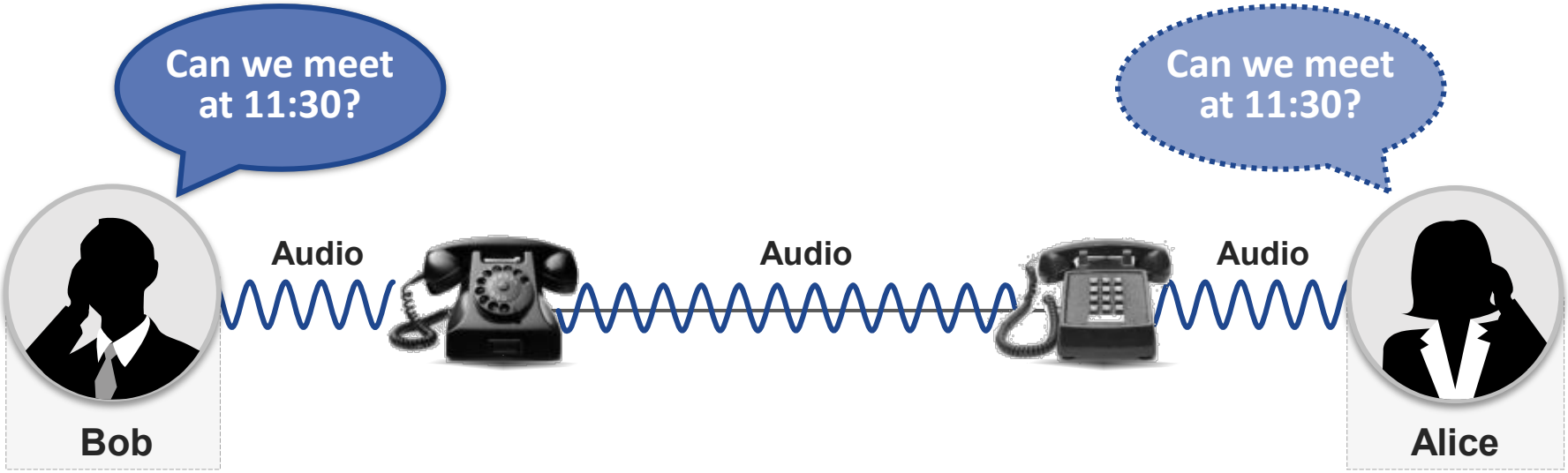
TCL/Hisense/LG, Petitioners
v.
ParkerVision, Inc., Patent Owner

Case No. IPR2021-00985
U.S. Patent No. 7,292,835

Patent Owner's Demonstratives

Technology Overview

Wired Communication

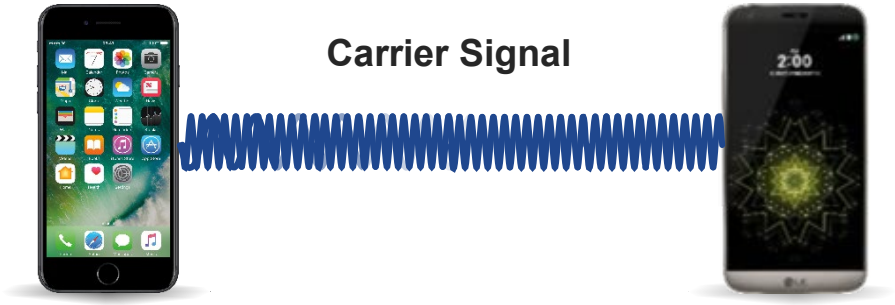


Audio signal is at low frequency.

Frequency

Wireless Communication

Wireless Communication



- **Cannot transmit the audio signal over the air.**
- **The audio signal must move to a higher frequency carrier signal.**

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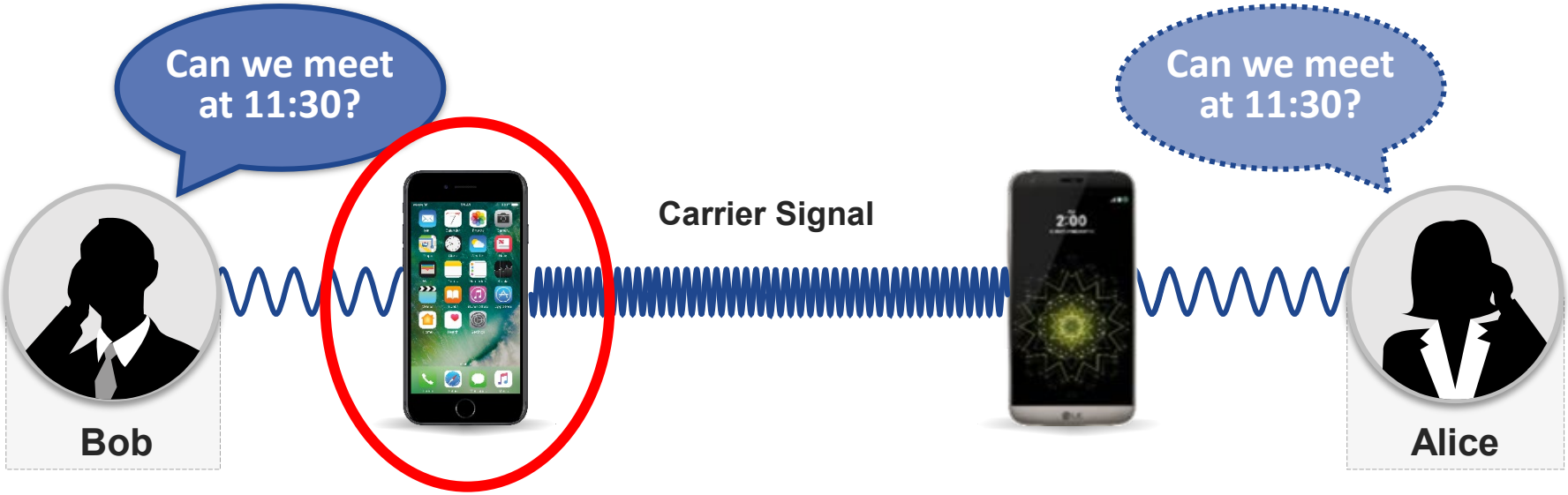
Wireless Communication



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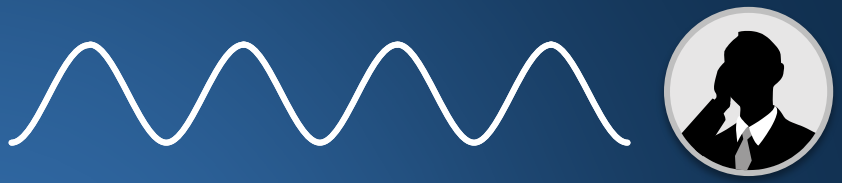
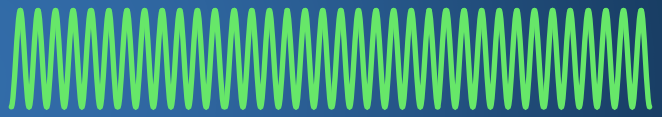
Modulation Involves Up-Conversion

Baseband Information

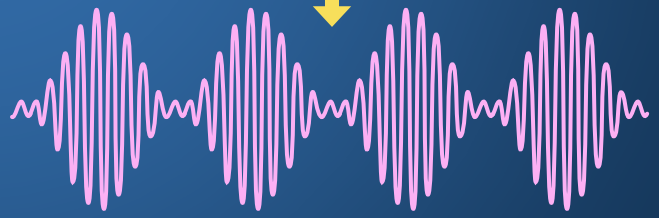


IMPRESSED ON

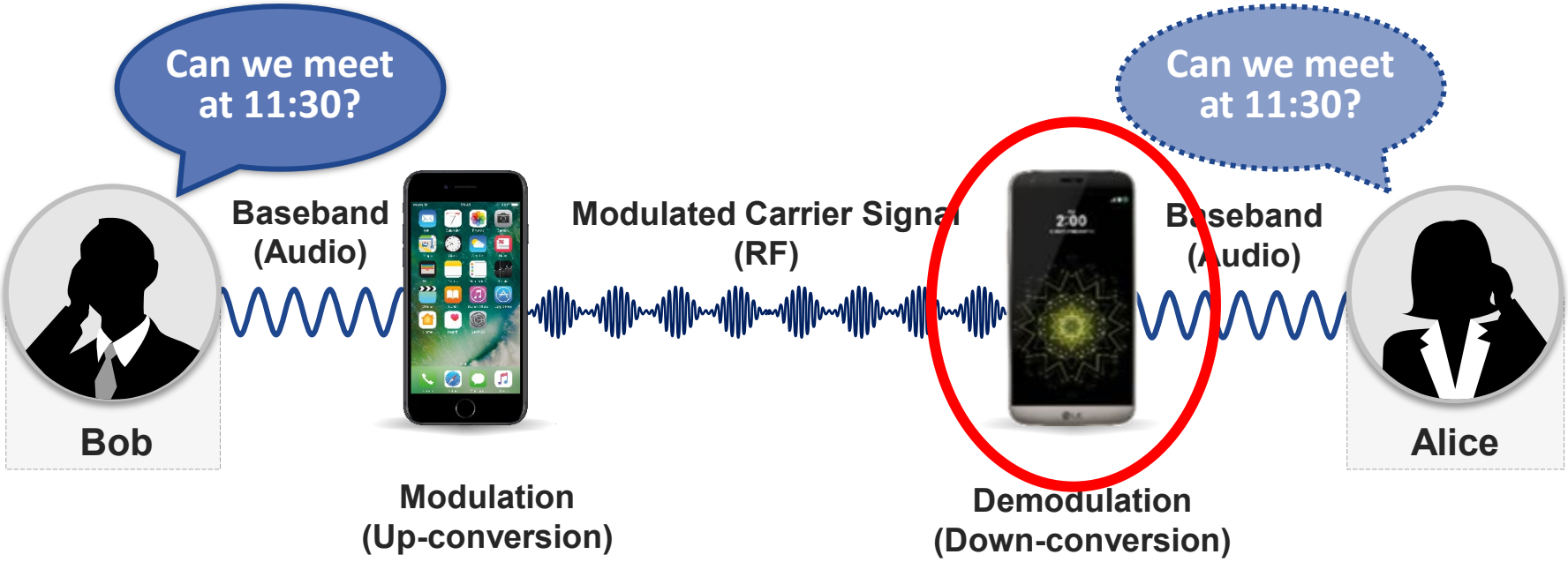
Carrier



Modulated Carrier

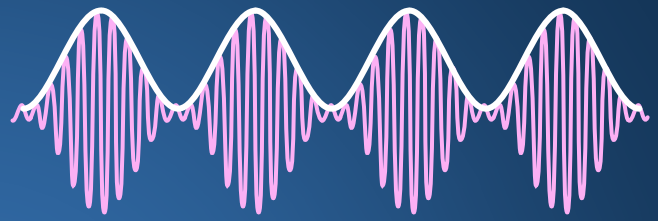


Wireless Communication



Demodulation Involves Down-Conversion

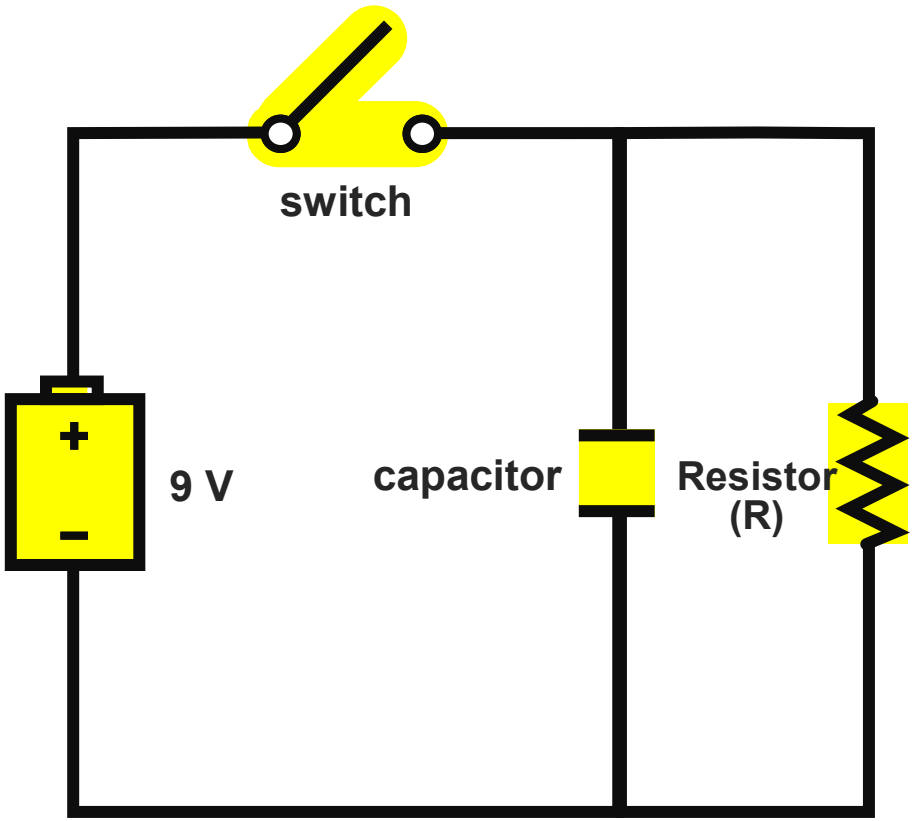
Modulated Carrier



Baseband Signal

Circuit Fundamentals

Circuit Fundamentals



- **Battery**
- **Switch**
- **Resistor**
- **Capacitor**

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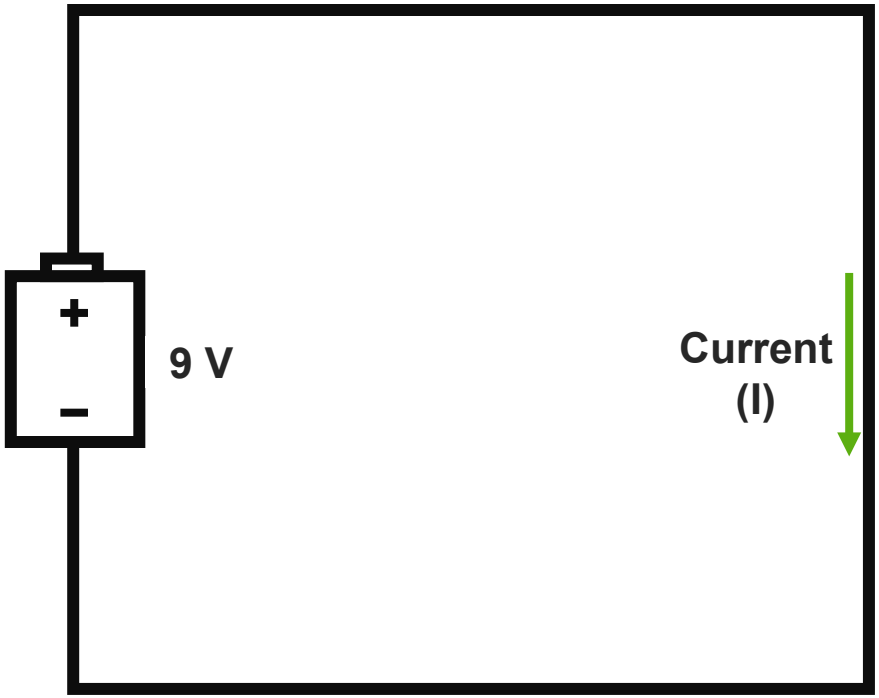
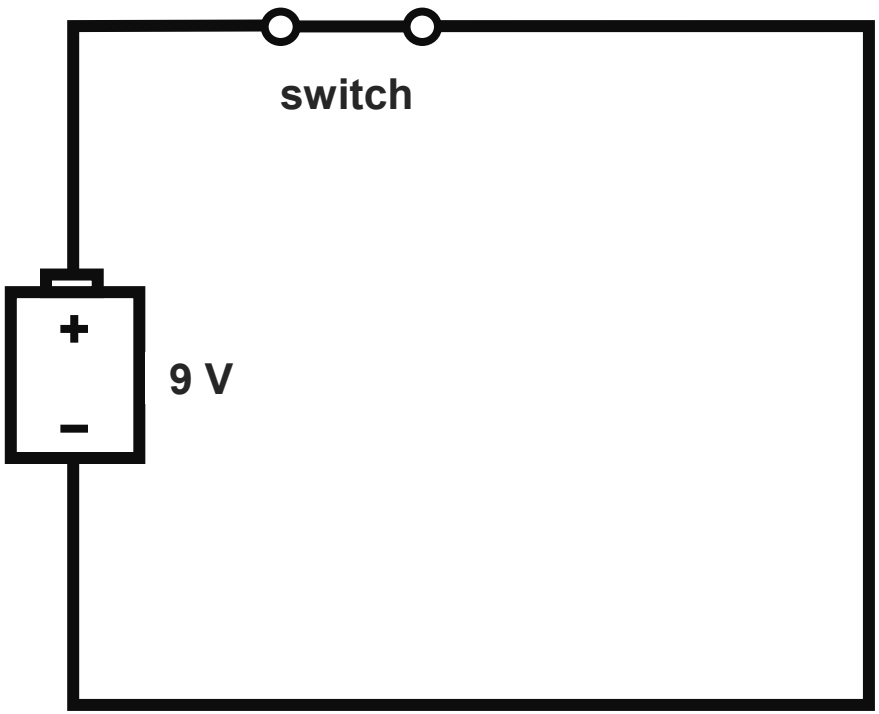
Circuit Fundamentals

Charge



- **Current**
  Movement of charge

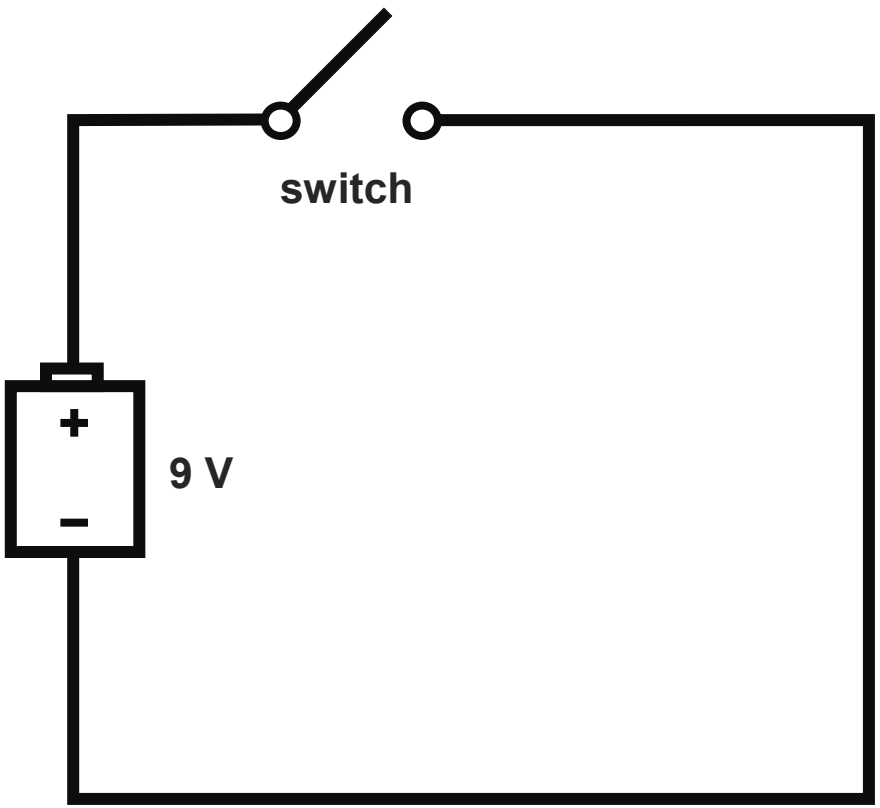
Circuit Fundamentals



- **Switch**
  - Current flows and energy transfers when on/closed
  - Current does not flow and energy does not transfer when off/open

Circuit Fundamentals

- Charge



- **Switch**
  - Current flows and energy transfers when on/closed
  - Current does not flow and energy does not transfer when off/open

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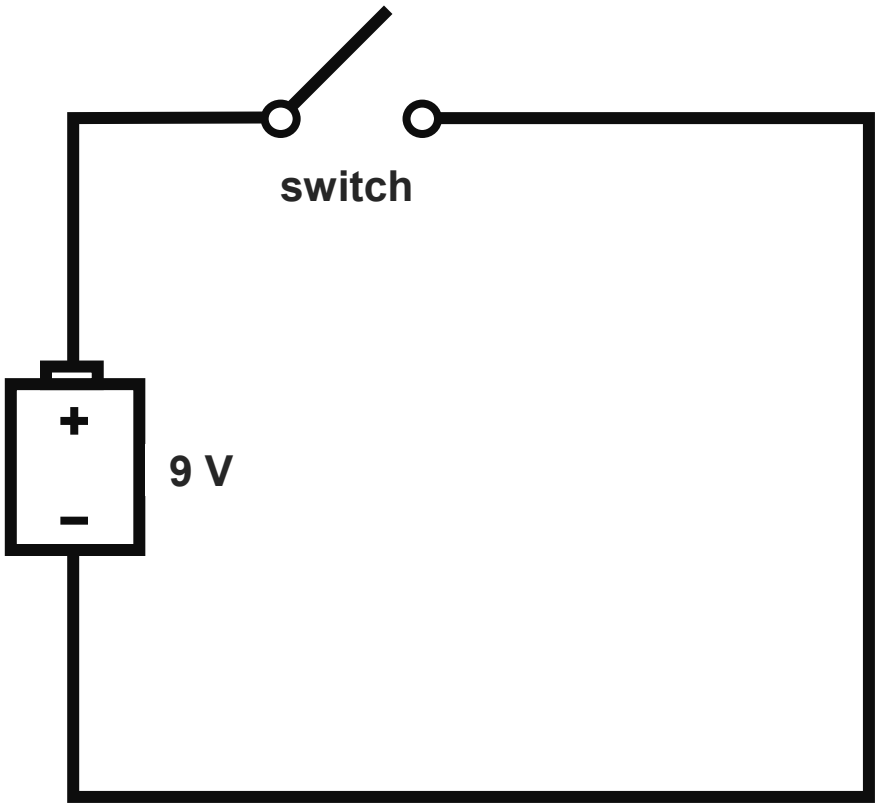
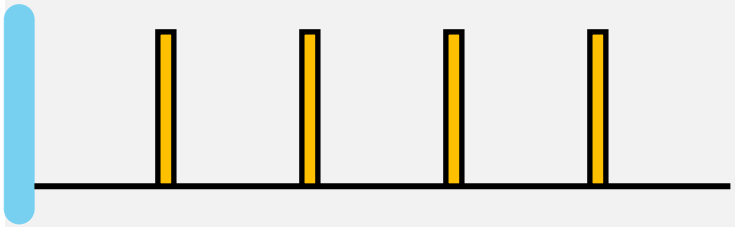
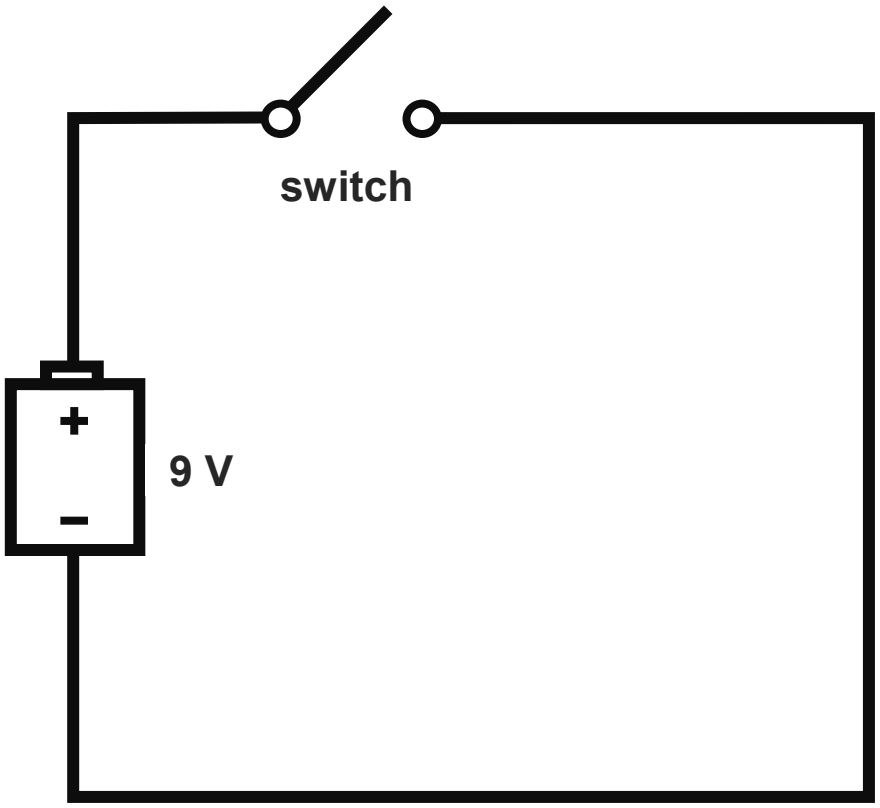
Circuit Fundamentals



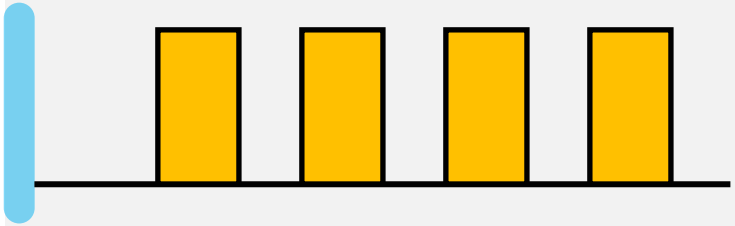
- **Control Signal**
  - Used to close/open an electronic switch
  - Controls Frequency
  - Controls Duration



Circuit Fundamentals

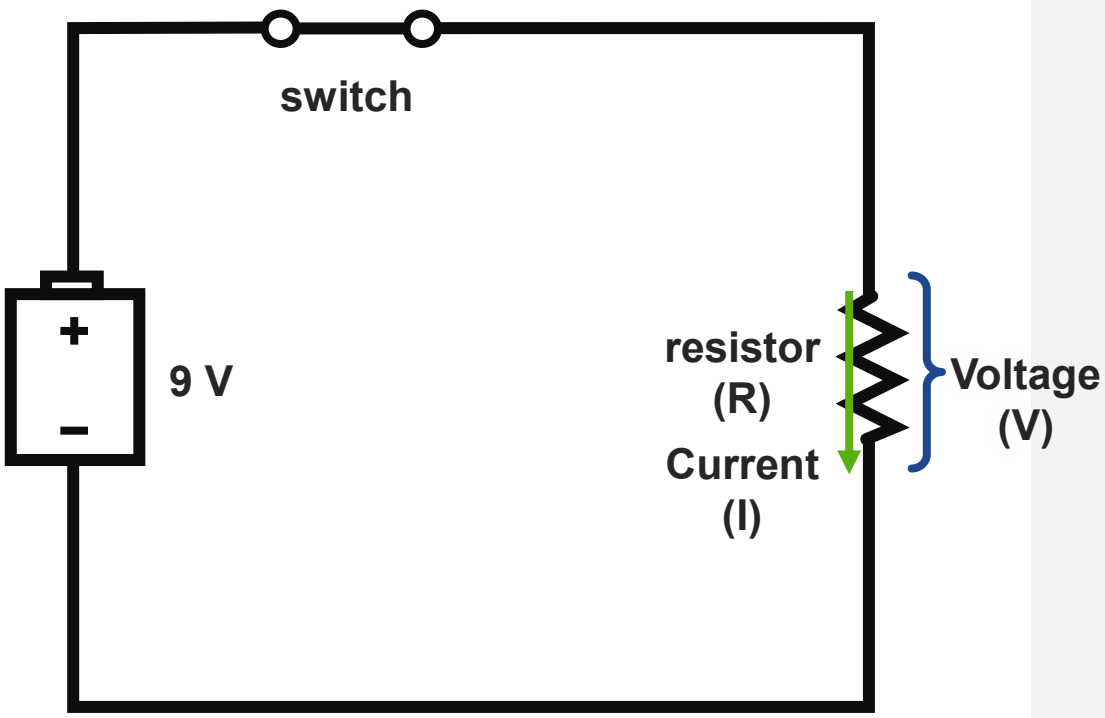


- **Control Signal**
  - Used to close/open an electronic switch
  - Controls Frequency
  - Controls Duration



Circuit Fundamentals

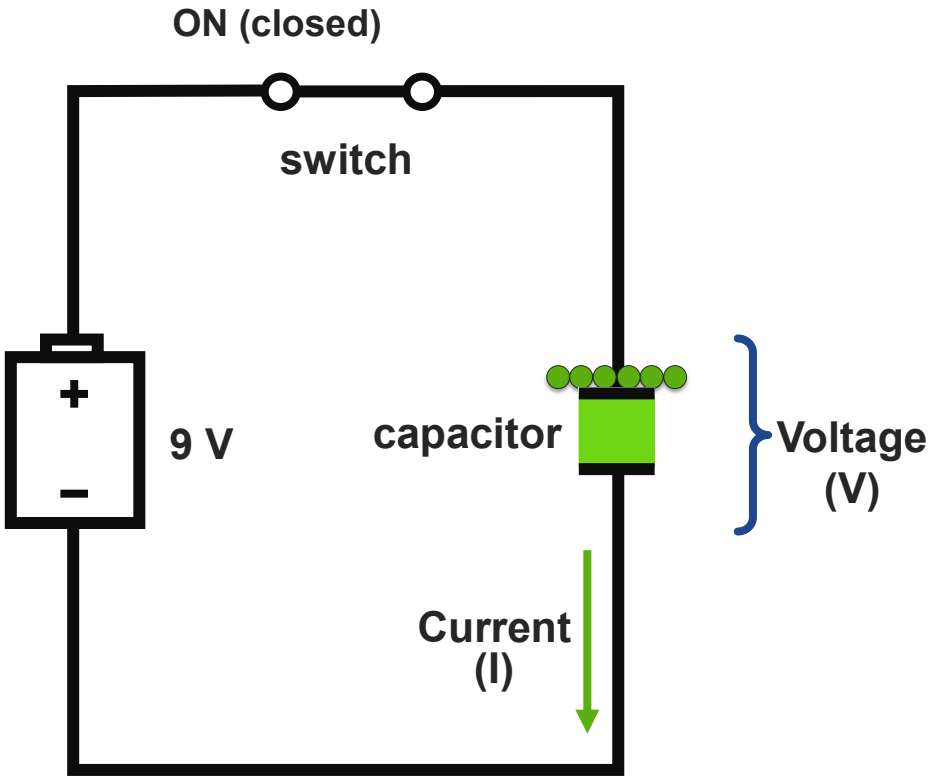
Charge



- **Resistor**
  Component that provides resistance to electrical current and dissipates energy
- **Voltage**
  The measure of energy dissipated in the resistor

Circuit Fundamentals

Charge

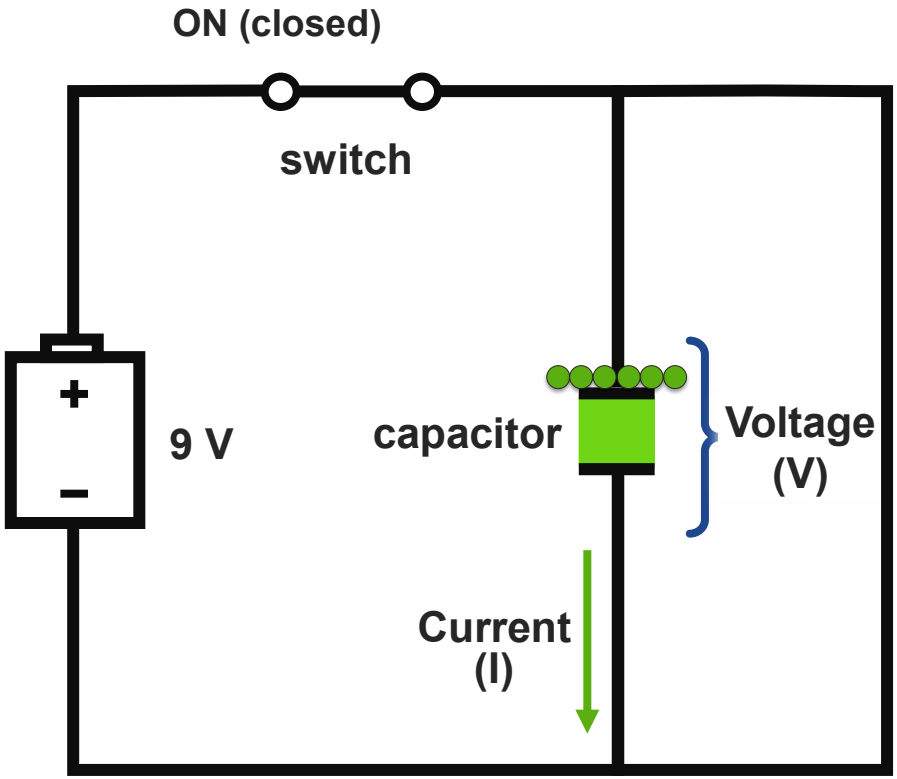


- **Capacitor**
  Component that collects charge
- **Voltage**
  - Difference in electrical potential between top and bottom plate
- **Charging**
  - Capacitor charges when the switch is closed
  - During charging current (charges) flows onto the plates of the capacitor

When a capacitor collects charge, it is charging.

Circuit Fundamentals

Charge



- **Capacitor**
  Component that collects charge
- **Discharging**
  - Capacitor discharges when it is shorted

When a capacitor loses charge, it is discharging.

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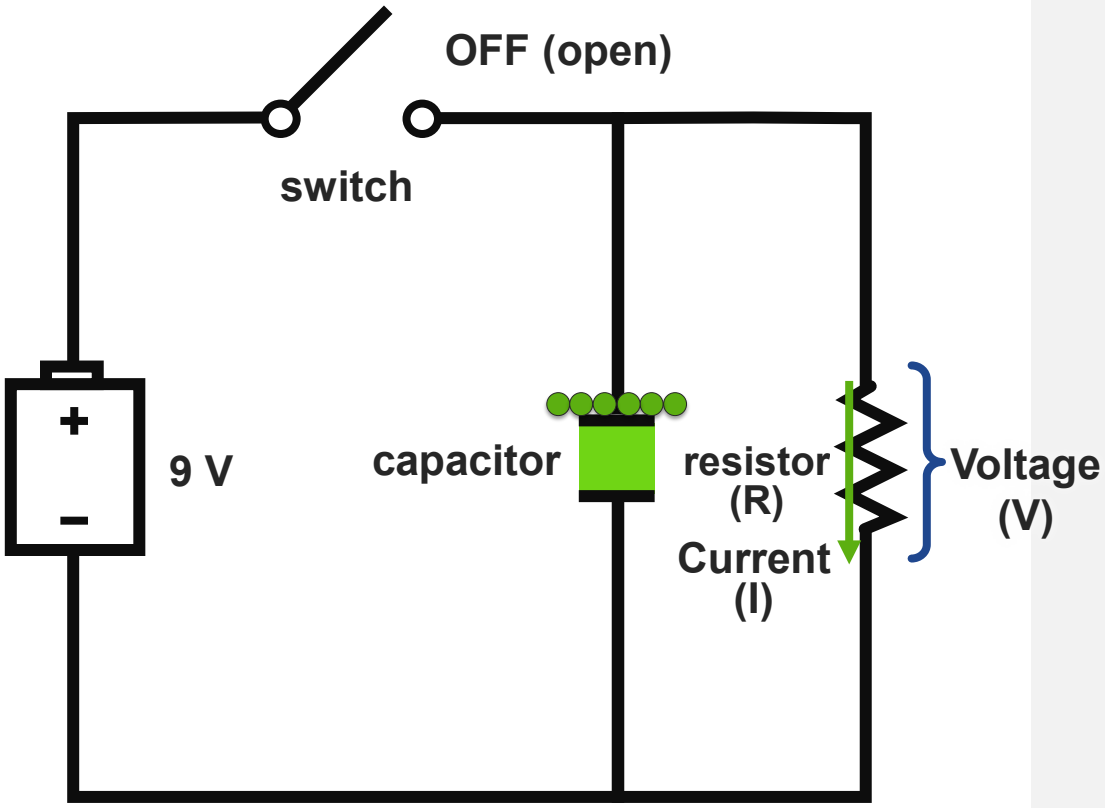
Circuit Fundamentals

Charge



- **Discharging**
  - Capacitor discharges when the switch is open
  - Current flows out from the capacitor

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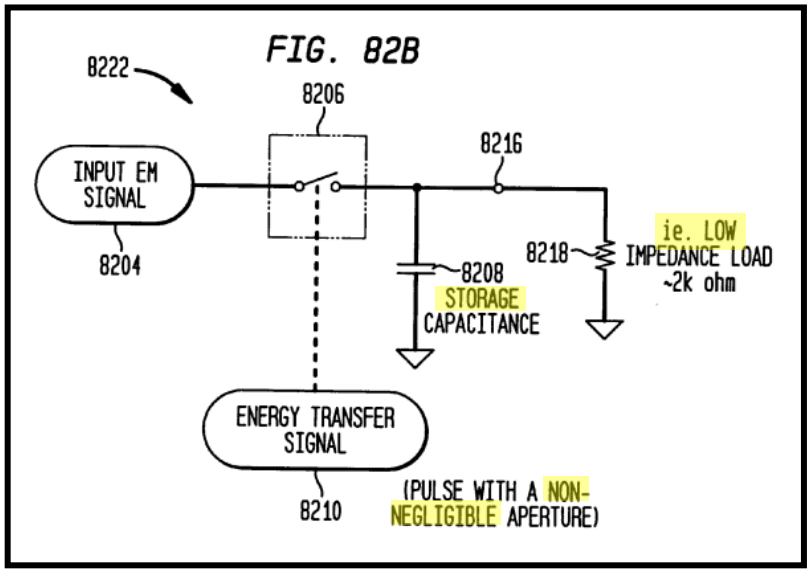
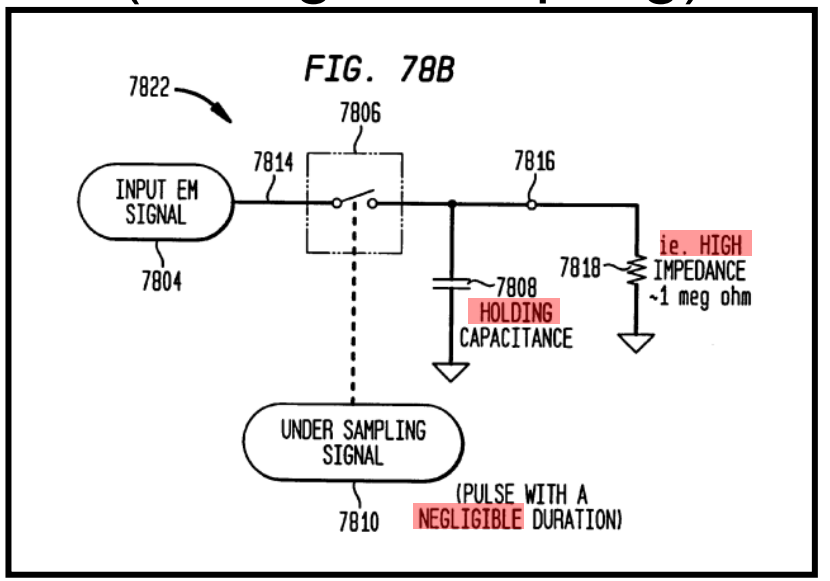
Energy Sampling
v.
Voltage Sampling

Energy Transfer (Energy Sampling)



Sample and Hold (Voltage Sampling)



Energy Transfer (Energy Sampling)

FIG. 82A

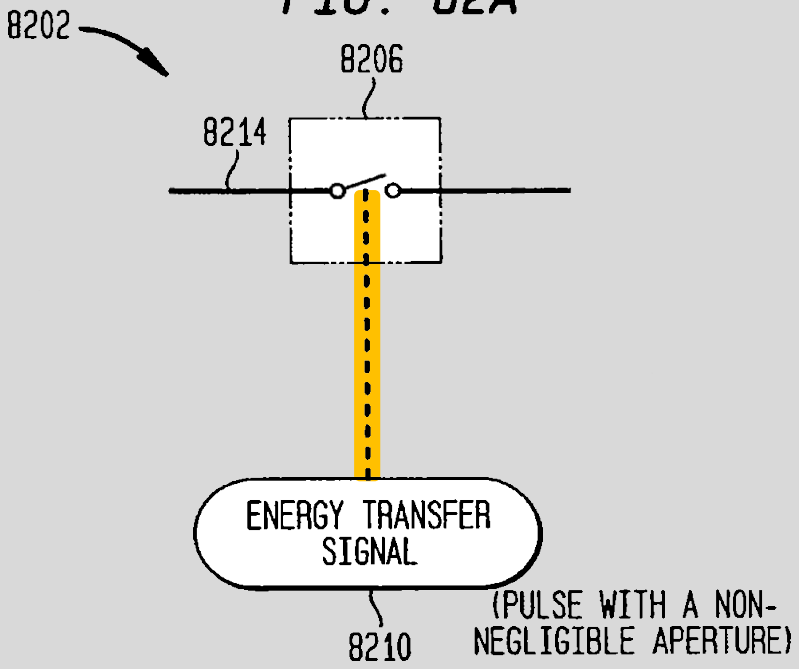


FIG. 57C

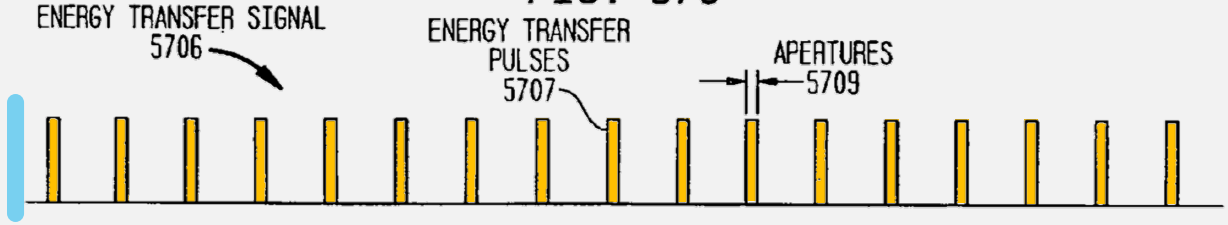


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FIG. 82A

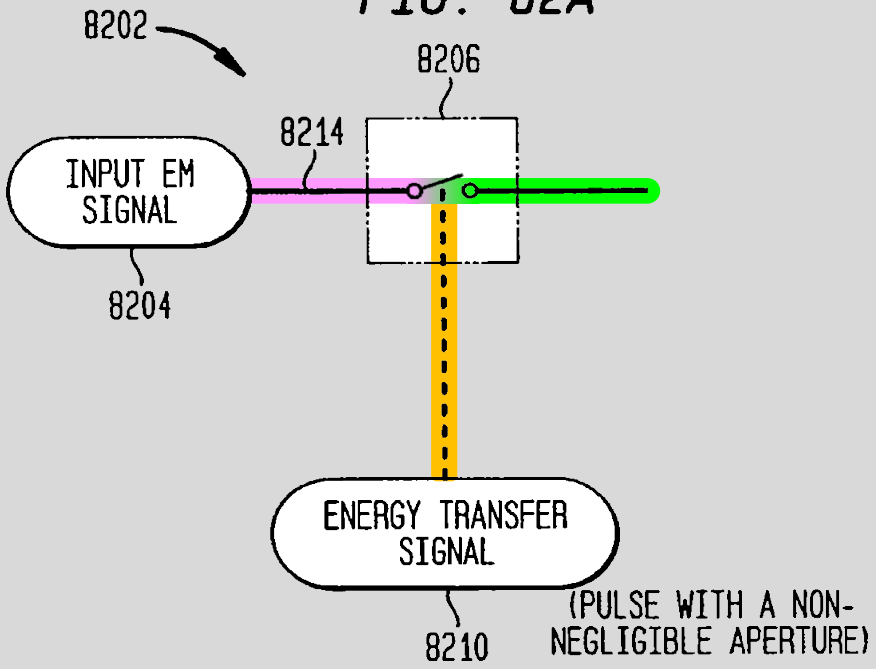

FIG. 57C

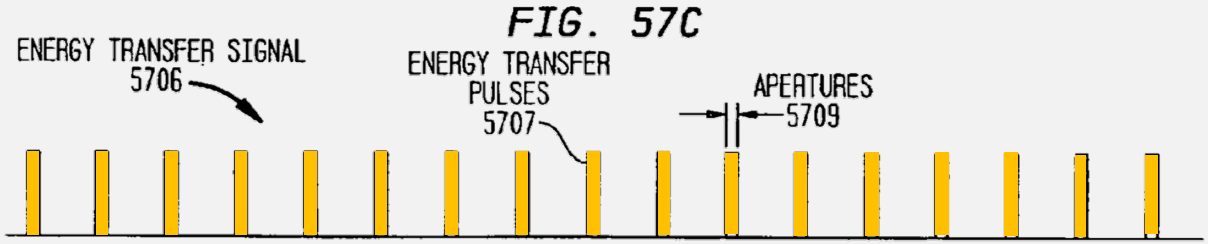

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FIG. 82A

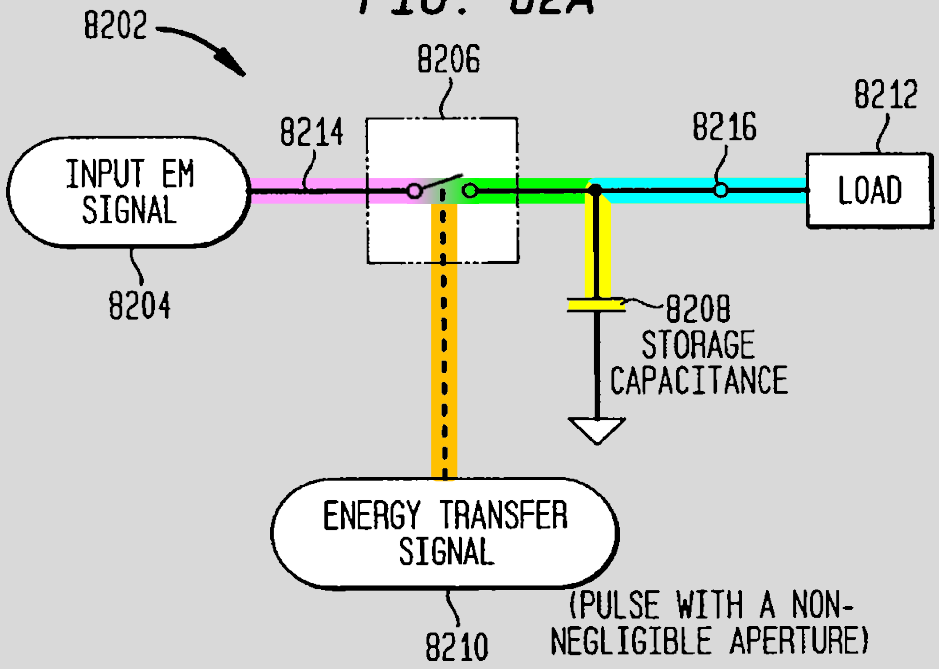
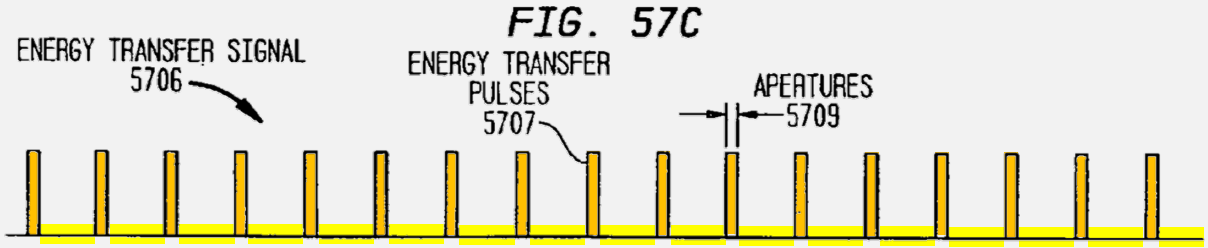
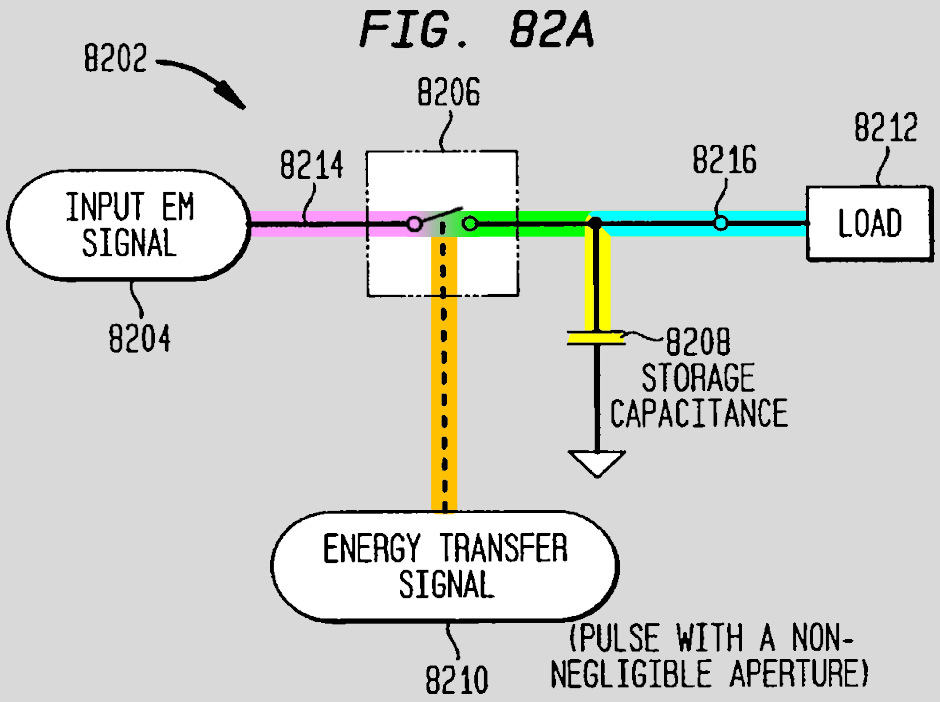


FIG. 57C





OUTPUT

FIG. 57E

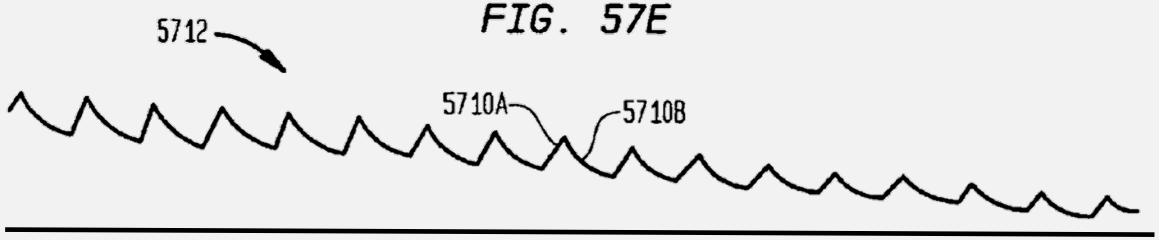


FIG. 82A

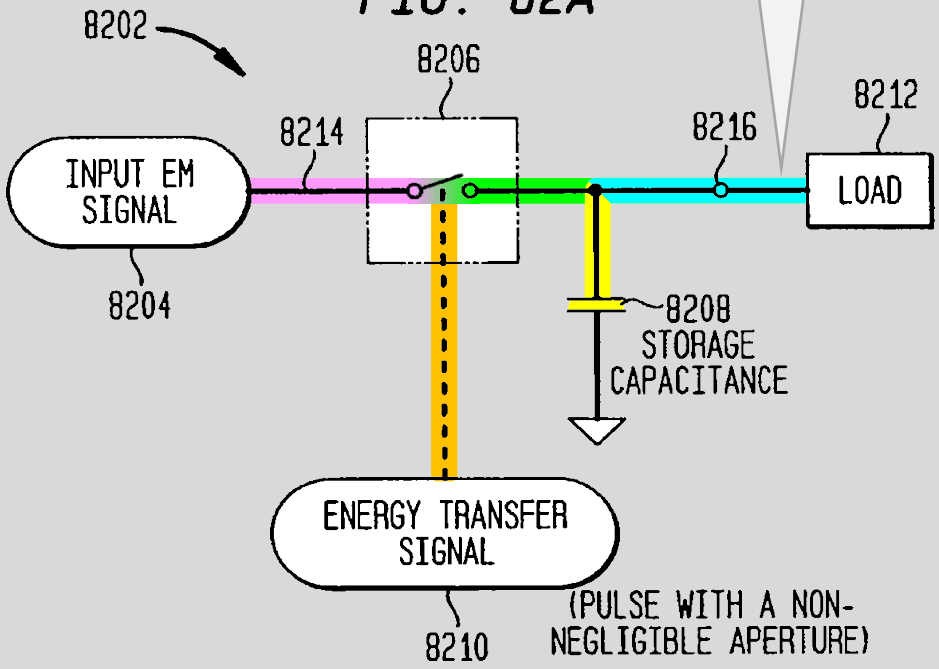


FIG. 57E

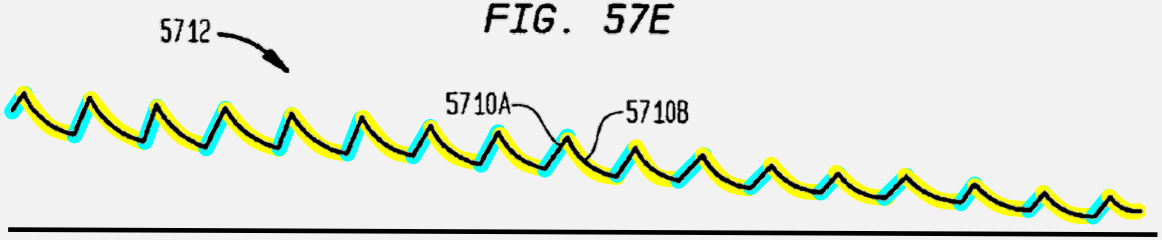
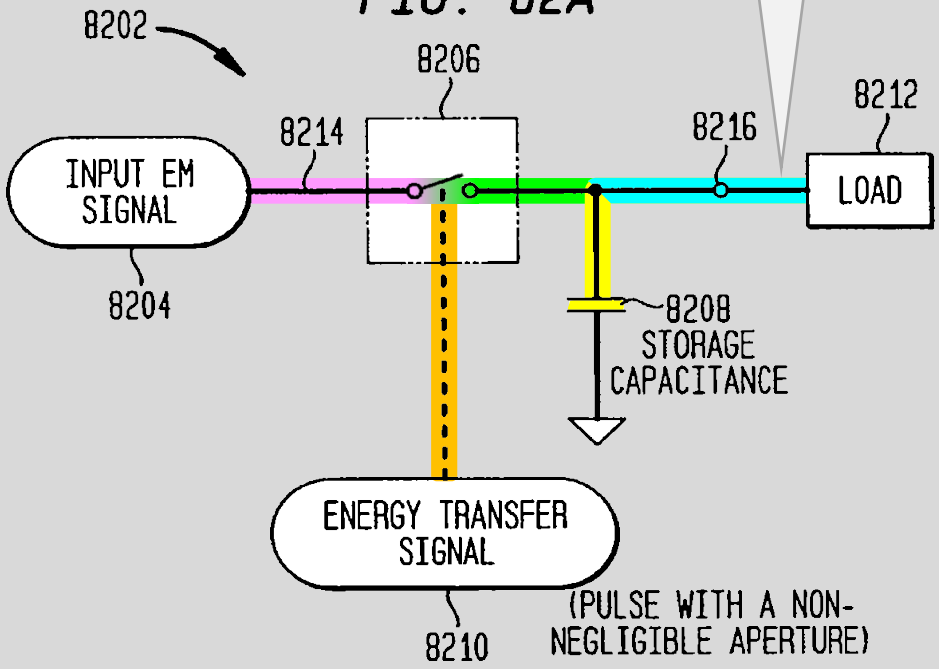
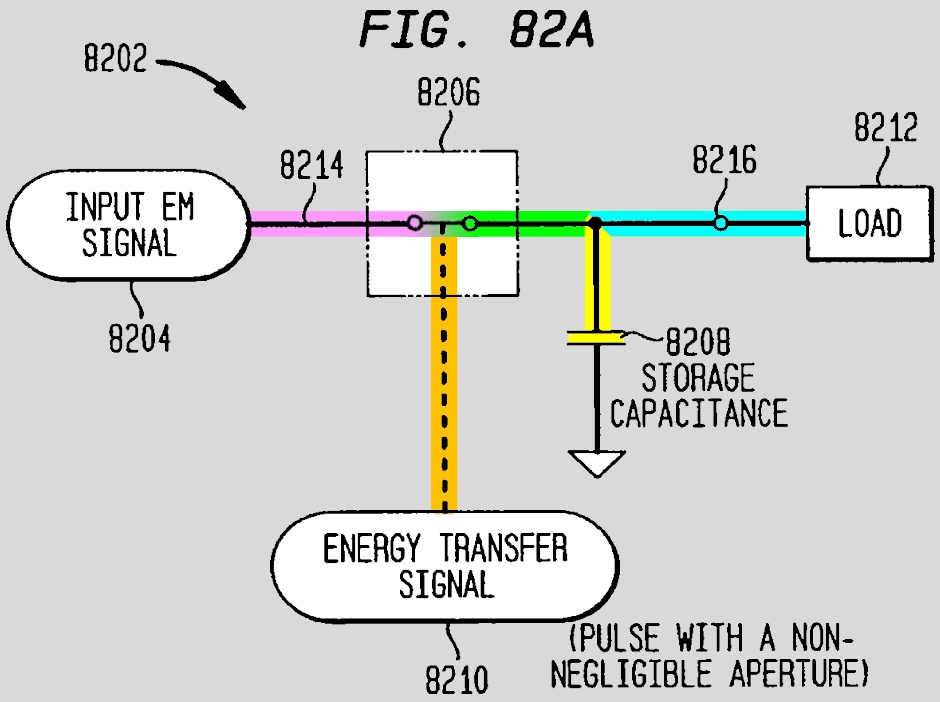


FIG. 82A





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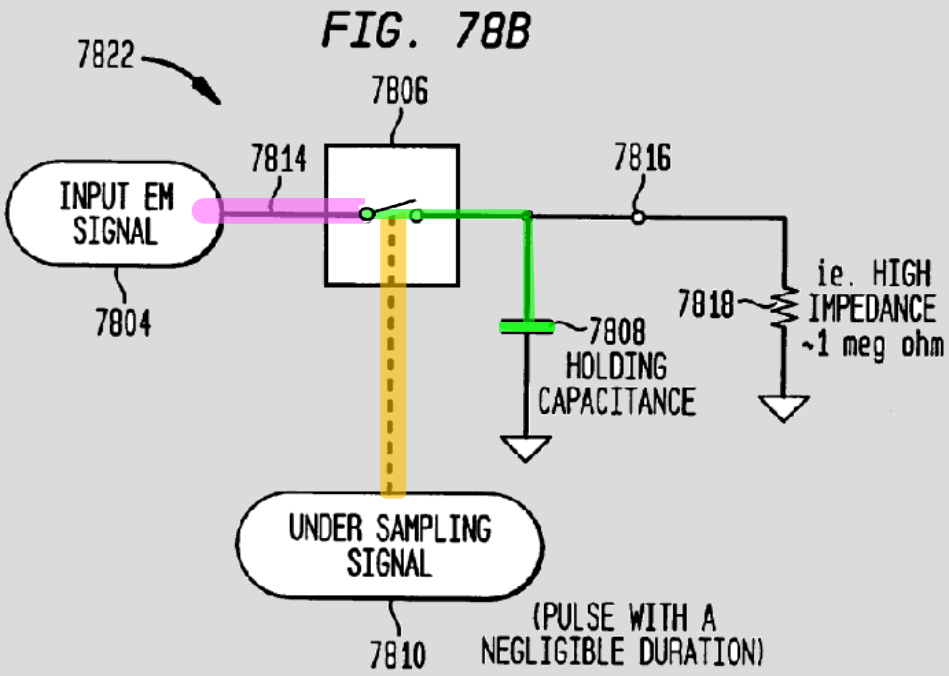
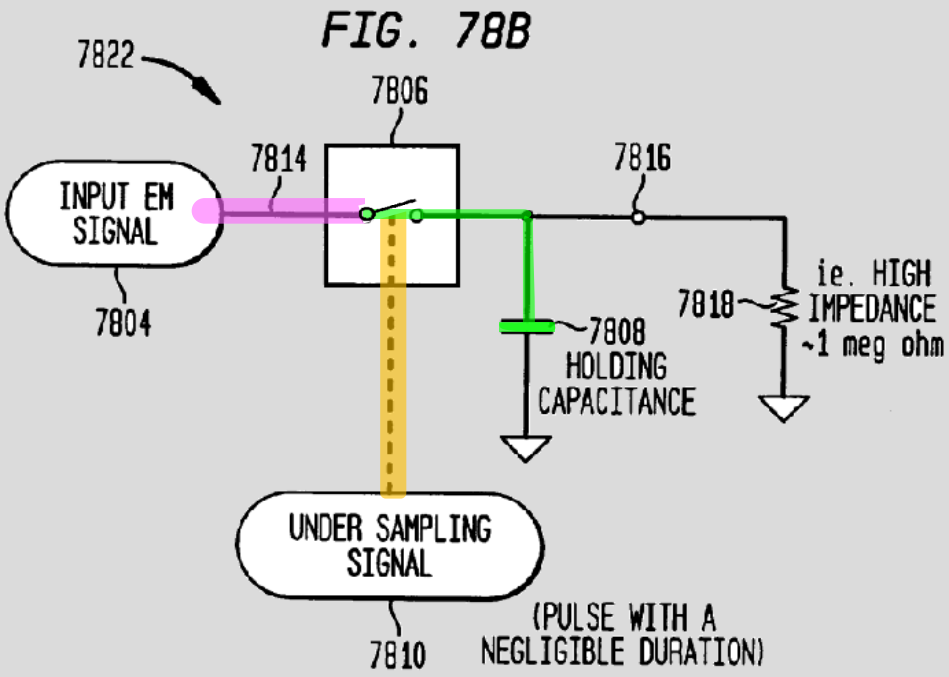
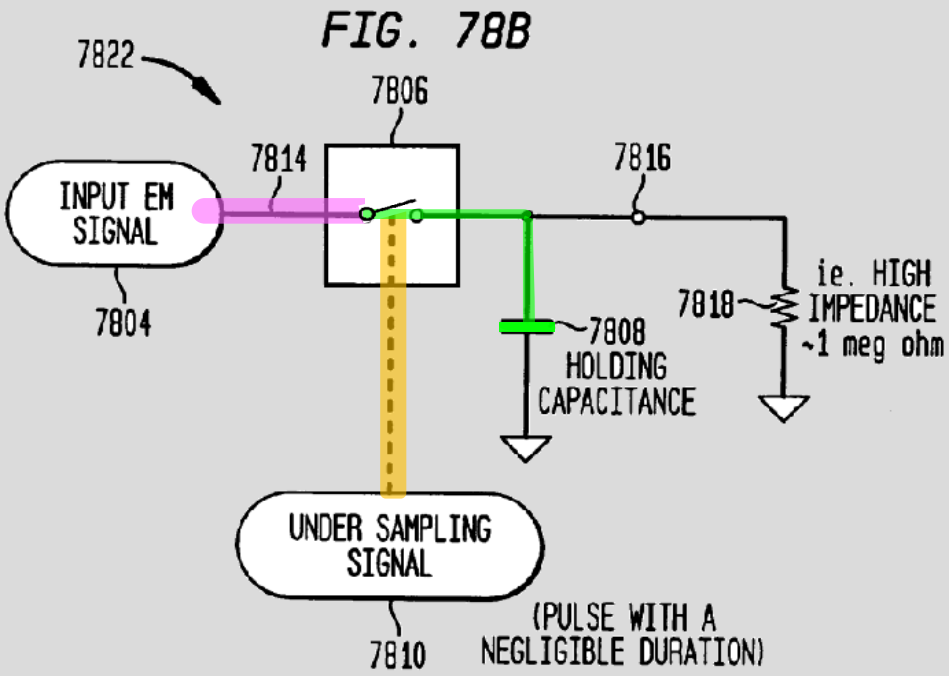
Sample and Hold (Voltage Sampling)







Claim Construction

“storage module”

ParkerVision’s Construction	Petitioners’ Construction
“a module of an *energy transfer system* that stores non-negligible amounts of energy from an input electromagnetic signal”	“an element of a system that stores non-negligible amounts of energy from an input EM signal”

“storage element” – Court’s claim construction

To act as their own lexicographer, the patentees must “clearly set forth a definition of the disputed claim term,” and “‘clearly express an intent’ to [define] the term.” *Thorner*, 669 F.3d at 1365. The Court does not find that Defendant has shown that both elements are met here for at least the following reasons.

First, the Court does not believe that—even in isolation—that the last sentence rises to the “exacting standards” necessary for lexicography. *Hill-Rom Servs.*, 755 F.3d at 1371. For the reasons described in Section II, a POSITA would understand that a “storage capacitance” is just a generic capacitor (as is a holding capacitance); a POSITA would not understand that a storage (or holding) capacitance is a special or particular type of capacitor with unique features or functionality, *e.g.*, a capacitor that only stores or is only capable of storing “a non-negligible amount of energy from an input electromagnetic (EM) signal.” In addition, the last sentence’s use of the phrase “on the other hand” indicates that it is making a comparison and, as such, a POSITA would not only look to this sentence in isolation—or even this passage alone—to understand the meaning the of “storage module” or “storage capacitance.” Similarly, based on the words “refers to,” a POSITA would not only look to this sentence to understand the meaning of those terms.

Ex.-2039 at 16

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“storage element” – Court’s claim construction

> the storage capacitance only stores a non-negligible amount of energy from an input EM signal. Therefore, based on last sentence in isolation, the Court does not find that the patentees “clearly set forth a definition” nor did they “clearly express an intent’ to [define] the term.” *Thorner*, 669 F.3d at 1365.

Ex.-2039 at 17

“storage element” – Court’s claim construction

Second, the passage as a whole (’518 Patent at 66:11–23) supports the Court’s conclusion that the last sentence does not rise to the level of a lexicographical statement. This passage, when read in context, describes the operation of a capacitor in an energy transfer system (*i.e.*, the “storage capacitance” and “storage module”) as compared to the operation of the corresponding capacitor in a sample-and-hold system (*i.e.*, the “holding capacitance” and “holding module”). For example, the passage initially recites that the “storage module” and “storage capacitance” are components of an energy transfer system. The passage then recites “[t]he terms storage module and storage capacitance, as used herein, are distinguishable from the terms holding module and holding capacitance, respectively.” Based on these two sentences, a POSITA would understand that the remainder of the passage will compare a storage module / capacitance, which this passage describes as a component of an energy transfer system, with a holding module / capacitance (which

Ex.-2039 at 17

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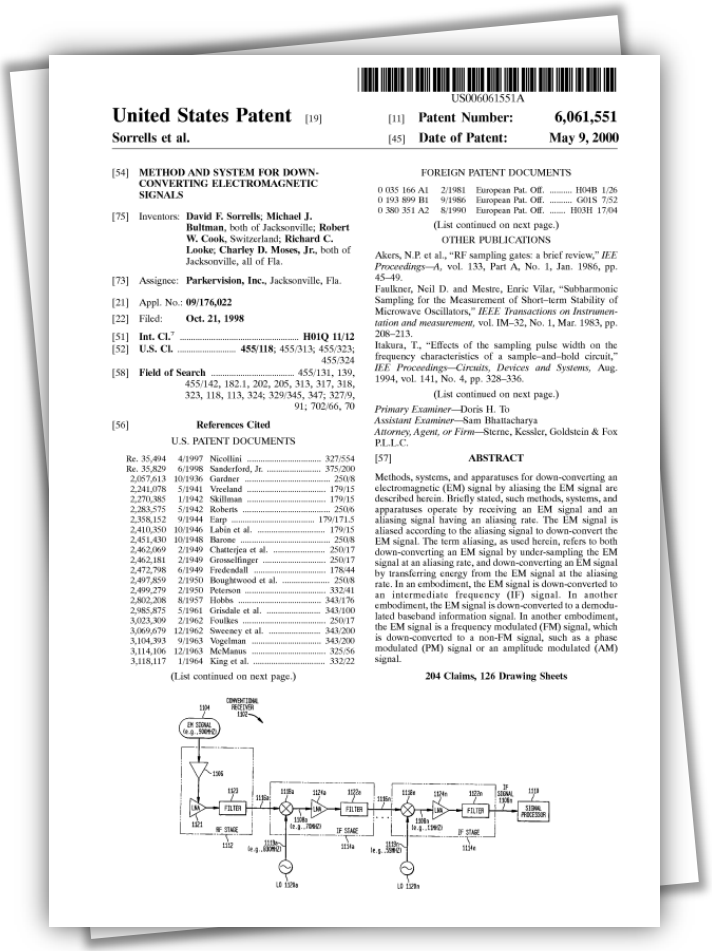
“storage element” – Court’s claim construction

Third, the specification as a whole provides definitive confirmation that the patentees did not intend for the last sentence to be a lexicographical statement. For example, this passage appears within a sub-section entitled “0.1.2 Introduction to Energy Transfer.” ’518 Patent at 65:56. The previous sub-section is entitled “0.1.1 Review of Undersampling.” *Id.* at 62:62. Both of these sub-sections are within a section entitled “0.1 Energy Transfer Compared to Under-Sampling.” Therefore, based on the organization of the sub-sections, a POSITA would understand that this passage will compare a storage module / capacitance in the context of an energy transfer system with a holding module / capacitance in the context of a sample-and-hold system, and not that the passage is specifically defining that a storage module /capacitance is a generic capacitor that is capable of holding a non-negligible amount of charge. These comparisons further confirm the Court’s conclusion that the passage as a whole compares the capacitance in energy transfer and sample-and-hold systems. At minimum, this comparison casts serious doubt as to whether the patentees “‘clearly express an intent’ to [define] the term.” *Thorner*, 669 F.3d at 1365.

Ex.-2039 at 18

“storage element”



US006061551A

United States Patent [19]
Sorrells et al.

[11] **Patent Number: 6,061,551**
[45] **Date of Patent: May 9, 2000**

[54] **METHOD AND SYSTEM FOR DOWN-CONVERTING ELECTROMAGNETIC SIGNALS**

[75] Inventors: **David F. Sorrells**, **Michael J. Bultman**, both of Jacksonville; **Robert W. Cook**, Switzerland; **Richard C. Looke**; **Charley D. Moses, Jr.**, both of Jacksonville, all of Fla.

[73] Assignee: **Parkervision, Inc.**, Jacksonville, Fla.

[21] Appl. No.: **09/176,022**

[22] Filed: **Oct. 21, 1998**

[51] **Int. Cl.**[7] **H01Q 11/12**

[52] **U.S. Cl.** **455/118**; 455/313; 455/323; 455/324

[58] **Field of Search** 455/131, 139, 455/142, 182.1, 202, 205, 313, 317, 318, 323, 118, 113, 324; 329/345, 347; 327/9, 91; 702/66, 70

[56] **References Cited**

U.S. PATENT DOCUMENTS

Re. 35,494	4/1997	Nicollini	327/554
Re. 35,829	6/1998	Sanderford, Jr.	375/200
2,057,613	10/1936	Gardner	250/8
2,241,078	5/1941	Vreeland	179/15
2,270,385	1/1942	Skillman	179/15
2,283,575	5/1942	Roberts	250/6
2,358,152	9/1944	Earp	179/171.5
2,410,350	10/1946	Labin et al.	179/15
2,451,430	10/1948	Barone	250/8
2,462,069	2/1949	Chatterjea et al.	250/17
2,462,181	2/1949	Grosselfinger	250/17
2,472,798	6/1949	Fredendall	178/44
2,497,859	2/1950	Boughtwood et al.	250/8
2,499,279	2/1950	Peterson	332/41
2,802,208	8/1957	Hobbs	343/176
2,985,875	5/1961	Grisdale et al.	343/100
3,023,309	2/1962	Foulkes	250/17
3,069,679	12/1962	Sweeney et al.	343/200
3,104,393	9/1963	Vogelman	343/200
3,114,106	12/1963	McManus	325/56
3,118,117	1/1964	King et al.	332/22

(List continued on next page.)

FOREIGN PATENT DOCUMENTS

0 035 166 A1	2/1981	European Pat. Off.	H04B 1/26
0 193 899 B1	9/1986	European Pat. Off.	G01S 7/52
0 380 351 A2	8/1990	European Pat. Off.	H03H 17/04

(List continued on next page.)

OTHER PUBLICATIONS

Akers, N.P. et al., “RF sampling gates: a brief review,” *IEE Proceedings—A*, vol. 133, Part A, No. 1, Jan. 1986, pp. 45–49.

Faulkner, Neil D. and Mestre, Enric Vilar, “Subharmonic Sampling for the Measurement of Short–term Stability of Microwave Oscillators,” *IEEE Transactions on Instrumentation and measurement*, vol. IM–32, No. 1, Mar. 1983, pp. 208–213.

Itakura, T., “Effects of the sampling pulse width on the frequency characteristics of a sample–and–bold circuit,” *IEE Proceedings—Circuits, Devices and Systems*, Aug. 1994, vol. 141, No. 4, pp. 328–336.

(List continued on next page.)

Primary Examiner—Doris H. To
Assistant Examiner—Sam Bhattacharya
Attorney, Agent, or Firm—Sterne, Kessler, Goldstein & Fox P.L.L.C.

[57] **ABSTRACT**

Methods, systems, and apparatuses for down-converting an electromagnetic (EM) signal by aliasing the EM signal are described herein. Briefly stated, such methods, systems, and apparatuses operate by receiving an EM signal and an aliasing signal having an aliasing rate. The EM signal is aliased according to the aliasing signal to down-convert the EM signal. The term aliasing, as used herein, refers to both down-converting an EM signal by under-sampling the EM signal at an aliasing rate, and down-converting an EM signal by transferring energy from the EM signal at the aliasing rate. In an embodiment, the EM signal is down-converted to an intermediate frequency (IF) signal. In another embodiment, the EM signal is down-converted to a demodulated baseband information signal. In another embodiment, the EM signal is a frequency modulated (FM) signal, which is down-converted to a non-FM signal, such as a phase modulated (PM) signal or an amplitude modulated (AM) signal.

204 Claims, 126 Drawing Sheets

0.1.2 Introduction to Energy Transfer

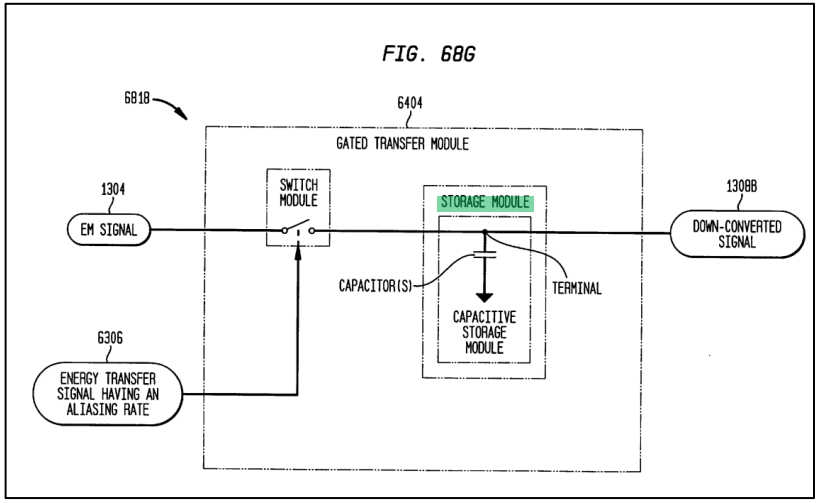
Exhibit 2027 (’551 patent), 66:33

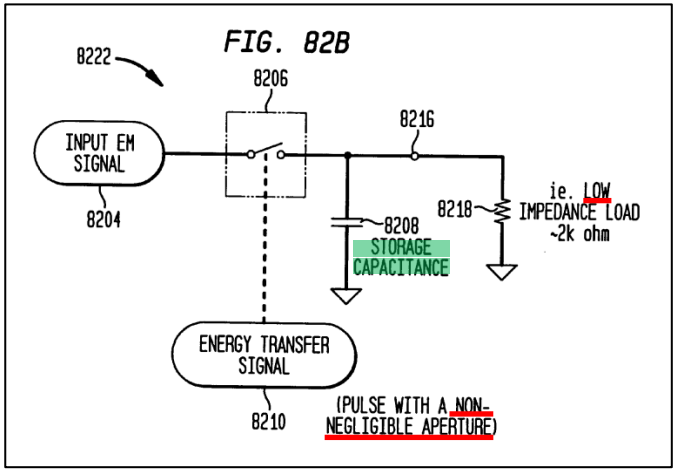
FIG. **82**A illustrates an exemplary energy transfer system **8202** for down-converting an input EM signal **8204**. The energy transfer system **8202** includes a switching module **8206** and a storage module illustrated as a storage capacitance **8208**. The terms storage module and storage capacitance, as used herein, are distinguishable from the terms holding module and holding capacitance, respectively. Holding modules and holding capacitances, as used above, identify systems that store negligible amounts of energy from an under-sampled input EM signal with the intent of “holding” a voltage value. Storage modules and storage capacitances, on the other hand, refer to systems that store non-negligible amounts of energy from an input EM signal.

Exhibit 2027 (’551 patent), 66:55-67

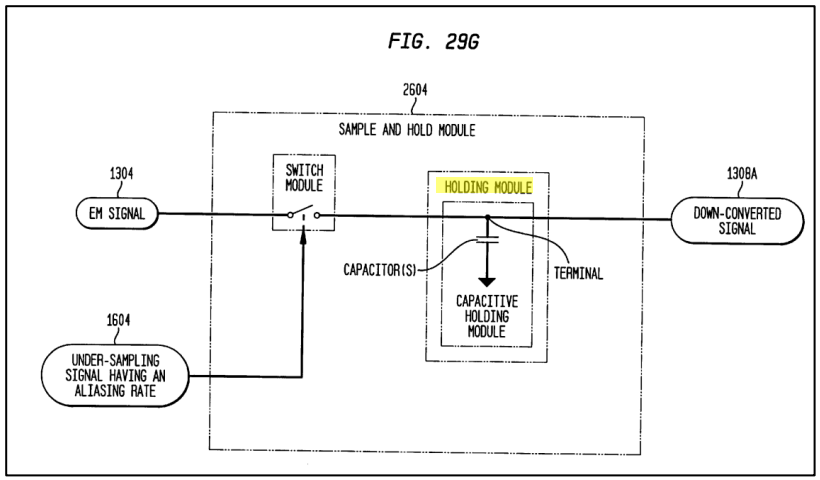
“storage element”

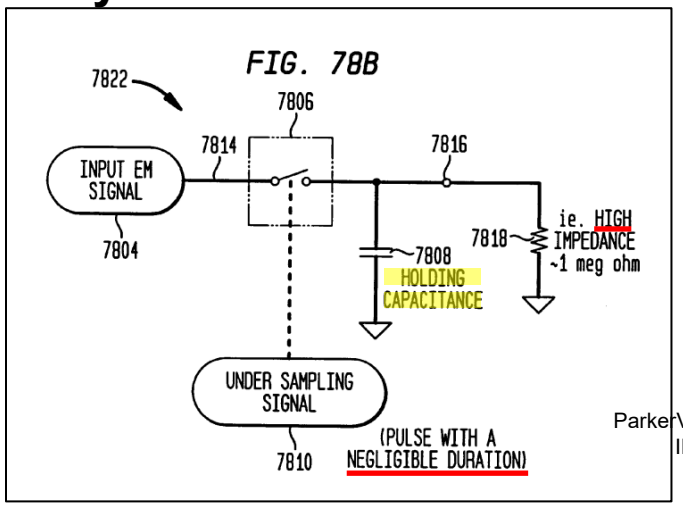
Energy transfer systems





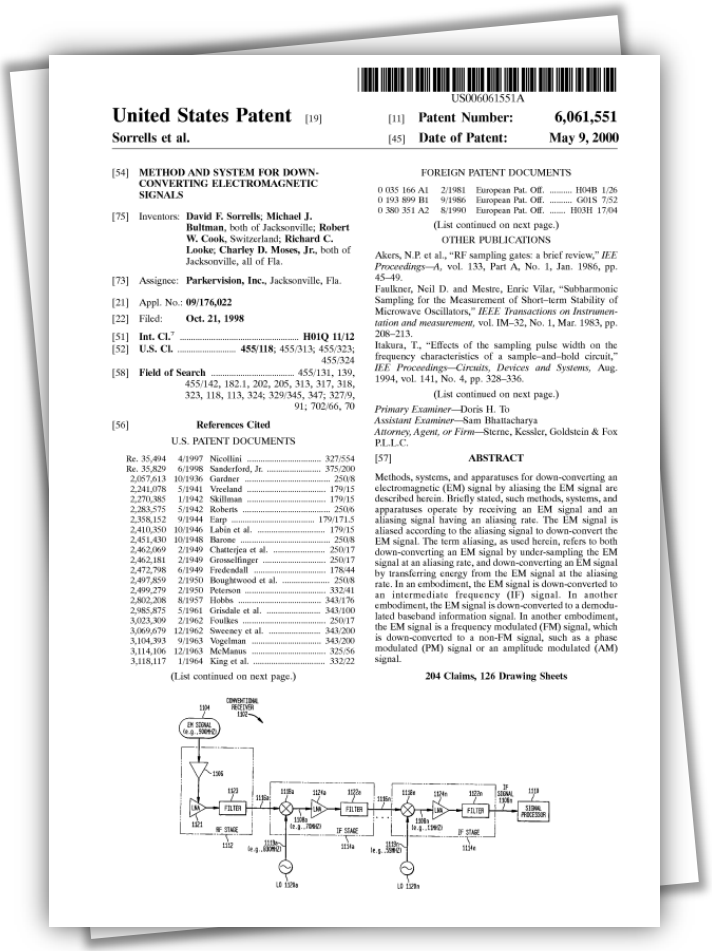
Sample and hold systems





ParkerVision Ex. 2040
IPR2021-00985
Page 43 of 82

“storage element”



US006061551A

United States Patent [19]
Sorrells et al.

[11] **Patent Number: 6,061,551**
[45] **Date of Patent: May 9, 2000**

[54] **METHOD AND SYSTEM FOR DOWN-CONVERTING ELECTROMAGNETIC SIGNALS**

[75] Inventors: **David F. Sorrells**; **Michael J. Bultman**, both of Jacksonville; **Robert W. Cook**, Switzerland; **Richard C. Looke**; **Charley D. Moses, Jr.**, both of Jacksonville, all of Fla.

[73] Assignee: **Parkervision, Inc.**, Jacksonville, Fla.

[21] Appl. No.: **09/176,022**

[22] Filed: **Oct. 21, 1998**

[51] **Int. Cl.**[7] **H01Q 11/12**

[52] **U.S. Cl.** **455/118**; 455/313; 455/323; 455/324

[58] **Field of Search** 455/131, 139, 455/142, 182.1, 202, 205, 313, 317, 318, 323, 118, 113, 324; 329/345, 347; 327/9, 91; 702/66, 70

[56] **References Cited**

U.S. PATENT DOCUMENTS

Re. 35,494	4/1997	Nicollini	327/554
Re. 35,829	6/1998	Sanderford, Jr.	375/200
2,057,613	10/1936	Gardner	250/8
2,241,078	5/1941	Vreeland	179/15
2,270,385	1/1942	Skillman	179/15
2,283,575	5/1942	Roberts	250/6
2,358,152	9/1944	Earp	179/171.5
2,410,350	10/1946	Labin et al.	179/15
2,451,430	10/1948	Barone	250/8
2,462,069	2/1949	Chatterjea et al.	250/17
2,462,181	2/1949	Grosselfinger	250/17
2,472,798	6/1949	Fredendall	178/44
2,497,859	2/1950	Boughtwood et al.	250/8
2,499,279	2/1950	Peterson	332/41
2,802,208	8/1957	Hobbs	343/176
2,985,875	5/1961	Grisdale et al.	343/100
3,023,309	2/1962	Foulkes	250/17
3,069,679	12/1962	Sweeney et al.	343/200
3,104,393	9/1963	Vogelman	343/200
3,114,106	12/1963	McManus	325/56
3,118,117	1/1964	King et al.	332/22

(List continued on next page.)

FOREIGN PATENT DOCUMENTS

0 035 166 A1	2/1981	European Pat. Off.	H04B 1/26
0 193 899 B1	9/1986	European Pat. Off.	G01S 7/52
0 380 351 A2	8/1990	European Pat. Off.	H03H 17/04

(List continued on next page.)

OTHER PUBLICATIONS

Akers, N.P. et al., “RF sampling gates: a brief review,” *IEE Proceedings—A*, vol. 133, Part A, No. 1, Jan. 1986, pp. 45–49.

Faulkner, Neil D. and Mestre, Enric Vilar, “Subharmonic Sampling for the Measurement of Short–term Stability of Microwave Oscillators,” *IEEE Transactions on Instrumentation and measurement*, vol. IM–32, No. 1, Mar. 1983, pp. 208–213.

Itakura, T., “Effects of the sampling pulse width on the frequency characteristics of a sample–and–hold circuit,” *IEE Proceedings—Circuits, Devices and Systems*, Aug. 1994, vol. 141, No. 4, pp. 328–336.

(List continued on next page.)

Primary Examiner—Doris H. To
Assistant Examiner—Sam Bhattacharya
Attorney, Agent, or Firm—Sterne, Kessler, Goldstein & Fox P.L.L.C.

[57] **ABSTRACT**

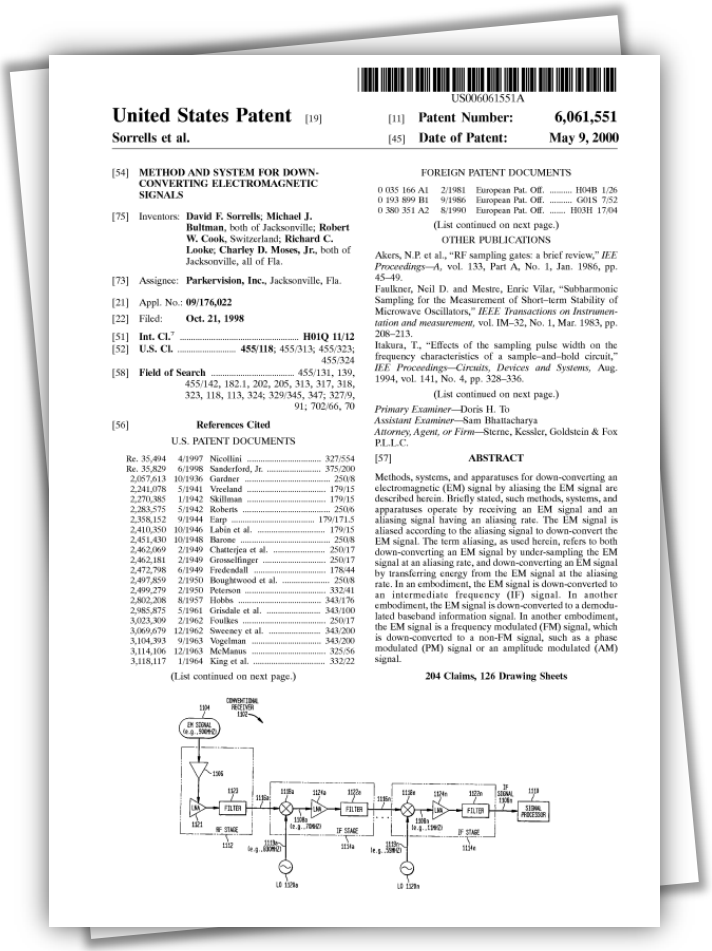
Methods, systems, and apparatuses for down-converting an electromagnetic (EM) signal by aliasing the EM signal are described herein. Briefly stated, such methods, systems, and apparatuses operate by receiving an EM signal and an aliasing signal having an aliasing rate. The EM signal is aliased according to the aliasing signal to down-convert the EM signal. The term aliasing, as used herein, refers to both down-converting an EM signal by under-sampling the EM signal at an aliasing rate, and down-converting an EM signal by transferring energy from the EM signal at the aliasing rate. In an embodiment, the EM signal is down-converted to an intermediate frequency (IF) signal. In another embodiment, the EM signal is down-converted to a demodulated baseband information signal. In another embodiment, the EM signal is a frequency modulated (FM) signal, which is down-converted to a non-FM signal, such as a phase modulated (PM) signal or an amplitude modulated (AM) signal.

204 Claims, 126 Drawing Sheets

is relatively significant. Another benefit of the energy transfer system **8202** is that the non-negligible amounts of transferred energy permit the energy transfer system **8202** to effectively drive loads that would otherwise be classified as low impedance loads in under-sampling systems and conventional sampling systems. In other words, the non-negligible amounts of transferred energy ensure that, even for lower impedance loads, the storage capacitance **8208** accepts and maintains sufficient energy or charge to drive the load **8202**. This is illustrated below in the timing diagrams

Exhibit 2027 (’551 patent), 67:37-46

“storage element”



US006061551A

United States Patent [19]
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[54] **METHOD AND SYSTEM FOR DOWN-CONVERTING ELECTROMAGNETIC SIGNALS**

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[73] Assignee: **Parkervision, Inc.**, Jacksonville, Fla.

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3,104,393	9/1963	Vogelman	343/200
3,114,106	12/1963	McManus	325/56
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OTHER PUBLICATIONS

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Itakura, T., “Effects of the sampling pulse width on the frequency characteristics of a sample–and–hold circuit,” *IEE Proceedings—Circuits, Devices and Systems*, Aug. 1994, vol. 141, No. 4, pp. 328–336.

(List continued on next page.)

Primary Examiner—Doris H. To
Assistant Examiner—Sam Bhattacharya
Attorney, Agent, or Firm—Sterne, Kessler, Goldstein & Fox P.L.L.C.

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204 Claims, 126 Drawing Sheets

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Ex.-2027, 66:55-67

“cable modem”

ParkerVision’s Construction	Petitioners’ Construction
a modem that communicates across ordinary cable TV network cables	Not limiting a device that can down-convert signals from a TV network

“cable modem”

6.13 Cable Modem

Cable Modems refer to modems that communicate across ordinary cable TV network cables. A cable modem allows a

Ex.-1001, 36:19-20

’835 Patent

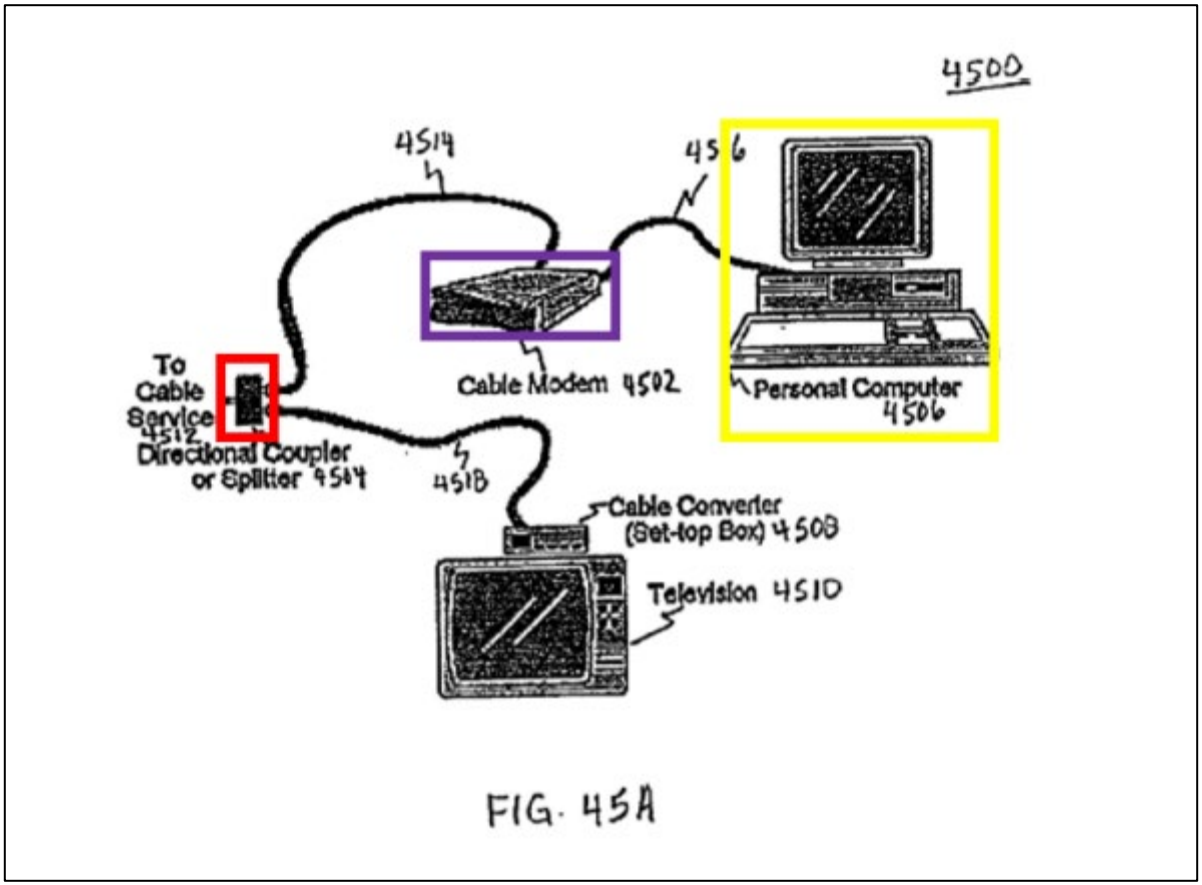
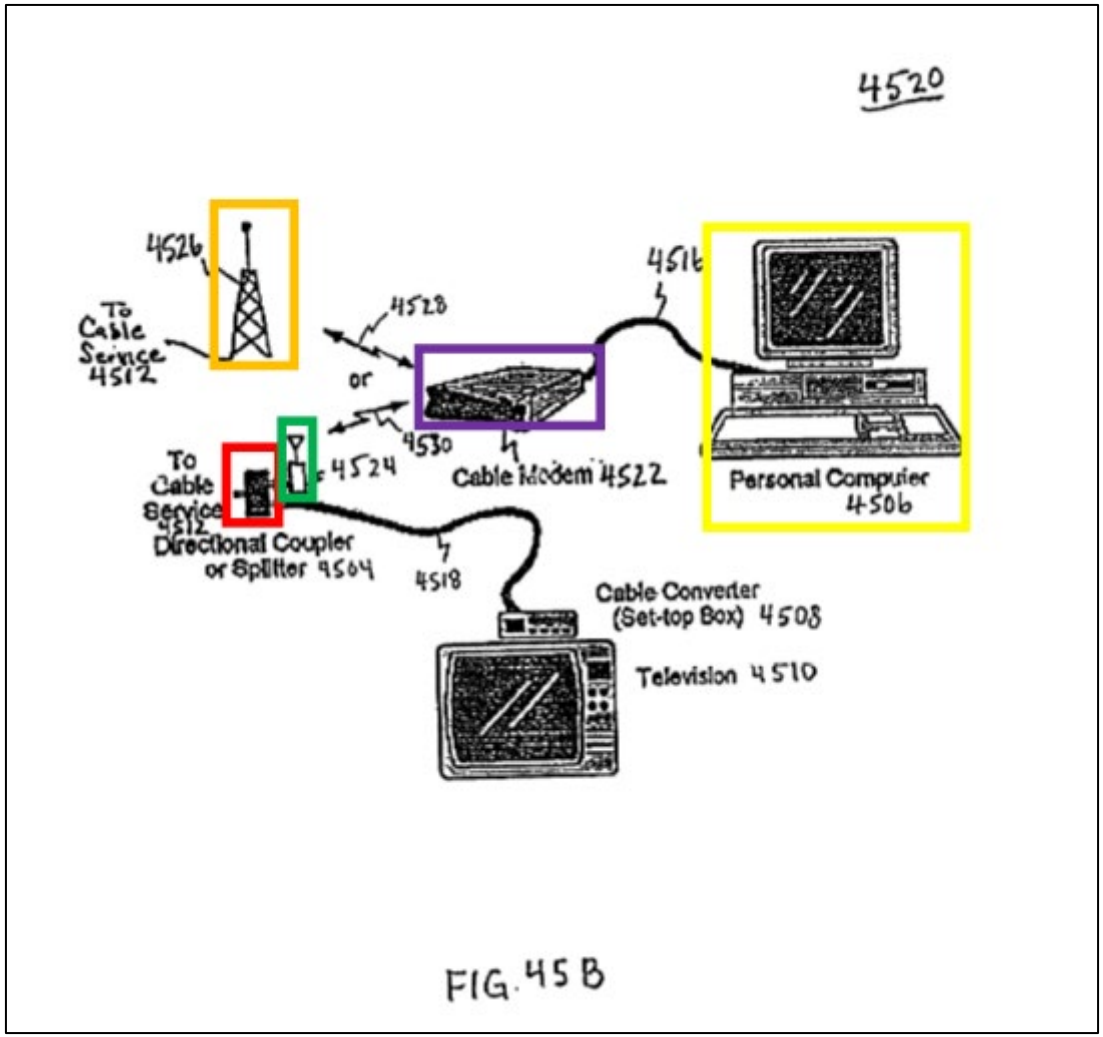


FIG. 45A

POR at 28

’835 Patent



POR at 29

’835 Patent

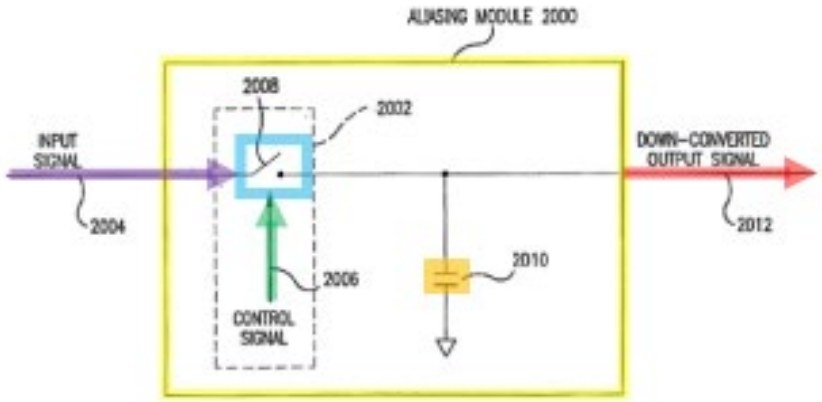


FIG. 20A

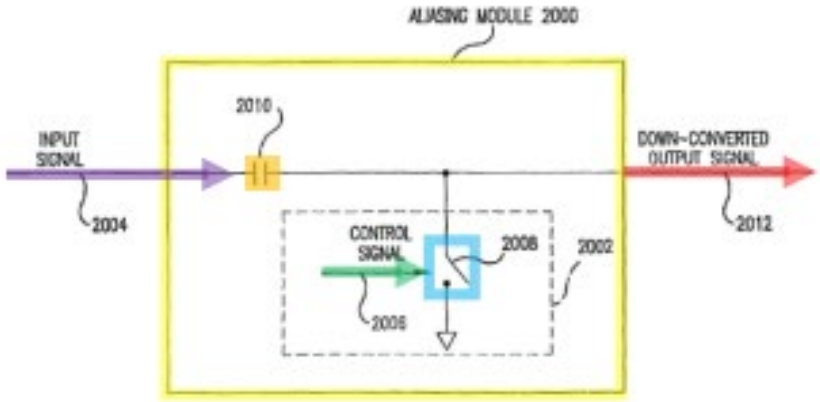


FIG. 20A–1

POR at 30

’835 Patent

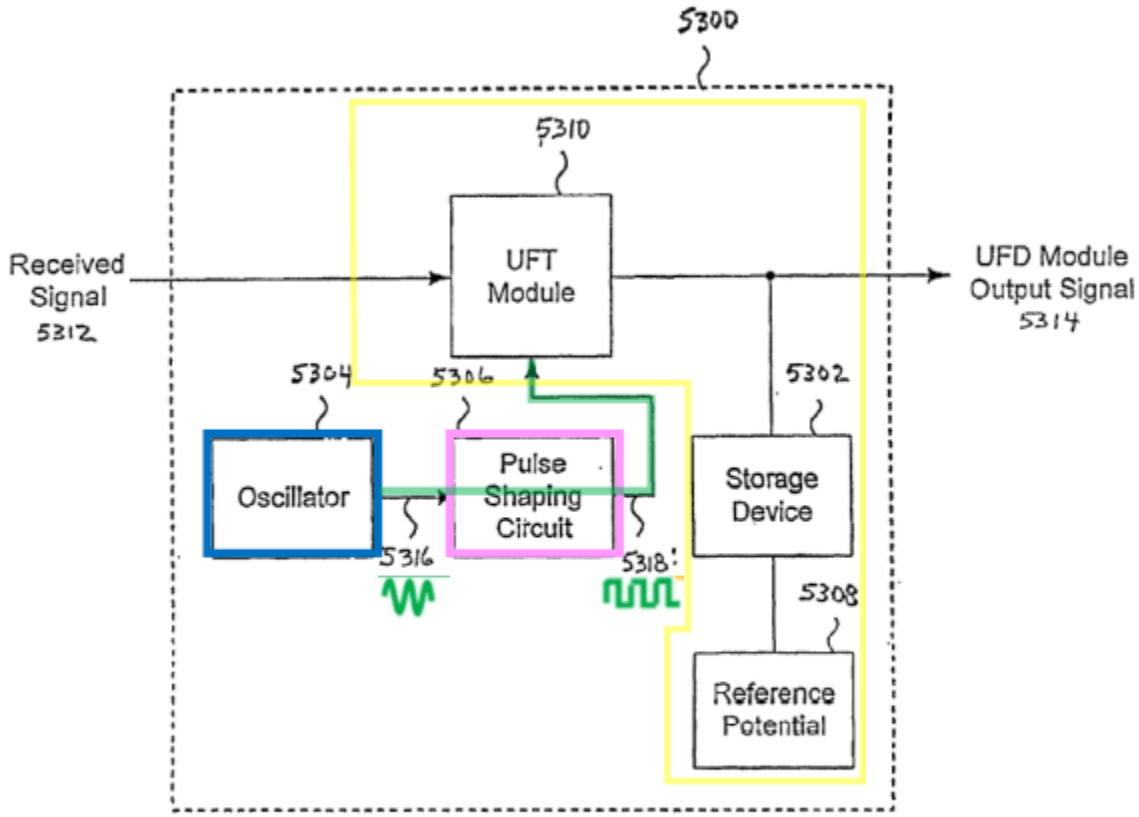


FIG. 53

POR at 31

’835 Patent

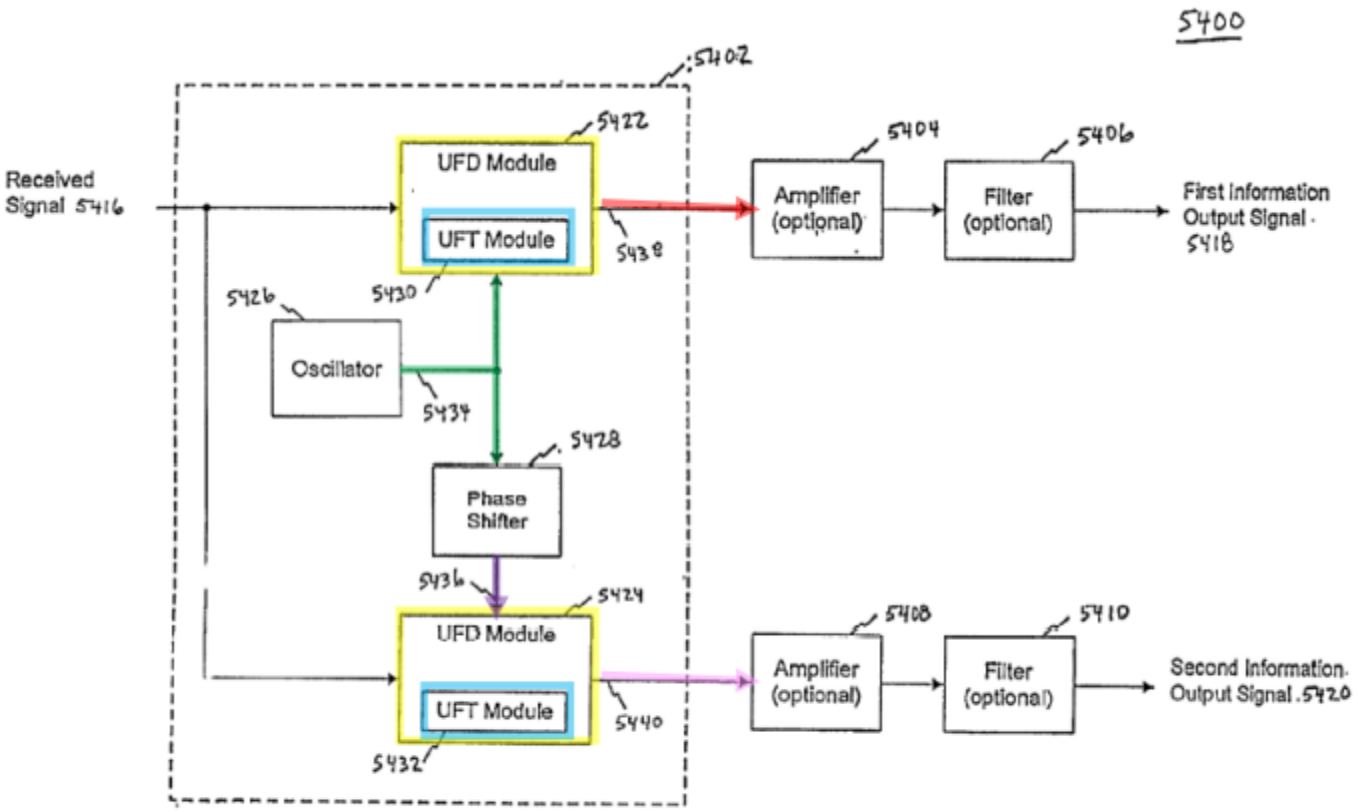


FIG. 54B

POR at 32

’835 Patent, Claim 1

1. A cable modem for down-converting an electromagnetic signal having complex modulations, comprising:

an oscillator to generate an in-phase oscillating signal;

a phase shifter to receive said in-phase oscillating signal and to create a quadrature-phase oscillating signal;

a first frequency down-conversion module to receive the electromagnetic signal and said in-phase oscillating signal;

a second frequency down-conversion module to receive the electromagnetic signal and said quadrature-phase oscillating signal; wherein

said first frequency down-conversion module further comprises a first frequency translation module and a first storage module, wherein said first frequency translation module samples the electromagnetic signal at a rate that is a function of said in-phase oscillating signal, thereby creating a first sampled signal; and

said second frequency down-conversion module further comprises a second frequency translation module and a second storage module, wherein said second frequency translation module samples the electromagnetic signal at a rate that is a function of said quadrature-phase oscillating signal, thereby creating a second sampled signal.

ParkerVision Ex. 2040
IPR2021-00985
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’835 Patent, Claim 17

Preamble provide antecedent basis = LIMITING

> **17**. The cable modem of claim 1, wherein the electromagnetic signal has been transmitted by a wireless method to the cable modem.

Hulkko

(U.S. Patent No. 5,734,683)

Hulkko

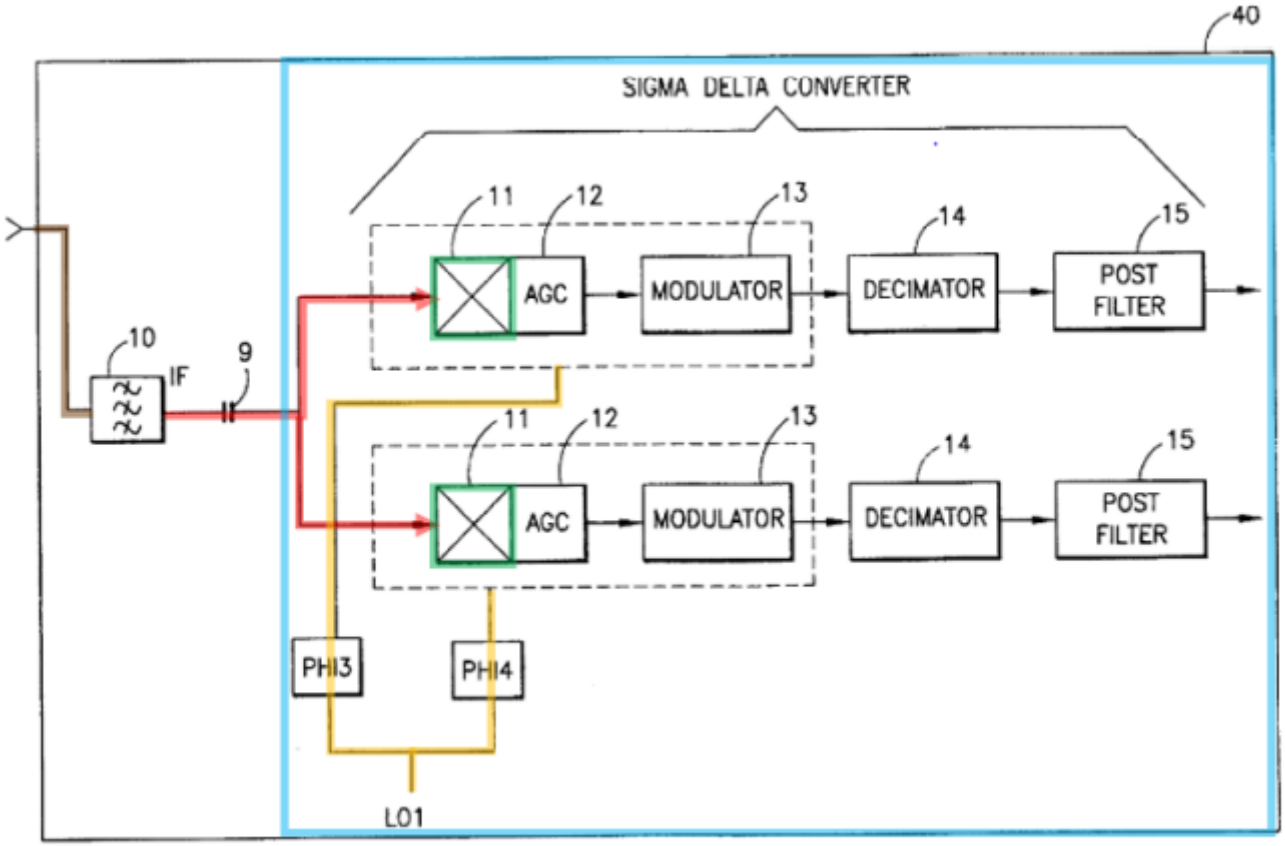


FIG.2

POR at 53

Hulkko

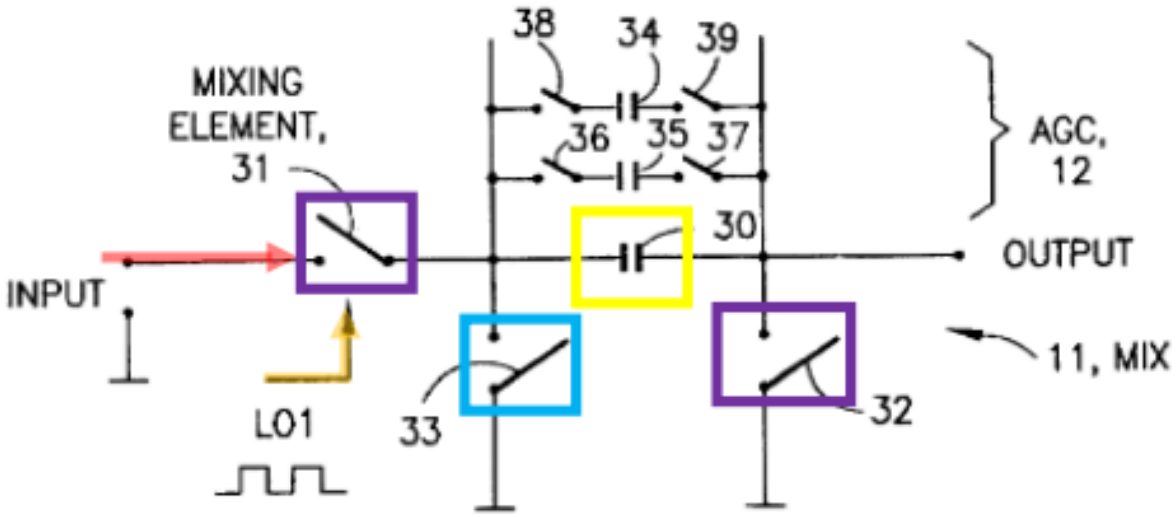


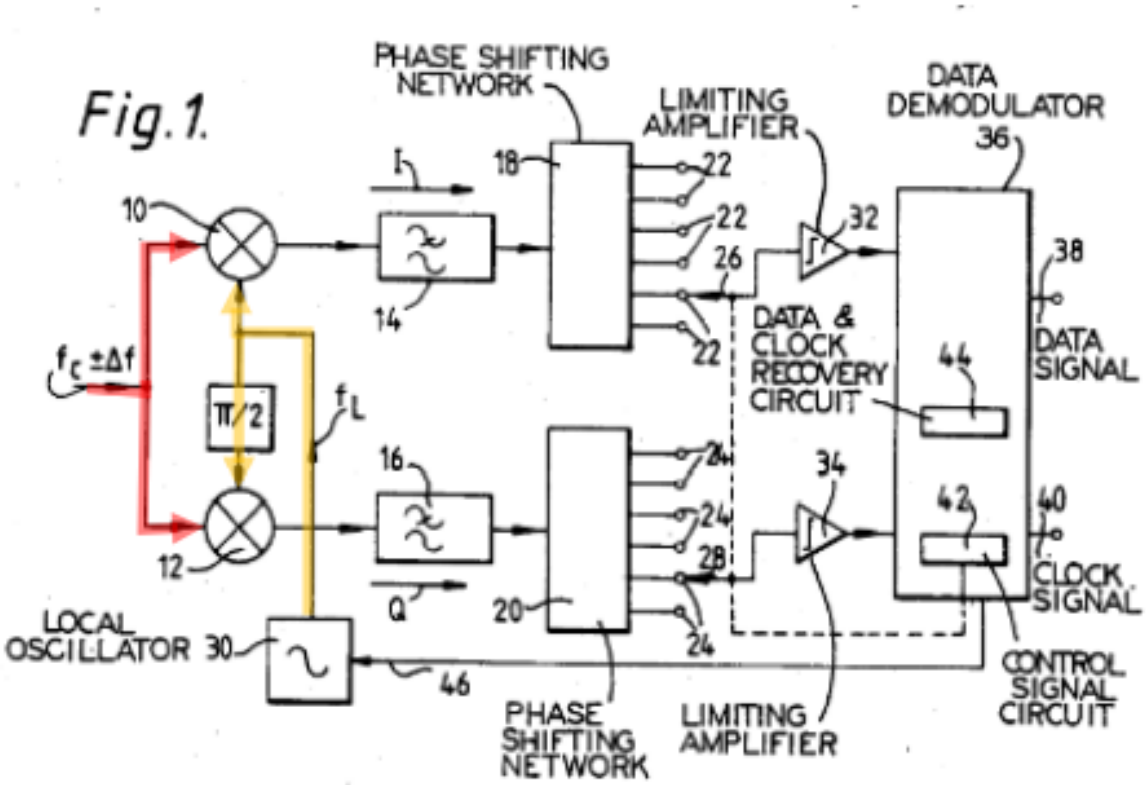
FIG.4

POR at 54

Gibson

(U.S. Patent No. 4,682,117)

Gibson



POR at 55

Schiltz

(U.S. Patent No. 5,339,459)

Schiltz

HIGH SPEED SAMPLE AND HOLD CIRCUIT AND RADIO CONSTRUCTED THEREWITH

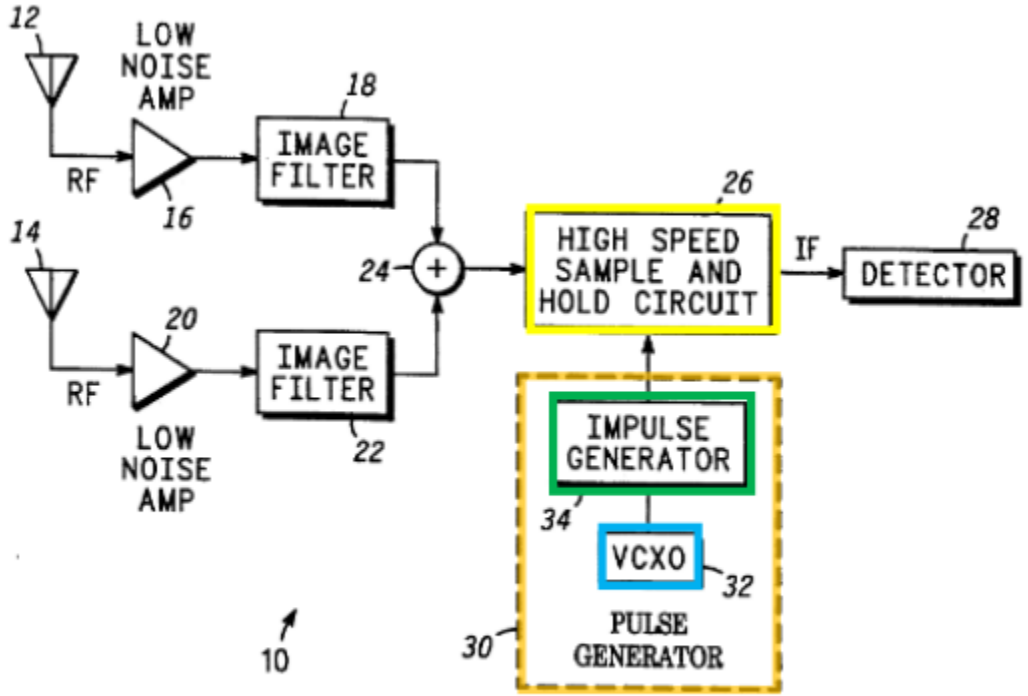


FIG. 1

POR at 56-57

Schiltz

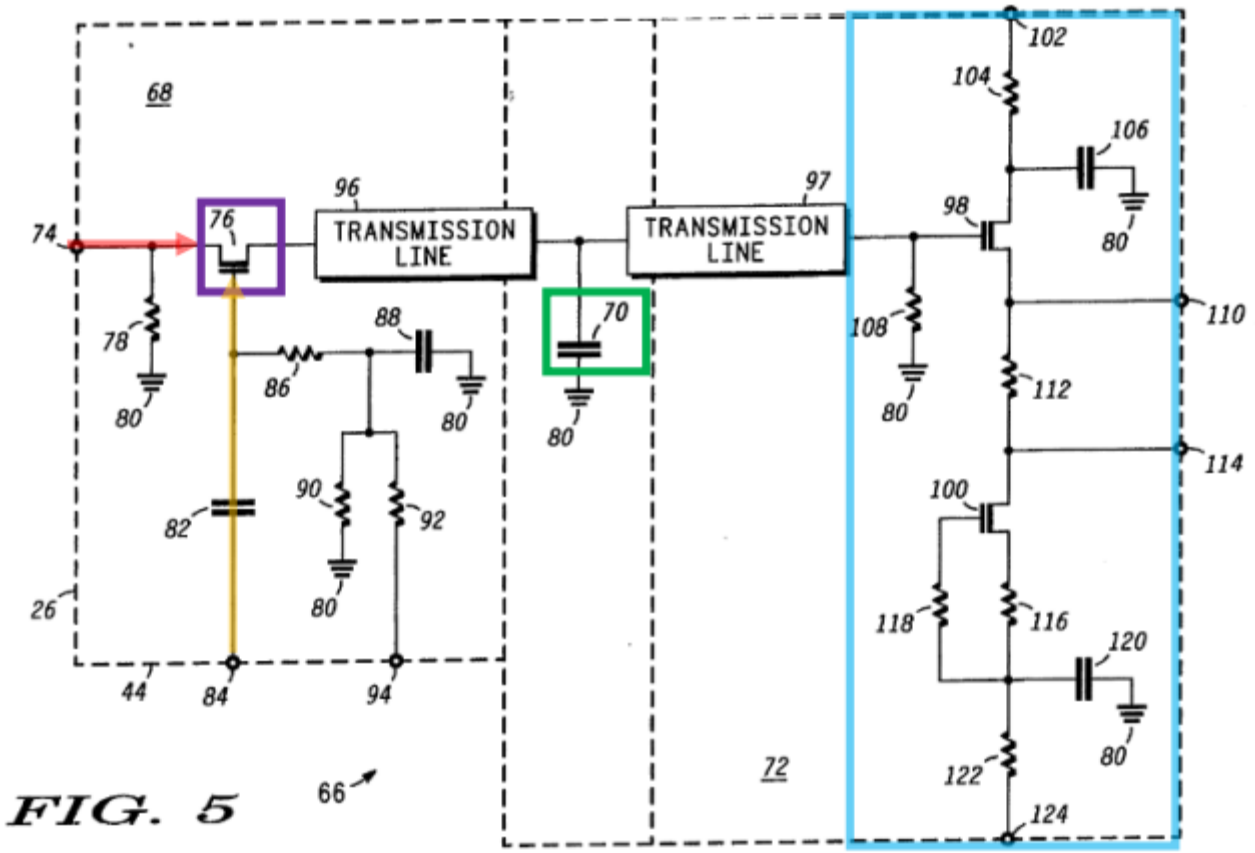


FIG. 5

POR at 59

Hulkko/Gibson Does Not Disclose "Storage Module"

ParkerVision's/Texas District Court's Construction
"a module of an *energy transfer system* that stores *non-negligible amounts of energy* from an input electromagnetic signal"

- Hulkko/Gibson does not disclose an energy transfer system
- The capacitors do not store non-negligible amounts of energy

Hulkko/Gibson Is Not An Energy Transfer System

Hulkko

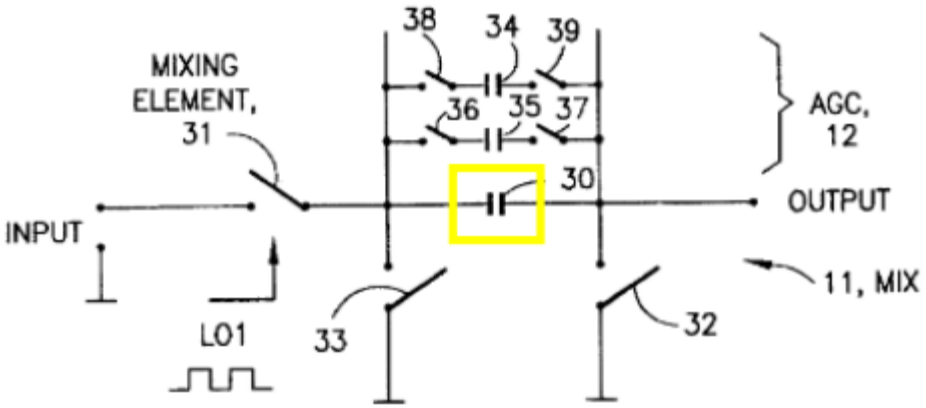


FIG.4

FIG. 4 shows the input stage of the receive arrangement of the embodiment of FIG. 2 showing switched capacitor switching elements of the mixer 11 and the AGC 12 in greater detail. A first capacitor 30 is used to sample end hold the incoming signal. First switches 31, 32 are closed to provide a sample to the first capacitor 30. Once the input signal has been sampled, a third switch 33 is closed to

Ex.-1004, 4:61-65

Hulkko Capacitors Do Not Store Non-Negligible Amounts of Energy

Hulkko

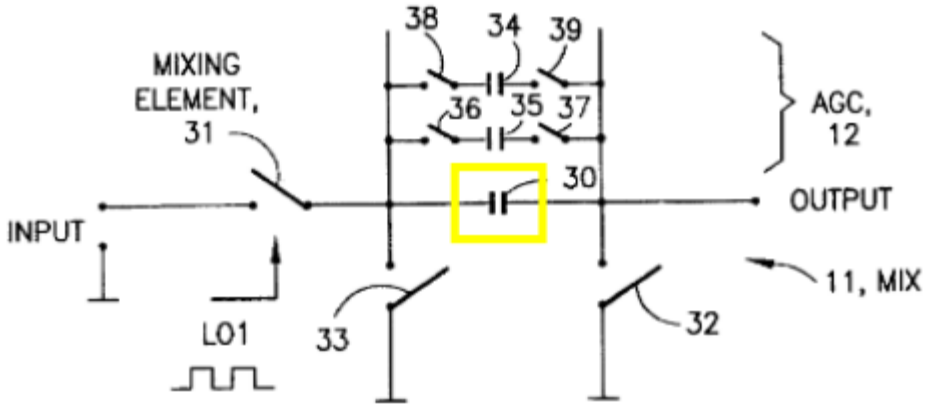


FIG.4

Ex.-1004 (Hulkko)

Hulkko

c. STEP 3: Percentage of available energy.

Knowing the available energy (**115.43 fJ**) and amount of energy held in a capacitor (**576.0 aJ**), one can calculate the percentage of available energy that is held on Hulkko's capacitor:

$$\frac{576.0\ aJ}{115.43\ fJ} = 0.00499 = 0.5\%$$

Only **0.5%** of the energy available is held on a Hulkko capacitor.[16] A POSITA understand that **0.5%** is a *negligible* (nearly zero) amount of energy. Ex.-2038 ¶¶329-330.

POR at 67

ParkerVision Ex. 2040
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Dr. Steer's opinions

[18] The amount of energy stored cannot simply be calculated using the energy formula, $E = \frac{1}{2} CV^2$ (E=energy; C=capacitance; V=voltage), because this formula fails to take Schiltz configuration into account. The energy formula, by itself, merely provides the maximum amount of energy that can be stored in a capacitor given a source voltage.

Exhibit 2038 at ¶358 n.18

Distinguishable from noise

The Federal Circuit noted that "Mr. Sorrells explained at trial that transferring a non-negligible amount of energy into the *storage capacitor* means 'that you have to transfer enough energy to overcome the noise in the system to be *able to meet your specifications*.'" *Id.*, 1019. With regard to meeting the specifications, Mr. Sorrells "further testified that the fact that the accused [] products *meet 'all of the cellular/cellphone specifications'* is proof that a 'non-negligible' amount of energy is *transferred* to the storage element in those products." *Id.* In other words, according to Mr. Sorrells, energy is "distinguishable from noise" if a product meets cellular/wireless specifications.[12] Petitioners'

Within this context, the Federal Circuit stated that according to Mr. Sorrells, "one *may* look to whether the down-converting circuit functions in practice. If a circuit *successfully* down-converts, that is proof that enough energy has been transferred to overcome the noise in the system." *Id.*

POSR at 10, 11

ParkerVision Ex. 2040
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Gibson/Schiltz Does Not Disclose "Storage Module"

ParkerVision's/Texas District Court's Construction
"a module of an *energy transfer system* that stores *non-negligible amounts of energy* from an input electromagnetic signal"

- Gibson/Schiltz does not disclose an energy transfer system
- The capacitors do not store non-negligible amounts of energy

Gibson/Schiltz Is Not An Energy Transfer System

Schiltz

In the preferred embodiment, hold capacitor 70 exhibits a capacitance of around 1 picoFarad. In general, this capacitance needs to be as small as possible so that acquisition time may be as fast as possible and bandwidth extended as far as possible. On the other hand,

Ex.-1006,8:31-34

HIGH SPEED SAMPLE AND HOLD CIRCUIT AND RADIO CONSTRUCTED THEREWITH

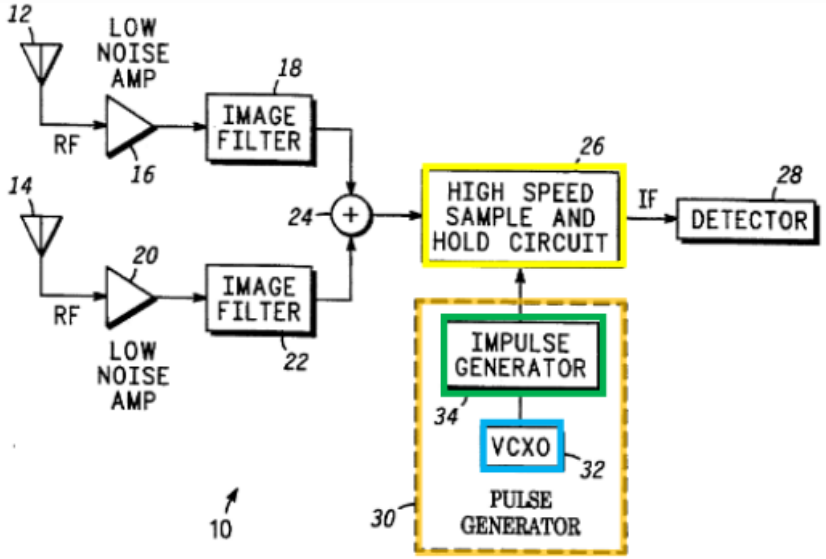


FIG. 1

Schiltz Capacitors Do Not Store Non-Negligible Amounts of Energy

Schiltz

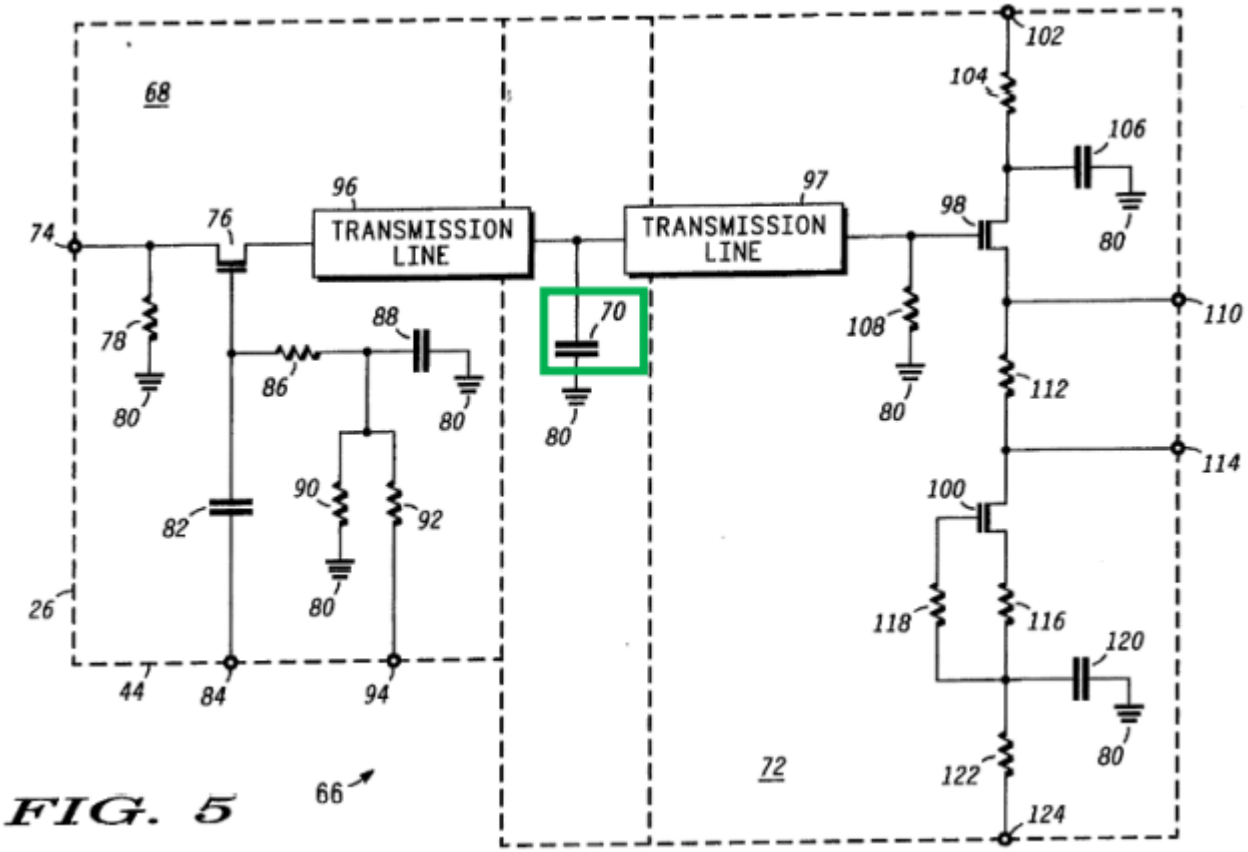


FIG. 5

Ex.-1006 (Schiltz)

Schiltz

In the preferred embodiment, hold capacitor **70** exhibits a capacitance of around 1 picoFarad. In general, this capacitance needs to be as small as possible so that acquisition time may be as fast as possible and bandwidth extended as far as possible. On the other hand,

Ex.-1006,8:31-34

Schiltz

Finally, the maximum amount of energy stored on the capacitor relative to the input RF energy is:

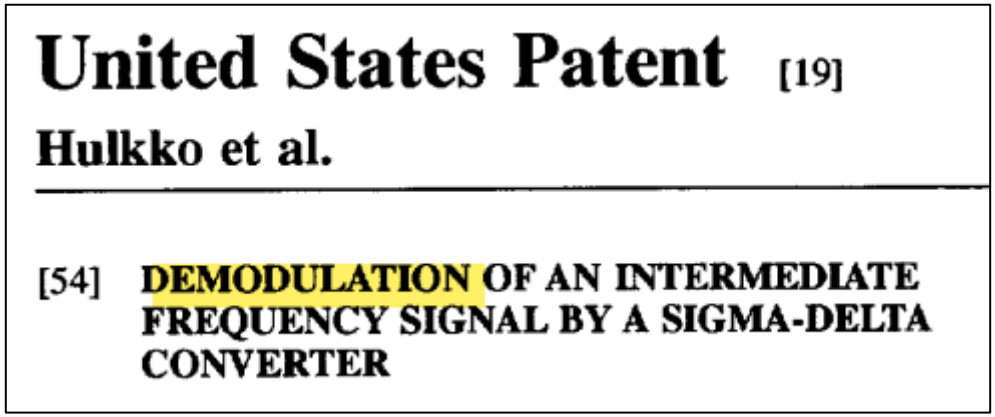
$$F_{MAX} = \frac{E_{C70,MAX}}{E_{RF}} = \frac{0.0003724(10^{-12}\ \text{F})(25\ \Omega)}{(452.5 \cdot 10^{-12}\ \text{s})} = 0.00002057 = 0.002057\%$$

The maximum energy held on the hold capacitor 70 in Fig. 5 is **0.002%** of the energy available in an RF cycle. As such, a POSITA understands that the capacitor 70 in Schiltz only stores a *negligible* amount of energy. *See* Ex.-2059 ¶¶358-366.

POSR at 76

Hulkko/Gibson Does Not Disclose "Cable Modem"

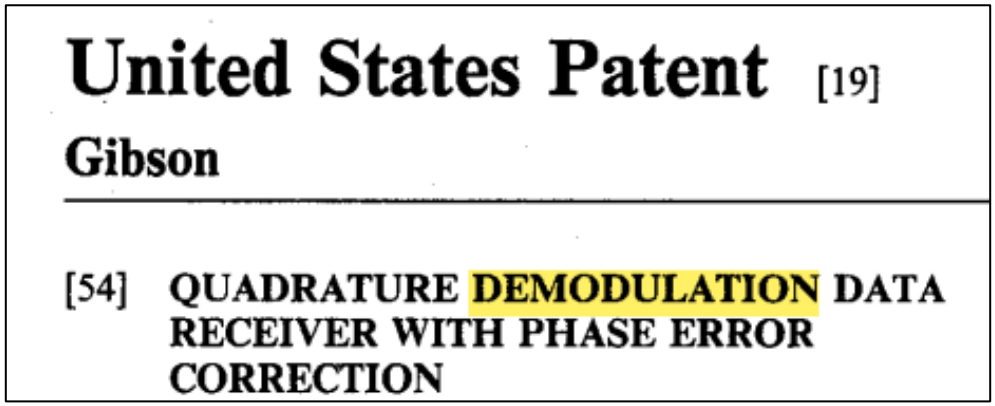
Modem performs ***mod***ulation and ***dem***odulation



United States Patent [19]

Hulkko et al.

[54] **DEMODULATION OF AN INTERMEDIATE FREQUENCY SIGNAL BY A SIGMA-DELTA CONVERTER**



United States Patent [19]

Gibson

[54] **QUADRATURE DEMODULATION DATA RECEIVER WITH PHASE ERROR CORRECTION**

Hulkko/Gibson Does Not Disclose "Cable Modem"

344. A POSITA understands that a modem requires both a transmitter and receiver that must be configured so that sensitivity of the receiver is not unduly degraded by the relatively high power transmit signal. A wireless modem must support a receiver and a transmitter communicating using a shared antenna. In one mode of operation, a wireless modem transmits and receives simultaneously. In this mode, it is important to configure the modem so that the sensitivity of the receiver is not unduly degraded by the relatively high power transmit signal. In another mode of operation, a wireless modem transmits and receives signals at different times. In this mode, the receiver can be destroyed by the high power transmit signals. In either situation, it is critical that consideration be given to protecting receiver operation. It is not obvious how to combine a receiver and a transmitter to realize a modem.

Ex.-2038 ¶344

ParkerVision Ex. 2040
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346. Given the lack of disclosure of a transmitter, using Hulkko/Gibson in a modem would not yield expected/predictable results. There is simply no disclosure in Hulkko or Gibson to make such a determination or determine whether the circuit configurations can be used in anything other than a stand-alone receiver. Indeed, the fact that Hulkko's receiver has poor energy efficiency (only 0.5% of the energy available is held in a Hulkko capacitor) suggests the circuit would be very sensitive to interference from nearby transmissions and, thus, not compatible as a receiver in a modem.

347. Merely because cable standards existed using I/Q modulation does not mean that a POSITA would use the specific configuration of Hulkko (as modified by Gibson) in a cable modem.

Ex.-2038 ¶346-347

Hulkko/Gibson Does Not Disclose "Cable Modem"

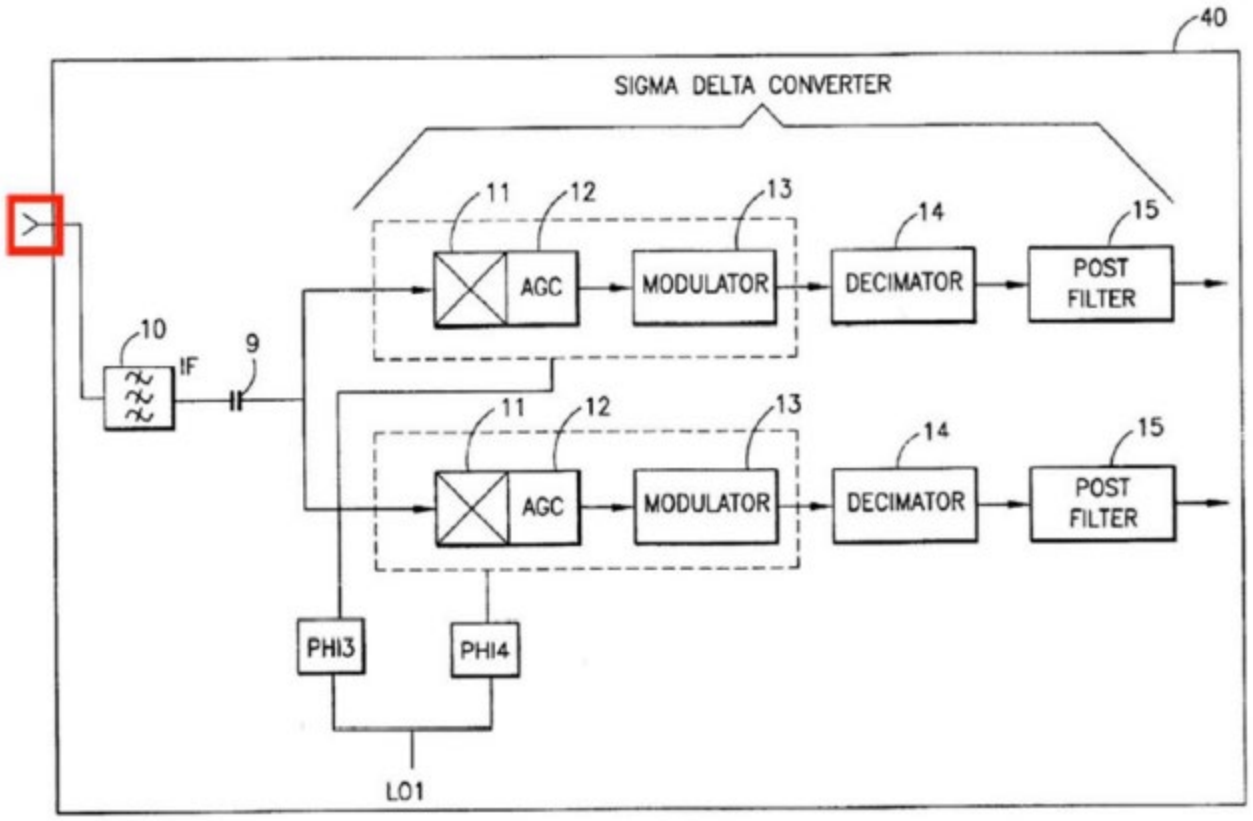

FIG.2

Ex.-1004
Ex.-2038 ¶348-349

Gibson Does Not Disclose Sampling