependent Claims 13 and 26

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

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

For the same reasons set forth for claims 40 and 54 in Section VII.A.9, *supra*, Pugel teaches the additional limitations of claims 13 and 26. Ex. 1202, ¶ 218.

10. Dependent Claims 35, 36, 49, 50, 63, 64, 77 and 78

[35/36/63/64] “The cable TV device of claim [27/55], wherein: the DFE is operable to provide the plurality of desired channels via a [parallel/serial] interface.”

[49/50/67/78] “The cable TV device of claim [41/69], wherein: the plurality of digital down converters is operable to provide a plurality of digital channel outputs, comprising each digital channel output, via a [parallel/serial] interface.”

As discussed above in Sections VII.A.1-4, Pugel teaches the base claims from which these claims depend. And for the same reasons set forth above in Sections VII.E.1-2, and VII.E.5, Chandrakasan teaches the additional limitations of these claims. Ex. 1202, ¶ 219.

F. Ground F: Pugel in view of Chandrakasan and further in view of Crols

1. Dependent claims 3 and 16

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

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

As discussed above in Sections VII.E.1-2, Pugel in view of Chandrakasan teaches the base claims from which these claims depend. And for the same reasons set forth above in Section VII.B.2, Crols teaches the additional features of these claims. Ex. 1202, ¶ 220. Modifying Pugel in view of Chandrakasan further in view of Crols would have been obvious for the same rationales as discussed above, and the additional references would have presented no additional difficulties for the combination to a POSITA. Ex. 1202, ¶ 220; *see* Section VII.B.2, *supra*.

2. Dependent claims 4 and 17

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

As discussed above in Sections VII.E.1-2, Pugel in view of Chandrakasan teaches the base claims from which these claims depend. And for the same reasons set forth above in Section VII.B.3, Crols teaches the additional features of these claims. Ex. 1202, ¶ 221. Modifying Pugel in view of Chandrakasan further in view of Crols would have been obvious for the same rationales as discussed above, and the additional references would have presented no additional difficulties for the combination to a POSITA. Ex. 1202, ¶ 221; *see* Section VII.B.3, *supra*.

3. Dependent claims 6 and 19

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

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

As discussed above in Sections VII.E.1-VII.E.2, Pugel in view of Chandrakasan teaches the base claims from which these claims depend. And for the same reasons set forth above in Section VII.B.4, Crols teaches the additional features of these claims. Ex. 1202, ¶ 222. Modifying Pugel in view of Chandrakasan further in view of Crols would have been obvious for the same rationales as discussed above, and the additional references would have presented no additional difficulties for the combination to a POSITA. Ex. 1202, ¶ 222; *see* Section VII.B.4, *supra*.

G. Ground G: Pugel in view of Chandrakasan and further in view of Zaltsman

1. Dependent Claims 10 and 23

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

As discussed above in Sections VII.E.12, Pugel in view of Chandrakasan teaches the base claims from which these claims depend. And for the same reasons set forth above in Section VII.C.1, Zaltsman teaches the additional features of these claims. Ex. 1202, ¶ 223. Modifying Pugel in view of Chandrakasan and further in view of Zaltsman would have been obvious for the same rationales as discussed

above, and the additional references would have presented no additional difficulties for the combination to a POSITA. Ex. 1202, ¶ 223; *see* Section VII.C.1, *supra*.

H. Ground H: Pugel in view of Chandrakasan and further in view of Crols, Zaltsman, and Jensen '170

1. Dependent Claims 5 and 18

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

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

As discussed above in Section VII.F.1, Pugel in view of Chandrakasan and Crols teaches the base claims from which these claims depend. And for the same reasons set forth above in Section VII.D.1, Zaltsman and Jensen '170 teach the additional features of these claims. Ex. 1202, ¶ 224. Modifying Pugel in view of Chandrakasan and Crols further in view of Zaltsman and Jensen '170 would have been obvious for the same rationales as discussed above, and the additional references would have presented no additional difficulties for the combination to a POSITA. Ex. 1202, ¶ 224; *see* Section VII.D.1, *supra*.

VIII. GROUNDS FOR STANDING & FEE PAYMENT

Petitioner hereby certifies that the '866 Patent is available for, and Petitioner is not barred or estopped from requesting, *inter partes* review challenging claims 1-82.

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 1-82 canceled.

Dated: February 16, 2024

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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 13,712, which is less than the 14,000 allowed under 37 CFR § 42.24(a)(1)(i). This total includes 13,655 words as counted by the Word Count feature of Microsoft Word and 57 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

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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. 11,381,866 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. 11,381,866

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

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

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

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

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

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

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

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

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

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

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

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

