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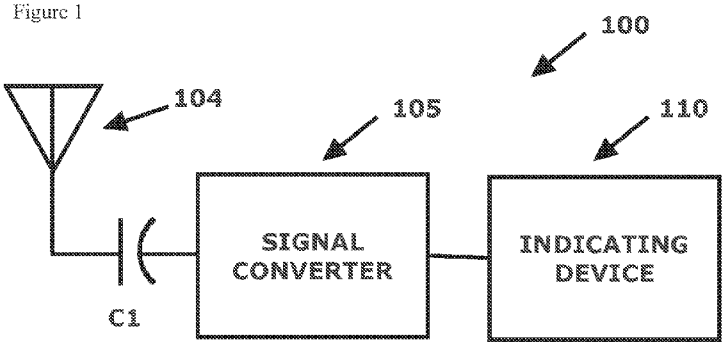
(54) Title: MOBILE ELECTRIC COMMUNICATIONS DEVICE TRANSMISSION MONITORING DEVICE

Figure 1



(57) Abstract: A mobile electronic device monitoring system is disclosed. The monitoring system includes an antenna configured to generate a first signal having alternating current characteristics and having a first amplitude characteristic. The first signal is based upon a radio frequency signal transmitted, or emitted, by the monitored mobile electronic communication device. The system also includes a signal converter communicatively coupled to the antenna. The signal converter is configured to generate a DC current based upon the first signal. The DC current amplitude characteristic is proportional to the first amplitude characteristic. The system also includes an indication device communicatively coupled to the signal converter and configured to cause an indication that the mobile electronic communication device is transmitting the radio frequency signal.

MOBILE ELECTRONIC COMMUNICATIONS DEVICE TRANSMISSION MONITORING DEVICE

BACKGROUND

[0001] A cellular phone normally transmits voice or streaming video communications with radio frequency energy emitted from the handheld device to a local cell site and thus onto the telephone network. From the network the call is routed to the appropriate subscriber(s), typically via another cell site via a second radio frequency air interface.

SUMMARY

[0002] A mobile electronic communication device monitoring system is disclosed. The monitoring device attaches to the communications device being monitored or may be included as an integral part of the manufactured handset. The monitoring system includes an antenna configured to capture local radio frequency (RF) energy (i.e., electromagnetic radiation) from the device being monitored and generates a first signal having alternating current characteristics based upon the detected local RF energy. The first signal is based upon a radio frequency signal transmitted, or emitted, by a mobile communications device. The system also includes a signal converter communicatively coupled to the antenna. The signal converter is configured to generate a second signal having direct current (DC) characteristics based upon the first signal. The system also includes an indication device communicatively coupled to the signal converter and configured to cause an indication that the mobile electronic communication device is transmitting the radio frequency signal.

[0003] This Summary is provided to introduce a selection of concepts in a simplified form that are further described below in the Detailed Description. This Summary is not intended to identify key features or essential features of the claimed subject matter, nor is it intended to be used as an aid in determining the scope of the claimed subject matter.

DRAWINGS

[0004] The detailed description is described with reference to the accompanying figures. The use of the same reference numbers in different instances in the description and the figures may indicate similar or identical items.

[0005] Figure 1 is a block diagram illustrating a mobile electronic device (e.g., a cell phone) transmission monitoring device in accordance with an example implementation of the present disclosure.

[0006] Figure 2 is a diagrammatic illustration of an external cell phone transmission monitoring device in accordance with an example implementation of the present disclosure, wherein the cell phone transmission monitoring device is embedded within a plastic semi-flexible printed circuit board and is coupled to an exterior of a mobile electronic device.

[0007] Figure 3 is a diagrammatic illustration of a circuit diagram of the cellular phone transmission monitoring device in accordance with an example implementation of the present disclosure.

[0008] Figure 4 is a diagrammatic illustration of a micro-strip antenna in accordance with an example implementation of the present disclosure, wherein the antenna is designed to have a broad bandwidth that covers at least seven hundred (700) Megahertz to three thousand (3000) Megahertz and the antenna comprises copper foil, such as copper foil at least approximately 15 mils in thickness.

[0009] Figure 5 is a diagrammatic illustration of a cell phone transmission monitoring device integrated with a mobile electronic device in accordance with an example implementation of the present disclosure, wherein an indication device is exposed for external viewing.

DETAILED DESCRIPTION.

[0010] Normally, a mobile cellular or radio communication device indicates when a voice or video transmission is taking place with various screen indications (e.g., graphics, etc.). There exists software that allows eavesdropping by third parties that

can be installed into the device's operating system covertly, both through a physical connection to the phone device, or remotely, via wireless programming, etc. Eavesdropping is accomplished through this software and designed so that the device does not give any indication whatsoever that the phone is transmitting a signal. This can occur even with the device in the "off" condition (e.g., a device that appears to be in a non-operational, or non-transmitting, state). It is possible to activate the phones microphone and camera in this manner, so that parties being eavesdropped on are unaware that they are being monitored. The same thing is possible with mobile radio communication devices. The ability to monitor mobile radios in the same manner is often a built in feature of the radio.

[0011] The mobile electronic device transmission monitoring (MDTM) device 100 is configured to, when operational, continuously monitor transmission activity of a mobile electronic device 102, such as a mobile electronic communication device (e.g., a cellular phone, a land mobile radio, etc.). For example, the mobile electronic device 102 is configured to transmit signals representing communication (e.g., transmit electronic radiation occurring within the radio frequency spectrum of wavelengths). In a specific implementation of the present disclosure, any type of continuous transmission causes the MDTM light-emitting diode (LED) indicator to be visibly illuminated. In another implementation of the present disclosure, any type of continuous transmission causes an audible alert from an audio device. Short burst transmissions, such as text messages or handshakes, may cause only a momentary illumination of the LED. Discrete continuous transmissions may occur during transmission of voice and/or streaming video data, which causes an LED to illuminate continuously or to flash continuously, depending on the configuration of the LED flasher circuit. This illumination, or an audio indication, alerts the subscriber to the fact that the phone is actively transmitting.

[0012] With eavesdropping software in place, the discrete continuous transmission may occur when the device appears to be in a non-transmitting state (e.g., when the device appears to be in an off state, or powered down state). When confidential discussions are taking place in the vicinity of the device, simply watching the LED of the MDTM device 100 may ensure that no transmissions are taking place, as long as the LED is not illuminated. When using the mobile electronic device 102 normally, such as engaging

in a call, the MDTM LED is illuminated, thus allowing the user to frequently verify that the MDTM device 100 is operational and working.

[0013] In a first implementation, the MDTM device 100 may be external to a mobile electronic device 102, such as a cellular communication device. The external MDTM device 100 may be configured as an add-on component that is adhered (e.g., coupled) to the mobile electronic device, or imbedded in a case that fits on the phone. It may be in the form of a small piece of flexible tape like material that is coupled (e.g., adhered or attached) to the device 102, (see Figure 2), or it may be molded into the phones external protective case itself (see Figure 5).

[0014] As shown in Figure 3, an antenna 104 is coupled via a capacitor C1 to a signal converter 105, such as a voltage doubler 106. In an implementation, the voltage doubler 106 comprises a pair of Schottkey detector diodes 108A, 108B. Radio frequency (RF) energy (i.e., electromagnetic radiation occurring within a first limited spectrum of wavelengths) captured by the antenna assembly 104 is converted to direct current (DC) by Schottkey diodes 108A, 108B, which creates a voltage at an indication device 110. In an implementation, the indication device 110 comprises a light emitting diode oscillator (i.e., flasher) circuit. The indication device 110 is configured to detect the DC current and cause an indication (i.e., generate a signal to cause an indication) in response to detecting the DC current. For example, the indication, as described in greater detail herein, is configured to alert an individual that the mobile electronic device 102 is operational and in a transmission state (i.e., transmitting radio frequency signals representing voice data, etc.).

[0015] In a specific implementation, the light emitting diode flasher comprises a 3909 integrated circuit chip. The voltage may be applied to the Vcc terminal of the light emitting diode flasher chip and this causes an illumination source, such as a light emitting diode 112 (LED), to emit electromagnetic radiation (i.e., illuminate) at a predefined frequency (i.e., flash). For example, the LED 112 is configured to emit electromagnetic radiation occurring within a second limited spectrum of wavelengths (i.e., the visible light spectrum). The frequency (i.e., flash rate) of the LED 112 is determined by the value of capacitor C3. (See Figure 3). In another implementation, the indication device 110 comprises an audio device configured to generate an audio

signal to indicate that the mobile electronic device 102 is emitting RF energy (e.g., electromagnetic radiation).

[0016] The antenna 104 design shown in Figure 4 is a wide band antenna that covers approximately seven hundred (700) Megahertz to approximately three (3) Gigahertz. This is the standard frequency range of most cell phones currently used throughout the world. The approximate size of the MDTM board is 82 millimeters (mm) x 52 millimeters (mm). Multiple circuits may be used if necessary to cover a wider range of frequencies, with each antenna being designed for the intended frequency.

[0017] The external MDTM device 100 is isolated from the internal electronics of the phone and cannot be disabled or circumvented by software changes. The MDTM device 100 is powered from the energy emitted by the device 102, thus, no batteries or external power is required.

[0018] In another implementation, the MDTM device 100 may be internal to the mobile electronic device 102. For example, mobile electronic devices 104 may be designed with the MDTM as an integral part of the phone. The MDTM may be exactly the same as the external MDTM, only mounted inside the phone case with the LED exposed to the outside via a hole or window, to allow the user to see it. Other variations of the MDTM may be used which use a direct electronic connection to the phones transmitter or control circuitry, to determine when the phone is in transmit mode.

[0019] The MDTM is configured as an indicating device that will show the presence of a continuous transmit signal from a cellular device (or other radio transmitter). This will alert the user to unauthorized eavesdropping from the device whether in voice or streaming video modes. This monitoring device is a separate piece of hardware and cannot be defeated with any type of device software modifications. It may be included as part of the original manufactured features of the device or simply mounted or adhered to the exterior of the device, or, embedded inside the case of the device. In the case of an originally manufactured MDTM included as a cell phone feature, the circuitry may incorporate monitoring via internal control or transmitter circuitry monitoring (i.e. voltages present only when the transmitter is active) in addition to or instead of, air coupled RF power monitoring. The MDTM is configured to indicate use

of the device for covertly monitoring sound via the device microphone as well, as unauthorized transmission of streaming video from the device's camera.

[0020] Although the subject matter has been described in language specific to structural features and/or process operations, it is to be understood that the subject matter defined in the appended claims is not necessarily limited to the specific features or acts described above. Rather, the specific features and acts described above are disclosed as example forms of implementing the claims.

What is claimed is:

1. A monitoring system comprising:

an antenna configured to capture electromagnetic radiation occurring within a limited spectrum of wavelengths emitted by a mobile electronic communication device proximate to antenna to generate a first signal having alternating current characteristics;

a signal converter communicatively coupled to the antenna, the signal converter configured to generate a second signal having direct current characteristics based upon the first signal; and

an indication device communicatively coupled to the signal converter and configured to detect the second signal to cause an indication that the mobile electronic communication device is transmitting the radio frequency signal.

2. The monitoring system as recited in claim 1, wherein the indication device comprises a light emitting diode communicatively coupled to a light emitting diode flasher circuit.

3. The monitoring system as recited in claim 2, further comprising a visible light emitting diode operatively coupled to the light emitting diode flasher circuit, the light emitting diode flasher circuit configured to cause the light emitting diode to emit a flashing light indicating the mobile electronic device is transmitting the first signal when the antenna receives the first signal.

4. The monitoring system as recited in claim 1, wherein the signal converter comprises a voltage doubler.

5. The monitoring system as recited in claim 4, further comprising a first capacitor having a first terminal and a second terminal, the first terminal coupled to the antenna and the second terminal coupled to the voltage doubler.

6. The monitoring system as recited in claim 5, wherein the voltage doubler comprises a first diode, a second diode, and a second capacitor, the first diode and the second diode each including an anode and a cathode, the second capacitor including a first terminal and a second terminal, wherein the anode of the first diode is connected to ground and the cathode of the first diode is connected to the first terminal

of the second capacitor and the cathode of the second diode, the anode of the second diode connected to the second terminal of the first capacitor.

7. The monitoring system as recited in claim 6, wherein at least one of the first diode or the second diode comprises a Schottky diode.

8. The monitoring system as recited in claim 1, wherein the indication device is configured to generate an audio signal to indicate that the mobile electronic device is transmitting the radio frequency signal.

9. A monitoring system comprising:

an antenna configured to generate an alternating current signal having a first amplitude characteristic, the alternating current signal based upon a radio frequency signal transmitted by a monitored mobile device;

a voltage doubler communicatively coupled to the antenna, the voltage doubler configured to generate a direct current signal based upon the alternating current signal, the direct current signal having an increased amplitude characteristic with respect to the first amplitude characteristic; and

a light emitting diode flasher communicatively coupled to the voltage doubler, the light emitting diode flasher configured to cause a light emitting diode to emit electromagnetic radiation occurring in limited spectrum of wavelengths indicating that the mobile electronic device is transmitting a radio frequency signal.

10. The monitoring system as recited in claim 9, further comprising a first capacitor having a first terminal and a second terminal, the first terminal coupled to the antenna and the second terminal coupled to the voltage doubler.

11. The monitoring system as recited in claim 10, wherein the voltage doubler comprises first diode, a second diode, and a second capacitor, the first diode and the second diode each including an anode and a cathode, the second capacitor including a first terminal and a second terminal, wherein the anode of the first diode is connected to ground and the cathode of the first diode is connected to the first terminal of the second capacitor and the cathode of the second diode, the anode of the second diode connected to the second terminal of the first capacitor.

12. The monitoring system as recited in claim 11, wherein at least one of the first diode or the second diode comprises a Schottky diode.

13. A monitoring system comprising:

an antenna configured to generate an alternating current signal having a first amplitude characteristic, the alternating current signal based upon a radio frequency signal transmitted by a monitored mobile electronic communication device;

a voltage doubler communicatively coupled to the antenna, the voltage doubler configured to generate a direct current signal based upon the alternating current signal, the direct current signal having an increased amplitude characteristic with respect to the first amplitude characteristic;

a light emitting diode flasher communicatively coupled to the voltage doubler; and

a light emitting diode operatively coupled to the light emitting diode flasher,

wherein the light emitting diode flasher is configured to cause the light emitting diode to emit electromagnetic radiation occurring in the visible spectrum at a predefined frequency indicating that the mobile electronic communication device is transmitting a radio frequency signal.

14. The monitoring system as recited in claim 13, further comprising a first capacitor having a first terminal and a second terminal, the first terminal coupled to the antenna and the second terminal coupled to the voltage doubler.

15. The monitoring system as recited in claim 14, wherein the voltage doubler comprises a first diode, a second diode, and a second capacitor, the first diode and the second diode each including an anode and a cathode, the second capacitor including a first terminal and a second terminal, wherein the anode of the first diode is connected to ground and the cathode of the first diode is connected to the first terminal of the second capacitor and the cathode of the second diode, the anode of the second diode connected to the second terminal of the first capacitor.

16. The monitoring system as recited in claim 14, wherein at least one of the first diode or the second diode comprises a Schottky diode.

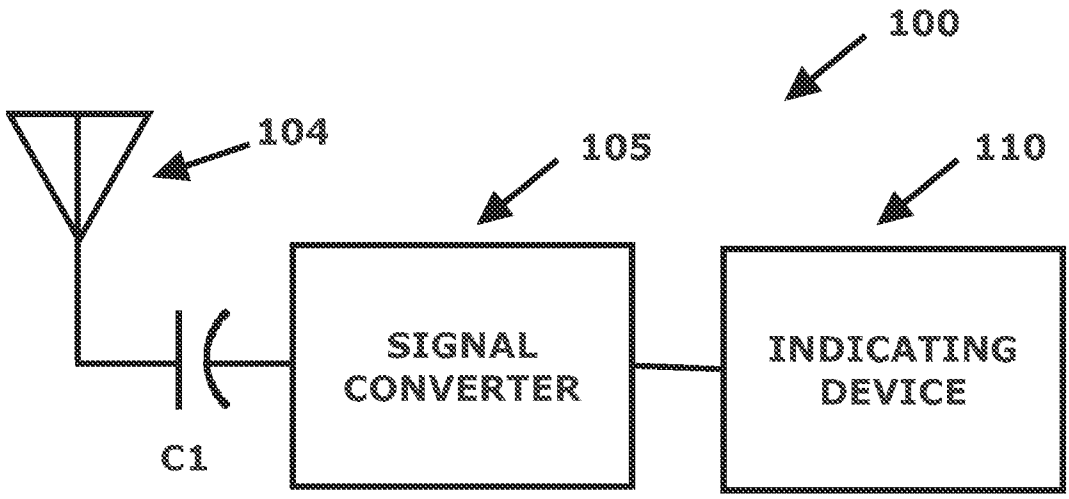


Figure 1

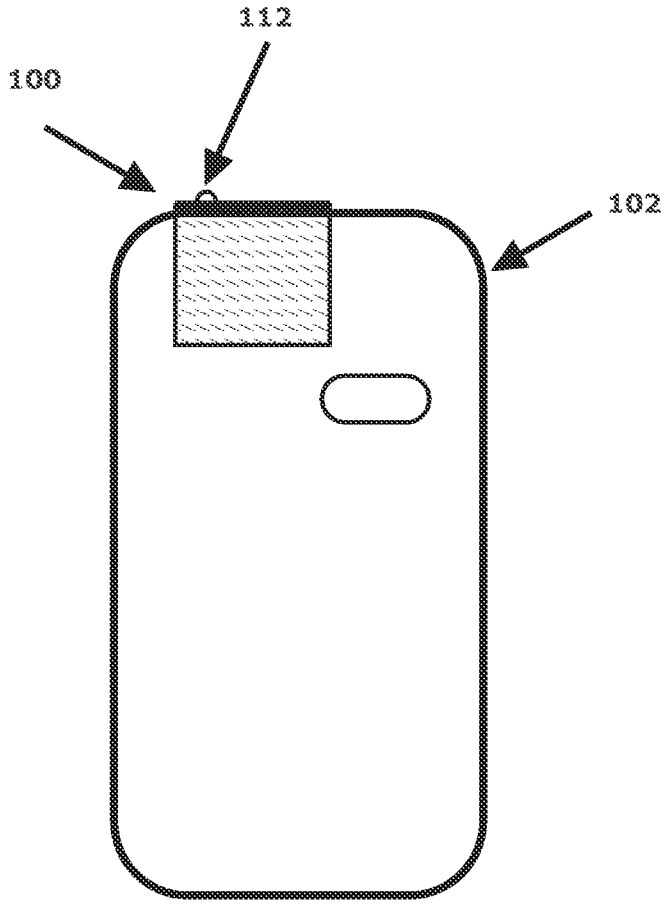


Figure 2

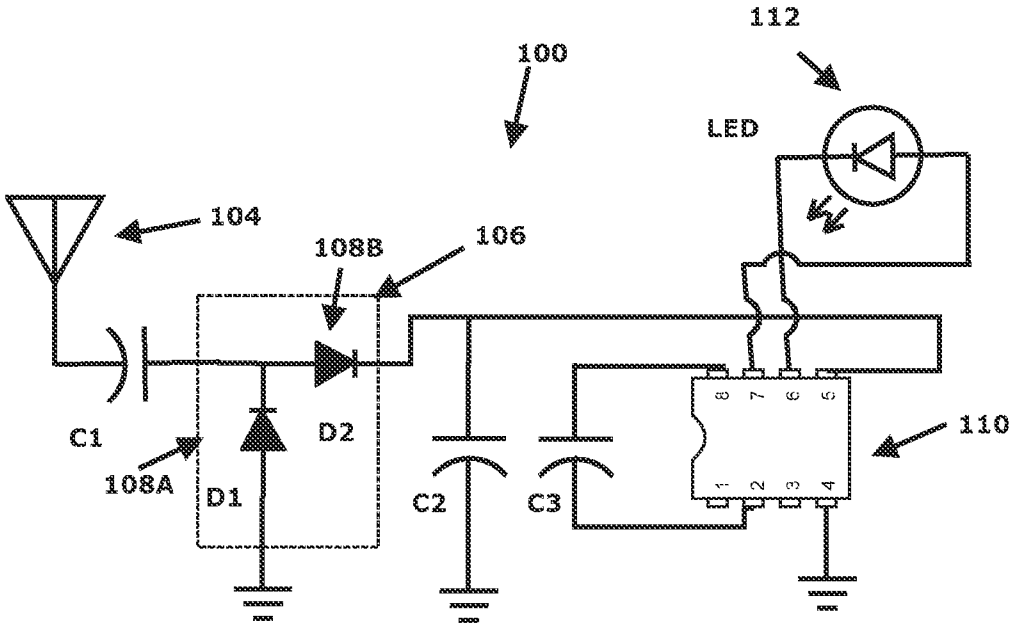


Figure 3

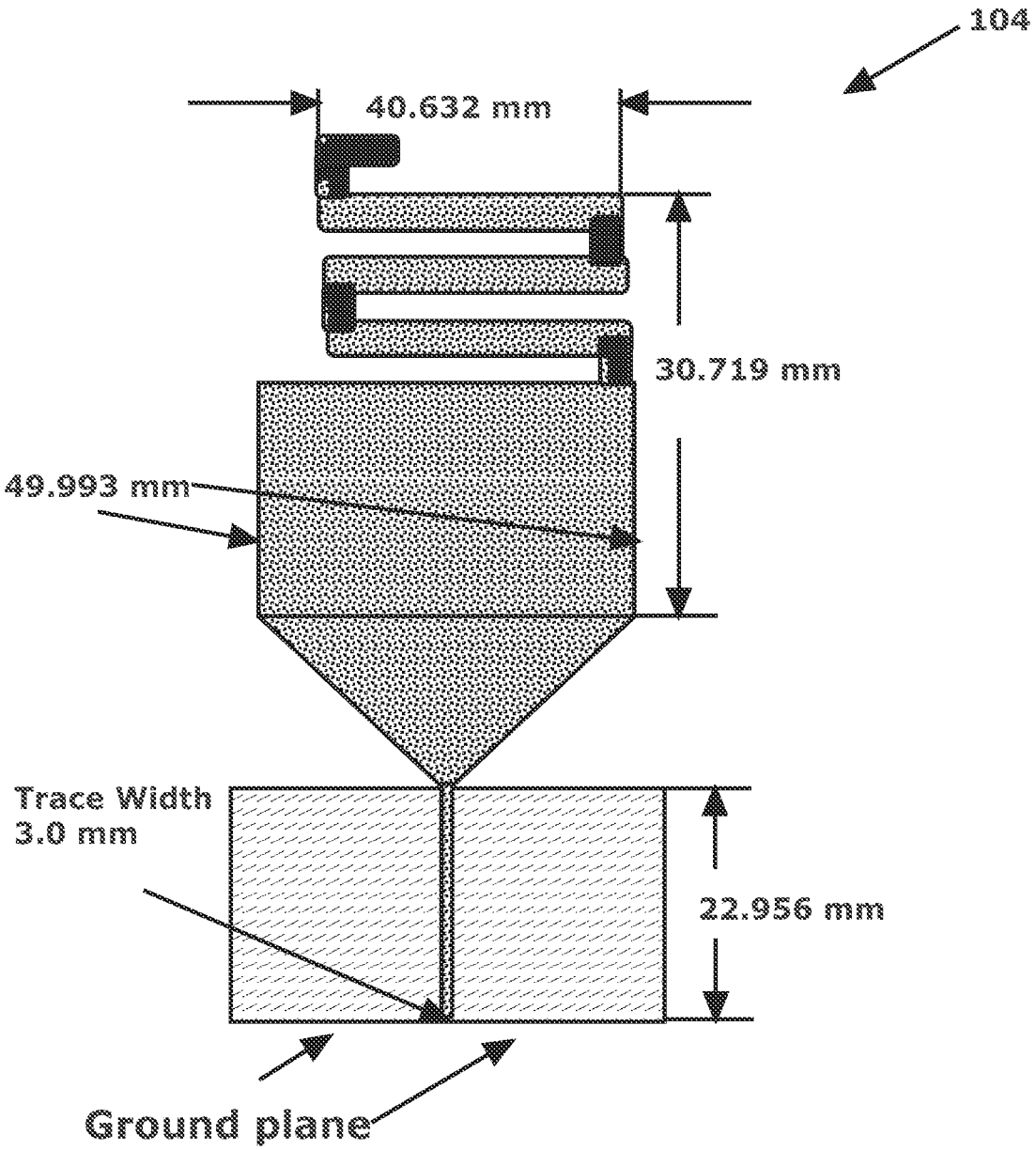

104
40.632 mm
30.719 mm
49.993 mm
Trace Width
3.0 mm
22.956 mm
Ground plane

Figure 4

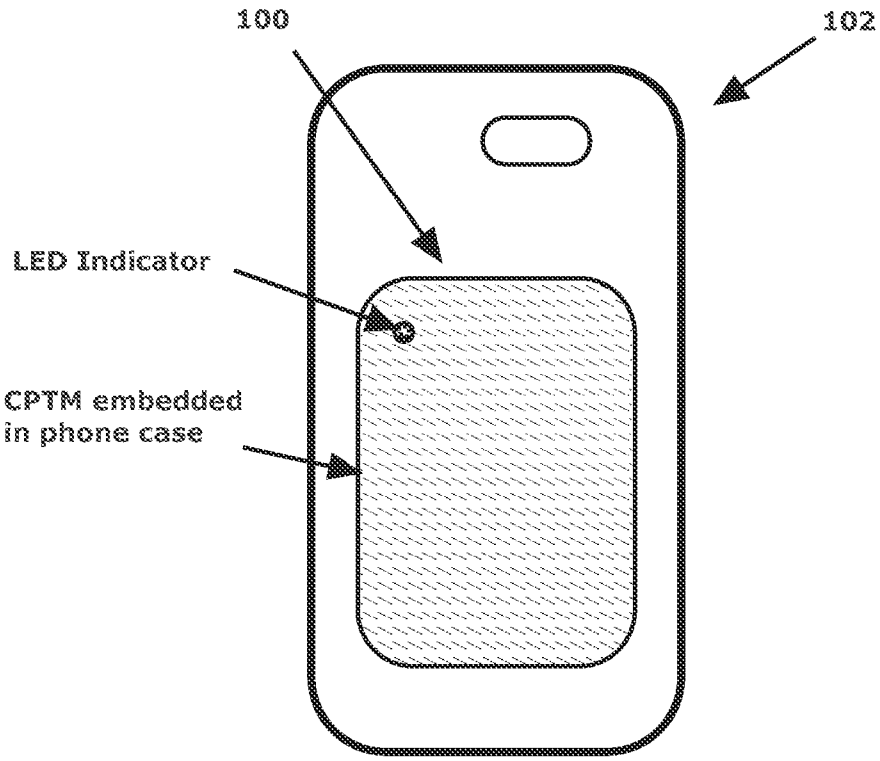


Figure 5

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2013/050849

A. CLASSIFICATION OF SUBJECT MATTER

H04W 24/00(2009.01)i, H04B 1/38(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
H04W 24/00; G01R 13/00; G01R 29/08; H04Q 1/00; G06F 15/20; G01R 33/02; G01R 33/06; H04B 1/38

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Korean utility models and applications for utility models
Japanese utility models and applications for utility models

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
eKOMPASS(KIPO internal) & Keywords: radiation, AC, DC, convert, indication

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 03-083495 A1 (QINETIQ LIMITED) 09 October 2003 See abstract; page 3, lines 9-14; page 5, line 29 - page 6, line 16; page 7, line 14 - page 8, line 36; page 9, lines 26-29; and figure 5.	1-4,8,9,13
A		5-7,10-12,14-16
A	US 4996525 A (EARL M. BECKER, JR. et al.) 26 February 1991 See abstract; column 2, line 47 - column 3, line 66; and figure 2.	1-16
A	US 5311130 A (RICHARD BILL et al.) 10 May 1994 See abstract; column 1, line 57 - column 2, line 18; column 3, lines 7-36; column 4, lines 64-67; and figure 2.	1-16
A	EP 0955548 A1 (YOSHIMITSU SUDA) 10 November 1999 See abstract; paragraphs [8]-[10], [20], [22], [24]-[26].	1-16
A	US 5256960 A (AMIR R. NOVINI) 26 October 1993 See abstract; and column 3, line 17 - column 4, line 28.	1-16

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
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"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents,such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
31 March 2014 (31.03.2014)	**31 March 2014 (31.03.2014)**

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.
PCT/US2013/050849

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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US 5311130 A	10/05/1994	CN 1080727 A	12/01/1994
		US 5309097 A	03/05/1994
		WO 93-21538 A1	28/10/1993
EP 0955548 A1	10/11/1999	US 6064190 A	16/05/2000
US 5256960 A	26/10/1993	None	