

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

MEDIATEK INC.,

Petitioner,

v.

PARKERVISION, INC.,

Patent Owner.

IPR2024-00796

Patent No. 7,483,686

**PETITION FOR *INTER PARTES* REVIEW
OF U.S. PATENT NO. 7,483,686**

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EXHIBIT LIST

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EX1001	U.S. Patent No. 7,483,686
EX1002	Larson Declaration
EX1003	U.S. Patent No. 6,643,522 (“Young”)
EX1004	U.S. Patent No. 6,600,726 (“Nevo”)
EX1005	Estabrook, “The Direct Conversion Receiver: Analysis and Design of the Front-End Components,” Aug. 1989 (“Estabrook-Thesis”)
EX1006	Avitabile <i>et al</i> , “S-band digital downconverter for radar applications based on a GaAs MMIC fast sample-and-hold,” IEE Proc.-Circuits Devices Syst., Vol. 143, No. 6, December 1996 (“Avitabile”)
EX1007	File History of U.S. Patent No. 7,483,686
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EX1009	Joint Claim Construction Chart, <i>ParkerVision v. MediaTek, Inc. et al.</i> , No. 6:23-cv-00375 (W.D. Tex. May 3, 2024), ECF No. 40
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EX1013	Agreed Scheduling Order, <i>ParkerVision v. MediaTek, Inc.</i> , No. 6:23-cv-00375 (W.D. Tex. Jan. 4, 2024), ECF No. 32
EX1014	Markman Order, <i>ParkerVision, Inc. v. Qualcomm Inc.</i> , No. 3:11-cv-719-RBD-JK (M.D. Fla. Feb. 20, 2013), ECF No. 243.
EX1015	<i>Sotera</i> Stipulation Letter dated May 21, 2024
EX1016	P. Estabrook and B. B. Lusignan, “A Mixer Computer-Aided Design Tool Based in the Time Domain,” IEEE Microwave Theory and Techniques Symposium, 1988, pages 1107-1110 (“Estabrook-1988”)
EX1017	P. Estabrook and B. B. Lusignan, “The Design of a Mobile Radio Receiver Using a Direct Conversion Architecture,” In Proc. of the

EXHIBIT No.	DESCRIPTION
	IEEE Vehicular Technology Conference, pages 63-72, May 1989 (“Estabrook-1989”)
EX1018	Declaration of June Munford
EX1019	Declaration of Polly Estabrook, Ph.D.
EX1020	Declaration of G. Avitabile
EX1021	Docket, <i>ParkerVision v. MediaTek, Inc. et al.</i> , No. 6:23-cv-00375 (W.D.Tex. filed May 16, 2023)
EX1022	U.S. Patent No. 6,879,817
EX1023	U.S. Patent No. 6,853,690
EX1024	U.S. Patent No. 6,704,549
EX1025	U.S. Patent No. 7,006,805
EX1026	U.S. Patent No. 6,370,371
EX1027	U.S. Patent Application No. 09/514,004
EX1028	U.S. Provisional Patent Application No. 60/195,328
EX1029	U.S. Provisional Patent Application No. 60/147,129
EX1030	Markman Order, <i>ParkerVision v. Mediatek, Inc. et al.</i> , Civ. No. 6:22-CV-01163-ADA (W.D. Tex. Apr. 29, 2024), ECF No. 70.
EX1031	IEEEExplore Citation search results for Estabrook-1989
EX1032	Google Scholar Citation search results for Estabrook-1989
EX1033	U.S. Patent No. 6,873,836
EX1034	SPICE Version 2G User’s Guide, 1981
EX1035	Excerpts from the Microsoft Computer Dictionary, 5 th Edition, pgs. 26, 482

EXHIBIT No.	DESCRIPTION
EX1036	U.S. Patent No. 6,477,378
EX1037	U.S. Patent No. 6,570,394
EX1038	Excerpts from the Electrical Engineering Dictionary (ISBN 0-8493-2170-0), pgs. 50, 302, 539, 662
EX1039	IEEE Std 802.11a-1999 (Supplement to IEEE Std 802.11-1999)
EX1040	Excerpts from P. Nahin, The Science of Radio (ISBN 1-56396-347-7) (1996), pgs. 36, 165, 182-184
EX1041	EP0551857
EX1042	Excerpts from Serway, Physics for Scientists and Engineers, 3 rd Ed. (ISBN 0-8493-3128-5) (1999).
EX1043	Excerpts from Davis, Operating Systems, A Systematic View (ISBN 0-201-11116-0) (1983)
EX1044	Bluetooth Spec. V. 1.0 B (1998)
EX1045	Appellant's Brief, <i>ParkerVision Inc. v. Intel Corp.</i> , Case No. 2022-1548 (Fed. Cir. July 15, 2022)
EX1046	Federal Circuit Rule 36 Judgment, Case No. 2022-2173 (May 16, 2024)
EX1047	Reply Claim Construction Brief, <i>ParkerVision v. MediaTek, Inc. et al.</i> , No. 6:23-cv-00375 (W.D. Tex. Apr. 15, 2024)

LISTING OF CHALLENGED CLAIMS

Reference	Claim Limitation
Claim 1	
1[pre]	An apparatus capable of performing simultaneous multi-platform operations, comprising:
1[a]	at least one multi-platform module including a plurality of transceivers each having at least one frequency translating module, wherein said at least one frequency translating module comprises
1[b]	a switch configured to operate according to an energy transfer signal, and to sub-sample and transfer energy from a first electromagnetic (EM) signal, and
1[c]	a control module configured to enable the at least one multi-platform module to communicate with at least one of a plurality of communication links, the control module including a plurality of protocol/standard sub-modules.
Claim 2	
2	The apparatus of claim 1, wherein the control module is configured to enable the at least one multi-platform module to simultaneously communicate with a quantity of the plurality of communication links by employing an equal quantity of the plurality of standard/protocol sub-modules.
Claim 3	
3	The apparatus of claim 1, wherein the at least one multi-platform module includes a plurality of receivers and a plurality of transmitters each having at least one frequency translating module.
Claim 4	

Reference	Claim Limitation
4	The apparatus of claim 1, wherein the plurality of protocol/standard sub-modules comprise a first protocol/standard sub-module configured to operate a first transceiver in conformance with a first protocol/standard combination and a second protocol/standard sub-module configured to simultaneously operate a second transceiver in conformance with a second protocol/standard combination.
Claim 5	
5	The apparatus of claim 4, wherein the first protocol/standard combination is different from the second protocol/standard combination.
Claim 6	
6	The apparatus of claim 4, wherein the first and second protocol/standard sub-modules contain respective first and second implementation and operational instructions for the at least one multi-platform sub-module.
Claim 7	
7	The apparatus of claim 6, wherein the first and second implementation and operational instructions include respective first and second protocol stacks and specification information about the first and second protocol architectures.
Claim 8	
8	The apparatus of claim 6, wherein the first and second implementation and operational instructions can be updated, upgraded, replaced, or modified to provide the at least one multi-platform sub-module with additional functionality.
Claim 9	

Reference	Claim Limitation
9	The apparatus of claim 4, wherein the first and second protocol/standard sub-modules are configured to operate the first and second transceivers in conformance with respective requirements of first and second protocols and operating environments.
Claim 10	
10	The apparatus of claim 9, wherein the first and second operating environments include at least one of respective standards, content encoders and decoders, and protocol gateways.
Claim 11	
11[pre]	A method for performing simultaneous multi-platform operations, comprising
11[1.1]	(1) controlling at least one multi-platform module to communicate with at least one of a plurality of communication links
11[1.2]	using a control module
11[1.3]	having a plurality of standard/protocol sub-modules, wherein the at least one multi-platform module includes
11[1.4]	a plurality of transceivers each having at least one frequency translation module, wherein said at least one ¹ frequency translation module comprises
11[FTM-1.1]	a switch
11[FTM-	configured to operate according to an energy transfer signal

¹ Certificate of Correction replaced “on” with “one.”

Reference	Claim Limitation
1.2]	
11[FTM-1.3]	and to sub-sample and transfer energy from a first electromagnetic (EM) signal, and
11[FTM-2.1]	a storage module coupled to said switch and configured to store said transferred energy
11[FTM-2.2]	wherein a second EM signal is generated from said stored energy, said second EM signal having a frequency different from said first EM signal
11[2]	(2) operating a first transceiver in conformance with a first protocol/standard combination using a first standard/protocol sub-module; and
11[3]	(3) operating a second transceiver in conformance with a second protocol/standard combination using a second standard/protocol sub-module.
Claim 12	
12	The method of claim 11, wherein step (1) comprises: controlling the at least one multi-platform module to simultaneously communicate with a quantity of the plurality of communications links by employing an equal quantity of the plurality of standard/protocol sub-modules.
Claim 13	
13	The method of claim 11, wherein step (1) comprises: controlling the at least one multi-platform module to communicate with at least one of the plurality of communication links using the control module, the at least one multi-platform module including a plurality of receivers and a plurality of transmitters each having at least one frequency translating module.

Reference	Claim Limitation
Claim 14	
14	The method of claim 11, wherein step (3) comprises: simultaneously operating the second transceiver in conformance with a second protocol/standard combination that is different from the first protocol/standard combination
Claim 15	
15	The method of claim 11 ² , wherein steps (2) and (3) comprise: programming the first and second protocol/standard sub-modules with respective first and second implementation and operational instructions for the at least one multi-platform sub-module.
Claim 16	
16	The method of claim 15, wherein steps (2) and (3) further comprise: programming the first and second protocol/standard sub-modules with respective first and second protocol stacks and specification information about first and second protocol architectures.
Claim 17	
17	The method of claim 15, wherein steps (2) and (3) further comprise: updating, upgrading, replacing, or modifying the first and second implementation and operational instructions to provide the at least one multi-platform sub-module with additional functionality.
Claim 18	

² Certificate of Correction replaced “claim 14” with “claim 11.”

Reference	Claim Limitation
18	The method of claim 11, wherein steps (2) and (3) further ³ comprise: simultaneously operating the first and second transceivers in conformance with respective requirements of first and second protocols and operating environments.
Claim 19	
19	The method of claim 18, wherein steps (2) and (3) further comprise: simultaneously operating the first and second transceivers in conformance with respective standards, content encoders and decoders, and protocol gateways of the first and second protocol and operating environments.
Claim 20	
20	The method of claim 11, wherein step (3) comprises simultaneously operating the second transceiver and the first transceiver.

³ Certificate of Correction inserted “further” after “(3).”

I. INTRODUCTION

MediaTek Inc. (“Petitioner”) petitions for *inter partes* review (“IPR”) of claims 1-20 (“challenged claims”) of U.S. Patent No. 7,483,686 (EX1001, “’686 Patent”).

II. GROUNDS FOR STANDING (37 C.F.R. §42.104(A))

Petitioner certifies the ’686 Patent is available for IPR and Petitioner is not barred or estopped from requesting IPR challenging claims of the ’686 Patent on the grounds identified herein. PO never formally served its complaint asserting the ’686 Patent in the related litigation.⁴ EX1021 (no proof of service); *see Amneal Pharm., LLC v. Endo Pharm. Inc.*, IPR2014-00360, Paper 15 (June 27, 2014). Petitioner nevertheless files this Petition within one year of its agreement to accept service (even though PO never actually served the complaint).

III. STATEMENT OF PRECISE RELIEF REQUESTED

Petitioner respectfully requests cancellation of the Challenged Claims in view of:

⁴ This Petition refers to the co-pending litigation between ParkerVision and MediaTek (6:23-cv-00375 (W.D.Tex.) as the “related litigation.”

Prior Art
Young, U.S. Patent 6,643,522, filed March 27, 2000, prior art at least under §102(e) ⁵ (EX1003).
Nevo, U.S. Patent 6,600,726, filed Nov. 12, 1999, prior art at least under §102(e) (EX1004).
Estabrook-Thesis, Aug. 1989, prior art under at least §102(b) (EX1005). ⁶
Estabrook-1988, May 1988, prior art under at least §102(b) (EX1016).
Estabrook-1989, May 1989, prior art under at least §102(b) (EX1017). ⁷
Avitabile, December 1996, prior art under at least §102(b) (EX1006). ⁸

⁵ §§102, 103 refers to the pre-AIA statutory framework.

⁶ Estabrook-Thesis is a 1989 Stanford PhD thesis, published in 1989 and catalogued and made accessible by the Stanford Library system no later than 1991. EX1018, ¶¶9-14; EX1019, ¶¶6-7.

⁷ Estabrook-1988 and Estabrook-1989 were both published in IEEE conference papers. Estabrook-1989 was cited by at least a dozen papers by others prior to the '686 Patent's priority date, and in turn cites Estabrook-1988. EX1018 ¶¶16-20; EX1019 ¶¶9-13; EX1031; EX1032; EX1017, 72.

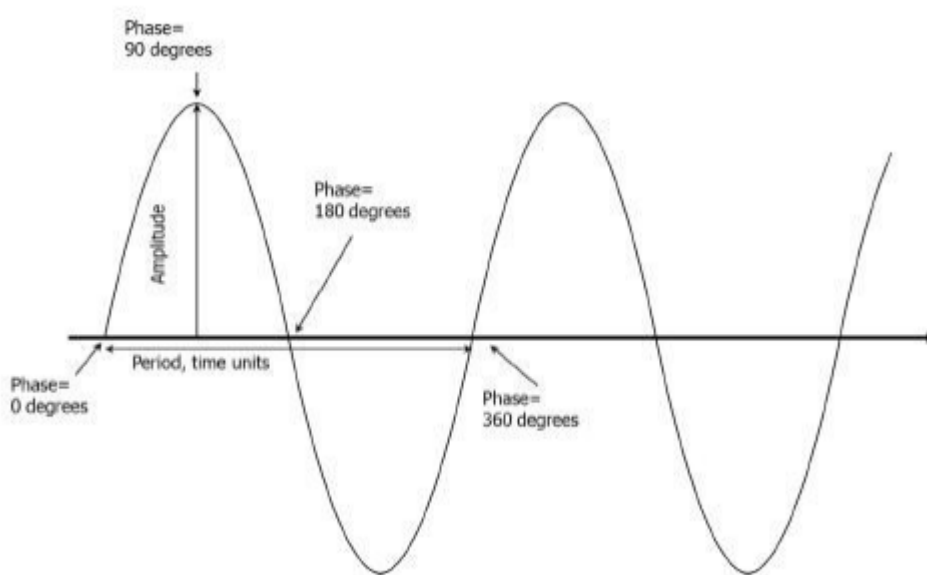
⁸ Avitabile was published in the Proceedings of *IEE Circuit, Devices, and Systems* in December 1996 and was made accessible to the public by at least the Penn State Library and via Dr. Avitabile (its main author) in December 1996. EX1018, ¶¶6-8; EX1020, ¶¶3-6.

Ground (all under 35 U.S.C. § 103)	Claims	References
1	1-20	Nevo, Avitabile
2A	1-20	Young, Estabrook-Thesis
2B	1-20	Young, Estabrook-1988, Estabrook-1989

IV. TECHNOLOGY BACKGROUND

A. Wireless Communication Signals

Wireless devices (e.g., cellular phones and Wi-fi receivers) exchange information by transmitting and receiving electromagnetic signals. Before transmission, information (e.g., voice information) exists as a “baseband signal,” which has a relatively low frequency and may be converted into an analog signal for wireless transmission. As shown below, an analog signal is a continuous waveform



that oscillates at a particular frequency between maximum and minimum values:

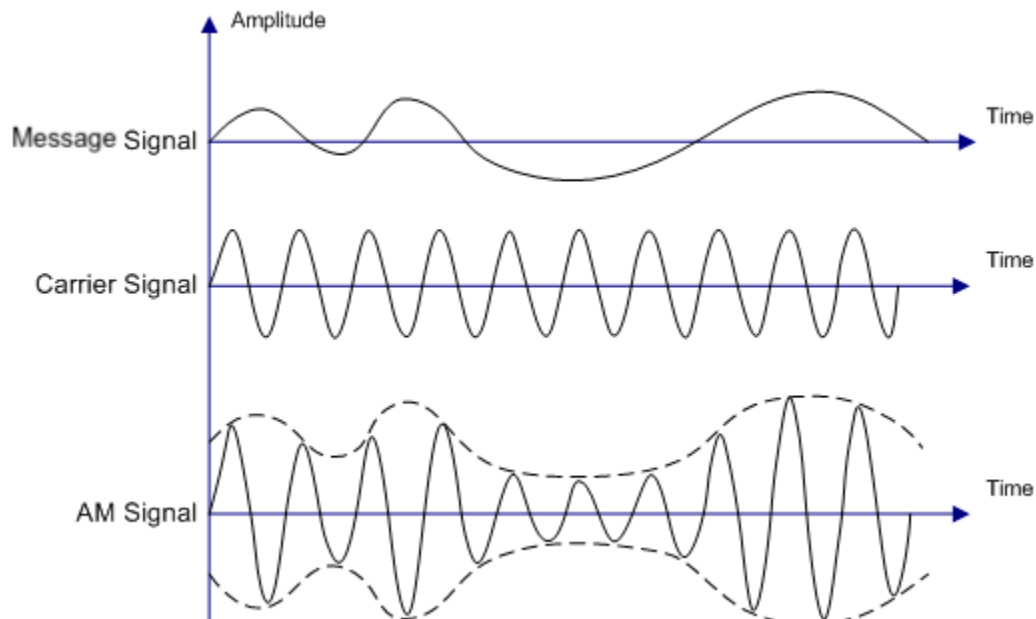
EX1002, ¶¶42-44.

B. Signal Modulation

Because baseband signals have relatively low frequencies, they cannot be effectively transmitted through the air between wireless devices. Instead, a baseband signal must be “modulated” onto a higher frequency signal—called a “carrier” signal—that can be transmitted more easily. This carrier signal “carries” the baseband signal through the air from one device to another. EX1002, ¶¶45-47.

Baseband signals may be modulated onto carrier signals in numerous ways, including modifying the frequency, phase, and/or amplitude of the carrier signal based on the baseband signal.

For example, in amplitude modulation, the amplitude of the carrier signal is varied with the amplitude of the baseband signal, resulting in an amplitude-modulated (AM) signal:



In each case, the receiver is tuned to the carrier frequency and can recover the original baseband signal by demodulating the signal according to the amplitude, frequency, or phase of the carrier. EX1002, ¶¶48-55.

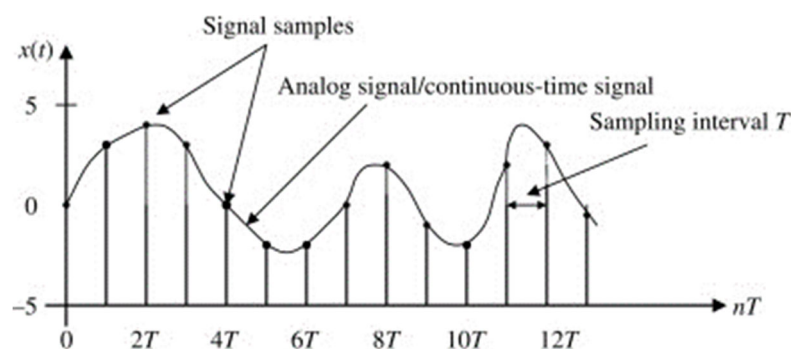
C. Frequency Conversion

Wireless communication systems may also need to convert higher-frequency modulated signals to modulated signals at a lower frequency, either directly to the baseband or to an intermediate frequency (IF). For example, the use of an IF may allow amplifiers within a receiver to be tuned to a fixed IF so that those amplifiers do not need to be re-tuned whenever the receiver is tuned to a new carrier frequency. EX1002, ¶56.

Two common methods of frequency conversion are mixing, also known as heterodyning, and sampling. In mixing, two frequencies (typically an input signal

and a signal from a local oscillator) are mixed to produce two output signals, one at the sum of the two frequencies and the other at the difference between the two.

Sampling generally involves capturing samples (e.g., voltages from a received signal) at discrete time points from a continuous signal, such as a carrier wave. For example, the image below shows an input signal sampled at a sampling interval T :



The samples taken at discrete time points may then be used to reconstruct an apparent signal waveform, including one with the baseband signal modulated onto a carrier having a different frequency. EX1002, ¶¶57-59.

V. '686 PATENT OVERVIEW

A. Specification

The '686 Patent describes a “universal platform module that can transmit and receive one or more information signals in one or more protocols using one or more bearer services.” '686Pat., Abstract. Protocols “provide the format for the transfer of data,” and bearer services or standards “provide the communication pipeline...for the device to interact with the network.” '686Pat., 7:52-8:5. The '686 Patent

acknowledges “conventional” devices included multiple “platform modules” for communicating with different protocols and bearer services. *E.g.*, ’686Pat., Fig. 25A (below), 36:46-54 (describing a “conventional multi-mode device,” including both CDMA and Bluetooth platform modules for communicating with CDMA and Bluetooth networks, respectively).

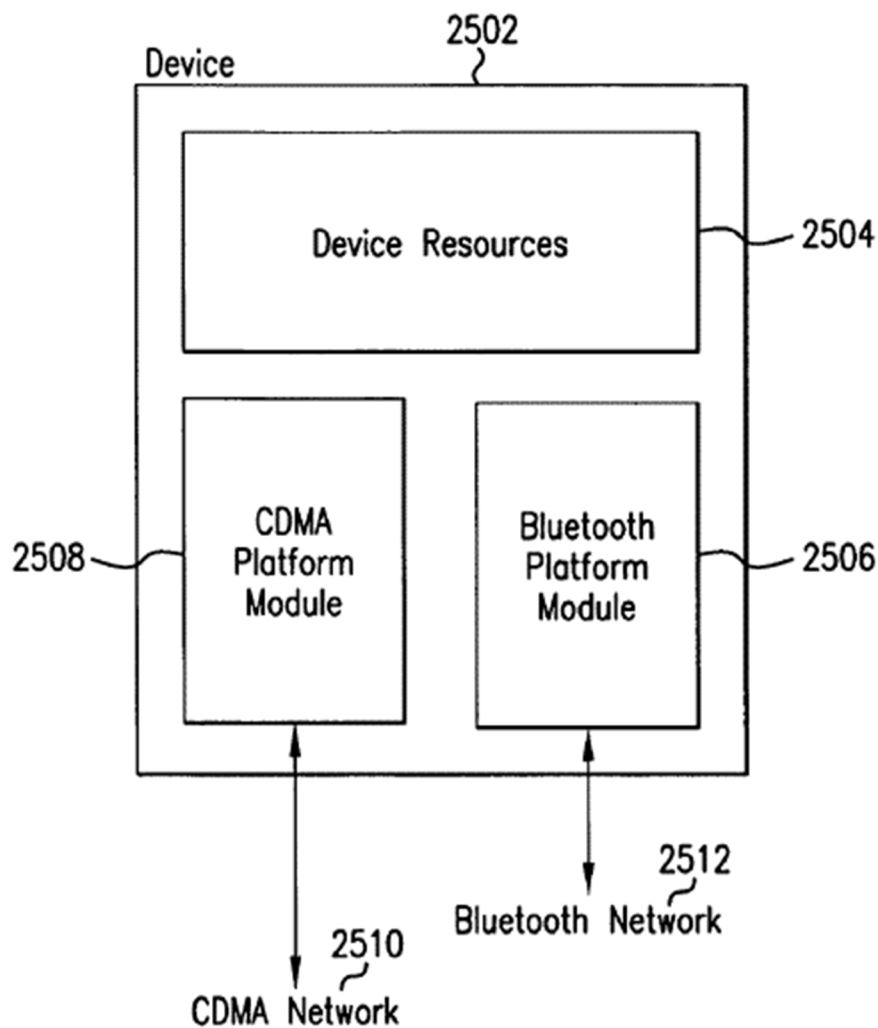


FIG.25A

The '686 Patent also depicts the “Universal platform module” (UPM) as including a plurality of “universal platform sub-modules” (UPSM), each of which includes a “Universal Frequency Translator” (UFT) module, and is shown linking to various network types 2610-2616, such as cellular and WLAN networks. '686Pat., 35:12-38, Fig. 26C:

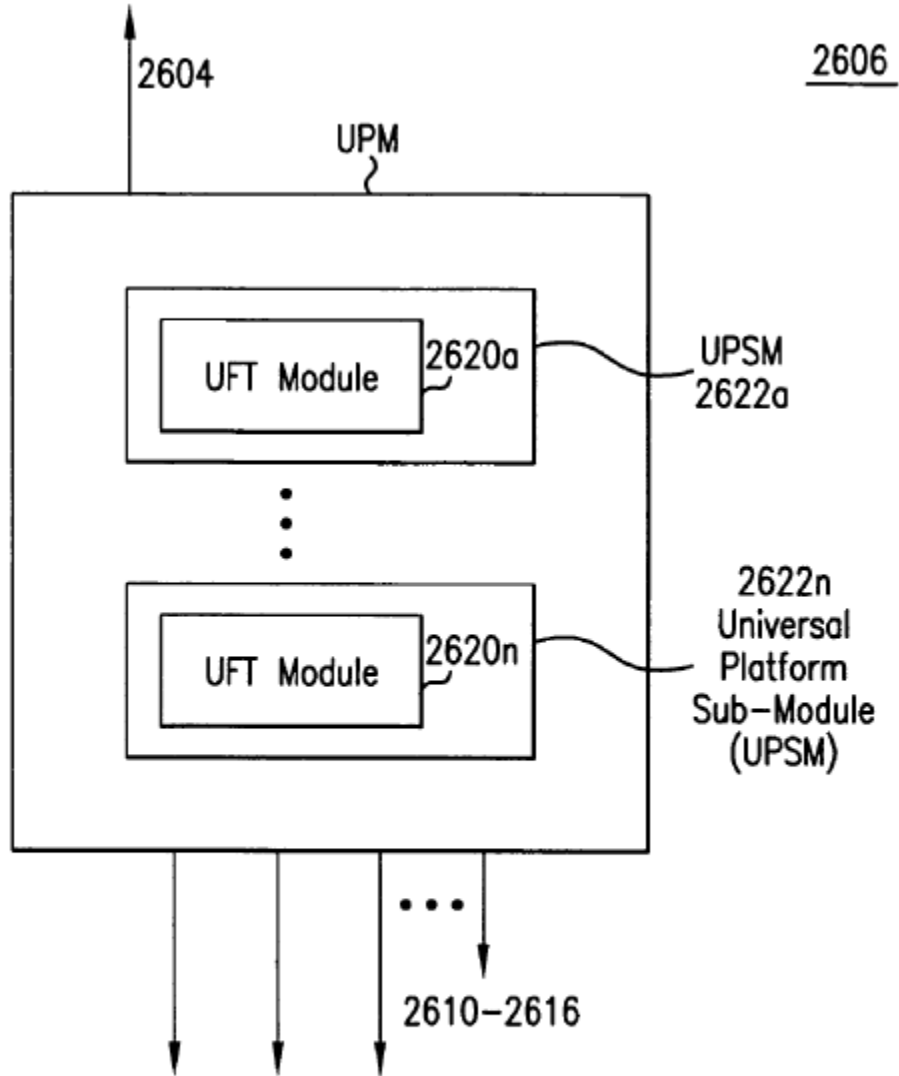


FIG.26C

The UPSM may include a “universal frequency down-converter” (UFD) which down-converts a received signal to a baseband signal:

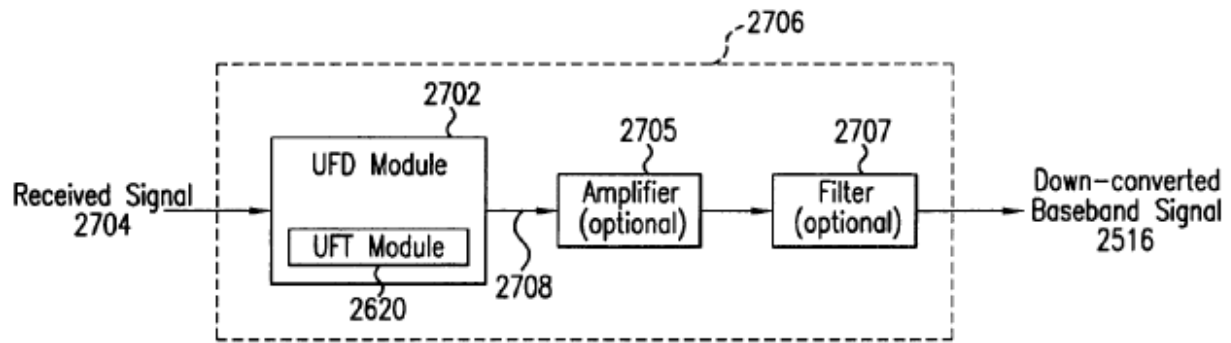


FIG.27B

'686Pat., Fig. 27B, 41:36-49.

Figure 28 illustrates a block diagram of an exemplary UFD, including a UFT module which may comprise a switch, an oscillator, and pulse shaping circuit 2806, which produce control signal 2812, and a storage device 2802 such as a capacitor:

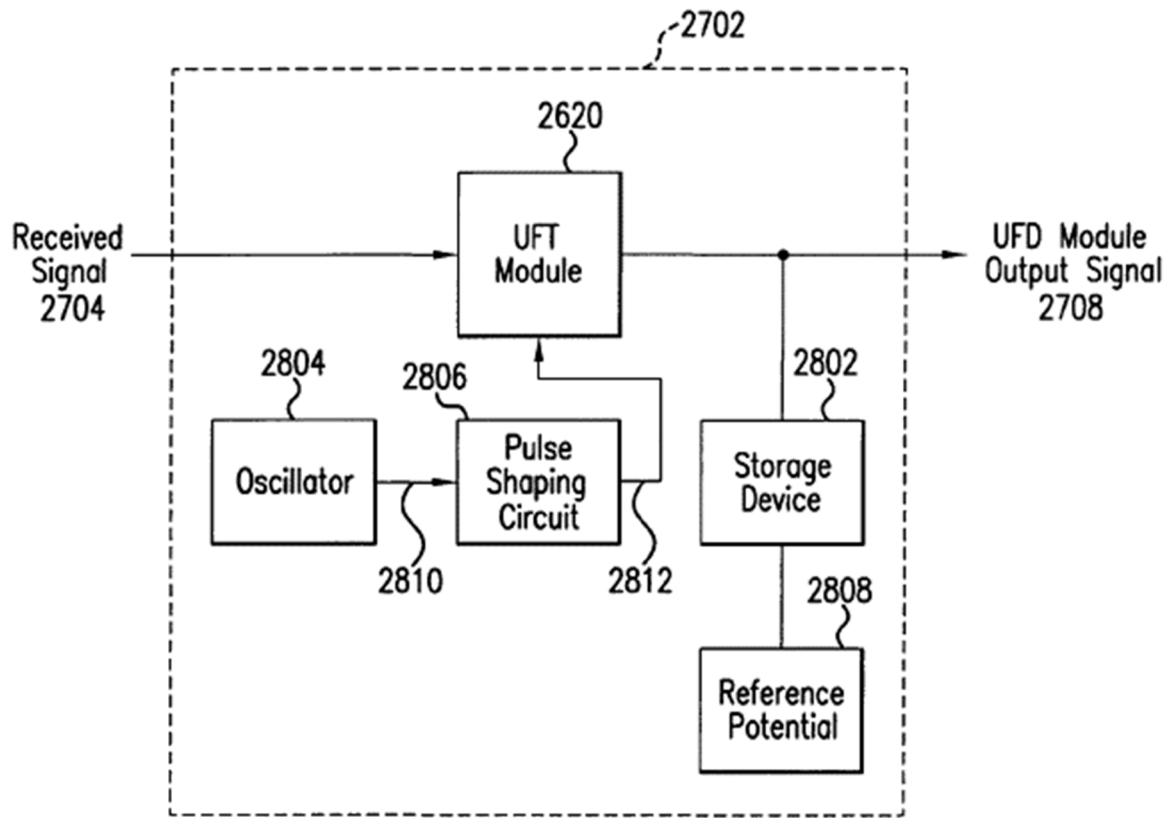
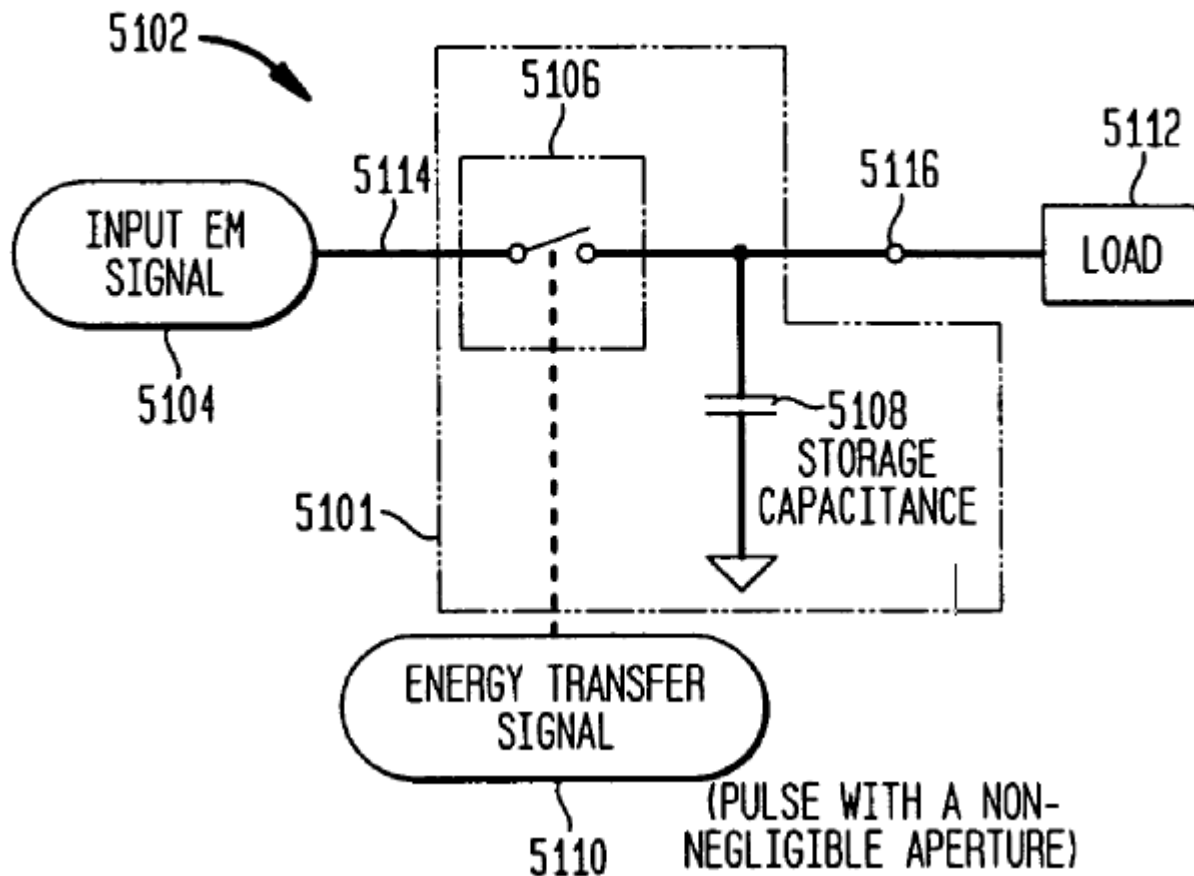


FIG.28

'686Pat., Fig. 28, 42:17-56.

The '686 Patent also sometimes refers to the control signal as an energy transfer signal. '686Pat., 13:27-31. Figure 51A shows a circuit diagram using a switch as the UFT module, capacitor as a storage device, and a pulse with a non-negligible aperture as an energy transfer signal:

FIG. 51A



'686Pat., Fig. 51A, 18:6-19.

B. File History

The first claims to be examined during prosecution of the '686 Patent (after two preliminary amendments) required a multi-platform module with a frequency translation module ("FTM") but did not specify the operation of the FTM. EX1007, 243-48.

The Examiner's first office action rejected all claims under §§102/103 over

Zehavi (U.S. Patent Number 6,894,988) alone or in combination with other references. EX1007, 802-08. The Applicant then amended the pending claims to recite the FTM “comprises” the “switch” and “storage module” elements and to delete the recitation that “operating a second transceiver” occurs “simultaneously” in the independent method claim. EX1007, 971-84.

The Examiner thereafter issued a Notice of Allowability without further substantive comment. EX1007, 1006-08. The added elements of the FTM, the “switch” and “storage module,” were all known in the prior art, as discussed below.

A certificate of correction issued on January 27, 2009. EX1001, Certificate of Correction.

C. Claims

Claims 1 and 11 are independent, claims 2-9 depending from claim 1 and claims 12-20 depending from claim 11. Claim 1 is similar to claim 11, but recites an apparatus and lacks the “storage module” of claim 11.

D. Priority Date

The application leading to the '686 Patent was filed on October 27, 2004 and claims priority as a continuation of U.S. Patent Application 09/569,044, filed on May 10, 2000. EX1001, (22), (63), 1:9-14. The '686 Patent also claims priority earlier than May 10, 2000 as a continuation-in-part to several applications, and based on two provisional applications (EX1022-EX1029). EX1001, (60), (63), 1:14-45.

None of these earlier applications, however, contains any support for the “multi-platform module” required by all ’686 challenged claims. EX1002, ¶¶37-38. The subject matter was first introduced in the continuation application filed on May 10, 2000. EX1033, Figs. 43-44. Indeed, none of the earlier applications contain the words⁹ “multi-platform,” or “simultaneous”¹⁰ with regard to two or more platforms/standards/protocols. EX1002, ¶38. Therefore, the priority date for the challenged claims is May 10, 2000 at the earliest. EX1002, ¶38.

VI. LEVEL OF ORDINARY SKILL

As of the ’686 Patent’s priority date, a POSITA would have had at least a bachelor’s degree in electrical engineering or a related subject and two or more years of experience in the field of RF circuit design, or at least five years of work experience and training in the design and development of RF circuits and/or systems. Less work experience may be compensated by a higher level of education, such as a

⁹ Or variations that would have provided support for those terms. EX1002, ¶38.

¹⁰ U.S. Patent No. 6,704,549 describes a frequency selection module, e.g., Figure 1, but this provides no detail on simultaneous signal processing for more than one protocol/standard/platform. EX1002, ¶38.

master's degree. EX1002, ¶39-41.

VII. CLAIM CONSTRUCTION

As discussed below, several claim terms in the '686 Patent, or closely related claim terms for patents related to the '686 Patent, have been construed during ParkerVision's extensive litigation campaign. All other terms should be given their plain and ordinary meaning. EX1002, ¶74.

A. "Storage module" in claim 11

"Storage module" should be construed as "a module that stores non-negligible amounts of energy from an input electromagnetic signal." Support for this construction is found in the '551 Patent specification (EX1008, 66:55–67), incorporated by reference at '686Pat., 1:47-52; EX1002, ¶¶ 76-77.

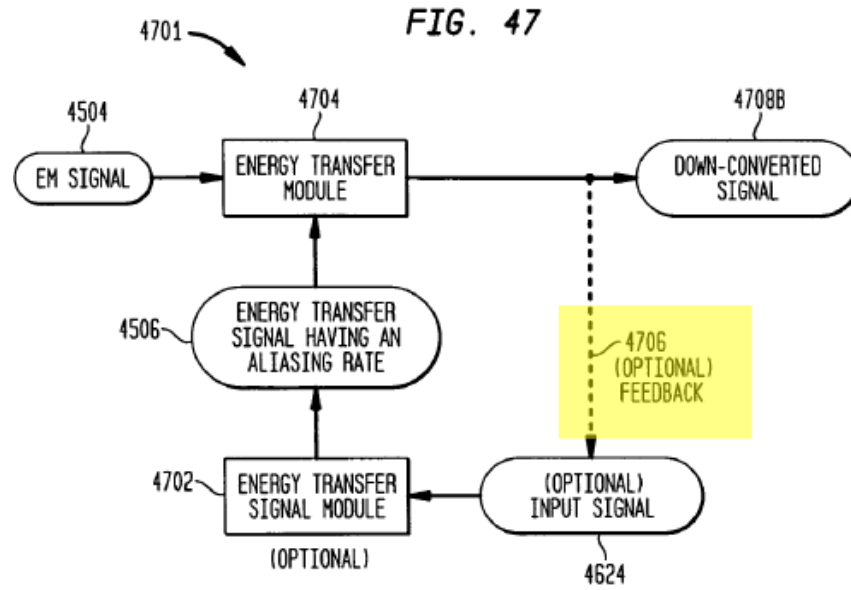
PO's proposed construction in related litigation differs only in that PO would require the "storage module" to be part of an "energy transfer system." EX1009, 2. The Federal Circuit has already rejected this construction in the context of another of PO's patents that, like the '686 Patent, incorporates the '551 Patent. *Parkervision, Inc. v. Vidal*, 88 F.4th 969, 975-78 (Fed. Cir. 2023). In that decision, the Federal Circuit analyzed the '551 Patent's disclosure of a "storage module," determined the Board correctly construed "storage element" as "an element of a system that stores non-negligible amounts of energy from an input EM signal" based on the '551 disclosure, and rejected PO's attempt to limit the term to an element of an energy

transfer system. *Id.* Regardless, Petitioner’s unpatentability grounds below show the Challenged Claims are unpatentable under either construction.

Further, in another case involving the ’551 Patent and other related patents, the district court construed “non-negligible amounts of energy” (as recited in the claims-at-issue) to mean “energy in amounts distinguishable from noise,” and PO did not dispute that construction on appeal. *ParkerVision, Inc. v. Qualcomm Inc.*, 621 Fed. App’x 1009, 1018 (Fed. Cir. 2015).

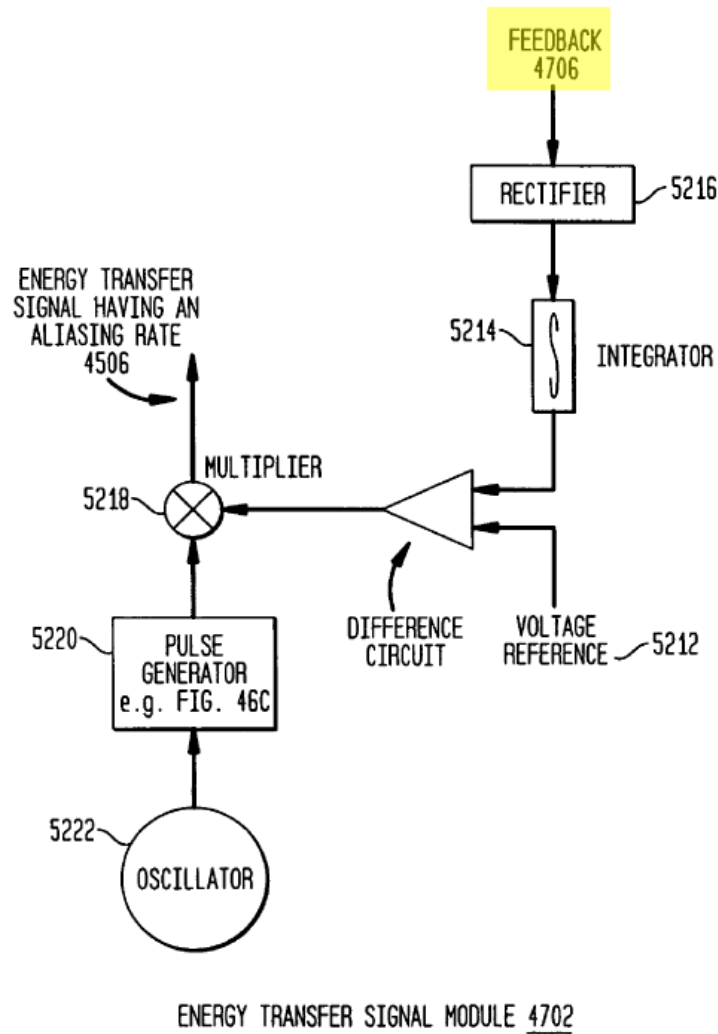
B. “Switch” in claims 1 and 11

“Switch” should be construed as “an electronic device for opening and closing a circuit.” In the related litigation, the only dispute between the parties is whether the switch must be “dictated by an independent control input.” EX1009, 3. Petitioner acknowledges that some courts have construed the term in related patents to require an independent control input. *See* EX1030, 49. However, the plain and ordinary meaning of “switch” does not require an “independent” control input, and the specification discloses examples of switches lacking an “independent control input.” For example, control signal 2006 controls a switch and may be an energy transfer signal. ’686Pat., Fig. 20A-1, 13:27-31. As shown in Figures 47 and 52C, an energy transfer signal 4506 may be controlled based on feedback 4706 derived from down-converted signal 4708B (’686Pat., 20:23-21:5):



'686Pat., Fig. 47.

FIG. 52C



'686Pat., Fig. 52C. Because the control signal in Figures 47 and 52C is not “independent” of the feedback, construing the claim to require an “independent” control input would read out this embodiment, without any basis for doing so.

Moreover, in IPR2021-00346, the PTAB rejected PO's attempt to limit the “switch” recited in another of PO's patents to require an “independent” control input because like the '686 Patent, the patent in that IPR showed no clear intention to limit

the claim term in that way. EX1010, 15-26; EX1011, 56:46-52. The Federal Circuit affirmed. EX1046.

Regardless, Petitioner’s unpatentability grounds below show the Challenged Claims are unpatentable under either construction. EX1002, ¶¶78-80

C. “Coupled” in claim 11

In the related litigation, PO contends “coupled” should have its plain-and-ordinary meaning, and Petitioner contends “coupled” should be construed as “directly connected or connected through a wire (or a closed switch).” EX1009, 3; *see* EX1012, 25.

Regardless, Petitioner’s unpatentability grounds below show the Challenged Claims are unpatentable under either construction. EX1002, ¶81.

D. “multi-platform module” in claims 1 and 11

In the related litigation, the parties agree “multi-platform module” should be given its plain and ordinary meaning, and Petitioner further contends “platform” refers to a communications protocol and/or bearer service (which is supported by the intrinsic record). EX1009, 4; EX1047, 12. Although the phrase does not appear in the specification, the ’686 Patent teaches that “multi-platform operations” refer to “multiple protocols and multiple bearer services...employed simultaneously.” ’686Pat., 8:19-32; *see also id.*, 8:13-18; EX1002, ¶82.

E. “sub-sample” in claims 1 and 11

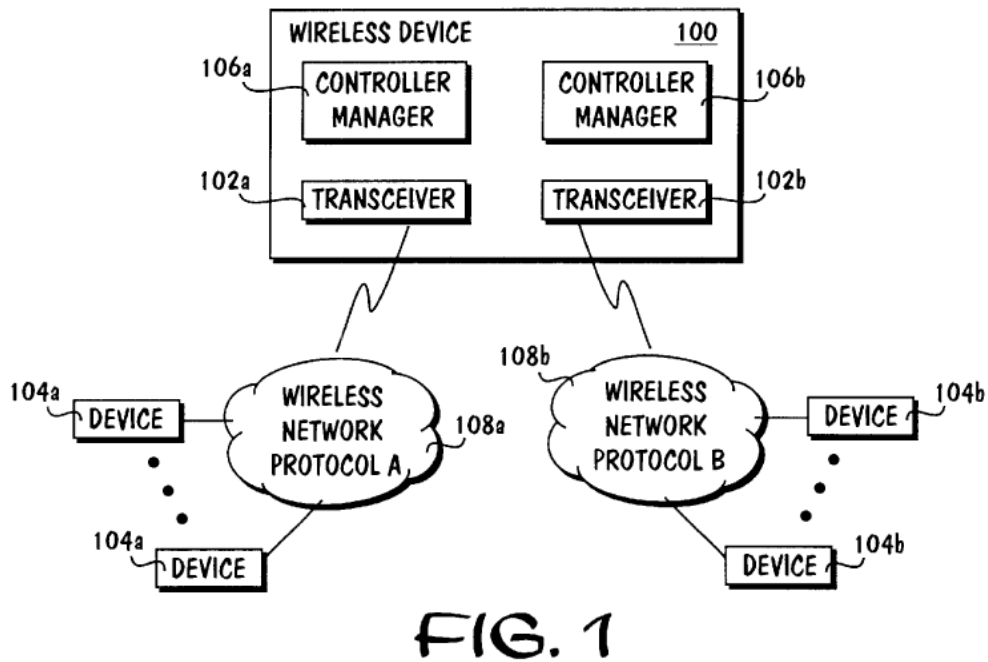
In previous litigation, a district court (M.D. Fla.) accepted PO’s proposal to construe “sub-sample” in related patents (which also incorporated the ’551 Patent by reference) to “refer to sampling at an aliasing rate, *i.e.*, at a rate that is less than or equal to twice the frequency of the signal being sampled.” EX1014, 6-10. Petitioner believes this term has its plain-and-ordinary meaning, but for purposes of this Petitioner, Petitioner does not contest that the plain and ordinary meaning encompasses PO’s previous proposal. EX1002, ¶83.

VIII. SPECIFIC GROUNDS FOR PETITION

A. Ground 1: Claims 1-20 are Unpatentable as Obvious Over Nevo and Avitable

1. Nevo

Nevo discloses a multi-protocol wireless device. Nevo, Abstract; EX1002, ¶¶84-86. Nevo’s wireless device has a plurality of controller managers 106a/106b that operate a plurality of transceivers 102a/102b to communicate with respective communication networks running different wireless network protocols 108a/108b, including Bluetooth, IEEE 802.11, and Home RF. *Id.*, 3:27-35, 4:46-55.



2. Avitable

Avitable teaches a digital downconverter having an SH (sample-and-hold) module (annotated yellow, below) that takes an input RF signal (red) and outputs a down-converted intermediate frequency (IF) signal (orange). Avitable, 338 (§3); EX1002, ¶¶87-92. It performs demodulation for carrier signals in the S-band and further provides examples using a 1 GHz carrier with a bandwidth of 30 MHz. *Id.*, 337 (§1), 339-340 (§5-5.1).

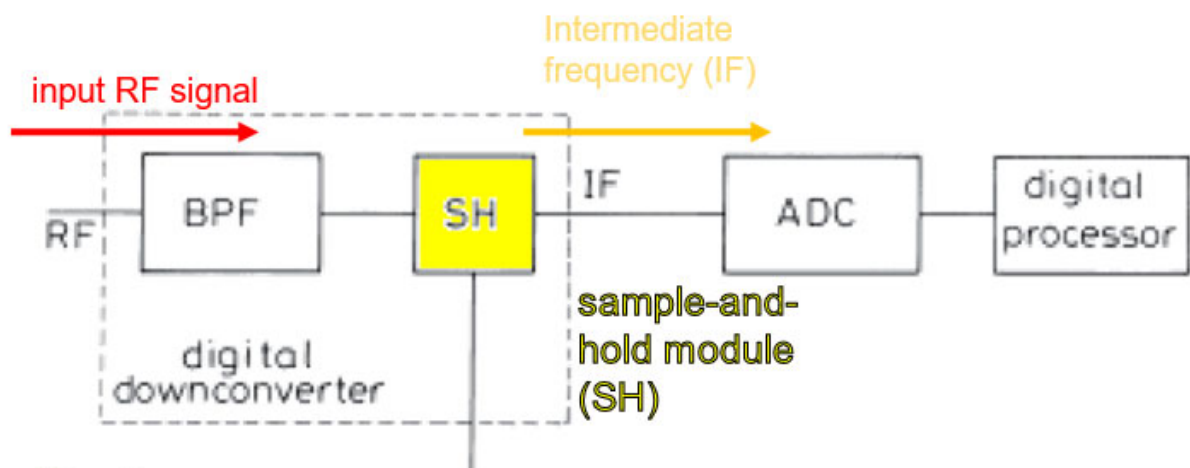


Fig.1 Schematic diagram

The SH circuit appears in schematic (e.g., FIG. 2), and two prototypes (e.g., Figs. 4-7, 8-10). Annotated Figure 2 illustrates a switch (blue) which controls the flow of an input RF signal (red) that charges capacitor (green) which in turn generates an IF output signal (orange). Avitabile, 338 (§§4, 4.1). Control signal (purple) controls flipping the switch closed/open. *Id.*

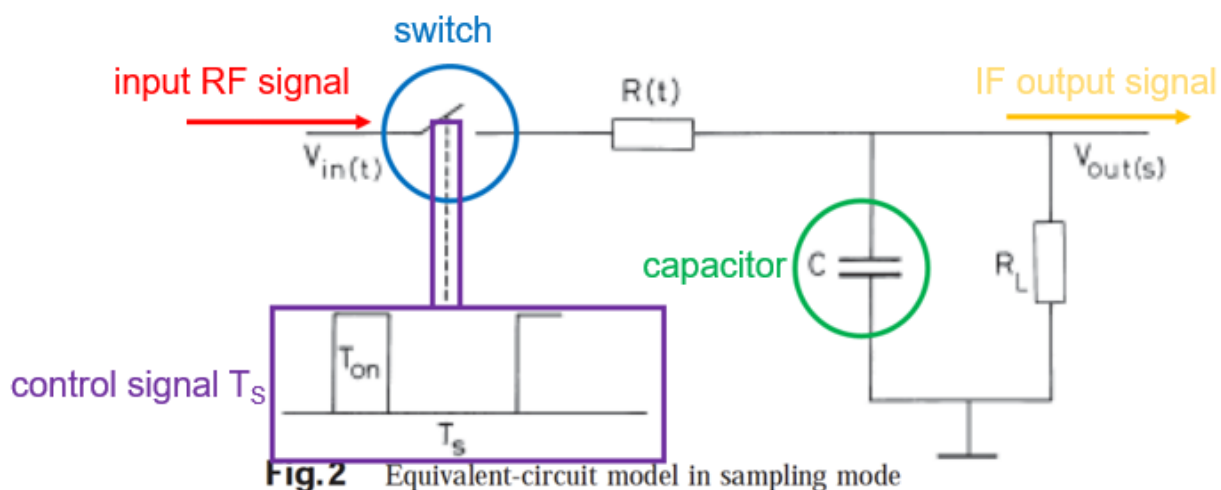


Fig.2 Equivalent-circuit model in sampling mode

Avitabile provides measurements from two prototypes. The first (Fig. 4,

below) illustrates a switch (annotated blue) that is pulsed to pass the RF signal (red) to the capacitor (green) whereupon the sample baseband signal (orange) is obtained. Avitable, 338-39 (§5.1).

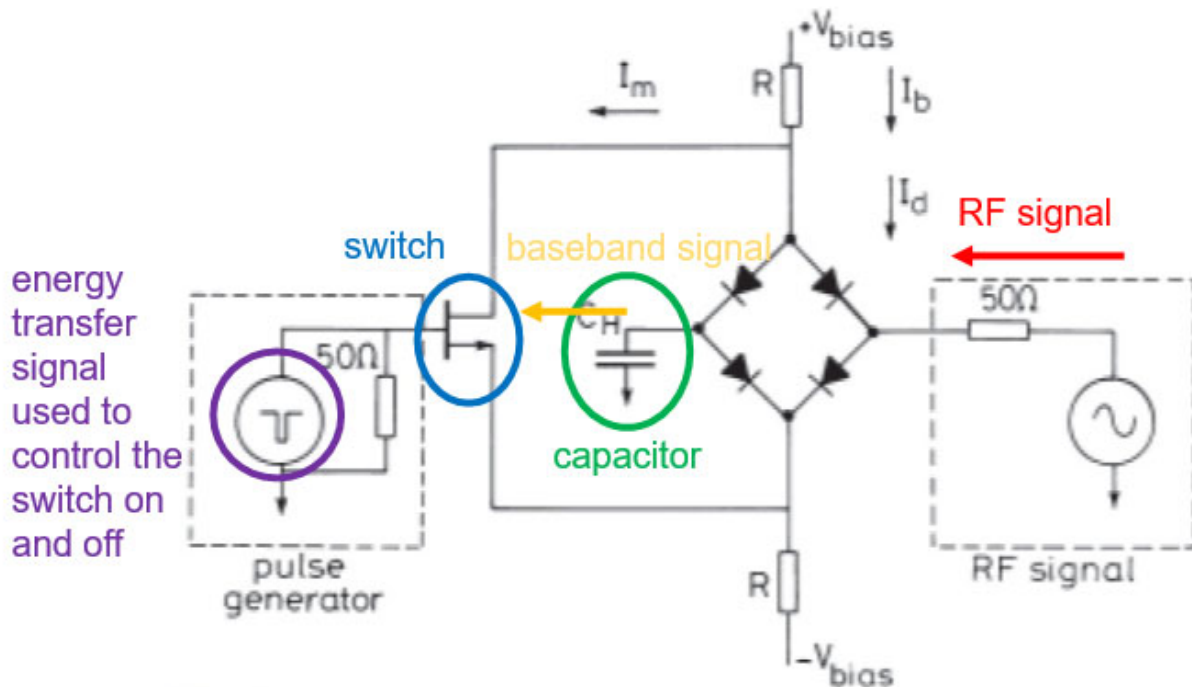


Fig.4 Schematic diagram of SH1 sample-and-hold circuit

Figure. 7 (below, left) illustrates the signal at the capacitor after two pulses. See Avitable, Fig. 5 (illustrating the pulsing every 4 ns). With each pulse, energy is stored in the capacitor. The measured baseband waveform is shown in Figure 6 (below, right).

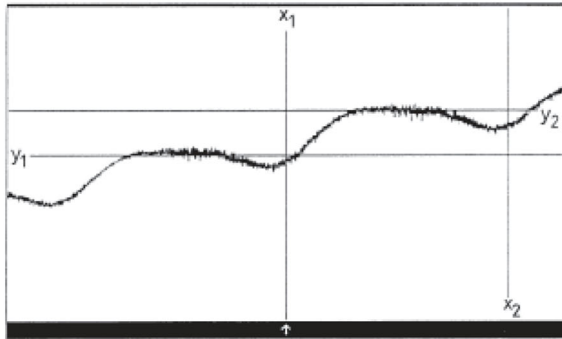


Fig. 7 Hold time and 'droop off' of the sampled signal
 $x_1 = 0$; $y_1 = 11$ mV; $x_2 = 4$ ns; $y_2 = 33.4$ mV
Horizontal scale: 1 ns/div.

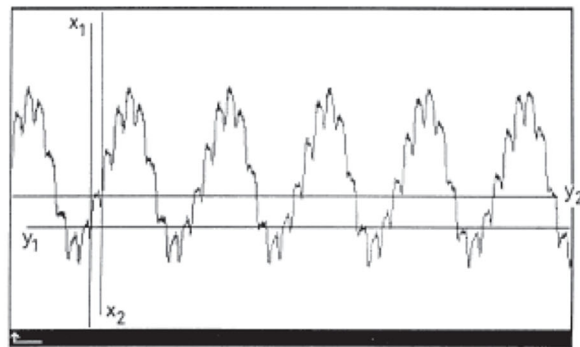
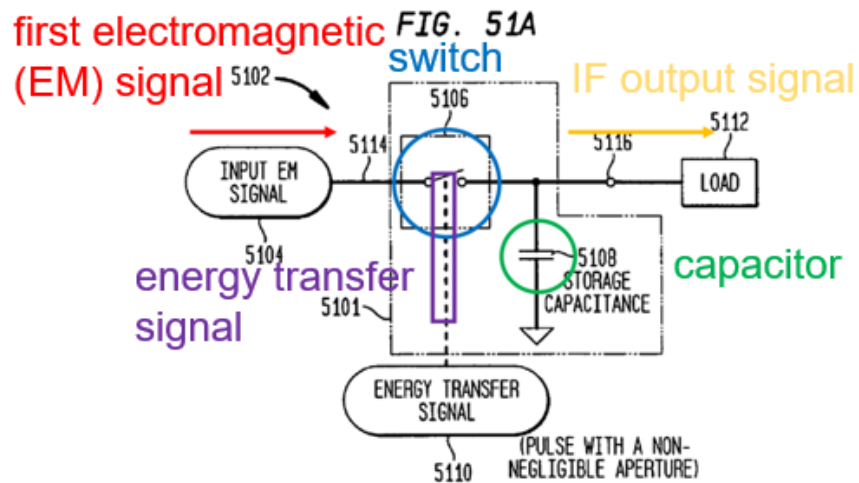
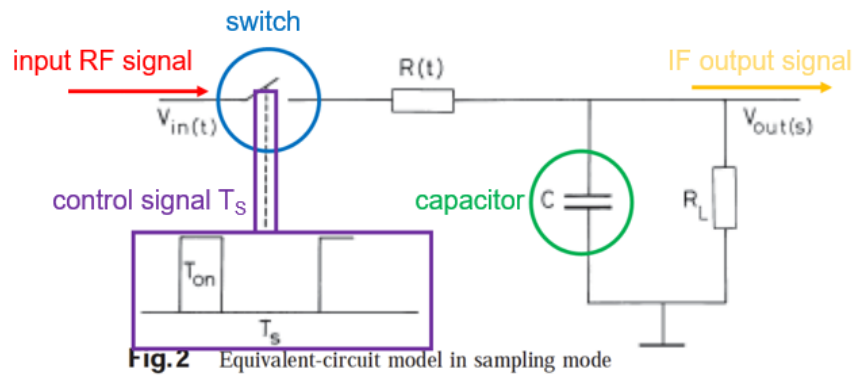


Fig. 6 Sampled signal obtained by SH1
 $x_1 = 28$ ns; $y_1 = -23$ mV; $x_2 = 32$ ns; $y_2 = -7.4$ mV
Horizontal scale: 20 ns/div.

Another prototype with respective measurements (in the frequency domain) is demonstrated in Figures 8-10.

The similarities between Avitabile and the '686 Patent are shown in their figures. *Compare '686Pat., Fig. 51A, with Avitabile's Fig. 2* (both annotated below, showing substantially similar components).





3. Motivation to Combine

A POSITA would have been motivated to include Avitabile's down-converters in Nevo's transceivers because they teach known elements whose combination would yield predictable results. EX1002, ¶¶93-99. Nevo describes using several well-known protocols and provides those protocols in a single chip (Nevo, Fig. 1). *Id.*, ¶94. Nevo, moreover, acknowledges down-converters are needed (Fig. 12) (as was known for Bluetooth/IEEE 802.11), but does not provide the particular circuitry for performing down-conversion. *Id.* The known need for down-converters for Nevo's disclosed protocols would have motivated a POSITA to look to references that provide the circuit level detail for down-converters such as Avitabile describes. *Id.* Avitabile provides circuitry for down-conversion in the s-band frequency range (Avitabile, Abstract), which is in the range of Bluetooth/IEEE802.11 (2.4 GHz). EX1002, ¶94. Moreover, Avitabile teaches a bandwidth of up to 50 MHz (Avitabile, 339) for a carrier up to 3 GHz (*id.*, 341 (§6)) and IEEE 802.11 at the time used bandwidths of up to 20 MHz for a 2.4 GHz carrier

while Bluetooth used 1 MHz bandwidths for a 2.4 GHz carrier (i.e., both 802.11 and Bluetooth used frequencies in Avitabile’s disclosed ranges). EX1002, ¶¶94. A POSITA would have been motivated to look to down-converters in the range of frequency needed, and would have been motivated to look to combine Nevo with Avitabile’s teachings. EX1002, ¶¶94-98.

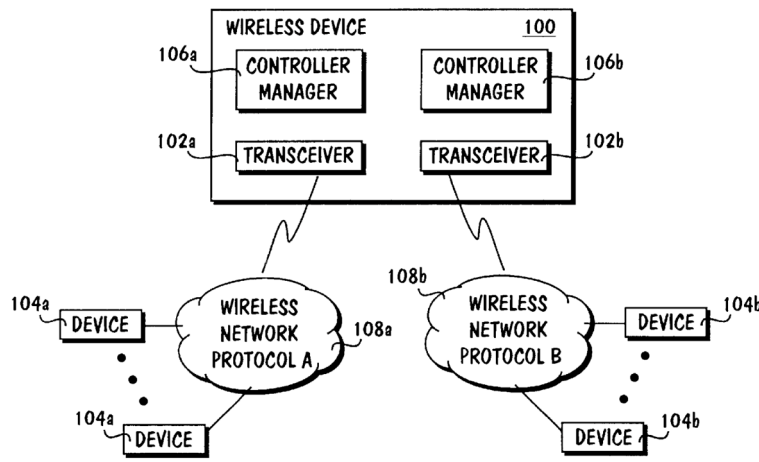
Further, a POSITA would have had a reasonable expectation of success in making the combination. EX1002, ¶98. As noted above, Avitabile and Nevo describe like-frequencies. Avitabile further provides prototype measurements that provide proof of concept in its down-converter design and illustrate the extraction of a base-band signal that is compatible with Bluetooth/IEEE 802.11 (OFDM) signal processing techniques. Avitabile, Figs. 6-7; EX1002, ¶¶93-99.

4. Claim 11

a. 11[pre]

If preamble is limiting, Nevo discloses or suggests it. Nevo, 3:28-35; EX1002, ¶¶100-104. Figure 1, for example, depicts a wireless device having two transceivers (102a/102b) that can connect to two separate wireless networks (108a/108b), Bluetooth and IEEE 802.11, respectively. Nevo, 3:28-35, 4:46-55, Figs. 3, 5, 7, 9a, 11a, 13. The wireless device has control managers 106a/106b that control transceiver operation in a “coordinated manner” to allow communication “with the respective wireless communication protocols at the same time” (i.e.,

“simultaneous multi-platform operations”). *Id.*, 3:38-45.

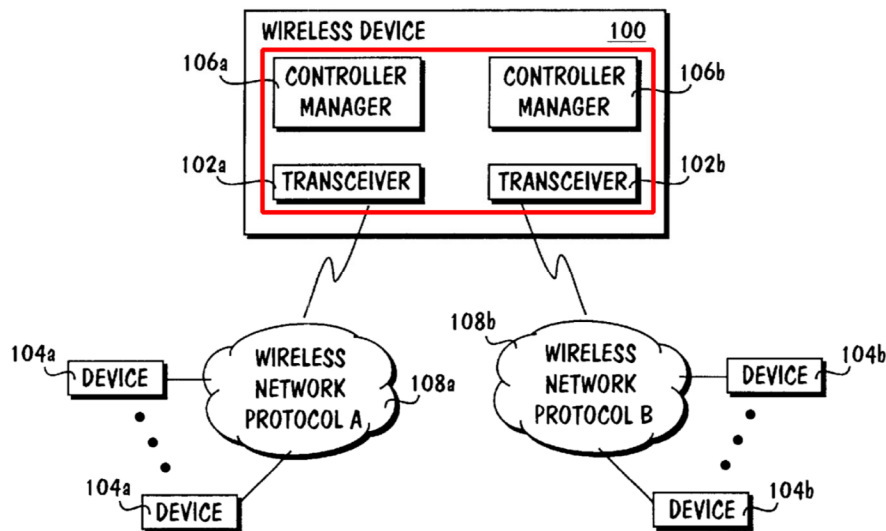


Nevo teaches this limitation similarly to the '686 Patent, which teaches “multi-platform operations” refer to “multiple protocols and multiple bearer services...employed simultaneously” and identifies Bluetooth and IEEE 802.11 as exemplary protocols. '686Pat., 8:31-32, 7:52-58. Moreover, the '686 Patent describes two transmission types as being “simultaneous, either actual or apparent.” *Id.*, 34:34-38, 8:19-37. Further, a POSITA would have understood “simultaneous multi-platform operations” encompasses time-sharing of a resource, e.g., a CPU to run software or a shared transmission resource to transmit data. EX1002, ¶103. Thus, the '686 Patent describes the types of operations Nevo teaches (e.g., coordinated transmissions at the same time, e.g., Nevo, 3:38-45) as being simultaneous.

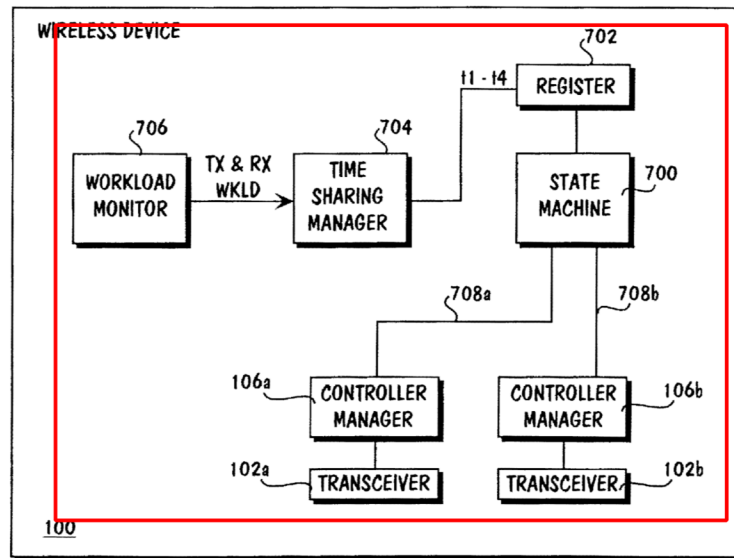
b. 11[1.1]

Nevo discloses or suggests 11[1.1]. EX1002, ¶¶105-108. Nevo's Figure 1

depicts a wireless device with a multi-platform module (control managers 106a/106b and transceivers 102a/102b (annotated in red, below)). Nevo, 3:28-45. Nevo's multi-platform module is controlled to communicate with at least one of a plurality of communication links; its two transceivers (102a/102b) connect to two separate wireless networks (108a/108b) (*id.*) that can be Bluetooth and IEEE 802.11 (*id.*, 4:46-55).

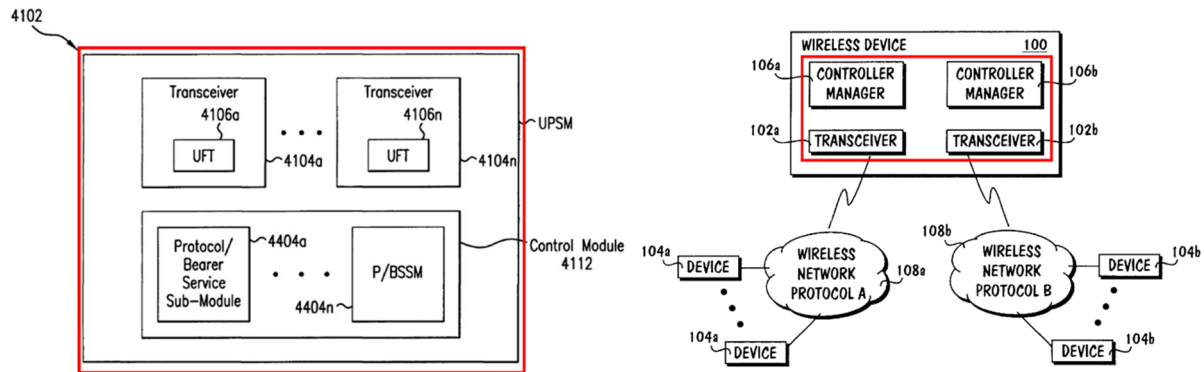


Nevo's other figures depict further detail of Figure 1 (which is a high-level figure) and provide additional functionality detail for Nero's multi-platform module. Nevo, Figs. 3, 5, 7, 9a, 11a, 13, 2:29-59. In addition to transceivers 102a/102b and controller manager 106a/106b, Figure 7 includes other circuitry such as state machine 700, register 702, time-sharing manager 704, and workload monitor 706 (all annotated in red, below) that work in conjunction to control communication to the networks. *Id.*, 6:34-57.



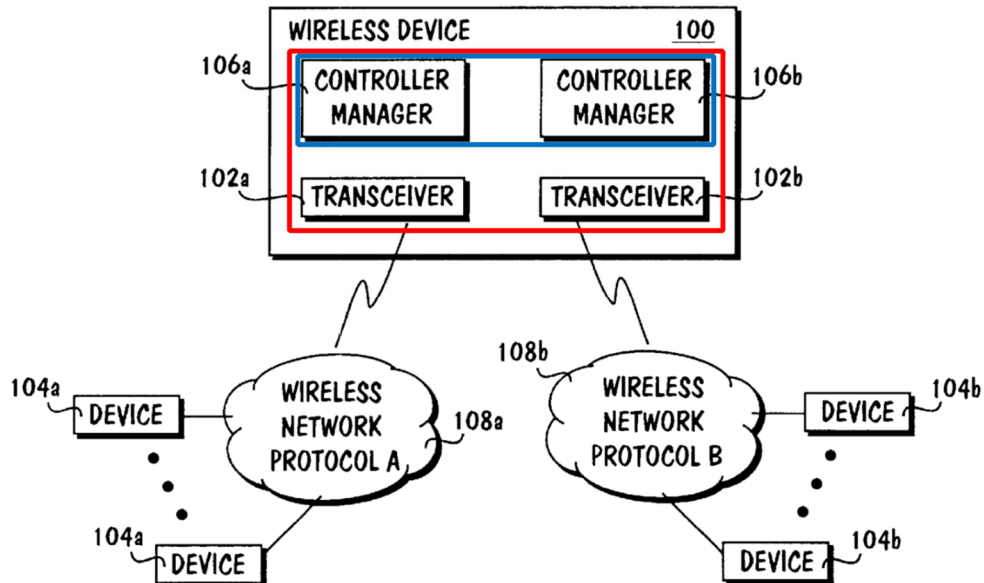
Nevo teaches the “multi-platform module” similarly to how the ’686 Patent describes it. ’686 Figure 44 (below-left) depicts a multi-platform module (UPSM 4102) (’686Pat., 38:39-42, 38:44-46, 40:36-46)¹¹ that has transceivers 4106a/n and control module 4112 which has protocol/bearer service sub-module 4404a (*id.*, 40:36-52). This is similar to Nevo’s multi-platform module (annotated red, below-right).

¹¹ A POSITA would have understood UPSM 4102 to be a multi-platform module because it performs multiple protocol/bearer service combinations. EX1002, ¶108.



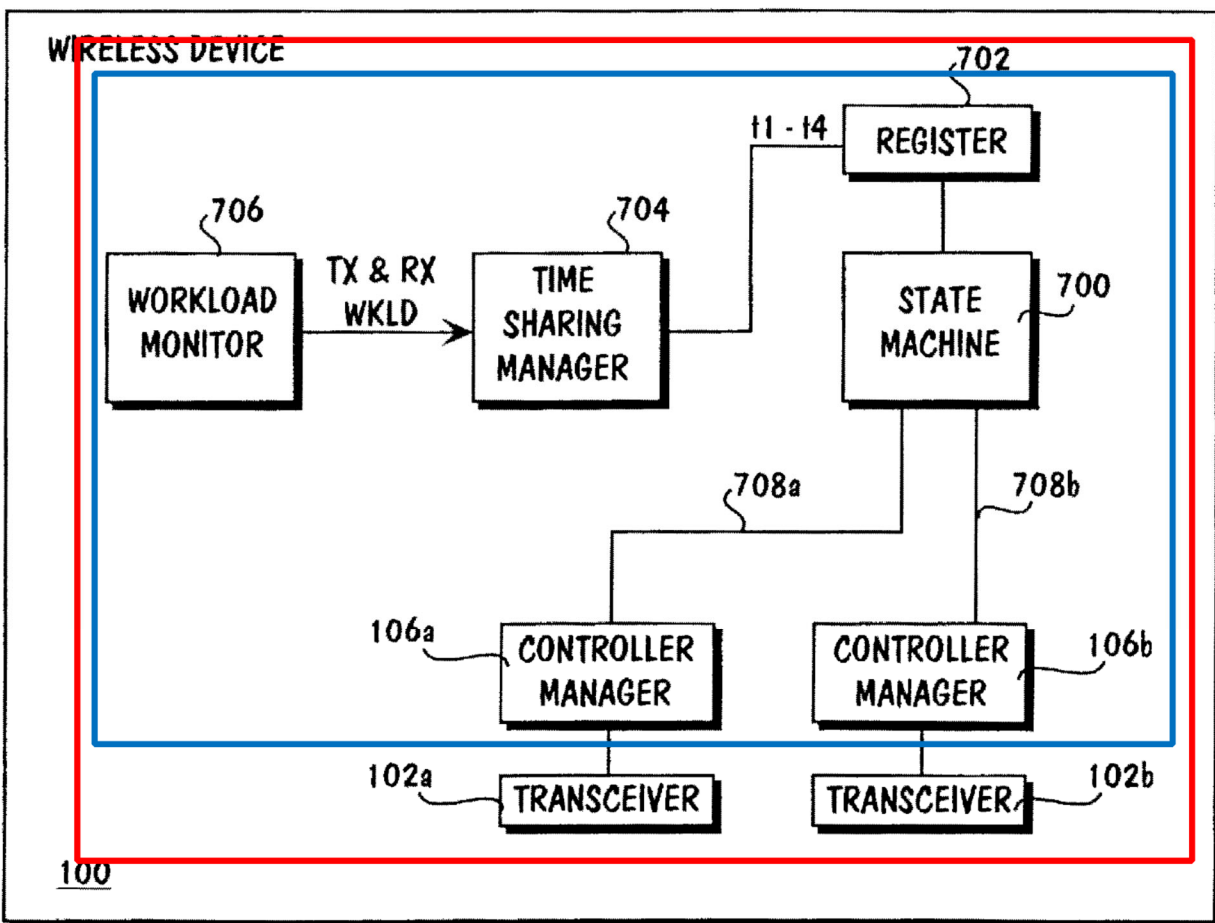
c. 11[1.2]

Nevo discloses or suggests 11[1.2]. EX1002, ¶¶109-111. Nevo’s multi-platform module has a plurality of controller managers 106a/106b (annotated in blue below) which teach a “control module.” Controller managers 106a/106b control wireless transceivers 102a/102b (Nevo, 3:39-41, Figs. 1, 3, 5, 7, 11a, 13) to work with Bluetooth and IEEE 802.11 (*id.*, 4:46-55).



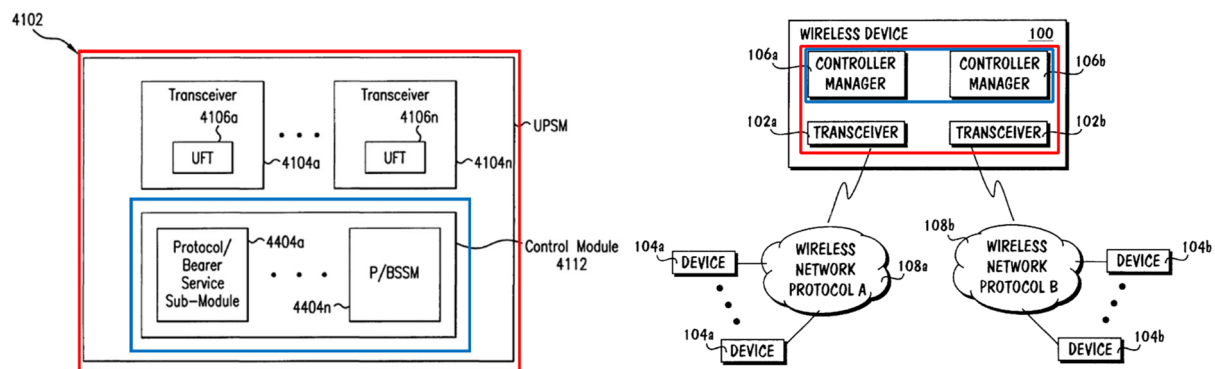
Further, Nevo teaches additional control circuitry within the multi-platform

module, which a POSITA would have further understood could form part of the “control module.” Figure 7 depicts state machine 700, register 702, time-sharing manager 704, and workload monitor 706 (annotated blue, below) which work together to control the operation of each respective transceiver. Nevo, 6:34-57. A POSITA would have understood controller managers 106a/106b alone, or controller managers 106a/106b and any of Figure 7’s other control blocks, teach a “control module.” EX1002, ¶110.



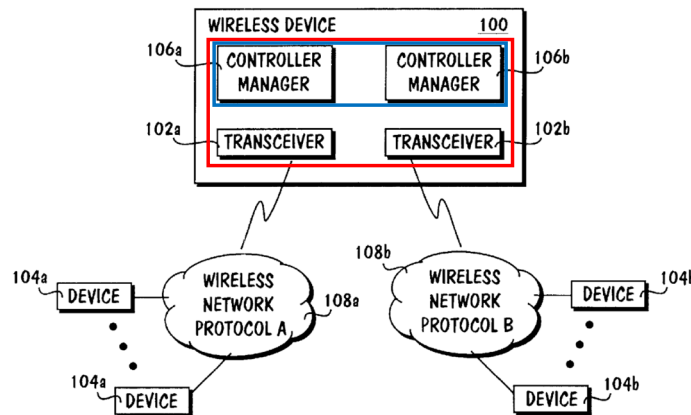
Finally, Nevo teaches 11[1.2] in a manner similar to the '686 Patent. The '686

Patent's multi-platform module (below-left, annotated red) has control module 4112 (blue) which has protocol/bearer service submodules 4404a/n. '686Pat., 38:39-42, 38:44-46, 40:36-52, Fig. 44. Similarly, Nevo teaches a multi-platform module (below-right, annotated red) with a control module (blue) that has several controller modules 106a/106b for each respective protocol, e.g., IEEE 802.11 or Bluetooth. Nevo, 3:39-41, 4:46-55, Fig. 1. Nevo's disclosure for this limitation mirrors the '686 Patent's.



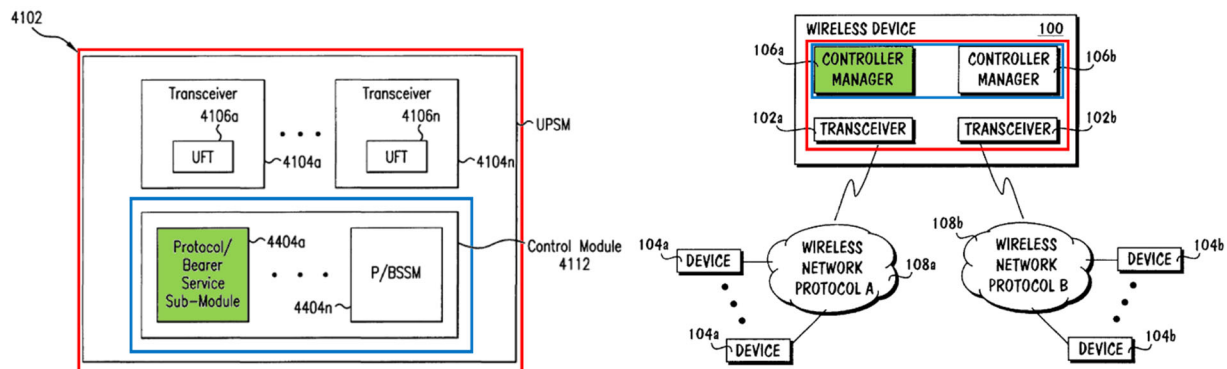
d. 11[1.3]

Nevo discloses or suggests 11[1.3]. EX1002, ¶¶112-114. Nevo's control module discussed above includes a plurality of separate standard/protocol submodules (e.g., controller managers 106a/106b), one of which is annotated in green in Figure 1, below.



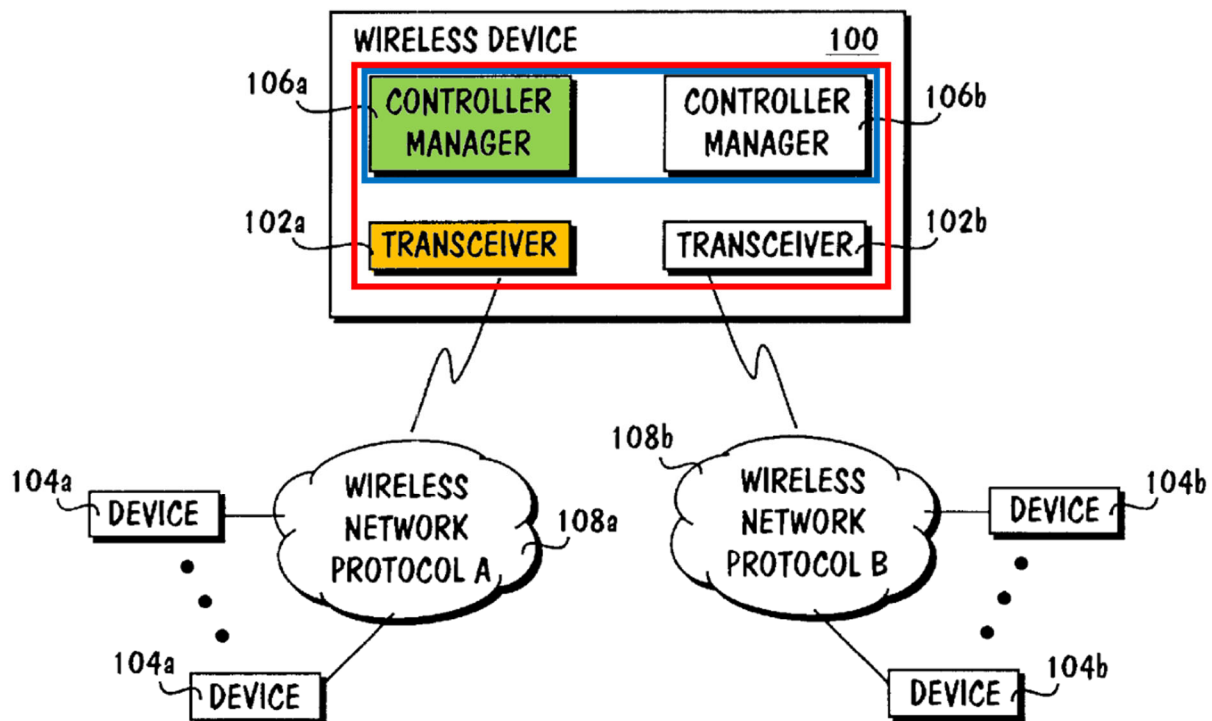
Controller managers 106a/106b teach “a plurality of standard/protocol sub-modules” because they control their respective transceivers to connect to two separate networks 108a/108b “in accordance with the respective protocols” (e.g., Bluetooth, IEEE 802.11). Nevo, 4:1-5, 4:46-55, Fig. 1 (PROTOCOL A, PROTOCOL B).

Finally, like 11[1.2], Nevo teaches this limitation in a similar manner to how the '686 Patent specification describes it. '686Pat., 38:39-42, 38:44-46, 40:36-52, Fig. 44; Nevo, 3:39-41, 4:46-55, Fig. 1.



e. 11[1.4]

The Nevo-Avitabile combination teaches 11[1.4]. EX1002, ¶¶115-119. Nevo's multi-platform module (annotated red, below) has a plurality of transceivers (one of which is annotated in orange in Figure 1 below). The transceivers transmit and receive signals wirelessly in accordance with their respective protocols. Nevo, 3:28-35.

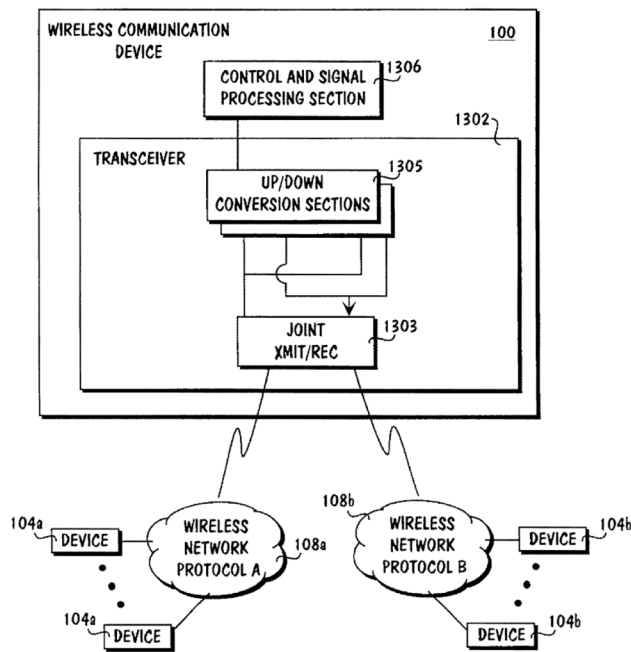


Although Nevo's Figure 1 does not explicitly include an FTM in each transceiver, a POSITA would have found it obvious to include FTMs in light of Nevo's own teachings as well as Avitabile. EX1002, ¶¶116-119.

First, a POSITA would have found it obvious to include an FTM in each of

Nevo's transceivers to up-convert signals for transmission and down-convert signals for receipt. EX1002, ¶116. A POSITA would have understood up/down conversion to be operations of an FTM because such operations change the output/input frequency. *Id.* For example, an up-converter takes a lower-frequency baseband signal and modulates it on a higher frequency carrier, creating a higher frequency output signal. *Id.* A down-converter does the opposite for receipt; it takes a higher frequency signal and modulates out the higher frequency signal to retrieve a lower frequency signal. *Id.*

Nevo's transceivers are for Bluetooth and IEEE 802.11 (Nevo, 4:46-55), and a POSITA would have understood both protocols used a 2.4 GHz carrier signal and required down-conversion in their receivers to obtain a baseband signal. EX1002, ¶118. Moreover, Nevo discloses embodiments (other than Figure 1) with an FTM. Figure 13, for example, teaches up/down conversion section 1305 (annotated yellow, below) within transceiver 1302. Nevo, 10:40-45; EX1002, ¶118. A POSITA would have been motivated to modify Nero's Figure 1 in light of Nevo's Figure 13 FTMs so that each Figure 1 transceiver had an FTM because, as described above, IEEE 802.11 and Bluetooth require extracting a lower frequency baseband from a higher frequency carrier. EX1002, ¶118. Thus, a POSITA would have been motivated to include an FTM in each of Nevo's transceivers.



Moreover, a POSITA would have been motivated to include an FTM as taught in Avitable in each of Nevo's transceivers for the reasons discussed in §VIII.A.3. Avitable's down-converter that translates an RF input signal to an output IF signal teaches an FTM. Avitable, 337 (Abstract), Figs. 1-2; §VIII.A.4.j; EX1002, ¶119.

The following limitations describe the internal structure of the FTM taught by Avitable. A POSITA would have been motivated to include an FTM as taught in Avitable in each of Nevo's transceivers as discussed in §VIII.A.3.

f. 11[FTM-1.1]

The Nevo-Avitable combination teaches 11[FTM-1.1]. Avitable teaches a down-converter (FTM), which includes a switch (Avitable, Fig. 2 (annotated blue below)), "modelled as an ideal switch" (*id.*, 338 (§2)), and a switch is further

described in prototype as being a MESFET (*id.*, 339 (§5); *see id.*, Figs. 4, 8-9). A POSITA would have understood a MESFET has a gate (which receives a control signal to turn the switch on). EX1002, ¶¶120-122.

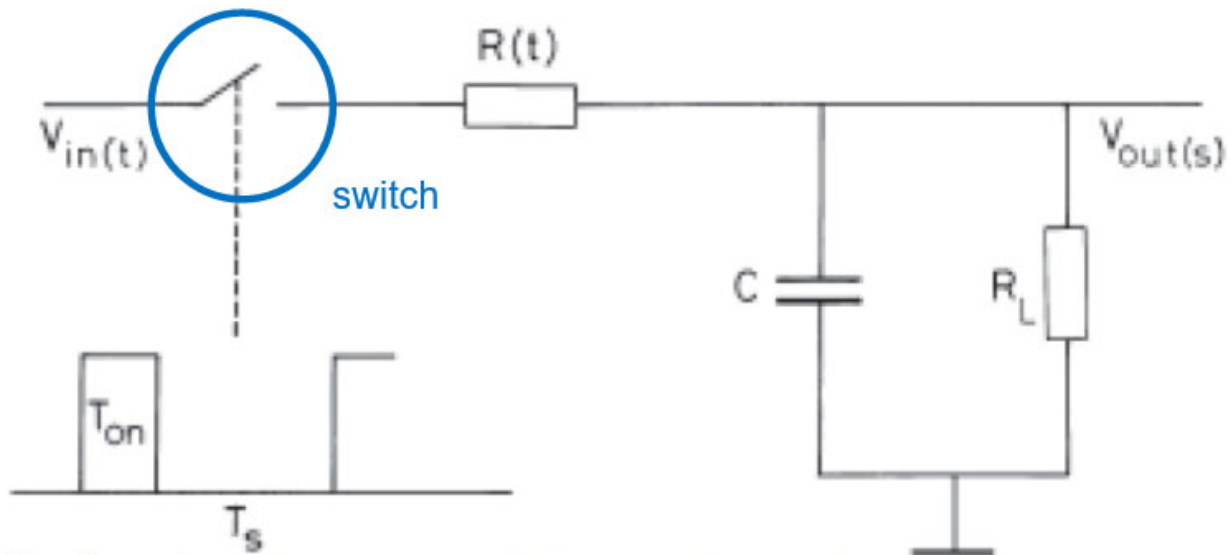


Fig.2 Equivalent-circuit model in sampling mode

g. 11[FTM-1.2]

The Nevo-Avitabile combination teaches 11[FTM-1.2]. Avitabile's switch receives a control signal that controls how long the switch is on. Control signal T_s (annotated purple below) controls when the energy is transferred via the switch, i.e., turned-on (T_{on}). Avitabile, 338 (§4.1) (describing turning switch on for "interval t_{on} "), Figs. 2, 4, 8-9.

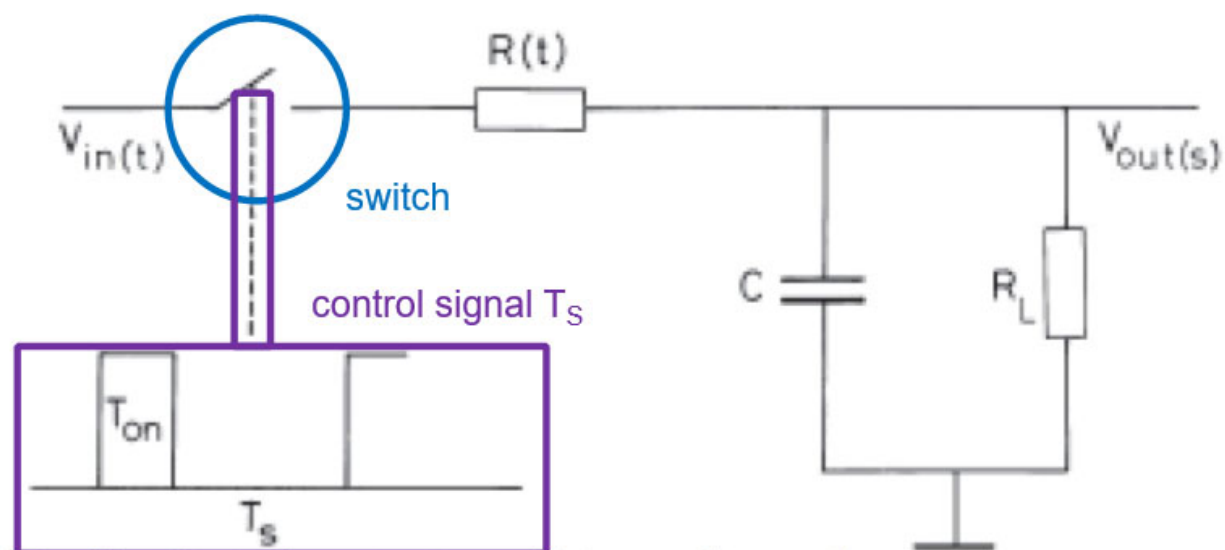
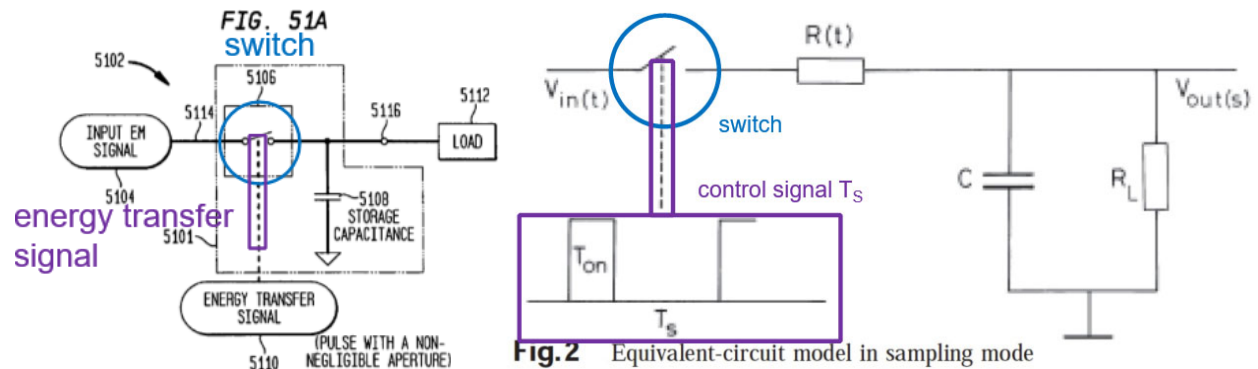


Fig.2 Equivalent-circuit model in sampling mode

A POSITA would have understood Avitable's control signal T_s controls the transfer of energy and thus teaches an "energy transfer signal." In an example, the switch's aperture time, i.e., its on time for the circuit (T_{on}), is 100 picoseconds. Avitable, 339, 341 (§5.2), 340 (§4.1). A POSITA would have understood that, during the aperture period, $V_{in}(t)$ would charge the capacitors (e.g., Figure 2's C , Figure 4's C_H , Figure 8's C_{hold}). EX1002, ¶126. Further, Avitable describes energy from the input signal being stored in its capacitor. Avitable, 339 (§4.1). A POSITA would have thus understood Avitable's switch controls the transfer of energy and the switch's control teaches an energy transfer signal. EX1002, ¶¶126-128; §VIII.A.4.h.

Finally, the '686 Patent depicts the energy transfer signal in the same way as Avitable's control signal T_s . '686Pat., Fig. 51A (excerpted below-left, switch, blue,

and energy transfer signal, purple). Avitabile's Figure 2 (below-right) similarly depicts a switch (blue) that is controlled via a signal (purple) to close and pass the signal to a capacitor.



h. 11[FTM-1.3]

The Nevo-Avitabile combination teaches 11[FTM-1.3]. Avitabile's switch sub-samples and transfers energy from a first EM signal.

As discussed in §VIII.A.4.g, when Avitabile's switch is on, it allows the signal to flow to the capacitor (thereby transferring energy). Avitabile describes the switch's aperture time, i.e., its on time (T_{on}), (Avitabile, 339, 341 (§5.2), 340 (§4.1)), and a POSITA would have understood, during T_{on} , the switch allows transfer of energy from the input ($V_{in}(t)$) ("first EM signal") to capacitor C. EX1002, ¶¶131-132; §VIII.A.4.i; Avitabile, Fig. 2 (control signals (purple), switch (blue), first EM signal (red)).

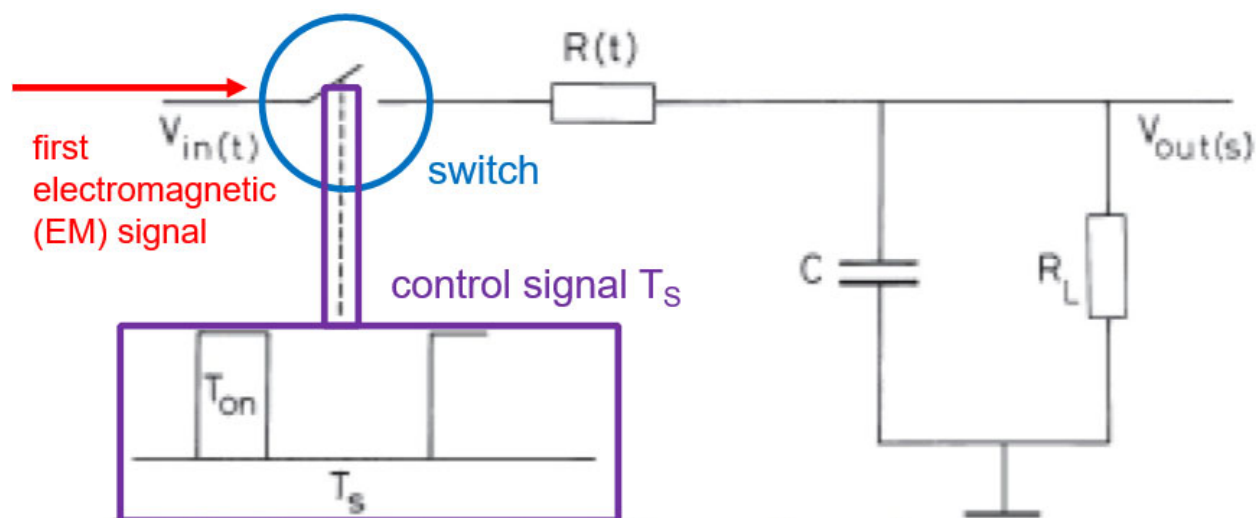


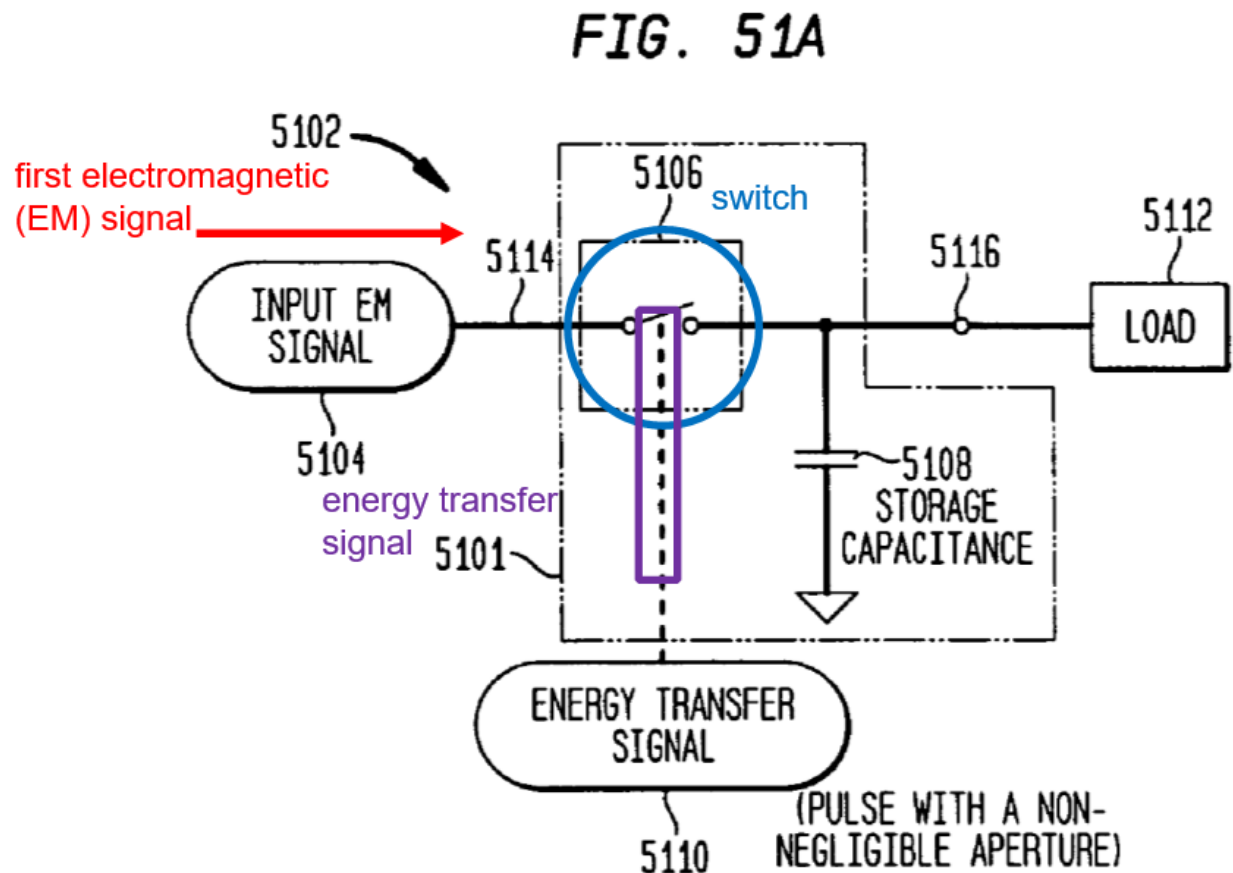
Fig. 2 Equivalent-circuit model in sampling mode

Avitabile’s switch also “sub-samples.” As discussed in §VII.E, PO previously proposed “sub-sample” “refer[s] to sampling at an aliasing rate, i.e., at a rate that is less than or equal to twice the frequency of the signal being sampled” (EX1014, 6-10), and Petitioner does not contest the plain and ordinary meaning encompasses PO’s previous proposal.

Avitabile teaches subsampling under this construction. EX1002, ¶130. Avitabile describes providing T as the “sampling interval” that is “related to the RF input-waveform bandwidth B through a positive integer k ” that can be as low as 1. Avitabile, 338 (§3). When k is one or two, Avitabile’s sampling interval T is “less than or equal to twice the frequency of the signal being sampled.” EX1002, ¶130. In addition, Avitabile teaches sampling at 249.85 MHz for an input signal at 1 GHz (i.e., sampling at about $\frac{1}{4}$ (less than twice) the frequency of the signal being sampled). Avitabile, Fig. 10; *see id.*, Fig. 5. A POSITA would have understood

these examples to teach sub-sampling. EX1002, ¶130.

Avitabile teaches these limitations similarly to the '686 Patent describes them. '686Pat., Fig. 51A (switch (blue), energy transfer signal (purple), first EM signal (red)).



i. 11[FTM-2.1]

The Nevo-Avitabile combination teaches 11[FTM-2.1]. Avitabile teaches a hold capacitor, which stores transferred energy from the input signal ($V_{in(t)}$). Avitabile, Fig. 2 (capacitor C), 4 (capacitor C_H in prototype 1), 8-9 (capacitor C_{hold} in prototype 2), 338-39 (§4.1), 340 (§5.1); EX1002, ¶135. As Figure 2 shows,

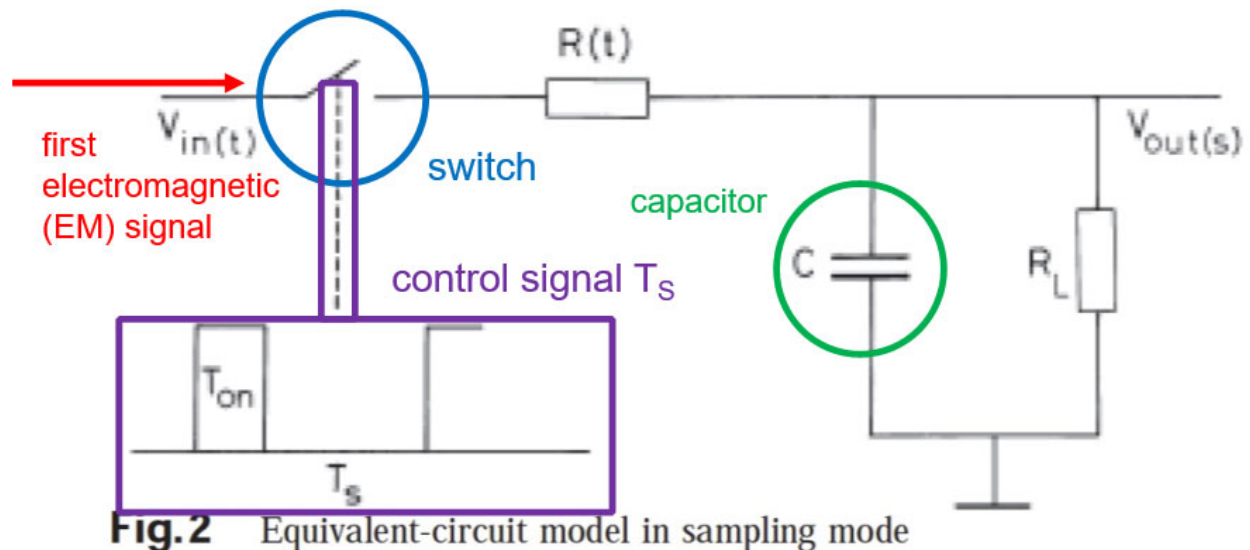
capacitor C (green) will store charge (transferred energy from $V_{in(t)}$ (red)) with time when the switch (blue) is closed. EX1002, ¶135; *see also* Avitabile, Figs. 4-5, 6-7. The energy stored is non-negligible and is energy transferred from the input to the capacitor. *See, e.g.*, Avitabile, 338-39 (§4.1) (stating that a “fraction [] of the input signal is stored in the hold capacitor”), Figs. 4-7 (showing current flowing into capacitor); *see also* EX1002, ¶¶135-138 (Dr. Larson explaining current flow and storage into the capacitor). Furthermore, Figure 2 also depicts a direct coupling of the switch to the capacitor because resistor (R(t)) is labeling for the switch’s resistance. Avitabile, 338 (§4.1) (stating that “sampler is modelled as an ideal switch with a time-variable resistor in series, which represents the switch internal resistance”); EX1002, ¶136. Avitabile’s capacitor (storage module) is coupled to the switch and it stores non-negligible amounts of transferred energy.

In addition, although the ’686 Patent does not explicitly define an “energy transfer system,” it explains that a system is an “energy transfer module” when the control signal has a “non-negligible aperture” and thus becomes an “energy transfer signal.” ’686Pat., 13:27-31. This is disclosed by Avitabile, which describes non-negligible apertures. As described in §VIII.A.4.g, the switch’s aperture time of the switch, i.e., its on time (T_{on}), is 100 picoseconds. Avitabile, 339 (“[s]witching time < 100 ps”); *see also id.*, 341 (§5.2) (“aperture time $T_a = 100$ ps”), 340 (§4.1) (“400 ps aperture time”). Further, as depicted in Figure 5, this aperture provides a non-

negligible current flow, as demonstrated in a prototype. *Id.*, Figs. 5, 7 (showing energy charge/discharge); EX1002, ¶¶137-138. A POSITA would have understood that Avitabile describes an energy transfer system. EX1002, ¶¶138-139.

Finally, PO may even further argue that an “energy transfer system” (which the “storage module,” properly construed, must have a “low impedance load.” EX1045, 15-16. If PO makes this argument, it has no basis. Nonetheless, Avitabile provides equations for R_L (load impedance/resistance), *see* Avitabile, Equations 13 and 14), and a POSITA would have found it obvious to include lower impedances of R_L by adjusting other parameters. EX1002, ¶139.

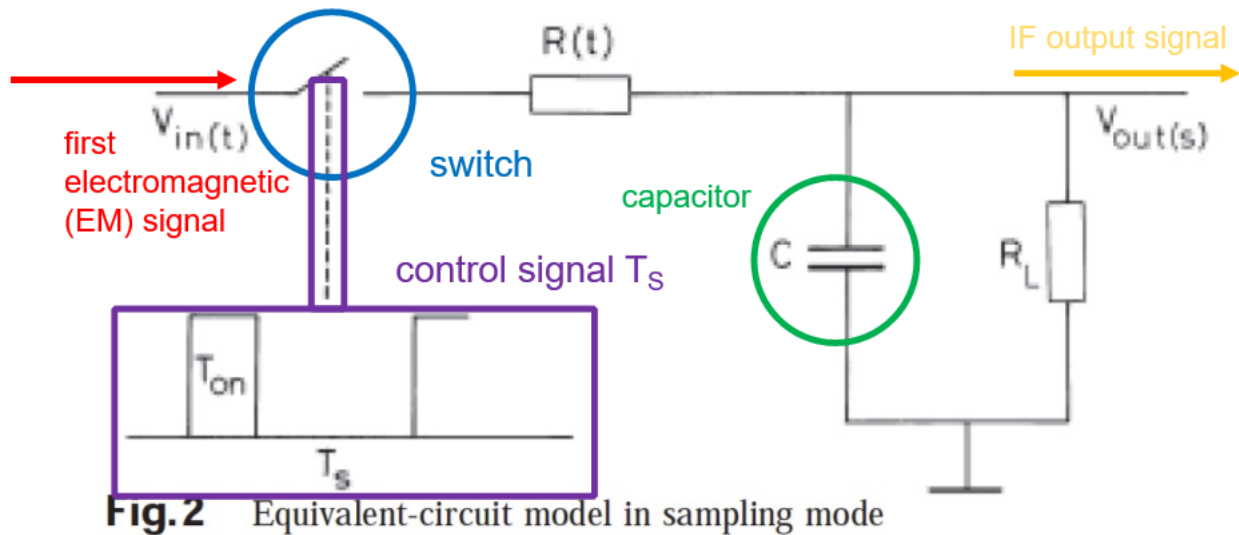
Further, the '686 Patent similarly describes its capacitor as a storage module. '686Pat., Fig. 51A, 5108.



j. 11[FTM-2.2]

The Nevo-Avitabile combination teaches 11[FTM-2.2]. As described in

§VIII.A.4.i, Avitabile teaches a capacitor (storage module, green) to store sub-sampled energy from the first EM signal (red). Avitabile, Fig. 2 (annotated below).



Avitabile describes generating an IF (intermediate frequency) signal from that stored energy (second EM signal having a frequency different from $V_{in(t)}$ (first EM signal)). Avitabile's Figure 1 illustrates the SH module from Figure 2 (annotated yellow in Figure 1, below) in a higher-level system block diagram. Avitabile, 338 (§3). The SH module outputs an intermediate frequency (IF) from a down-converter, which a POSITA would have understood to be a lower frequency signal than the RF due to the “downconvert[ing]” operation. EX1002, ¶¶142-145.

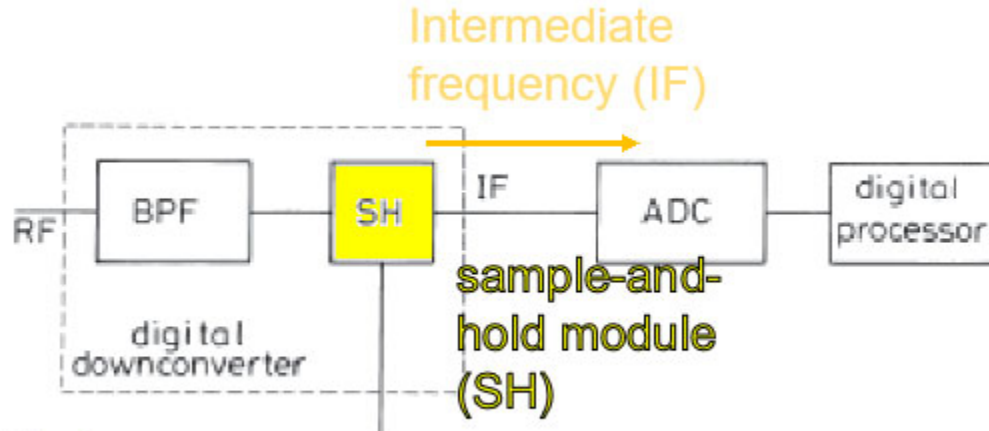


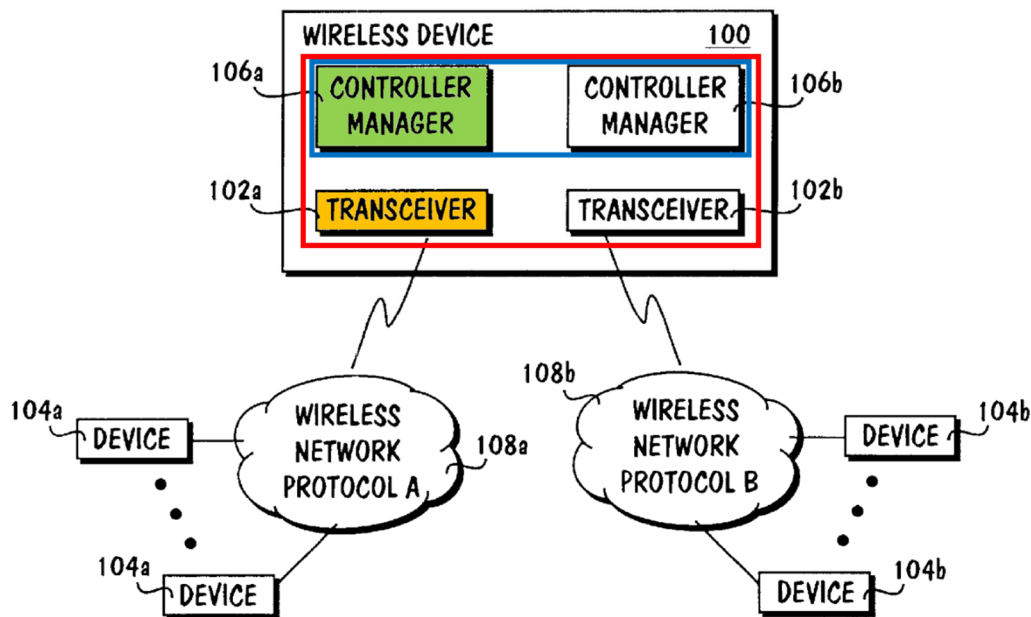
Fig.1 Schematic diagram

Avitabile further demonstrates the input RF signal has a higher frequency than the output IF signal. Avitabile’s down-converter receives higher signals in the GHz range for output bandwidths in the 50 MHz range (which is lower). Avitabile, 339 (§5) (“[t]he operation of the digital downconverter will be demonstrated for input waveforms up to the S-band with a signal bandwidth up to 50MHz.”); *see also id.*, 340 (§5.1) (“A -10 dBm 1030 MHz tone was used as RF input, simulating an SSB-SC AM signal with $F_c = 1\text{GHz}$ and $B = 30\text{ MHz}$ ”), Fig. 6, 341 (§5.2). Avitabile thus takes an RF signal at a carrier frequency (e.g., 1 GHz) and outputs a lower frequency signal. EX1002, ¶¶141-145.

k. 11[2]

The Nevo-Avitabile combination teaches 11[2]. EX1002, ¶¶146-147. As discussed regarding §VIII.A.4.d, Nevo teaches two protocols, Protocol A and B, which can be Bluetooth and 802.11. Nevo, 4:1-5, 4:46-55, Figs. 3, 5, 7, 9a, 11a, 13.

Nevo's first transceiver (e.g., transceiver 102a, orange) operates with a first protocol/standard combination (e.g., Bluetooth) using a first standard/protocol submodule (controller manager 106a, green). Nevo, 3:28-45. As described in §§VIII.A.4.f-VIII.A.4.j, Avitable teaches FTM operation to perform down-conversion. It would have been obvious to combine these teachings for the reasons in §VIII.A.3.

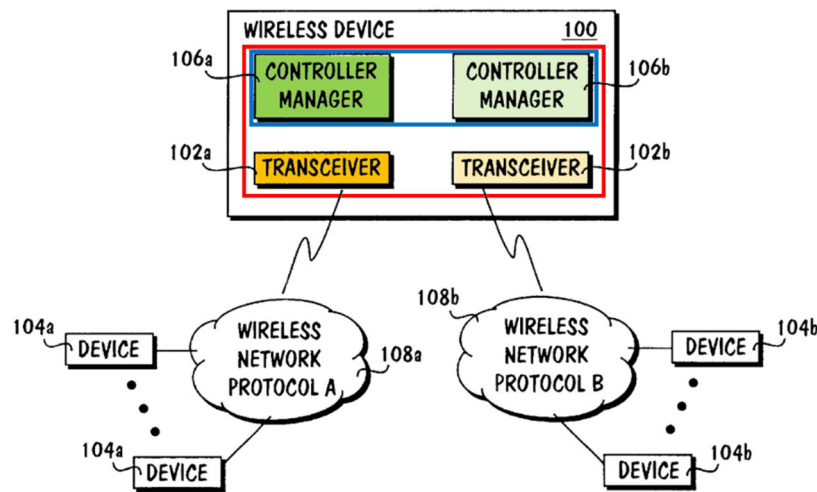


I. 11[3]

The Nevo-Avitable combination teaches 11[3]. EX1002, ¶¶148-149. As discussed in §VIII.A.4.d, Nevo teaches two protocols, Protocol A and B, which can be Bluetooth and 802.11. Nevo, 4:1-5, 4:46-55, FIGS. 3, 5, 7, 9a, 11a, 13.

Nevo's second transceiver (e.g., transceiver 102b, light orange) operates with a second protocol/standard combination (e.g., 802.11) using a second

standard/protocol sub-module (controller manager 106b, light green). Nevo, 3:28-45. As described in §§11VIII.A.4.f-VIII.A.4.j, Avitabile teaches FTM operation of the FTM to perform down-conversion.



5. Claim 12

Nevo teaches claim 12's additional limitations. EX1002, ¶¶150-153. As described in §VIII.A.4.a, Nevo discloses a system and method for performing simultaneous multi-platform operations. Nevo, 3:28-35. Figure 1, for example, depicts a wireless device having two transceivers (102a/102b) that can connect to two separate wireless networks (108a/108b) (*id.*) that are Bluetooth and IEEE 802.11. *Id.*, 4:46-55, FIGS. 3, 5, 7, 9a, 11a, 13. The wireless device has control managers 106a/106b that control transceiver operation in a “coordinated manner” to allow communication “with the respective wireless communication protocols at the same time” (i.e., simultaneously). *Id.*, 3:38-45, 4:13-15, 4:36-39.

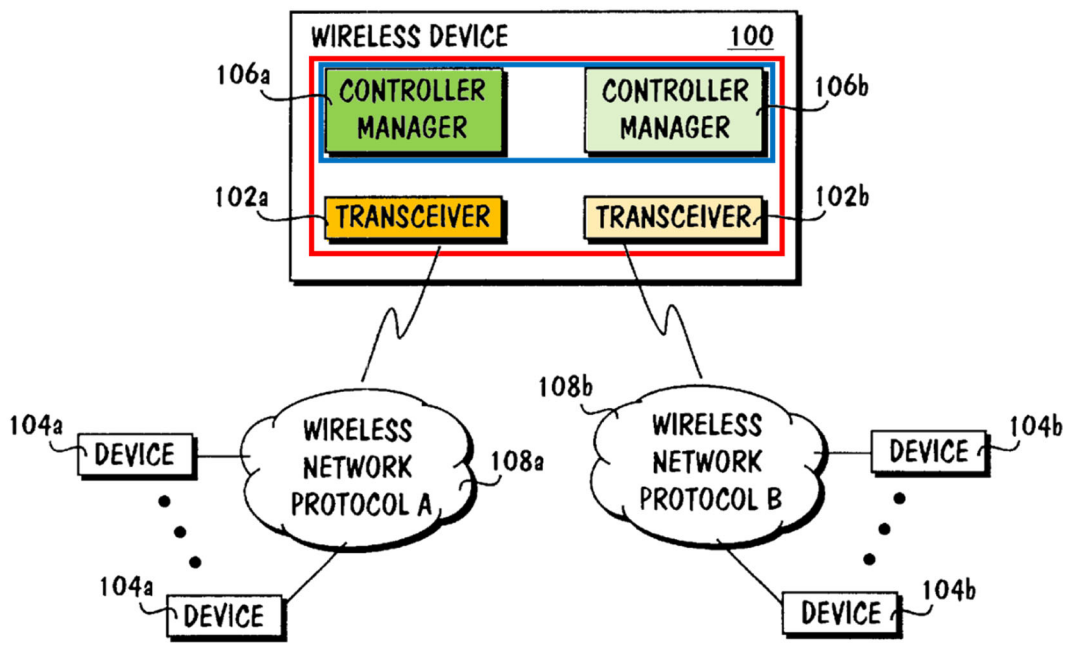
Nevo further teaches “an equal quantity of the plurality of standard/protocol sub-modules” for the “quantity of the plurality of communication links.” Nevo’s Figure 1 depicts controller manager 106a for wireless network protocol A 108a and controller manager 106b for wireless network protocol B 108b, i.e., one controller per network.

6. Claim 13¹²

The Nevo-Avitabile combination teaches claim 13’s additional limitations. EX1002, ¶¶154-156. As described in §VIII.A.4.b, Nevo teaches a multi-platform module (red, below) that, as described in §VIII.A.4.c, has a control module (blue) including at least controller managers 106a/106b (green and light green). *See* §VIII.A.4.d (depicting the controller managers as standard/protocol sub-modules). “[C]ontroller managers 106a and 106b control transmits and receives by wireless transceivers 102a and 102b [(orange and light orange)], in a coordinated manner,...to allow wireless device 100 to operate with devices 104a and devices

¹² Claim 13’s frequency translating module has the same meaning as claim 11’s frequency translation module. EX1002, ¶¶154-156. Claim 13’s FTM, however, does not have antecedent basis in claim 11, and thus need not be the same FTM.

104b of wireless network 108a and 108b in accordance with the respective wireless communication protocols at the same time.” Nevo, 3:39-45. As described in §VIII.A.4.e, transceivers 102a/102b render obvious an FTM (or, alternatively, a POSITA would have been motivated to combine the FTM from the teachings of Avitable). EX1002, ¶¶93-99.

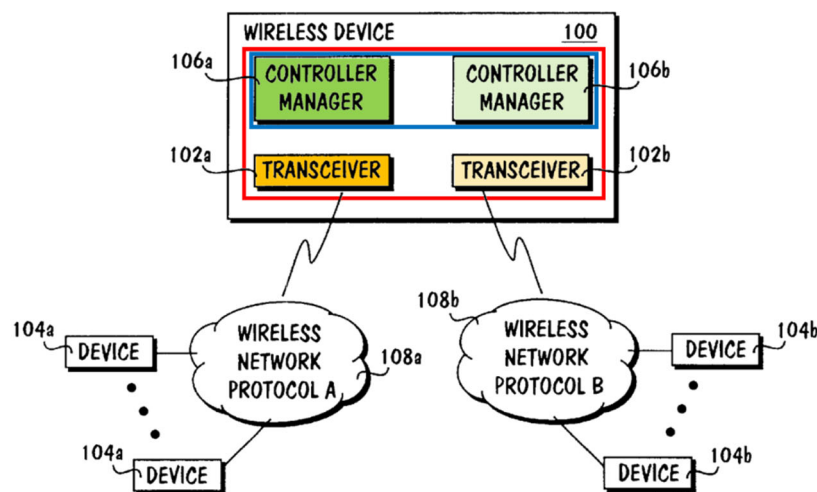


The Nevo-Avitable combination also teaches a multi-platform module including a plurality of receivers and a plurality of transmitters each having at least one FTM. Nevo’s transceivers transmit and receive signals for each respective protocol. Nevo, 3:39-41, 3:49-52, 4:6-23. A POSITA would have understood that transmitting requires a transmitter and receiving requires a receiver. EX1002, ¶156. Moreover, as described in §VIII.A.4.d, a POSITA would have understood that

Bluetooth/IEEE 802.11 transmitters and receivers require up-converters and down-converters, respectively to modulate/de-modulate a lower frequency baseband onto/from a higher frequency carrier, as discussed for the Nevo-Avitabile combination. EX1002, ¶156.

7. Claim 14

The Nevo-Avitabile combination teaches claim 14's additional limitation. EX1002, ¶¶157-160. As described in §§VIII.A.4.k-VIII.A.4.l, Nevo's first transceiver (e.g., transceiver 102a, orange) operates with a first protocol/standard combination (e.g., Bluetooth) using a first standard/protocol sub-module (controller manager 106a, green) and a second transceiver (e.g., transceiver 102b, light orange) operates with a second protocol/standard combination (e.g., IEEE 802.11) using a second standard/protocol sub-module (controller manager 106a, light green). Nevo, 3:28-45.



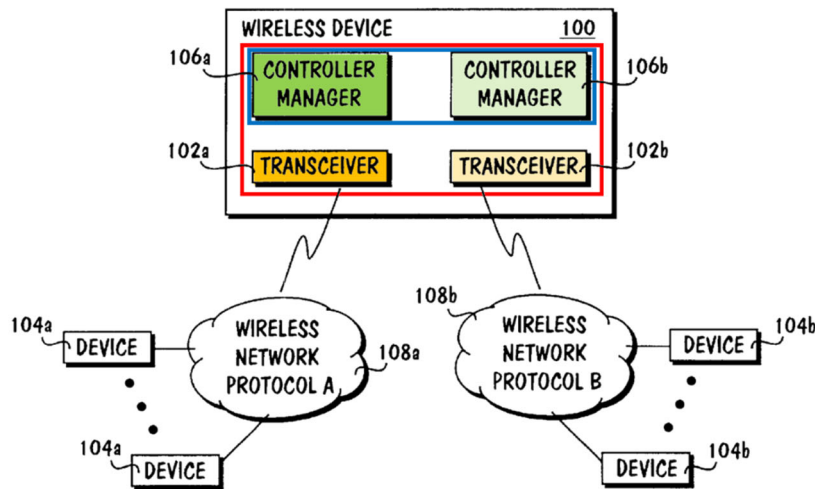
Nevo discloses a system and method for performing simultaneous multi-platform operations. Nevo, 3:28-35. Figure 1, for example, depicts a wireless device having two transceivers (102a/102b) that can connect to two separate wireless networks (108a/108b) (*id.*) that are Bluetooth and IEEE 802.11, respectively (which are different). *Id.*, 4:46-55, Figs. 3, 5, 7, 9a, 11a, 13. This is done so that communication can occur at the same time. *Id.*, 3:38-45, 4:13-15, 4:36-39; EX1002, ¶¶159, 101-103.

8. Claim 15

The Nevo-Avitabile combination teaches claim 15's additional limitation. EX1002, ¶¶161-169. As described in §§VIII.A.4.k-VIII.A.4.l, Nevo teaches a first/second protocol/standard sub-modules (control managers 106a/106b, green and light green) that provide a respective first and second implementation (e.g., Bluetooth and IEEE802.11, respectively). Nevo, 3:28-45, 4:46-55. "[T]he at least one multi-platform sub-module" appears to refer-back to the "multi-platform module" or to one of the multi-platform's sub-modules because there is no "multi-platform sub-module" recited in independent base claim 11 or dependent claim 14. EX1002, ¶163.

A POSITA would have understood each respective module would be programmed with implementation and operational instructions to work with each

respective protocol. EX1002, ¶¶165-169; Nevo, 8:14-20 (describing using programmed instructions).



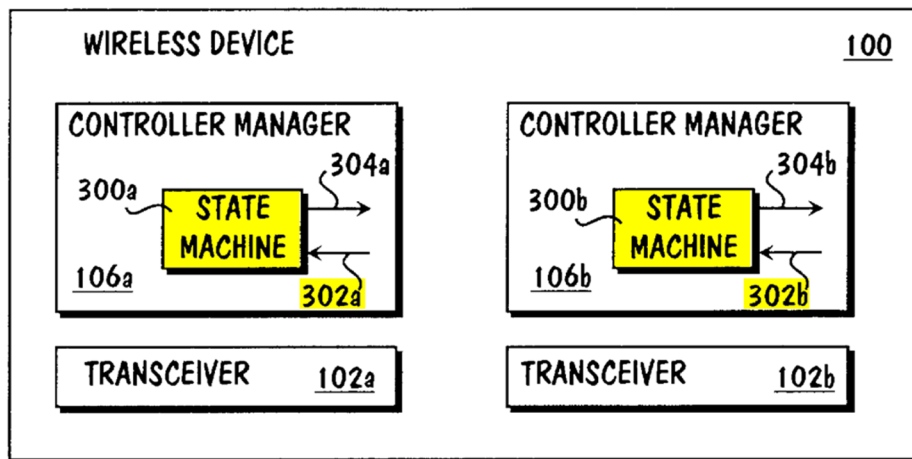
9. Claim 16

The Nevo-Avitabile combination teaches claim 16’s additional limitation. As described in §VIII.A.8, Nevo teaches operating its first and second protocol/standard sub-modules with protocols, e.g., Bluetooth and IEEE 802.11, respectively. A POSITA would have understood these sub-modules would be programmed with information relating to their protocol stacks and specification information to properly operate. EX1002, ¶¶170-173.

10. Claim 17

The Nevo-Avitabile combination teaches claim 17’s additional limitation. EX1002, ¶¶174-176. As described in §VIII.A.8, “the at least one multi-platform sub-module” appears to refer-back to the “multi-platform module” or to one of the

multi-platform's sub-modules. Nevo teaches updating the multi-platform module (or at least one of its sub-modules) to provide additional functionality. Figure 3 illustrates control managers that contain state machines 300a/300b (annotated yellow) that assist the controller managers in controlling the transceivers' transitioning between receipt, transmit, and no-operation states. Nevo, 4:63-5:8, 5:62-6:33. These state machines have configuration signals 302a/302b that control the state machine's transitions. *Id.*, 5:9-11. The state machine's initial state can be set via, e.g., jumpers (or via software). *Id.*, 5:15-17. Furthermore, Nevo teaches a network manager that monitors and manages transmission and receipt states devices in their respective communication environments (*id.*, 8:5-20) where the network manager can be updated via software or jumpers (*id.*, 8:16-20).



11. Claim 18

The Nevo-Avitabile combination teaches claim 18's additional limitation. EX1002, ¶¶177-184, 101-103. As described in §VIII.A.4.a, Nevo discloses a system

and method for performing simultaneous multi-platform operations. Nevo, 3:28-35. Figure 1, for example, depicts a wireless device having two transceivers (102a/102b) that can connect to two separate wireless networks (108a/108b) (*id.*) that are Bluetooth and IEEE 802.11, respectively. *Id.*, 4:46-55, Figs. 3, 5, 7, 9a, 11a, 13. The wireless device has control managers 106a/106b that control transceiver operation in a “coordinated manner” to allow communication “with the respective wireless communication protocols at the same time.” *Id.*, 3:38-45, 4:13-15, 4:36-39. Moreover, a POSITA would have understood the “operating environments” to encompass capability for using the respective standards, e.g., Bluetooth and IEEE 802.11, which is taught by Nevo. EX1002, ¶¶179-184.

12. Claim 19

The Nevo-Avitabile combination teaches claim 19’s additional limitation. Claim 19 is substantively similar to claim 18 but recites “content encoders, decoders, and protocol gateways.” This is taught by Nevo’s discussion of Bluetooth and IEEE 802.11, which a POSITA would have understood to have—as part of its standard—content encoders, decoders, and protocol gateways. EX1002, ¶¶185-195, 101-103.

13. Claim 20

The Nevo-Avitabile combination teaches claim 20’s additional limitation. EX1002, ¶¶196-199, 101-103. As described in §VIII.A.4.a, Nevo discloses a system and method for performing simultaneous multi-platform operations. Nevo, 3:28-35.

Figure 1, for example, depicts a wireless device having two transceivers (102a/102b) that can connect to two separate wireless networks (108a/108b) (*id.*) that are Bluetooth and IEEE 802.11, respectively. *Id.*, 4:46-55, Figs. 3, 5, 7, 9a, 11a, 13. The wireless device has control managers 106a/106b that control transceiver operation in a “coordinated manner” to allow communication “with the respective wireless communication protocols at the same time.” *Id.*, 3:38-45, 4:13-15, 4:36-39.

14. Claim 1

Claim 1 is similar to claim 11, except that it is written to cover an apparatus rather than a method of using that apparatus, and omits claim 11’s “storage module.”

a. 1[pre]

See §VIII.A.4.a. EX1002, ¶201.

b. 1[a]¹³

See §VIII.A.4.b regarding the “multi-platform module” and §VIII.A.4.e regarding the “plurality of transceivers each having at least one [FTM].” EX1002, ¶202.

¹³ Claim 1’s frequency translating module has the same meaning as claim 11’s frequency translation module. EX1002, ¶200.

c. 1[b]

See §§VIII.A.4.f-VIII.A.4.h. EX1002, ¶203.

d. 1[c]

See §§VIII.A.4.b-VIII.A.4.c11 regarding the “control module configured to enable the at least one multi-platform module to communicate with at least one of a plurality of communication links” and §VIII.A.4.d regarding the “plurality of protocol/standard sub-modules.” EX1002, ¶¶204-205.

15. Dependent claims 2-10

The claims that depend from claim 1 add substantially similar elements to the claims that depend from claim 11, and any differences are discussed in detail below.

a. Claim 2

See §VIII.A.5. Claim 2 is substantively similar to claim 12, but recites “configured to enable” instead of “controlling the at least one multi-platform module.” Nevo teaches “configured to enable,” as recited in claim 2. Nevo, 3:30-35 (stating transceivers enable coupling the device to the wireless networks), claim 16 (“two protocols to enable a master device to manage and control”); §VIII.A.5; EX1002, ¶206.

b. Claim 3¹⁴

See §VIII.A.6. EX 1002, ¶207.

c. Claim 4

See §VIII.A.7. EX1002, ¶208.

d. Claim 5

See §VIII.A.7. EX1002, ¶209.

e. Claim 6

See §VIII.A.8. EX1002, ¶210.

f. Claim 7

See §VIII.A.9. EX1002, ¶211.

g. Claim 8

See §VIII.A.10. EX1002, ¶212.

h. Claim 9

See §VIII.A.11. EX1002, ¶213. As illustrated in §VIII.A.4.1, Nevo teaches first and second protocol/standard sub-modules. *See* Nevo, Fig. 1.

i. Claim 10

See §VIII.A.11 (describing Nevo's teachings of first/second operating

¹⁴ Claim 3's frequency translating module has the same meaning as claim 11's frequency translation module. EX1002, ¶207.

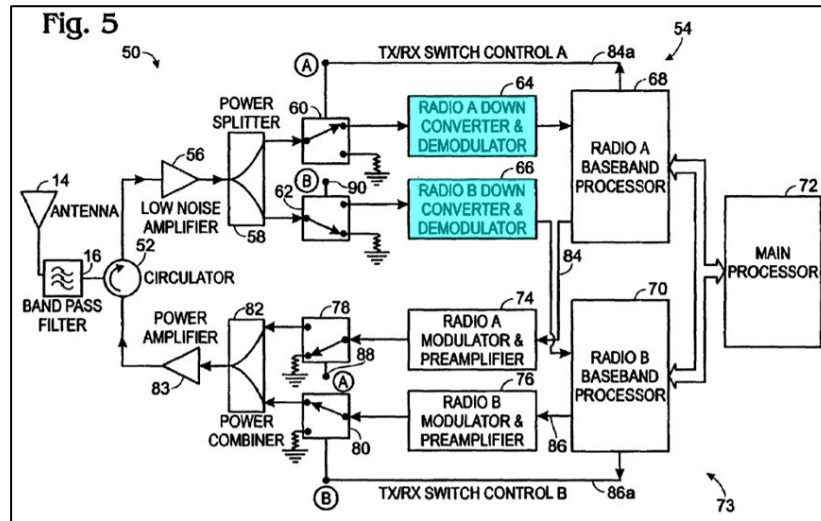
environments); §VIII.A.12 (describing Nevo’s teachings of standards, content encoders, and protocol gateways). EX1002, ¶214.

B. Ground 2A: Claims 1-20 are Unpatentable as Obvious Over Young and Estabrook

1. Young

Young discloses a device that can operate simultaneously in two protocols. Young, Abstract. Young explains the need for such a device arises when two protocols use the same spectrum, such as Bluetooth and IEEE 802.11. Young, 1:15-27. Young explains the issue of interference, but also of receiver desensitization, where one receiver fails to operate effectively because the relevant frequency spectrum is full of high-power transmissions from the other communication protocol. Young, 1:44-57.

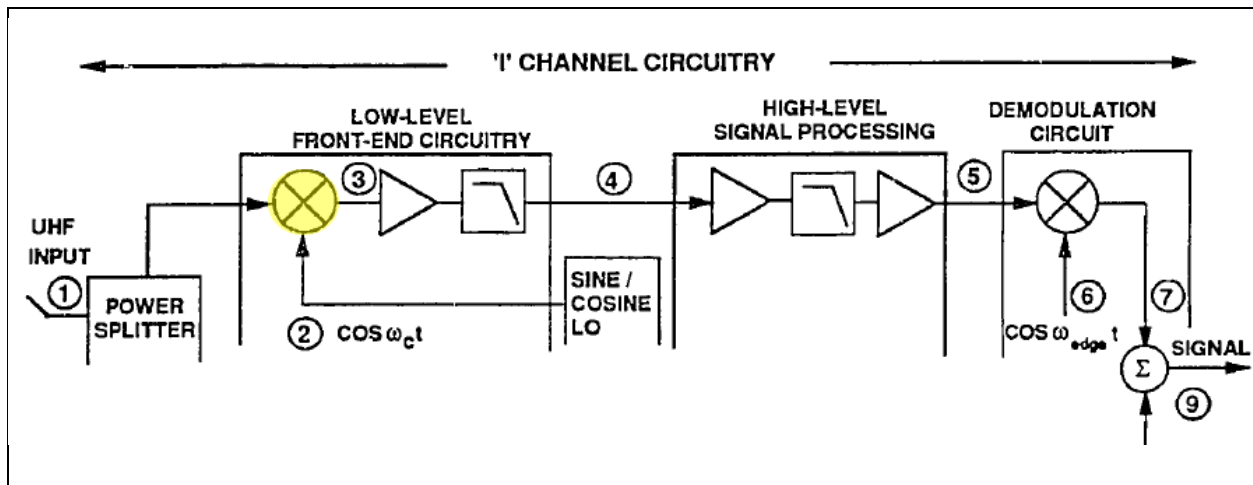
Young discloses a two-protocol transceiver, with separate transmit and receive chains for each protocol. Young, 5:65-6:17, Fig. 5. As shown in annotated Figure 5 below, each of the two receive chains includes a block for a down converter/demodulator 64 and 66 (Young, 6:6-11):



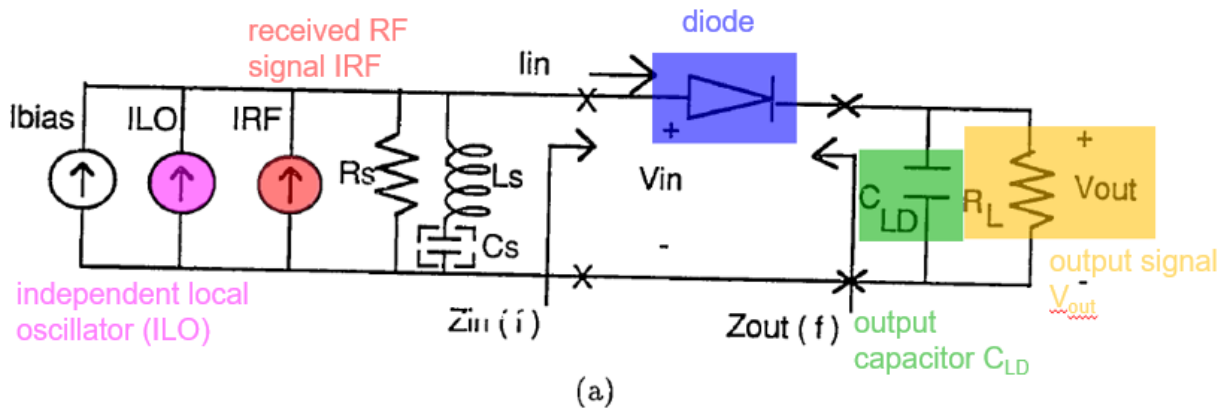
EX1002, ¶¶216-218.

2. Estabrook-Thesis

Estabrook-Thesis teaches a circuit (referred to as a “single-ended mixer”) “direct-conversion receiver” which down-converts and demodulates a received RF signal IRF, and is shown in Fig. 4. Estabrook-Thesis, 28, 31. Estabrook-Thesis’s direct conversion receiver has a single mixer (highlighted in yellow below) which down-converts to an intermediate frequency, which then undergoes “high-level signal processing” and is eventually demodulated:



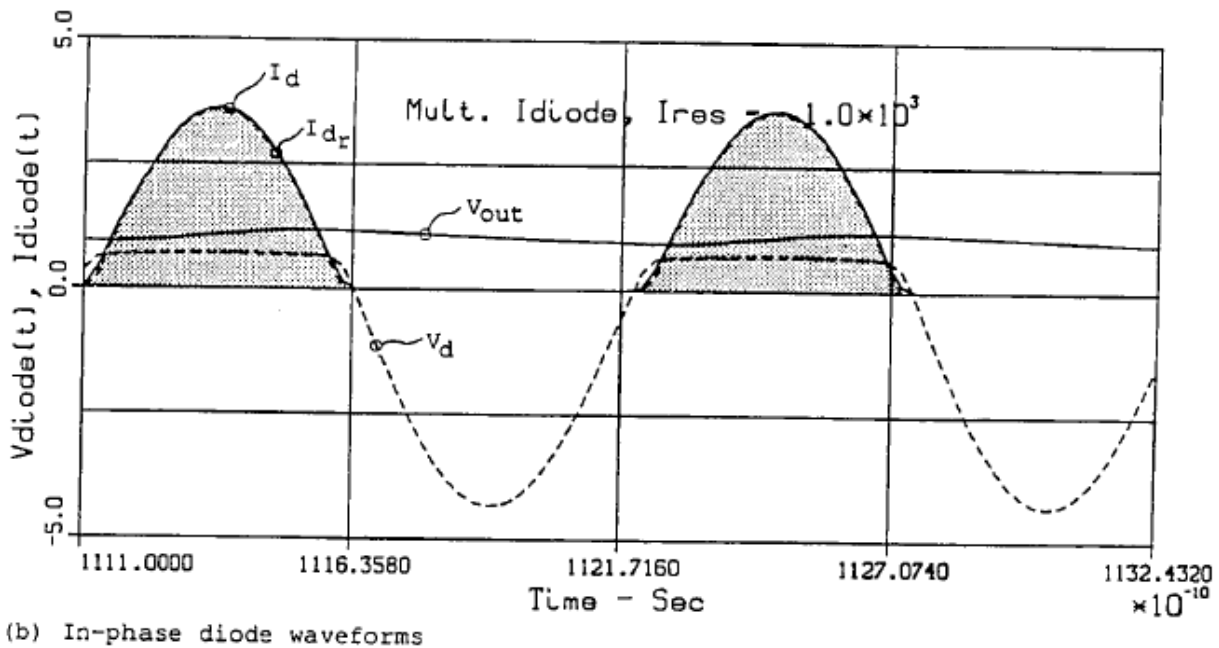
One embodiment of such a mixer is shown in Estabrook-Thesis's Figure 14(a):



Estabrook-Thesis (EX1005), 60, Fig. 14(a). As annotated above, Estabrook-Thesis's circuit includes a diode, an independent local oscillator (ILO), an output capacitor C_{LD} , and an output signal V_{out} .

Estabrook-Thesis's Fig. 16(b) (reproduced below) illustrates how the ILO controls the diode as a switch: when the diode voltage V_D (dotted line) reaches the forward voltage threshold (where the sine curve of V_D flattens out), the diode is "on"

and the diode current I_D flows, while below that threshold no current flows and the diode is off:



Estabrook-Thesis, 71; EX1002, ¶¶219-222.

3. Motivation to Combine

A POSITA would have been motivated to combine Young and Estabrook-Thesis. Both references are in the same field, because both describe RF receivers, including RF receivers which can receive signals in a digital format. Young, 1:8-32; Estabrook-Thesis, 26;¹⁵ EX1002, ¶¶223.

¹⁵ Page citations to Estabrook-Thesis refer to the numbering of EX1005, not the original page numbering of the paper.

Young teaches each receiver path includes a “down converter and demodulator” block 64 and 66, but omits a detailed description of those blocks. Therefore, a POSITA would have been motivated to look elsewhere to find a suitable circuit that accomplishes the functions specified by those blocks. EX1002, ¶224.

Estabrook-Thesis supplies such a down-conversion circuit, including a mixer that teaches the claimed FTM. Estabrook-Thesis teaches a “direct conversion receiver” with circuitry for down-conversion of a received RF signal, which provides several advantages over traditional heterodyne receivers, namely performing “as well as or better than a conventional super-heterodyne receiver” but with a “smaller volume, lower weight and power consumption, and...more versatil[ity]” than such receivers. Estabrook-Thesis, 8-9. A POSITA would have recognized that Estabrook-Thesis’s direct conversion circuit would perform the functions specified by Young’s blocks 64 and 66 (that is, down-conversion of received input signals using the mixer, followed by demodulation) and provide the same benefits in Young’s system. EX1002, ¶¶225-229.

Therefore, a POSITA would have recognized the down-conversion circuit of Estabrook-Thesis would improve the circuit taught by Young which requires such a down-conversion circuit, and would accomplish that function with predictable results and the same benefits taught by Estabrook-Thesis. EX1002, ¶229. Alternatively, Estabrook-Thesis’s down-conversion circuit provides a substitute

circuit performing the same function as other known down-conversion and demodulation circuits which would perform the function specified by Young's blocks 64 and 66. EX1002, ¶229. A POSITA would have recognized Estabrook-Thesis's circuit is designed to take as its input RF carrier signals like those taught by Young, down-convert them (using the mixer circuit), and then demodulate them. EX1002, ¶229. Because Estabrook's receiver is a "down converter and demodulator" as called for by Young, a POSITA would have had a reasonable expectation of success in integrating the circuit taught by Estabrook-Thesis into each "down-converter and demodulator" of Young's down-conversion system. EX1002, ¶229.

4. Claim 11

a. 11[pre]

If the preamble is limiting, Young discloses or suggests it. Young teaches a system for performing simultaneous multi-platform operations, and a method for performing such operations when that system is operated. Young teaches its system is designed to operate when two protocols share the same spectrum, such as Bluetooth and IEEE 802.11. Young, 1:15-27. Young describes its device as operating "simultaneously" in both protocols. Young, Title, Abstract, 3:47-57. The '686 Patent itself teaches "multi-platform operations" refer to "multiple protocols and multiple bearer services...employed simultaneously" and identifies

Bluetooth and IEEE 802.11 as exemplary protocols. '686Pat., 8:31-32, 7:52-58; EX1002, ¶231. Similarly, Young teaches Bluetooth and IEEE 802.11 employed simultaneously (Young, Title, Abstract, 1:15-27, 3:47-57) and so teaches a “method for performing simultaneous multi-platform operations.” EX1002, ¶¶231-235. As discussed above in section VIII(a)(5(a), a POSITA would recognize that “simultaneous” operations can encompass time-sharing of resources. EX1002, ¶¶231-235.

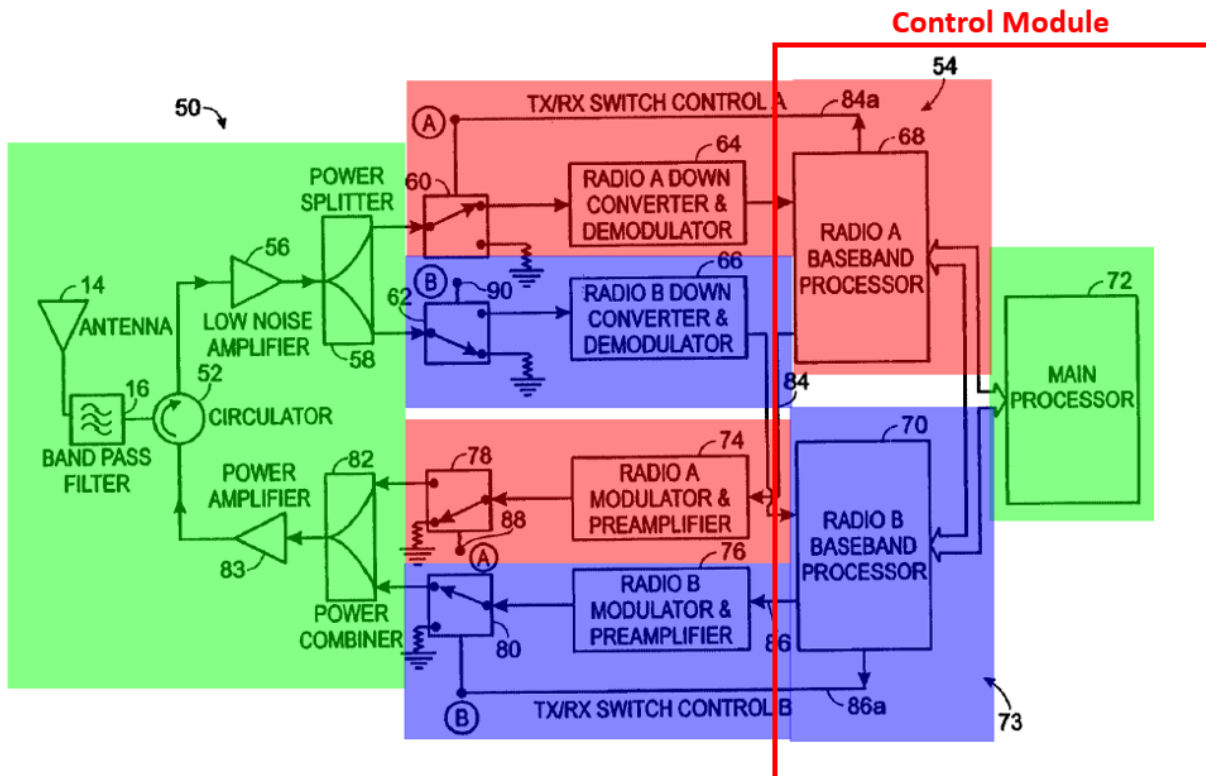
b. 11[1.1]

Young discloses or suggests 11[1.1]. Specifically, Young’s wireless receiver (Figure 5) discloses a “multi-platform module” because it can communicate simultaneously via separate protocols such as Bluetooth and IEEE 802.11, each of which constitutes a separate “communication link.” EX1002, ¶236. The “controlling” step is performed within the device by the processors (“control module”) described for 11[1.2] below, and by a user causing the device to connect simultaneously on different profiles. EX1002, ¶236.

c. 11[1.2]

Young discloses or suggests 11[1.2]. Young teaches a “control module” in the form of the processor elements for the dual-protocol transceiver shown in Figure 5, including a main processor and separate processors for radios A and B, each of which has an associated receiver and transmitter. Components specific to each radio

are annotated in red and blue below, while common components are annotated in green:



Young, Fig. 5, 5:65-6:55.

The combined set of processing components (including the main processor and the separate baseband processors) constitutes the “control module.” EX1002, ¶¶237-238. This mapping is consistent with the specification of the ’686 Patent, which teaches the control module includes sub-modules for separate protocols (in Figs. 43-44, WAP and Bluetooth) and includes “hardware, software, or combinations thereof to cause the [Universal Platform Sub-Module (UPSM)] 3802 to receive, transmit, process, and otherwise interact with signals according to the

particular protocol/bearer service combination.” ’686Pat., 36:47-51.

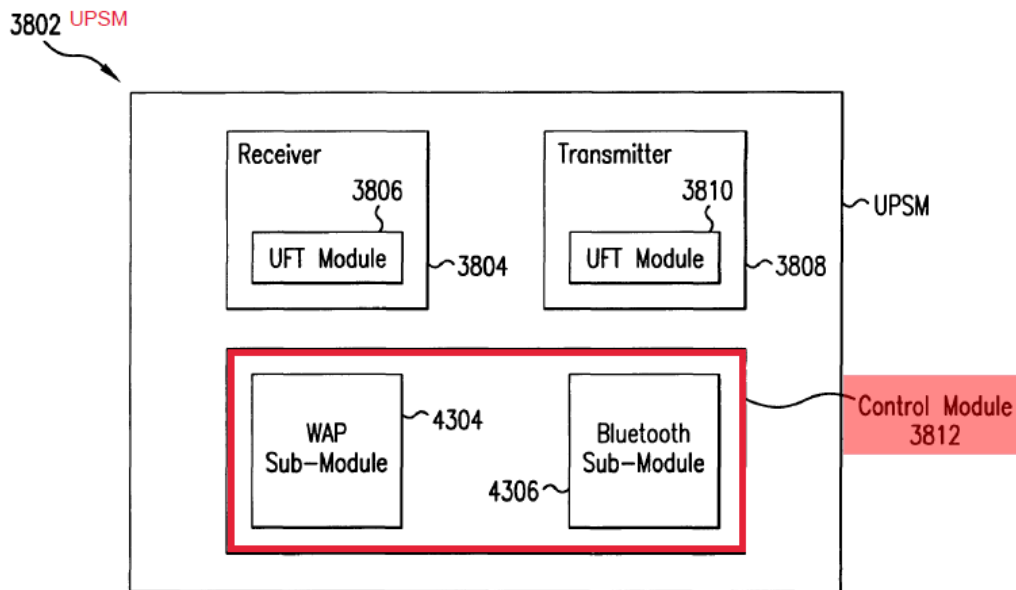


FIG.43

d. 11[1.3]

Young discloses or suggests 11[1.3]. Young’s processor elements, including a main processor and separate processors for radios A and B, (collectively, “control module” (§VIII.B.4.c)) have separate baseband processors for Radio A and Radio B (“sub-modules”), each of which includes its own associated receiver and transmitter paths. Young teaches the purpose of its device is to enable reception from a single “dual transceiver” device using multiple protocols such as Bluetooth, IEEE 802.11, and HomeRF. Young, Abstract, 1:8-12, 1:29-43, 2:65-67. In particular, Young discloses the transceivers of radio A and radio B operate according to separate standards/protocols. Young, 2:37-53. A POSITA would have recognized that in

Young's circuit, each of Radio A and Radio B, and their associated processors, are designed to operate with a particular protocol, which is described as "operating a [first/second] transceiver under a [first/second] transmitter/receiver protocol" in Young's Abstract and claim 1. EX1002, ¶239. Young uses an example of simultaneous operation using Bluetooth and HomeRF in which the "circuit of the invention" (i.e., Figure 5's circuit) results in substantial throughput improvement. Young, 10:1-19. Therefore, in the example, one of Radio A and B is used for Bluetooth and the other for HomeRF. EX1002, ¶239.

Although the '686 Patent distinguishes between "protocols" and "standards" (or "bearer services"), it acknowledges that some protocols may combine these functions, such as Bluetooth, for which "the transport standard is also supplied." '686Pat., 7:58-62. Each of Bluetooth, IEEE 802.11, and HomeRF provides both the "format for the transfer of data" and "the communications pipeline...for the device to interact with the network," and are therefore a "protocol/standard combination" as recited. EX1002, ¶¶240-241.

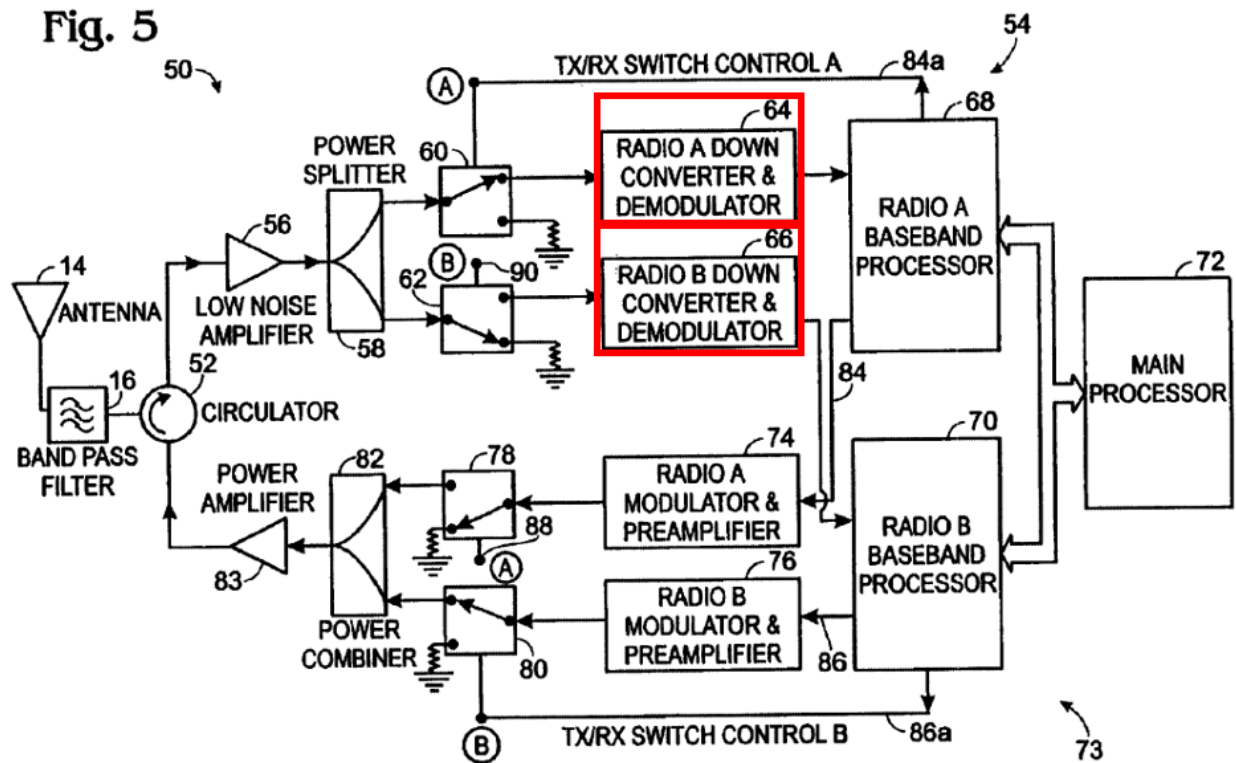
Young's transceivers are controlled to operate simultaneously by using control signal 84a (radio A) and control signal 86a (radio B). Those signals control switches 60, 62, 78, 80. Young, Fig. 5, 5:66-6:17. When the transceiver is being used, control signal 84a/86a controls the switch to connect its modulator/demodulator stage to the amplifier/antenna. When the transceiver is not

being used, the control signal 84a/86a controls the switch to disconnect its modulator/demodulator stage to the amplifier/antenna. *Id.*, 6:38-55. Hence, the baseband processors 68/70 are the sub-modules of the control module that controls their respective transceivers. EX1002, ¶242.

e. 11[1.4]

The Young-Estabrook-Thesis combination teaches 11[1.4]. In Young's wireless receiver (Fig. 5), the Radio A and Radio B circuits, together with the associated shared components (such as the antenna), teach "a plurality of transceivers." Young itself clarifies its wireless device 50 contains two transceivers: "The circuit described herein enables two transceivers to be co-located in the same enclosure." Young, 6:56-57. Although they share some components (such as the antenna 14, circulator 52, and amplifiers 56 and 83 in Fig. 5), Young's Radio A and B teach a "plurality of transceivers" because they receive and process distinct signals under separate transmitter/receiver protocols over different components, and are described in Young as separate transceivers. Young, Abstract; EX1002, ¶243. Nothing in the claims or specification of the '686 Patent precludes the first and second transceivers sharing components. EX1002, ¶243.

Each of Young's transceivers includes an associated "down converter and demodulator" (Figure 5, blocks 64 and 66), which teaches an FTM. Young, 6:6-11; EX1002, ¶243.



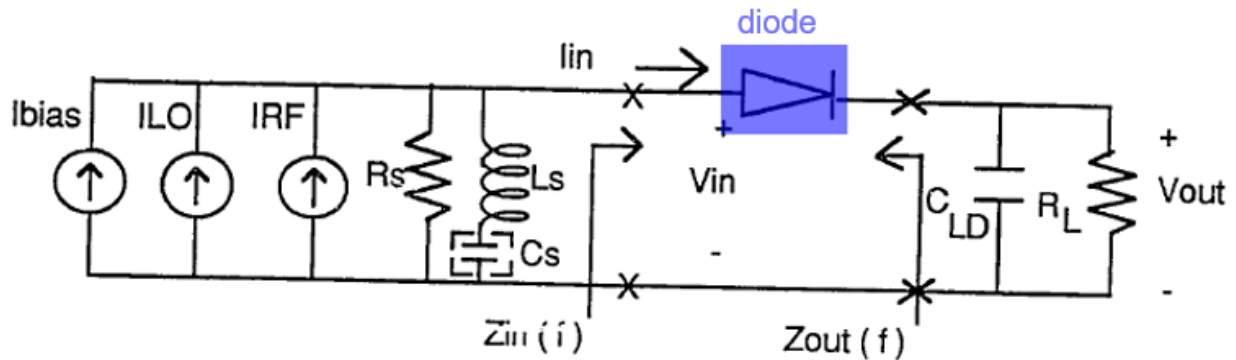
Young, Fig. 5 (annotated).

As explained in §VIII.B.3, Young does not teach the specific details of its two “down converter and demodulator[s],” and a POSITA would have been motivated to combine Estabrook-Thesis’s circuit with Young to accomplish the down-conversion and demodulation functions for Young’s Radio A and Radio B. The FTM components for which the Petition relies on Estabrook-Thesis are discussed in detail below.

f. 11[FTM-1.1]

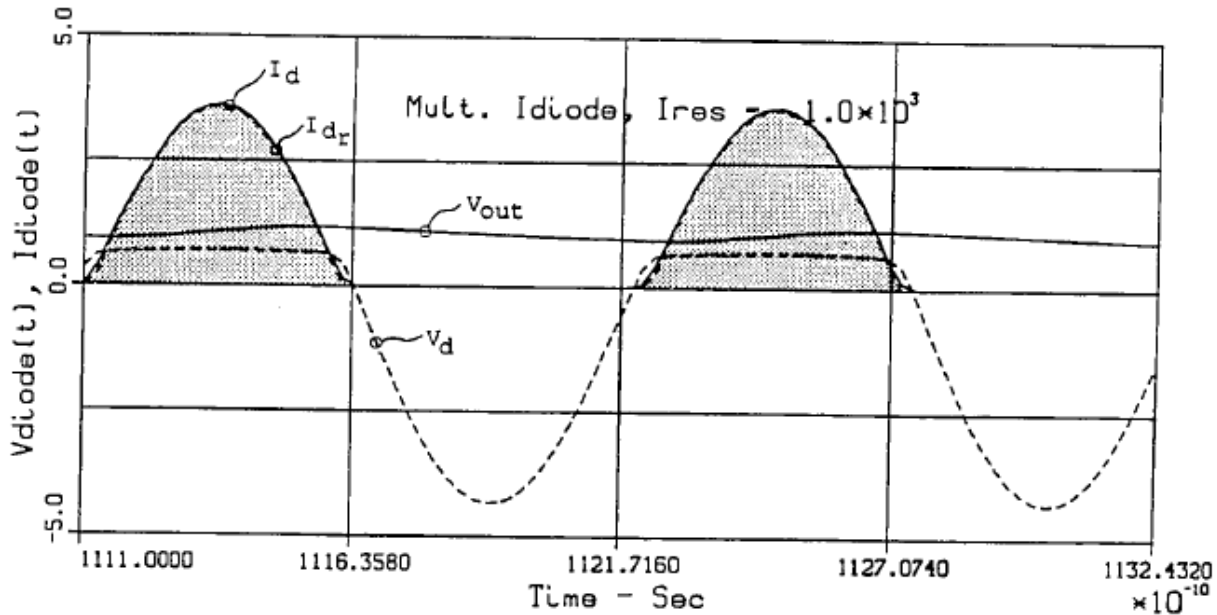
The Young-Estabrook-Thesis combination teaches 11[FTM-1.1]. When Estabrook-Thesis’s conversion circuit is used in Young’s down converter, the diode

in Estabrook-Thesis's Figure 14(a) operates as a switch¹⁶:



The diode is a switch because it passes current (and therefore closes the circuit) only when the forward voltage exceeds a threshold (i.e., it is “an electronic device for opening and closing a circuit” that meets Petitioner’s proposed construction). EX1002, ¶244-245. Estabrook-Thesis’s Figure 16(b) illustrates how the ILO controls the diode as a switch: when the diode voltage V_D (dotted line) reaches the forward voltage threshold (where the sine curve of V_D flattens out), the diode is “on” and the diode current I_D flows, while below that threshold no current flows and the diode is off:

¹⁶ Young’s switches 84a and 86a serve a different purpose and are not part of the combination’s FTM, and so are not mapped to this claim limitation.



(b) In-phase diode waveforms

Estabrook-Thesis, 71.

Estabrook-Thesis itself describes the diode as a switch. Estabrook-Thesis, 90 (“a switch, which is a square wave multiplier of sorts, can be realized at these frequencies using a diode as the switching element”), Fig. 14(a). This is consistent with the ’686 Patent’s disclosure that a diode can be the “switch” in the FTM. ’686Pat., 4:60-61, Figs. 45C-45D; EX1002, ¶246.

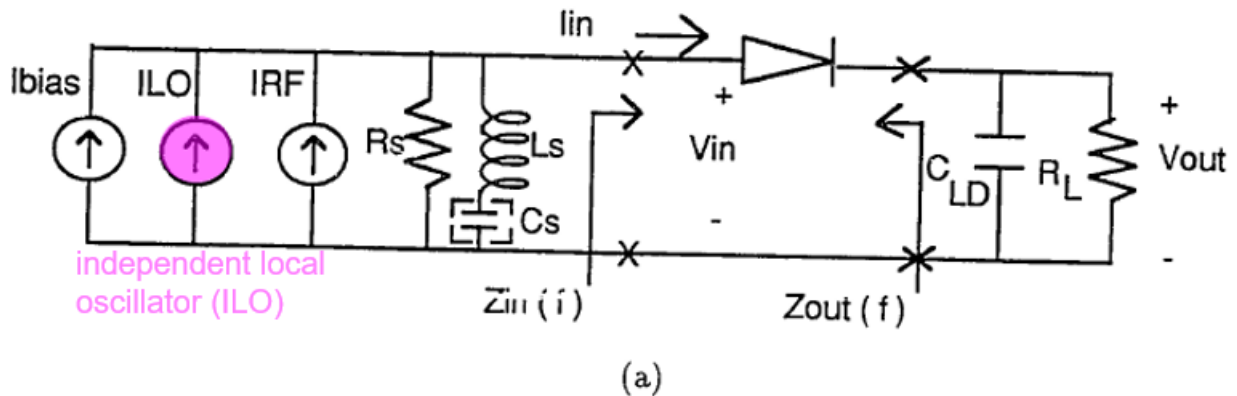
In addition, Estabrook-Thesis teaches a switch under PO’s proposal requiring the switch to be “dictated by an independent control input.” See §VI(B). The IRF input in Estabrook-Thesis’s Figures 14(a), 14(b) (showing input values associated with circuit in 14(a)) does not have a sufficient amplitude to activate the diode. EX1002, ¶¶247-249. Figures 16(b)-(c) show a sine curve at the frequency of the

ILO, where the V_D exceeds a threshold, and the diode is “on” and current flows for half the duty cycle of the ILO. EX1002, ¶245.

Therefore, the ILO, which does have sufficient amplitude to activate the diode, is an independent control input which dictates the closing of the diode. EX1002, ¶¶248-249.

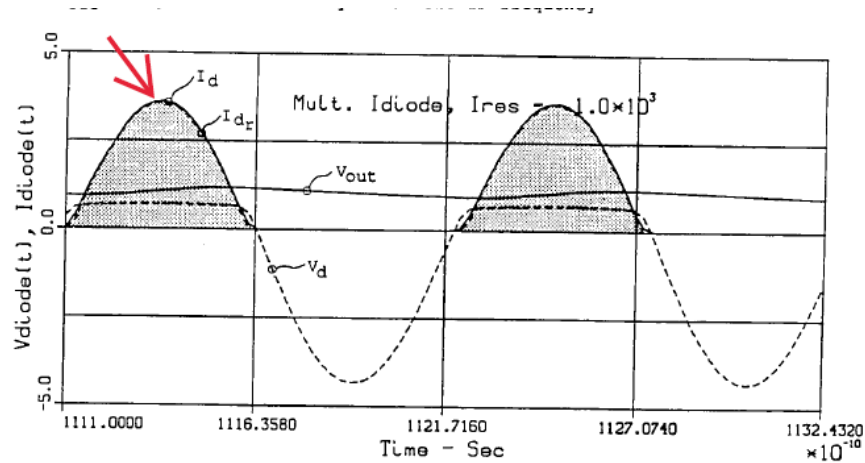
g. 11[FTM-1.2]

The Young-Estabrook-Thesis combination teaches 11[FTM-1.2]. Estabrook-Thesis teaches the diode (“switch”) is configured to operate according to an energy transfer signal in the form of local oscillator signal ILO:

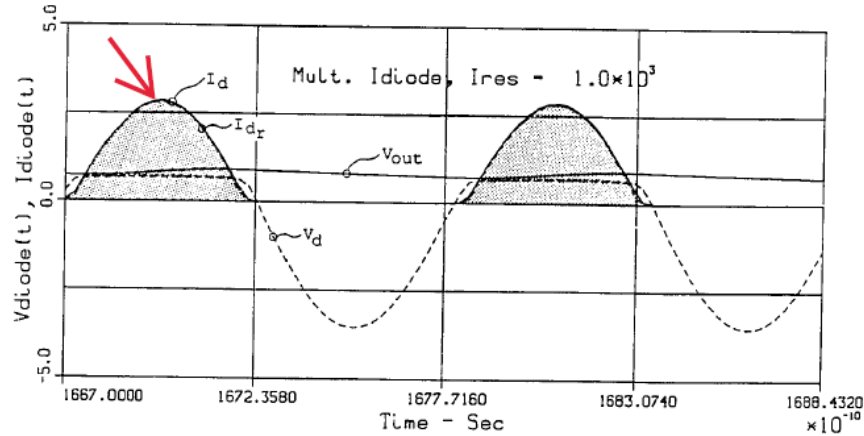


ILO is an energy transfer signal because the input from ILO is necessary to activate the diode and close the diode (as discussed in §VIII.B.4.f) and when the diode switch is closed, it passes current (and therefore energy) through the diode from the combined signal of the ILO and IRF. EX1002, ¶¶250-251. When the ILO and IRF are in phase (as in Figure 16(b)), more current flows (as shown by the

amplitude of I_D), and therefore more energy is transferred, than when they are out of phase (EX1002, ¶251):



(b) In-phase diode waveforms



(c) 180° out-of-phase diode waveforms

Therefore, ILO causes the diode to transfer energy, including energy from IRF in addition to ILO. EX1002, ¶252.

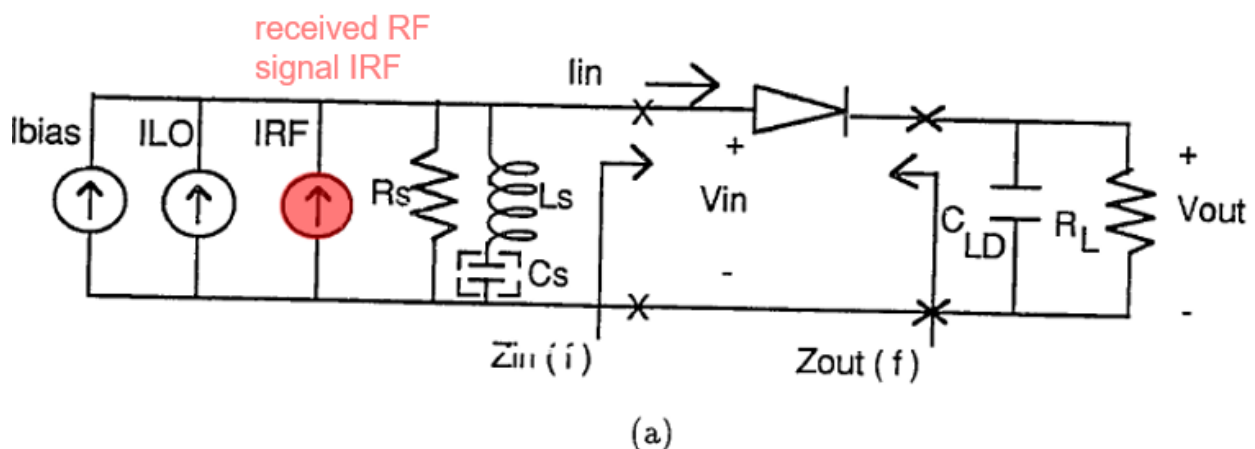
Estabrook-Thesis discloses the diode is most efficient (i.e., has the lowest conversion loss C_L) when it is turned on for 50% of the duration of the ILO period. Estabrook-Thesis, 94 ($T_{TON} = 0.50 T_{LO}$). Given that ILO and IRF have roughly the same frequency (Estabrook-Thesis, 94 (ILO frequency of 900 MHz and IRF

frequency of 909 MHz)), this would also be approximately 50% of the IRF period.
EX1002, ¶253.

Estabrook-Thesis's disclosure is consistent with the '686 Patent's aperture disclosed as an "energy transfer signal." '686Pat., 14:45-47 ("an aperture width of approximately $\frac{1}{2}$ the period of the EM signal being down-converted as a preferred embodiment..."), 9:38-46 (incorporating '551 Patent by reference); EX1008, 67:1-13 (energy transfer system with energy transfer signal having aperture of " $\frac{1}{2}$ the period of the EM signal"). EX1002, ¶253-254.

h. 11[FTM-1.3]

The Young-Estabrook-Thesis combination teaches 11[FTM-1.3]. As discussed for 11[FTM-1.2], §VIII.B.4.g, when Estabrook-Thesis's diode ("switch") is "on," it transfers energy from the combined signals of ILO and IRF, the latter of which teaches the "first EM signal":

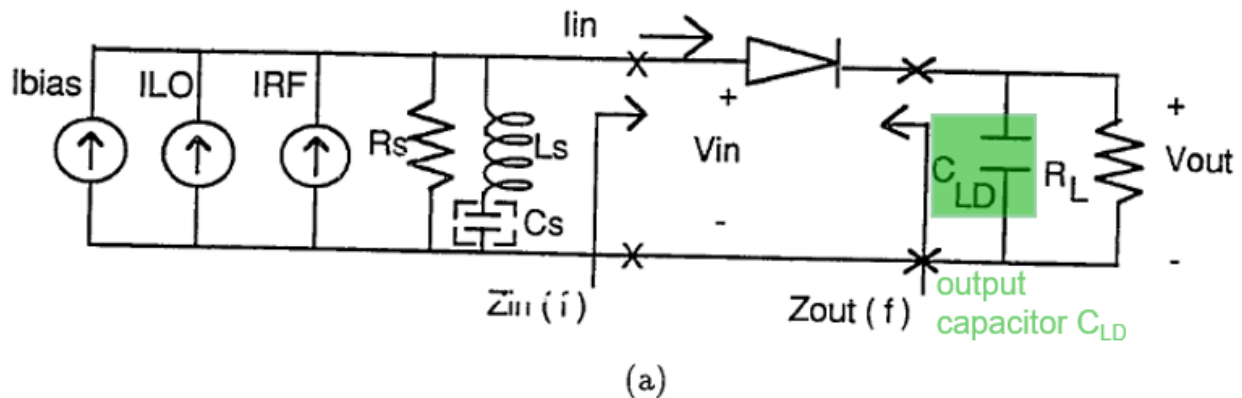


The switch "sub-samples" energy from the IRF because it passes energy from

the IRF at an aliasing rate driven by ILO (900 MHz), which is less than twice the frequency of the signal (IRF) being sampled (909 MHz). *See* §VII.E; EX1005, 90; EX1002, ¶256. The current flows through the diode (and therefore energy is transferred) for approximately 50% of the duty cycle of ILO, which is also approximately 50% of the duty cycle of IRF, which has a similar frequency. Estabrook-Thesis, 71, Figs. 16(b), 16(c) (showing current passing during 50% of duty cycle), 90 (explaining 50% duty cycle). EX1002, ¶256. As discussed above for 11[FTM-1.2], §VIII.B.4.g, the 50% duty cycle is consistent with the energy transfer described in the '686 Patent. PO may argue that the energy being transferred includes current from the ILO as well as the IRF, but nothing in the plain language of the claims requires that the switch transfer energy *exclusively* from the first EM signal. EX1002, ¶256. As discussed for 11[FTM-1.1], §VIII.B.4.f, because more current flows (and therefore more energy is transferred) when IRF is in phase with ILO, the diode switch transfers energy from IRF, and no more is required by this element. EX1002, ¶256.

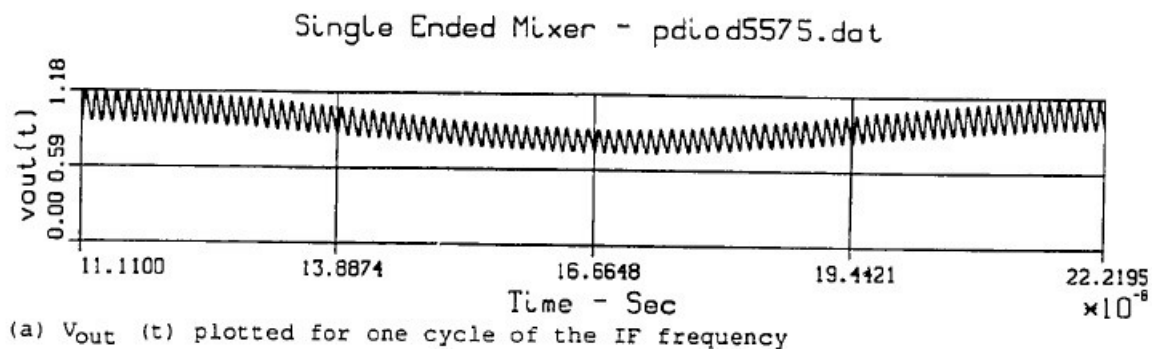
i. 11[FTM-2.1]

The Young-Estabrook-Thesis combination teaches 11[FTM-2.1]. Estabrook-Thesis teaches a storage module in the form of an output capacitor C_{LD} , which is coupled (directly connected) to and stores energy transferred from the diode (switch):



This is consistent with the '686 Patent's disclosure of using a capacitor for the storage module. '686 Pat., 14:39-44, 18:6-19, Figs. 20A, 51A; EX1002, ¶258-259.

Capacitor C_{LD} stores energy transferred through the diode when the diode is closed (on) and discharges it at V_{OUT} when the diode is open (off). The discharge of stored energy from the capacitor is shown in Fig. 16(a) (below) of Estabrook-Thesis (Estabrook-Thesis, 71):



A zoomed-in view of Estabrook-Thesis's Figure 16(a) shows each sawtooth waveform (corresponding to one closing and opening of the diode during a cycle of ILO) has a rising edge (**blue**) and a falling edge (**red**). The rising edge is generated

when the diode is on and current of both ILO and IRF pass through. The falling edge is generated when the diode is off, and no current passes through the diode. As a result, the only source of current during the falling edge is the energy stored in capacitor C_{LD} , so the falling edge voltage of V_{out} shown below is generated from the energy previously stored in capacitor C_{LD} :



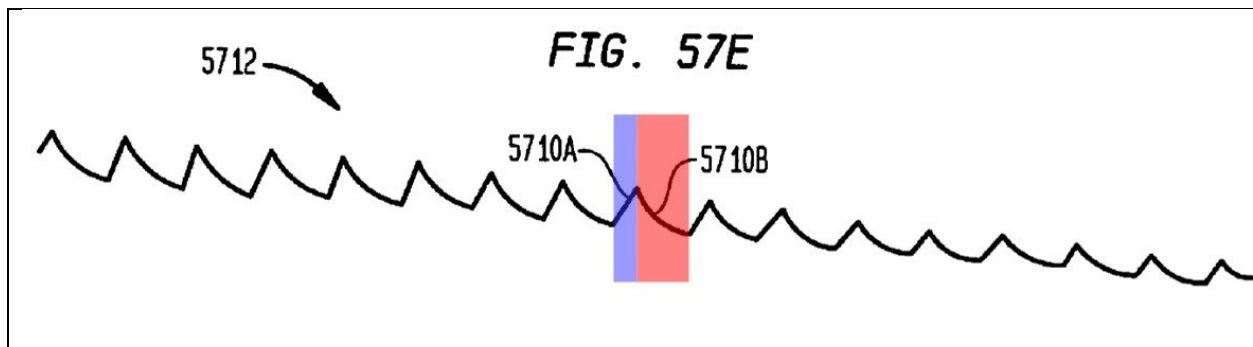
EX1002, ¶¶260-261. The amount of energy stored by the capacitor is non-negligible because the capacitor stores the energy transferred during half of the duty cycle of ILO, as discussed for 11[FTM-1.1] and 11[FTM-1.2], §§VIII.B.4.f-VIII.B.4.g. Because the output signal V_{out} is recovered from energy discharged by the capacitor, the energy discharged by the capacitor is distinguishable from noise. EX1002, ¶262.

This waveform in Estabrook-Thesis, and the way that it is generated (i.e., by a capacitor storing charge when a switch is open and discharging it across a load when the switch is closed) is substantially similar to the corresponding description and figures in the '551 Patent, which is incorporated by reference into the '686

Patent:

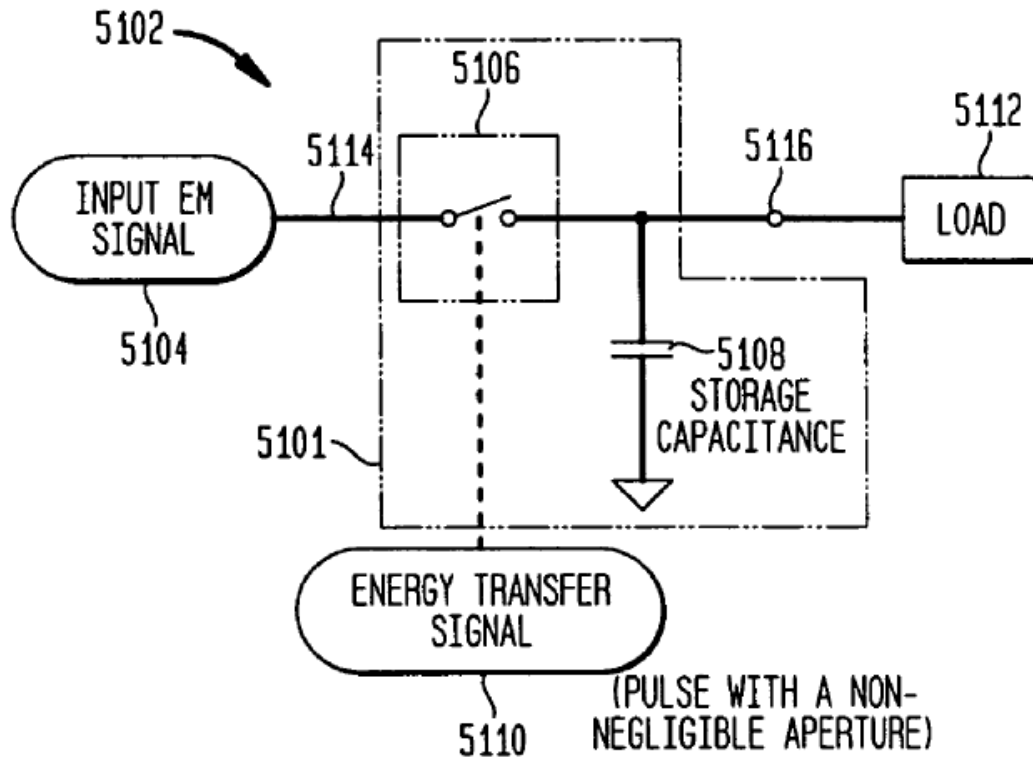
The demodulated baseband signal 5712 includes portions 5710A, which correlate with the energy transfer pulses 5707 in FIG. 57C, and portions 5710B, which are between the energy transfer pulses 5707. Portions 5710A represent energy transferred from the analog AM carrier signal 516 to a storage device, while simultaneously driving an output load. The portions 5710A occur when a switching module is closed by the energy transfer pulses 5707. Portions 5710B represent energy stored in a storage device continuing to drive the load. Portions 5710B occur when the switching module is opened after energy transfer pulses 5707.

EX1008, 85:48-58; EX1002, ¶263. The resulting waveform in '551 Figure 57E is substantially similar to that disclosed by Estabrook-Thesis:



If the term “storage module” must be part of an “energy transfer system,” as PO argues (§VII.A), Estabrook-Thesis still teaches it. The '686 Patent explains Figure 51A, which also includes a capacitor on the output side of a switch driven by an “energy transfer signal” is an “energy transfer system”:

FIG. 51A

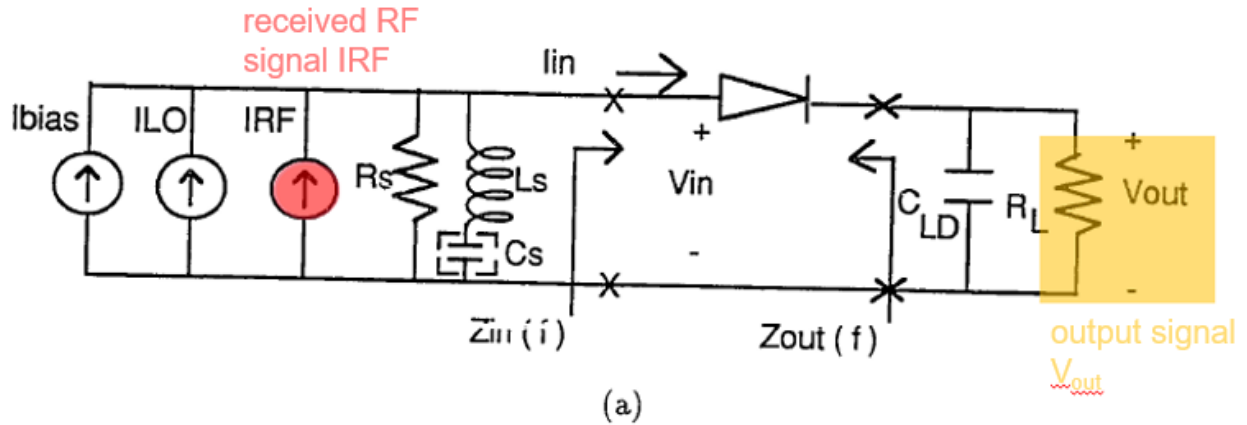


'686Pat., 5:10-11. Although the '686 Patent does not explicitly define an “energy transfer system,” it explains a system is an “energy transfer module” when the control signal has a “non-negligible aperture” and thus becomes an “energy transfer signal.” '686Pat., 13:27-31. Estabrook-Thesis’s ILO opens the diode (switch) for 50% of the duty cycle as discussed for 11[FTM-1.2] and 11[FTM-1.3], §§VIII.B.4.g-VIII.B.4.h, and thus has a “non-negligible aperture” which makes the system an “energy transfer system” even under PO’s restrictive construction. EX1002, ¶¶265-266.

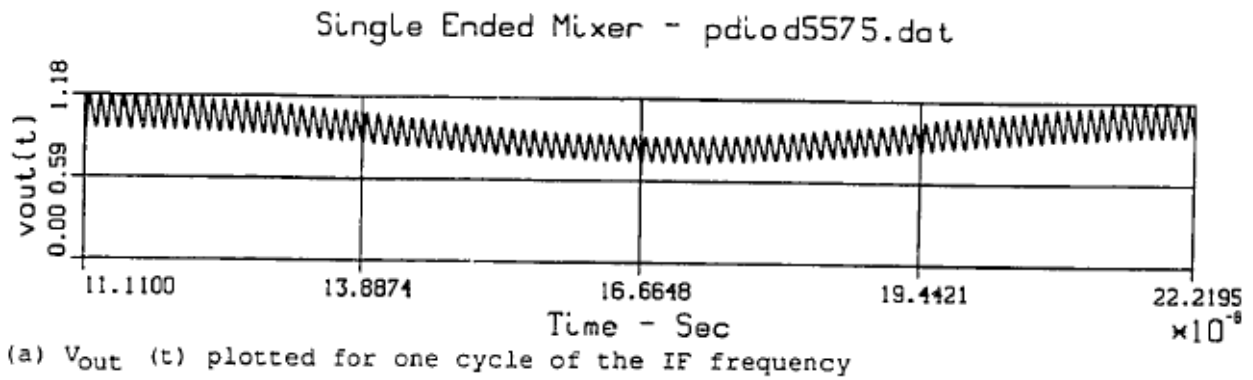
PO may even further argue that an “energy transfer system” (which the “storage module,” properly construed, does not require) must have a “low impedance load.” *See* EX1045, 15-16. Even under that restrictive construction, Estabrook-Thesis still teaches this element, because Estabrook-Thesis discloses resistive load RL can be 1 K Ω (Estabrook-Thesis, Fig. 14(b), 60, Table 19, 212), 500 Ω (Estabrook-Thesis, Fig. 27(b), 105), or any of 500 Ω , 1.5 K Ω , or 2 K Ω (Estabrook-Thesis, Table 26, 250) while downconverting a 900 MHz RF signal. EX1002, ¶267. This is consistent with the ’686 Patent’s disclosure of using 2 K Ω for downconverting a 900 MHz RF signal. ’686Pat., Fig. 51B; EX1002, ¶267.

j. 11[FTM-2.2]

The Young-Estabrook-Thesis combination teaches 11[FTM-2.2]. Estabrook-Thesis discloses Figure 14(a)’s mixer generates a second EM signal, V_{out} , that is a downconverted signal from the IRF input signal. Estabrook-Thesis, 67 (“The circuit shown in Figure 14(a) was chosen as a beginning point for the design of the mixer in the direct downconversion receiver[.]”). The load which generates V_{out} is shown in Figure 14(a), and the resulting signal is shown in Figure 16(a):



Estabrook-Thesis, Fig. 14(a).



Estabrook-Thesis, Fig. 16(a); EX1002, ¶268.

As discussed for 11[FTM-2.1], §VIII.B.4.i, the V_{out} signal is generated from energy stored in capacitor C_{LD} . While the output signal includes individual “sawtooth” waveforms at the frequency of ILO, the voltage of the peaks and troughs of those waveforms varies at the lower intermediate frequency (IF), for which Figure 16(a) illustrates one cycle. EX1002, ¶¶269-270. In the example of a 909 MHz IRF and a 900 MHz ILO (Estabrook-Thesis, 90), the resulting IF of V_{out} is 9 MHz, which

can also be calculated as the inverse of the cycle time (11.1095×10^{-8} seconds) shown in Figure 16(a). EX1002, ¶270. Thus, V_{out} 's frequency (second EM signal) is different from the 909 MHz frequency of IRF (first EM signal).

k. 11[2]

The Young-Estabrook-Thesis combination teaches 11[2]. As discussed for 11[1.3], §VIII.B.4.d, Young teaches operating the transceiver paths of Radio A and Radio B, and their associated sub-modules, to send and receive using different protocols, such as Bluetooth and IEEE 802.11 wi-fi or Bluetooth and HomeRF. Young, 2:37-64. Young, Abstract, 1:8-12, 1:29-43, 2:65-67. Young's Abstract explicitly states "operating a first transceiver under a first transmitter/receiver protocol" and "operating a second transceiver under a second transmitter/receiver protocol." *Id.*, Abstract. For example, Radio A may be operated according to the Bluetooth protocol using the Radio A baseband processor, while Radio B may be operated according to the IEEE 802.11 protocol using the Radio B baseband processor. EX1002, ¶271; Young, 10:31-37.

l. 11[3]

The Young-Estabrook-Thesis combination teaches 11[3]. As discussed for 11[2], §VIII.B.4.k, Young teaches operating two transceiver paths of two radios (Radio A and Radio B) and their associated sub-modules, to send and receive using two different protocols. EX1002, ¶272.

5. Dependent claims 12-20

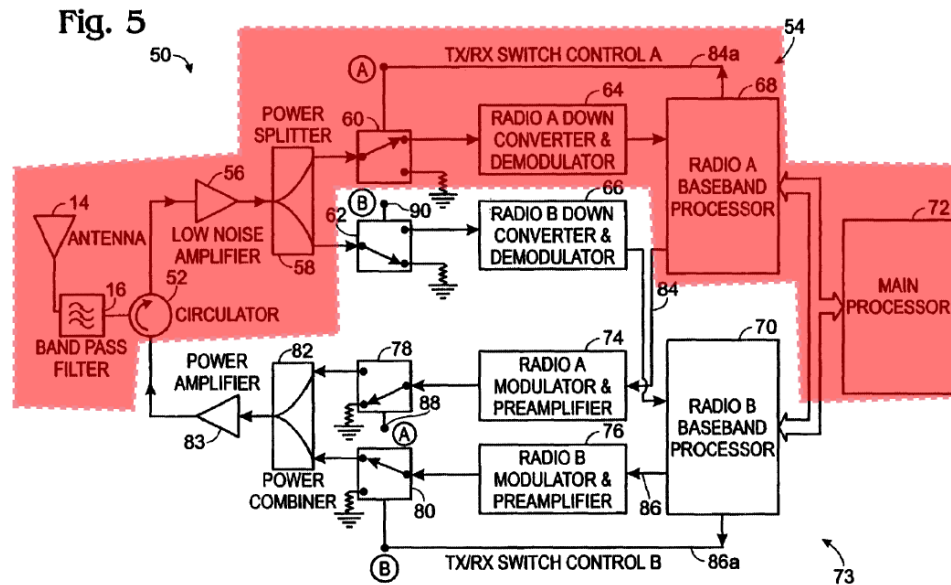
a. Claim 12

Young teaches claim 12's additional limitation. As discussed for 11[pre], §VIII.B.4.a, Young discloses communicating simultaneously in two protocols such as Bluetooth and IEEE 802.11, and as discussed for 11[1.3], §VIII.B.4.d that simultaneous communication employs sub-modules associated with Radio A and Radio B. Therefore, in Young's Figure 5, Young's radio communicates simultaneously with two communications links using an equal quantity (one each) of standard/protocol sub-modules. EX1002, ¶¶273-274.

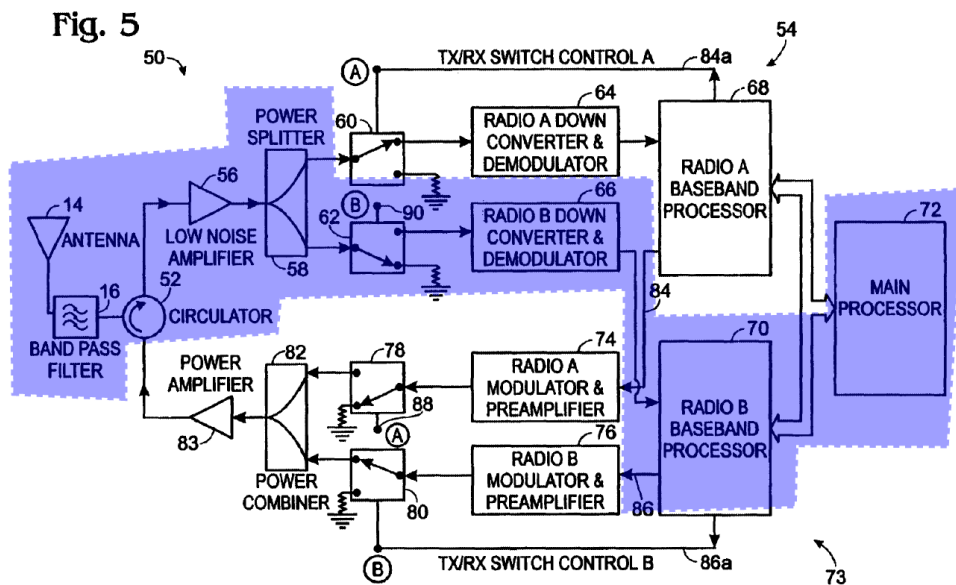
b. Claim 13

The Young-Estabrook-Thesis combination teaches claim 13's additional limitation. As discussed for 11[1.2], §VIII.B.4.c, Young teaches a control module (including a main processor and subband processors for radios A and B) that controls communications with at least one of a plurality of communications links such as Bluetooth or IEEE 802.11 connections. As discussed for 11[1.4], §VIII.B.4.e, Young teaches a plurality of receivers and transmitters that receiver and transmit different signals, with some common components. In Young's Figure 5, each of radios A and B has an associated transmitter and receiver path including the antenna, common components, "down converter and demodulator" for the receiver paths and "modulator and preamplifier" for the transmitter paths.

Young's four transmitter and receiver paths are shown below:

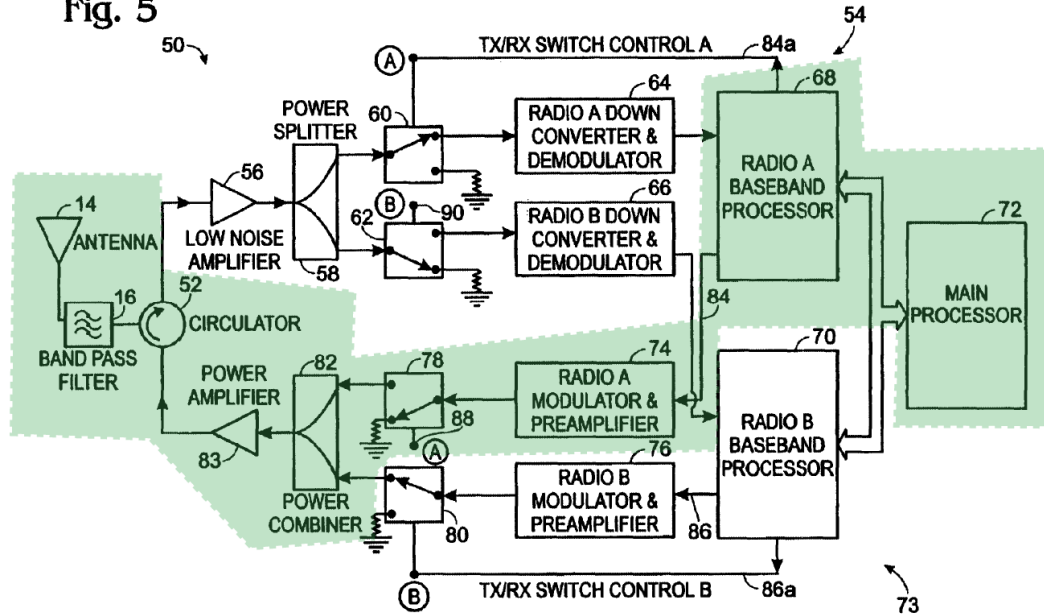


Receiver A



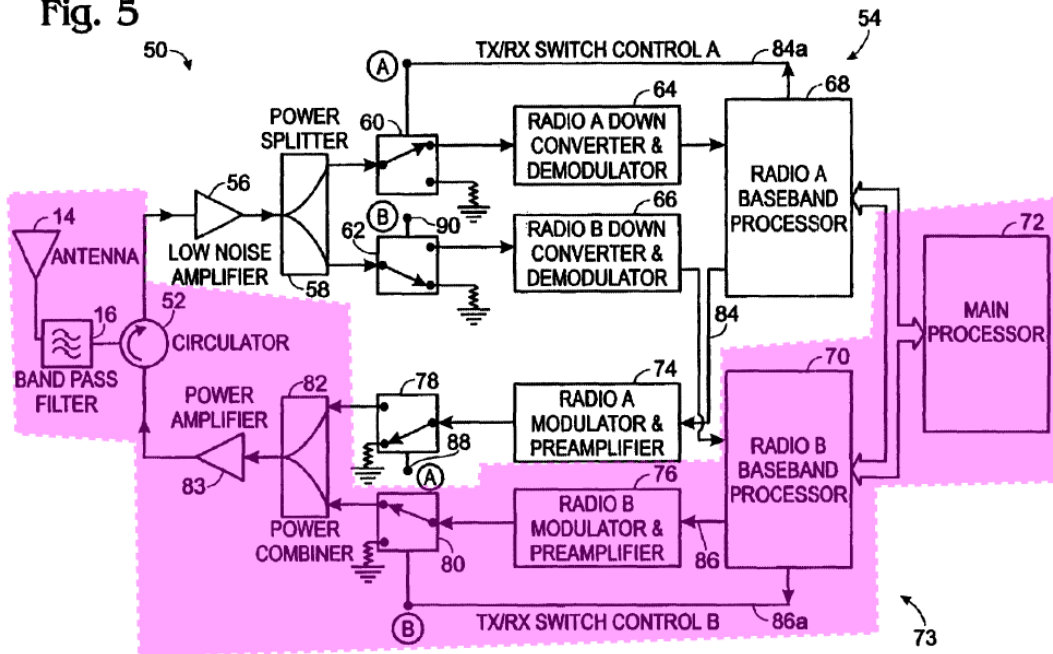
Receiver B

Fig. 5



Transmitter A

Fig. 5



Transmitter B

Each “down converter and demodulator” 64, 66 (as implemented using

Estabrook-Thesis's direct conversion circuit) is an FTM, as is each "modulator and preamplifier" 74, 76. EX1002, ¶¶275-276. This claim requires only that each receiver and transmitter have "at least one [FTM]," not that each FTM be the same FTM recited in claim 11. EX1002, ¶276. The modulators 74, 76 are FTMs according to the plain language of the term because they take a signal from a lower (e.g., baseband) frequency and translate it to a signal at a higher carrier frequency. EX1002, ¶277.

c. Claim 14

Young teaches claim 14's additional limitation. As discussed for 11[pre], §VIII.B.4.a, 11[1.3], §VIII.B.4.d, Young teaches its transceivers (Radio A and B) simultaneously operate on different protocols such as Bluetooth and IEEE 802.11 or HomeRF. When Young operates in this manner, the second transceiver (e.g., Radio B) operates in conformance with a protocol/standard combination that is different from the protocol/standard combination used by the first transceiver (e.g., Radio A) (i.e., one with Home RF and one with Bluetooth or IEEE 802.11). EX1002, ¶¶278-279.

d. Claim 15

Young teaches claim 15's additional limitation. Dr. Larson explains that this element is obvious based on Young because to operate in accordance with the various protocols taught by Young (e.g., those discussed for 11[pre], §VIII.B.4.a),

the software modules in main processor 72 and Radio A and B baseband processors are programmed with appropriate software instructions for those protocols, which would include implementation and operational instructions. EX1002, ¶¶280-285.

e. Claim 16

Young teaches claim 16's additional limitation. Young teaches operating the first and standard/protocol sub modules simultaneously in accordance with first and second protocols such as Bluetooth, IEEE 802.11, and HomeRF. Young, Abstract, 1:28-43, 3:47-62. As Dr. Larson explains, for the Radio A and Radio B baseband processors to operate in accordance with those standards, those processors need to be programmed with operating instructions consistent with the associated protocol stacks and information about their protocol architectures. EX1002, ¶¶286-291.

f. Claim 17

Young teaches claim 17's additional limitation. As Dr. Larson explains, a POSITA would have recognized that communications protocols and standards such as Bluetooth and IEEE 802.11, as taught in Young, are periodically updated with additional functionality, and it would accordingly be desirable for a device that relies on software to operate according to such protocols to be updated with the most current version of those protocols. EX1002, ¶¶292-293.

g. Claim 18

Young teaches claim 18's additional limitation. As Dr. Larson explains, to

operate in conformance with first and second protocols such as Bluetooth and IEEE 802.11 (and/or HomeRF), a POSITA would have understood, and found it obvious, Young’s transceiver operates in conformance with the requirements of those protocols and their operating environments. EX1002, ¶¶294-299; *see* 11[pre], 11[1.3], §§VIII.B.4.a, VIII.B.4.d.

h. Claim 19

Young teaches claim 19’s additional limitation. Claim 19 is substantively similar to claim 18 but recites “content encoders, decoders, and protocol gateways.” This is taught by Young’s discussion of Bluetooth and IEEE 802.11, which a POSITA would have understood to have—as part of its standard—content encoders, decoders, and protocol gateways. EX1002, ¶¶300-308.

i. Claim 20

Young teaches claim 20’s additional limitation. As discussed for 11[pre], §VIII.B.4.a, Young teaches the first and second transceivers Radio A and Radio B (discussed for 11[2] and 11[3], §§VIII.B.4.k-VIII.B.4.l) are operated simultaneously to communicate in different protocols. EX1002, ¶¶309-310.

6. Claim 1

Claim 1 is similar to claim 11, except that it is written to cover an apparatus rather than a method of using that apparatus, and omits the claim 11’s “storage module.”

a. 1[pre]

See 11[pre], §VIII.B.4.a. EX1002, ¶312.

b. 1[a]

See 11[1.1], §VIII.B.4.b regarding the “multi-platform module” and 11[1.4], §VIII.B.4.e, regarding the “plurality of transceivers each having at least one [FTM].” EX1002, ¶313.

c. 1[b]

See 11[FTM-1.1], 11[FTM-1.2], 11[FTM-1.3], §§VIII.B.4.f-VIII.B.4.h. EX1002, ¶314.

d. 1[c]

See 11[1.1], 11[11.2], §§VIII.B.4.b-VIII.B.4.c, regarding the “control module configured to enable the at least one multi-platform module to communicate with at least one of a plurality of communication links” and 11[1.3], §VIII.B.4.d, regarding the “plurality of protocol/standard sub-modules.” EX1002, ¶315.

7. Dependent claims 2-10

The claims that depend from claim 1 add substantially similar elements to the claims that depend from claim 11, and any differences are discussed in detail below.

a. Claim 2

See claim 12, §VIII.B.5.a. Young’s control module is configured to enable its Radio A and Radio B to communicate with separate protocols using an equal

quantity (one each) of sub-modules. EX1002, ¶317.

b. Claim 3

See claim 13, §VIII.B.5.b. EX 1002, ¶318.

c. Claim 4

See claim 14, §VIII.B.5.c. EX1002, ¶319.

d. Claim 5

See claim 14, §VIII.B.5.c. EX1002, ¶320.

e. Claim 6

See claim 15, §VIII.B.5.d. EX1002, ¶321.

f. Claim 7

See claim 16, §VIII.B.5.e. EX1002, ¶322.

g. Claim 8

See claim 17, §VIII.B.5.f. EX1002, ¶323.

h. Claim 9:

See claim 18, §VIII.B.5.g. As described for 11[1.4], 11[2], 11[3], §§VIII.B.4.e, VIII.B.4.k-VIII.B.4.l, Young's Radio A and Radio B are sub-modules that operate according to the requirements of the first and second protocols. EX1002, ¶324.

i. Claim 10

See claim 19, §VIII.B.5.h. As noted regarding claim 19, the claimed elements are aspects of the operating environments of the respective protocols.

EX1002, ¶325.

C. Ground 2B: Claims 1-20 are Unpatentable as Obvious Over Young, Estabrook-1988, and Estabrook-1989

Claims 1-20 are unpatentable as obvious over Young, Estabrook-1988, and Estabrook-1989. Estabrook-1988 and Estabrook-1989 are publications by the author of Estabrook-Thesis and correspond to chapters of Estabrook-Thesis. To the extent PO contends Estabrook-Thesis does not qualify as a printed publication (which it does), Estabrook-1988 and Estabrook-1989 present substantially the same relied-upon teachings as those in Estabrook-Thesis in Ground 2A. The same teachings from Young apply equally in this ground, as were applied in Ground 2A, §VIII.B.

1. Estabrook-1988

Estabrook-1988 (EX1016) describes and simulates the performance of mixers for use in a direct down-conversion scheme for converting a modulated signal to an RF. EX1016 at 1107.¹⁷ Estabrook-1988 first describes the theoretical operation of an ideal mixer with a switch driven at a local oscillator frequency f_{LO} , which produces a resulting signal I_L whose current averaged over the ILO ($\langle I_L \rangle$) varies at the IF. EX1016, 1107-08, Fig. 2:

¹⁷ Citations are to original page numbers for EX1016 and EX1017.

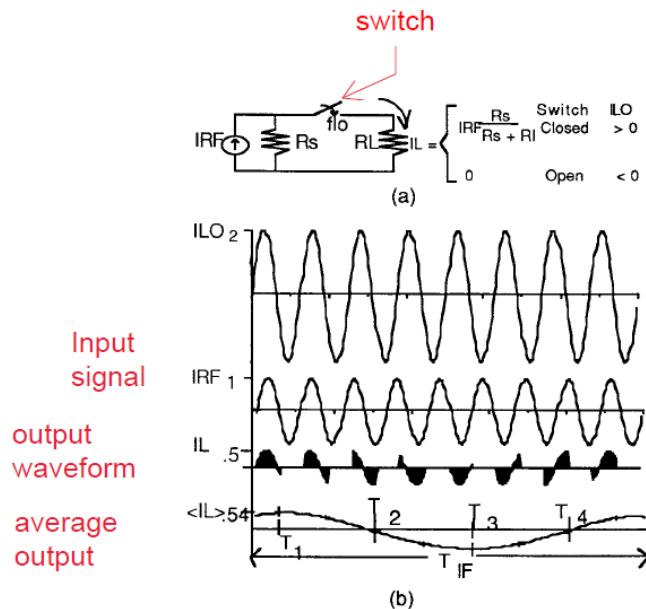
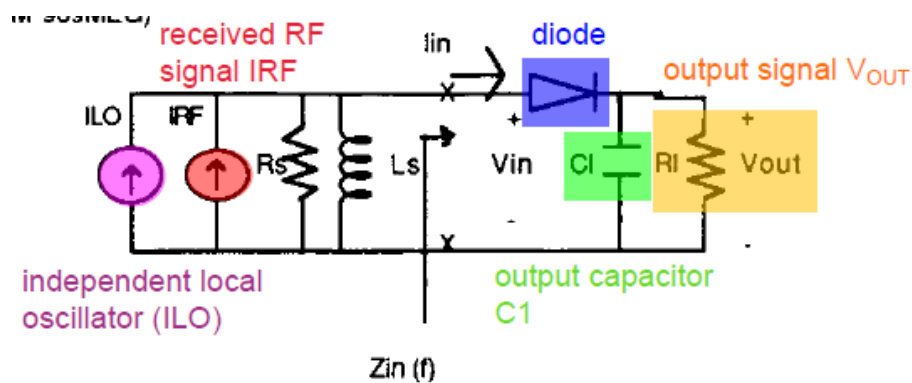
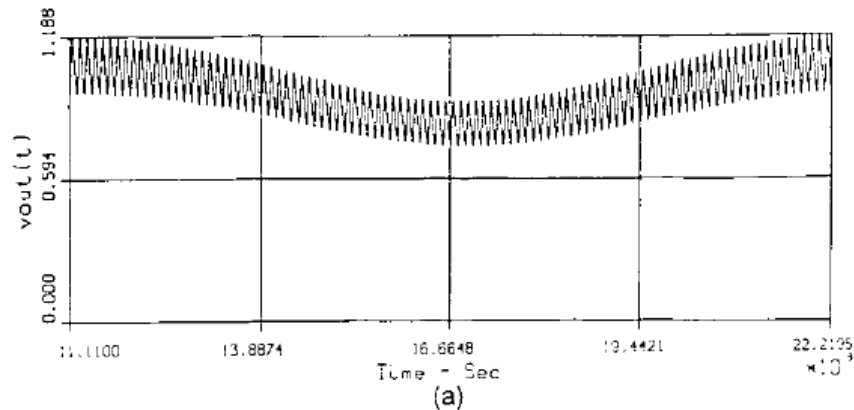


Figure 2. Mixer modelled as a simple switch:
(a) circuit diagram; (b) waveforms.

One embodiment of such a mixer for down-conversion is a single-ended mixer, depicted in Estabrook-1988's Figure 3 which has a nearly identical circuit diagram and the same simulation values as Estabrook-Thesis's Figure 14(a), including the ILO, IRF, diode switch, capacitor, and output V_{OUT} :



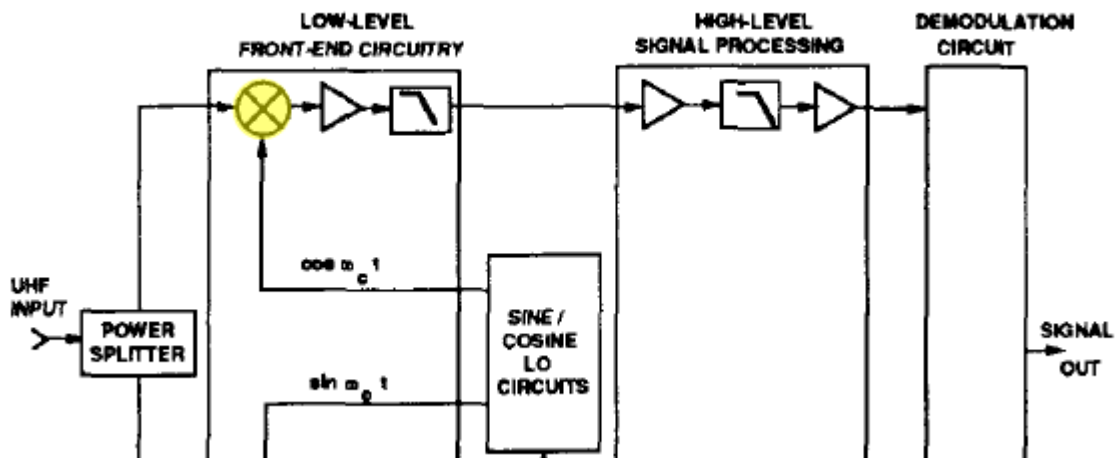
Estabrook-1988 shows the output V_{OUT} of this circuit as the same waveform shown in Figure 16(a) of Estabrook-Thesis:



EX1002, ¶¶328-331.

2. Estabrook-1989

Estabrook-1989 describes “The Design of Mobile Radio Receiver Using a Direct Conversion Architecture.” Figure 1 (corresponding to Estabrook-Thesis’s Figure 4) shows the high-level architecture of the receiver, including a mixer (highlighted in yellow below) at the front end:



Estabrook-1989 explains two types of mixers have been optimized for that purpose, including the single-ended mixer described in Estabrook-1988, to which

Estabrook-1989 refers back. EX1017, 66-67; EX1002, ¶¶332-334.

3. Motivation to Combine

A POSITA would have been motivated to combine Young, Estabrook-1988, and Estabrook-1989. First, a POSITA would have recognized Estabrook-1988 and Estabrook-1989 are related references describing ongoing work on the same project by the same authors, as shown by Estabrook-1989's citation to Estabrook-1988. EX1017, 67, 72; EX1002, ¶335. Estabrook-1989 describes at a high level a direct-conversion receiver which utilizes a mixer such as a single-ended mixer (EX1017, 67), whose structure and (simulated) performance are described in more detail in Estabrook-1988.

Young teaches its each receiver path includes a “down converter and demodulator” block 64 and 66, but omits a detailed description of those blocks. Therefore, a POSITA would have been motivated to look elsewhere to find a suitable circuit that accomplishes the functions specified by those blocks. EX1002, ¶336.

Estabrook-1989 supplies such a down-conversion and demodulation circuit, including a mixer whose structure and (simulated) performance are described in more detail in Estabrook-1988. Estabrook-1989 teaches that its direct-conversion receiver provides several advantages over traditional heterodyne receivers including reduced interference, good selectivity, size and power consumption advantages, and simplified signal performance at IF frequencies. Estabrook-1989, 64. A POSITA

would have recognized Estabrook-1989's and Estabrook-1988's direct conversion circuit would perform the functions specified by Young's blocks 64 and 66 (that is, down-conversion of received input signals using the mixer, followed by demodulation) and provide the same benefits in Young's system. EX1002, ¶¶338-339.

Therefore, a POSITA would have recognized the down-conversion circuit of Estabrook-1989 and Estabrook-1988 would improve the circuit taught by Young which requires such a down-conversion circuit, and would accomplish that function with predictable results and the same benefits taught by Estabrook-1989. EX1002, ¶¶340-342. Alternatively, Estabrook-1989's and Estabrook-1988's down-conversion circuit provides a substitute circuit performing the same function as other known down-conversion and demodulation circuits which would perform the function specified by Young's blocks 64 and 66. A POSITA would have recognized Estabrook-1989's and Estabrook-1988's circuit is designed to take as its input RF carrier signals like those taught by Young, down-convert them (using the mixer circuit), and then demodulate them. EX1002, ¶342. Because Estabrook-1989's and Estabrook-1988's receiver is a "down converter and demodulator" as called for by Young, a POSITA would have had a reasonable expectation of success in integrating the circuit taught by Estabrook-1989 and Estabrook-1988 into each "down-converter and demodulator" of Young's down-conversion system. EX1002, ¶342.

4. Claim 11

a. 11[pre]-11[1.3]

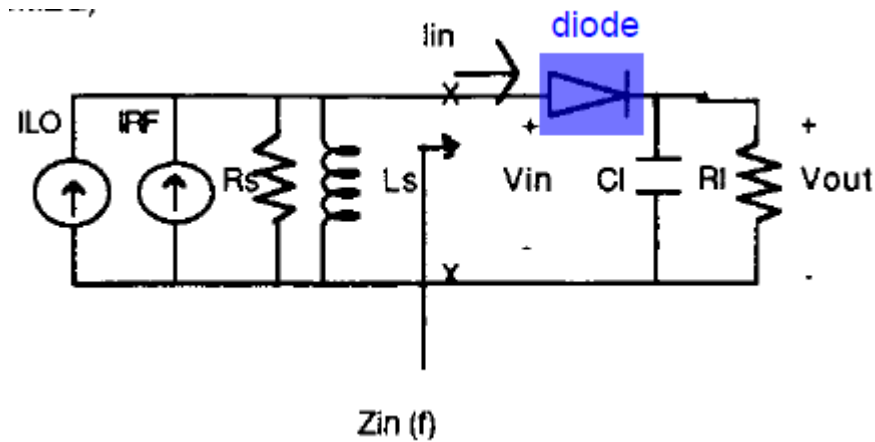
11[pre]-11[1.3] are disclosed by Young for the reasons described regarding Ground 2A. §§VIII.B, VIII.B.4.a-VIII.B.4.d; EX1002, ¶343.

b. 11[1.4]

The combination of Young, Estabrook-1989, and Estabrook-1988 teaches 11[1.4]. As discussed in §VIII.B.4.e, Young teaches all of 11[1.4] except it does not teach the specific details of its two “down converter and demodulator[s].” EX1002, ¶344. A POSITA would have been motivated to combine the circuit of Estabrook-1988 and Estabrook-1989 with Young to accomplish the down-conversion and demodulation functions for Young’s Radio A and Radio B. The FTM components for which the Petition relies on Estabrook-1988 and Estabrook-1989 are discussed in detail below. EX1002, ¶344.

c. 11[FTM-1.1]

The combination of Young, Estabrook-1989, and Estabrook-1988 teaches 11[FTM-1.1]. When the conversion circuit taught by Estabrook-1988 is used in the down-converter taught by Young, the diode in Estabrook-1988’s single-ended mixer operates as a switch. Estabrook-1988, 1108, Fig. 3:



The diode teaches a switch because it passes current (and therefore closes the circuit) only when the forward voltage exceeds a threshold (i.e., it is “an electronic device for opening and closing a circuit” that meets Petitioner’s proposed construction). EX1002, ¶¶345-347. Estabrook-1988’s Figure 5 illustrates how the diode passes current during the “on” time of the diode:

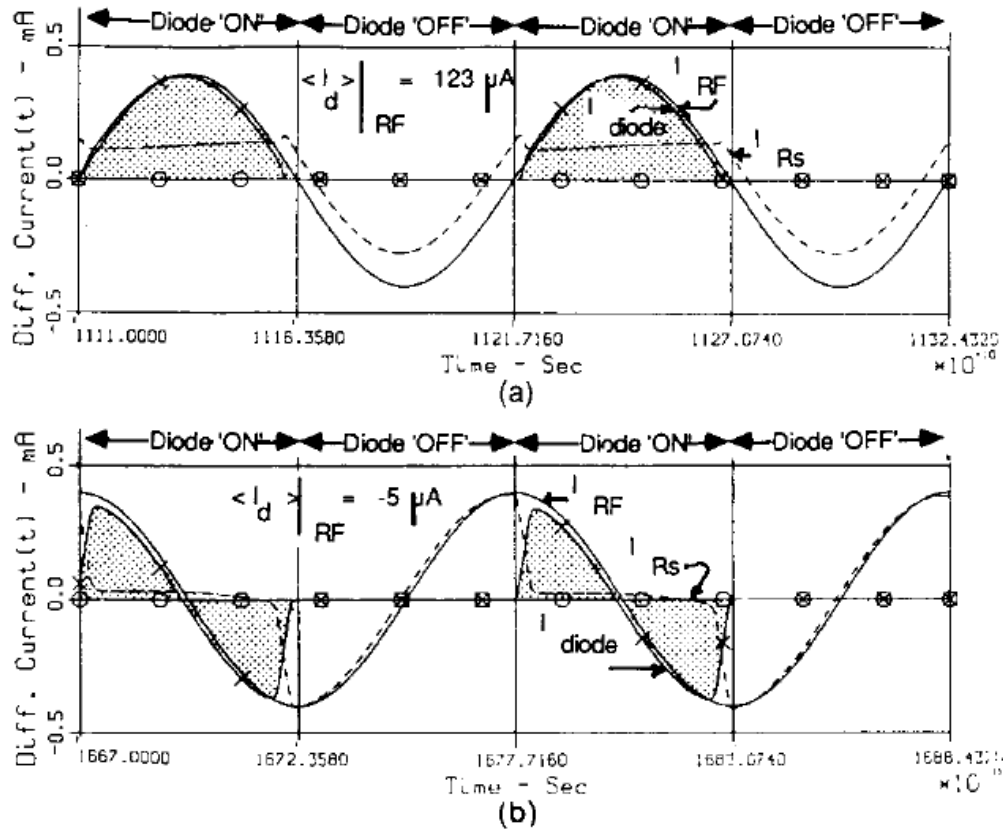
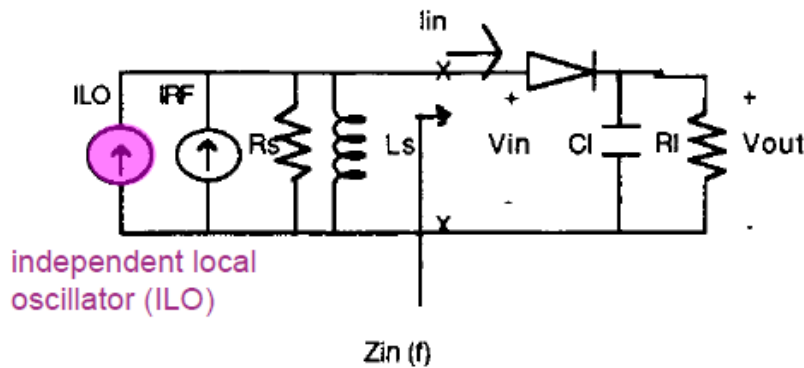


Figure 5. Differential currents due to I_{RF} :
(a) in-phase; (b) quadrature-phase.

As discussed in §§VII.B, VIII.B.4.b, Estabrook-1988 teaches a switch even if the switch must be “dictated by an independent control input,” because the diode is turned on by ILO (its on-time is half the ILO duty cycle), and ILO is an independent control input set to a defined frequency. EX1016, 1108; EX1002, ¶¶348-351.

d. 11[FTM-1.2]

The Young-Estabrook-1988-Estabrook-1989 combination teaches 11[FTM-1.2]. Estabrook-1988 teaches the diode (switch) is configured to operate according to an energy transfer signal in the form of local oscillator signal ILO:



ILO is an energy transfer signal because the input from ILO is necessary to activate the diode and close the diode (switch) (as discussed above regarding Ground 2A and element 11[FTM-1.1], §§VIII.B, VIII.B.4.f), and when the diode (switch) is closed, it passes current (and therefore energy) through the diode from the combined signal of ILO and IRF. EX1002, ¶¶352-354. Estabrook-1988's Figure 5 shows current from the RF signal (I_{RF}) passes through the diode (and therefore energy is transferred) when the diode is "on":

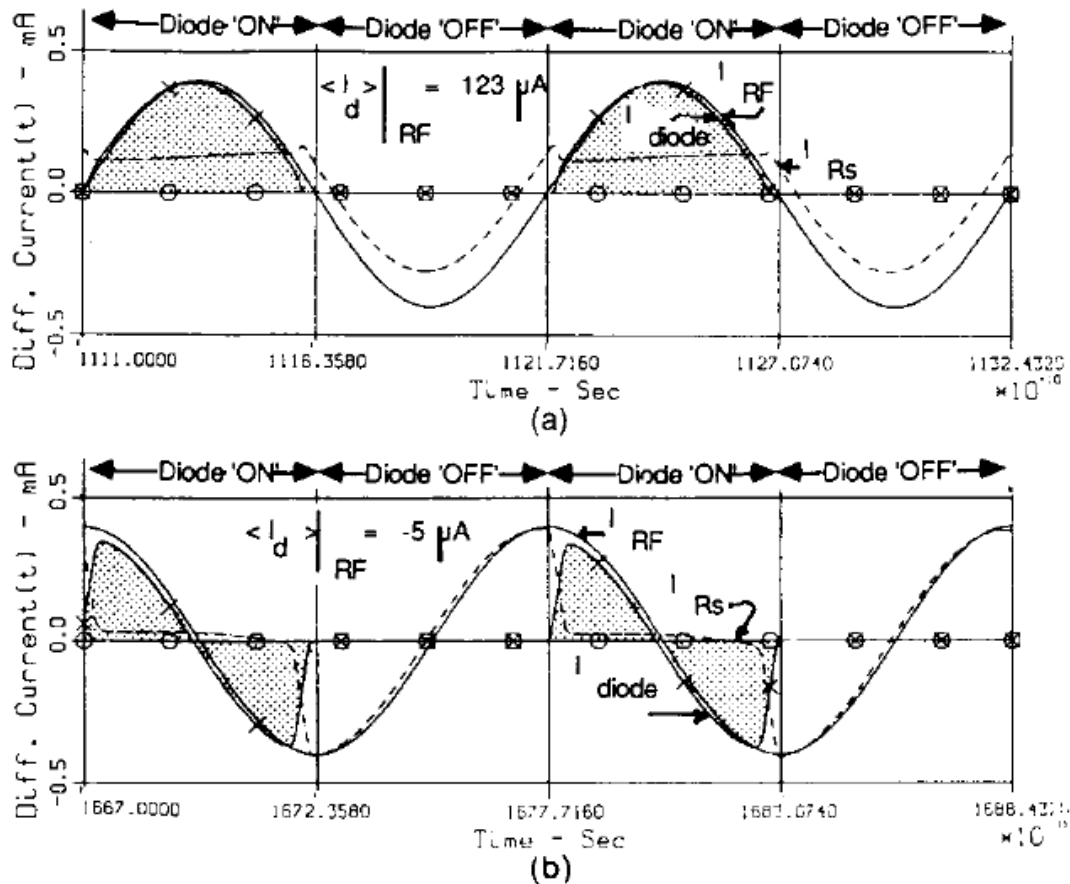


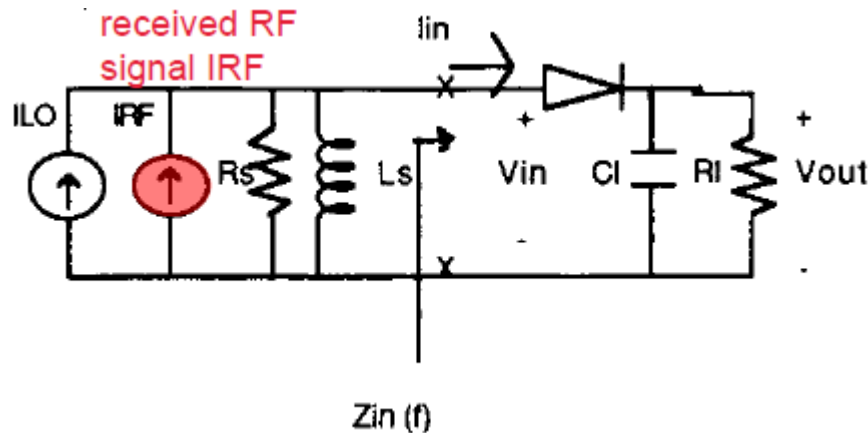
Figure 5. Differential currents due to I_{RF} :
(a) in-phase; (b) quadrature-phase.

EX1002, ¶353. Estabrook-1988 states the “on” time of the diode is 50% of the ILO period (Estabrook-1988, 1107-08), and as discussed regarding Ground 2A, §§VIII.B, VIII.B.4.g, this disclosure is consistent with the “energy transfer signal” disclosed in the ’686 Patent.

e. 11[FTM-1.3]

The Young-Estabrook-1988-Estabrook-1989 combination teaches 11[FTM-1.3]. As discussed above for 11[FTM-1.2], §VIII.B.4.g, when Estabrook-1988’s

diode (“switch”) is “on,” it transfers energy from the combined signals of ILO and IRF, the latter of which teaches first EM signal:

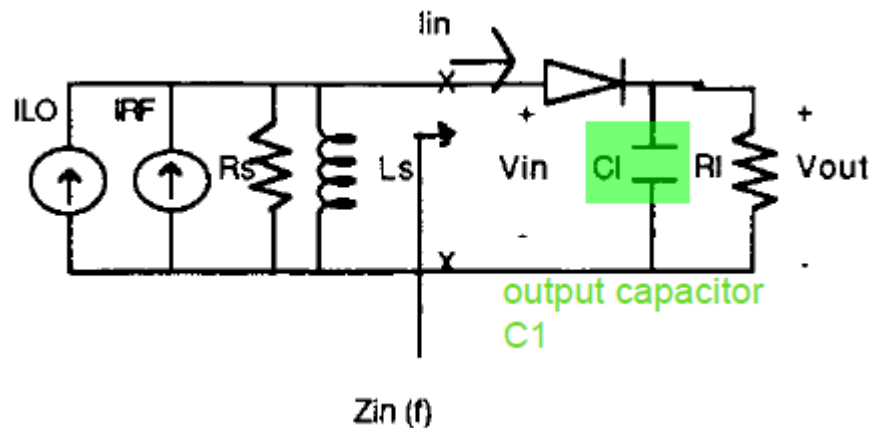


The diode (“switch”) “sub-samples” energy from IRF because it passes energy from IRF at an aliasing rate driven by ILO (900 MHz), which is less than twice the frequency of the signal (IRF) being sampled (909 MHz). *See* §VII.E; EX1016, 1107, Fig. 2 (simulation values showing ILO and IRF frequencies of 900 MHz and 909 MHz), Fig. 5; EX1002, ¶¶356-358. As shown in Figure 5 and discussed for 11[FTM-1.2], §VIII.B.4.g, the diode passes current (and therefore energy) from the IRF signal when the diode is on. EX1002, ¶353. As discussed regarding Ground 2A, §§VIII.B, VIII.B.4.h, the 50% diode “on” time for Estabrook-1988 is consistent with the energy transfer described in the preferred embodiment in the ’686 Patent. EX1002, ¶¶358-359.

f. 11[FTM-2.1]

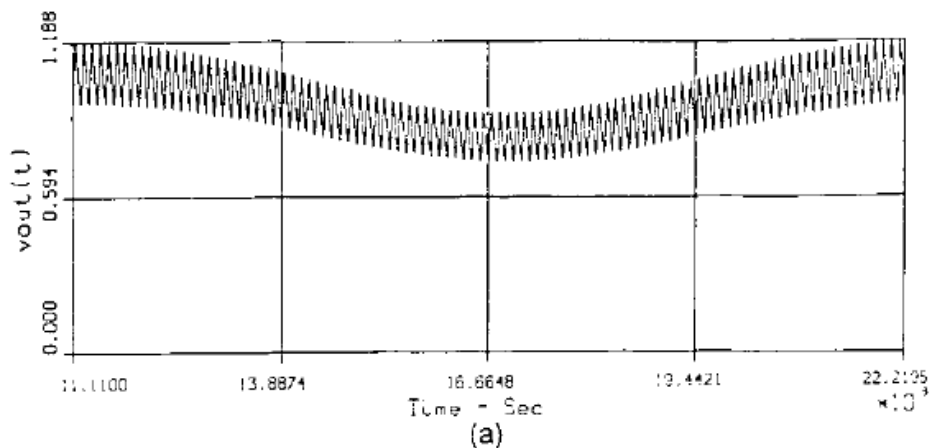
The Young-Estabrook-1988-Estabrook-1989 combination teaches 11[FTM-

2.1]. Estabrook-1988 teaches a storage module in the form of output capacitor C_1 , which is coupled to (directly connected) and stores energy transferred from the diode:

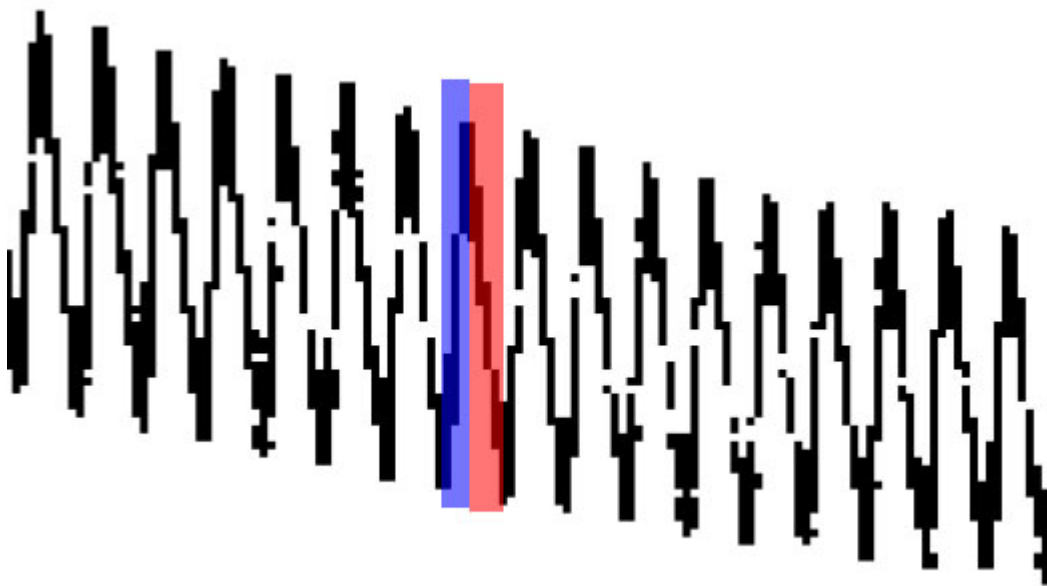


This is consistent with the '686 Patent's disclosure of using a capacitor for the storage module. '686 Pat., 14:39-44, 18:6-19, Figs. 20A, 51A; EX1002, ¶¶360-361.

The capacitor C_1 stores energy transferred through the diode when the diode is closed (on) and discharges it at V_{OUT} when the diode is open (off). The discharge of stored energy from the capacitor is shown in Figure 4(a) of Estabrook-1988:



A zoomed-in view of Estabrook-1988's Figure 4(a) shows that each sawtooth waveform (corresponding to one closing and opening of the diode during a cycle of ILO) has a rising edge (blue) and a falling edge (red). The rising edge is generated when the diode is on and current of both ILO and IRF pass through. The falling edge is generated when the diode is off, and no current passes through the diode. As a result, the only source of current during the falling edge is the energy stored in capacitor C_1 , so the falling edge voltage of V_{out} shown below is generated from the energy previously stored in capacitor C_1 :



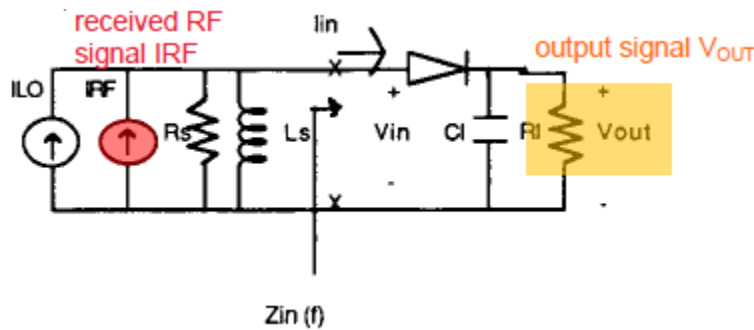
EX1002, ¶¶362-363. The amount of energy stored by the capacitor is non-negligible

because the capacitor stores the energy transferred during half of the duty cycle of ILO, as discussed above for 11[FTM-1.1], 11[FTM-1.2], §§VIII.B.4.f-VIII.B.4.g. Because the output signal V_{out} is recovered from energy discharged by the capacitor, the energy discharged by the capacitor is distinguishable from noise. EX1002, ¶364.

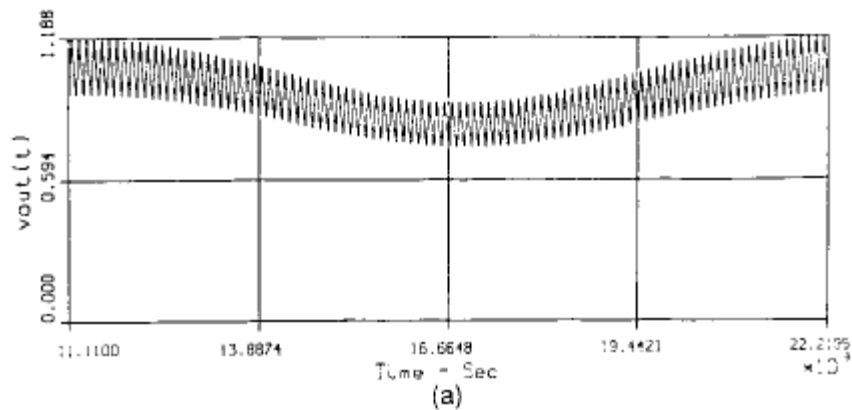
As discussed regarding Ground 2A, §§VIII.B, VIII.B.4.i, this waveform in Estabrook-1988, and the way that it is generated (i.e., by a capacitor storing charge when a switch is open and discharging it across a load when the switch is closed) is substantially similar to the corresponding description and figures in the '551 Patent, which is incorporated by reference into the '686 Patent. As further discussed regarding Ground 2A, §§VIII.B, VIII.B.4.i, a capacitor which stores energy during a 50% “on” time of the ILO duty cycle is an “energy transfer system” even under PO’s restrictive definition. And if the system must have a “low impedance load,” Estabrook-1988 teaches it because its load resistance (modeled as R_1) is 1 K Ω , less than the '686 Patent’s disclosure of using 2 K Ω for downconverting a 900 MHz RF signal. '686Pat., Fig. 51B; EX1002, ¶¶365-369.

g. 11[FTM-2.2]

The Young-Estabrook-1988-Estabrook-1989 combination teaches 11[FTM-2.2]. Estabrook-1988 discloses Figure 2’s mixer generates a second EM signal, V_{out} , that is a downconverted signal from the IRF input signal, and which is in turn shown in Fig. 4(a):



Estabrook-1988, Fig. 3.



Estabrook-1988, Fig. 4(a).

As discussed for 11[FTM-2.1], §VIII.B.4.i, the V_{out} signal is generated from energy stored in capacitor C_1 . Although the output signal includes individual “sawtooth” waveforms at the frequency of ILO, the voltage of the peaks and troughs of those waveforms varies at the lower intermediate frequency (IF), for which Figure 4(a) illustrates one cycle. EX1002, ¶¶370-371. In the example of a 909 MHz IRF and a 900 MHz ILO (Estabrook-1988, Fig. 2), the resulting IF of V_{out} is 9 MHz, which can be calculated as the inverse of the cycle time (11.1095×10^{-8} seconds) shown in Figure 4(a). EX1002, ¶¶371-372. Thus, V_{out} ’s frequency (second EM

signal) is different from the 909 MHz frequency of the IRF (first EM signal).

h. 11[2]-11[3]

Elements 11[2] and 11[3] are disclosed by Young for the reasons discussed in Ground 2A, §§VIII.B.4.k-VIII.B.4.l. EX1002, ¶¶373-374.

5. Dependent claims 12-20

The additional limitations of dependent claims 12 and 14-20 are taught or suggested by Young for the reasons discussed in Ground 2A, §§VIII.B.5.a, VIII.B.5.c-VIII.B.5.i, respectively. EX1002, ¶¶375-376, 380-412. Further, the Young-Estabrook-1988-Estabrook-1989 combination teaches claim 13’s additional limitation for the reasons explained in Ground 2A, §VIII.B.5.b. EX1002, ¶¶377-379.

6. Claim 1

Claim 1 is similar to claim 11, except that it is written to cover an apparatus rather than a method of using that apparatus, and omits the claim 11’s “storage module.”

a. 1[pre]

See 11[pre], §VIII.B.4.a. EX1002, ¶414.

b. 1[a]

See 11[1.1], §VIII.B.4.b, regarding the “multi-platform module” and 11[1.4], VIII.B.4.e and VIII.C.4.b, regarding the “plurality of transceivers each having at

least one [FTM].” EX1002, ¶415.

c. 1[b]

See 11[FTM-1.1], 11[FTM-1.2], 11[FTM-1.3], §§VIII.B.4.f-VIII.B.4.h. EX1002, ¶416.

d. 1[c]

See 11[1.1], 11[11.2], §§VIII.B.4.f-VIII.B.4.g, regarding the “control module configured to enable the at least one multi-platform module to communicate with at least one of a plurality of communication links” and 11[1.3], §VIII.B.4.h, regarding the “plurality of protocol/standard sub-modules.” EX1002, ¶417.

7. Dependent claims 2-10

The claims that depend from claim 1 add substantially similar elements to the claims that depend from claim 11, and these claims are taught by Young in view of Estabrook for similar reasons.

a. Claim 2

See claim 12 and Ground 2A, §§VIII.B, VIII.B.5.a. EX1002, ¶419.

b. Claim 3

See claim 13 and Ground 2A, §§VIII.B, VIII.B.5.b. EX 1002, ¶420.

c. Claim 4

See claim 14 and Ground 2A, §§VIII.B, VIII.B.5.c. EX1002, ¶421.

d. Claim 5

See claim 14 and Ground 2A, §§VIII.B, VIII.B.5.c. EX1002, ¶422.

e. Claim 6

See claim 15 and Ground 2A, §§VIII.B, VIII.B.5.d. EX1002, ¶423.

f. Claim 7

See claim 16 and Ground 2A, §§VIII.B, VIII.B.5.e. EX1002, ¶424.

g. Claim 8

See claim 17 and Ground 2A, §§VIII.B, VIII.B.5.f. EX1002, ¶425.

h. Claim 9

See claim 18 and Ground 2A, §§VIII.B, VIII.B.5.g. EX1002, ¶426.

i. Claim 10:

See claim 19 and Ground 2A, §§VIII.B, VIII.B.5.h. EX1002, ¶427.

IX. THE BOARD SHOULD INSTITUTE REVIEW

A. The Board Should Not Deny Institution Under *Fintiv*

Petitioner stipulates that if this IPR is instituted, Petitioner will not pursue in the related litigation the same grounds or any grounds of invalidity of the '686 Patent that could reasonably have been raised in this IPR. EX1015. The Board “will not discretionarily deny institution in view of parallel district court litigation where a petitioner presents” such a stipulation. *Interim Procedure for Discretionary Denials in AIA Post-Grant Proceedings with Parallel District Court Litigation*, 3 (June 21, 2022).

B. The Examiner Did Not Consider the References Forming the Basis of This Petition

The Board should also decline to exercise its discretion to deny review under 35 U.S.C. § 325(d) at least because the Examiner did not analyze the prior art forming the basis of this Petition; indeed, none of the references discussed herein were even cited during prosecution. Nor, to the best of Petitioner's knowledge, have any of the references presented here been considered in a Final Written Decision of an IPR on substantially similar claims. Moreover, the '686 Patent has never been subject to an IPR before.

X. CONCLUSION

Petitioner respectfully requests institution of *inter partes* review to cancel claims 1-20 of the '686 Patent.

XI. MANDATORY NOTICES UNDER 37 C.F.R. § 42.8(B)

A. REAL PARTY IN INTEREST

MediaTek Inc., MediaTek USA Inc., MTK Wireless Limited (UK), Gaintech Co. Limited, and MediaTek Investment Singapore Pte. Ltd. are the real parties-in-interest.

B. RELATED MATTERS

Patent Owner ParkerVision has asserted the '686 Patent in *ParkerVision v. MediaTek, Inc. et al.*, No. 6:23-cv-00375 (W.D.Tex. filed May 16, 2023) and *ParkerVision v. NXP Semiconductors NV et al.*, No. 6:23-cv-00389 (W.D.Tex. filed

May 19, 2023).

C. NOTICE OF COUNSEL AND SERVICE INFORMATION

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Petitioner consents to electronic service. All services and communications to the attorneys listed above may be sent to: PerkinsServiceMediatek-ParkerVisionIPRs@perkinscoie.com. A Power of Attorney is being filed concurrently.

Dated: May 21, 2024

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CERTIFICATE OF WORD COUNT UNDER 37 CFR §42.24(d)

Under 37 C.F.R. §42.24(d), the undersigned certifies that the word count for this *Petition for Inter Partes Review* totals 13,846, excluding the parts exempted by 37 C.F.R. §42.24(a).

The word count was made using the built-in word count function in the Microsoft® Word software used to prepare this document.

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CERTIFICATE OF SERVICE

The undersigned hereby certifies that true copies of this PETITION FOR *INTER PARTES* REVIEW OF U.S. PATENT NO. 7,483,686 and supporting materials (Exhibits 1001-XXX and Power of Attorney) were service via overnight delivery on the Patent Owner at the correspondence address of record as listed in the US Patent and Trademark Office Patent Center:

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