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(54) **GLUCOSE MEASUREMENT DEVICE AND METHODS USING RFID**

(71) Applicant: **ABBOTT DIABETES CARE INC.**, Alameda, CA (US)

(72) Inventors: **Timothy T. Goodnow**, Bethesda, MD (US); **Lei He**, Moraga, CA (US)

(73) Assignee: **ABBOTT DIABETES CARE INC.**, Alameda, CA (US)

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(63) Continuation of application No. 14/017,166, filed on Sep. 3, 2013, which is a continuation of application No. 13/744,322, filed on Jan. 17, 2013, now Pat. No. 8,542,122, which is a continuation of application No. 12/625,525, filed on Nov. 24, 2009, now Pat. No. 8,358,210, which is a continuation of application No. 12/476,921, filed on Jun. 2, 2009, now Pat. No. 8,106,780, which is a continuation of application No. 11/350,398, filed on Feb. 7, 2006, now Pat. No. 7,545,272.

(60) Provisional application No. 60/701,654, filed on Jul. 21, 2005, provisional application No. 60/650,912, filed on Feb. 8, 2005.

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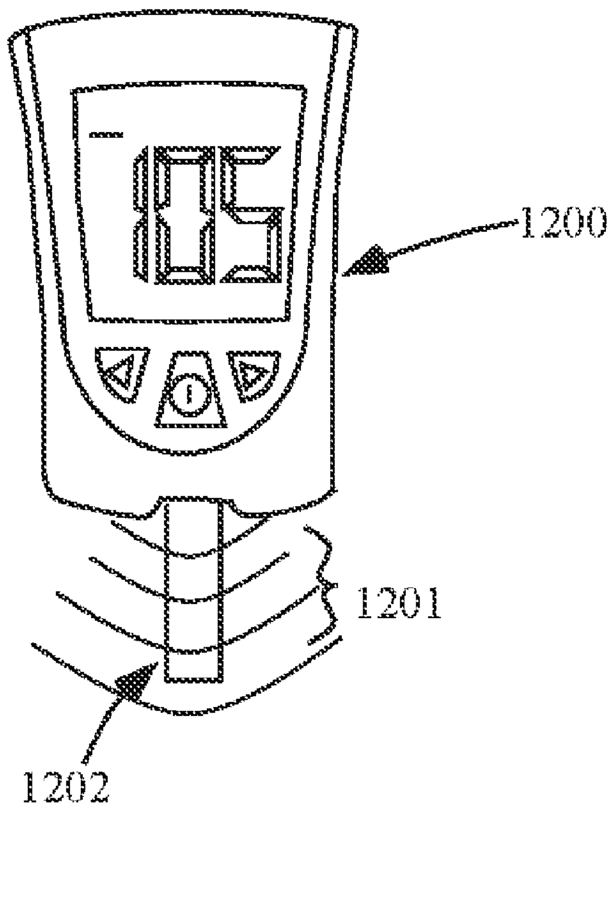
(52) **U.S. Cl.**
CPC ***A61B 5/0004*** (2013.01); ***A61B 5/14532*** (2013.01)
USPC **340/10.1**

(57) **ABSTRACT**

A glucose monitoring system includes a glucose sensor strip or package of strips. The strip includes a substrate and a glucose monitoring circuit that has electrodes and a bodily fluid application portion of selected chemical composition. An antenna is integrated with the glucose sensor strip. An RFID sensor chip is coupled with the glucose sensor strip and the antenna. The chip has a memory containing digitally-encoded data representing calibration and/or expiration date information for the strip.



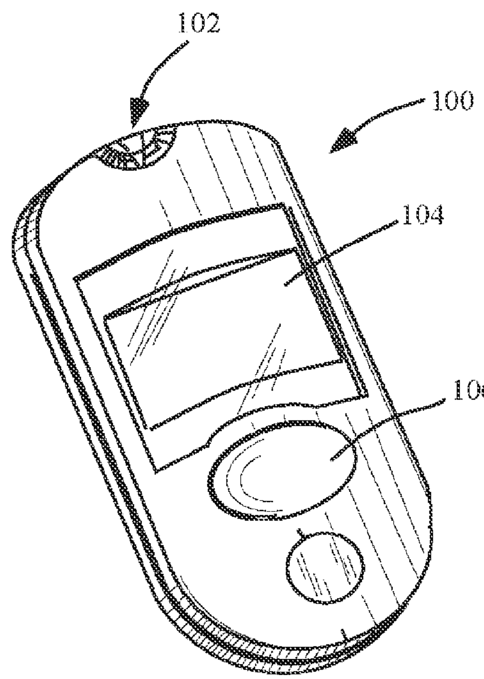


FIGURE 1

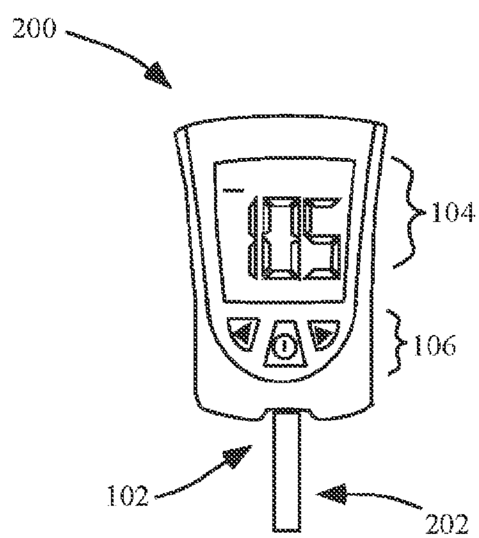


FIGURE 2

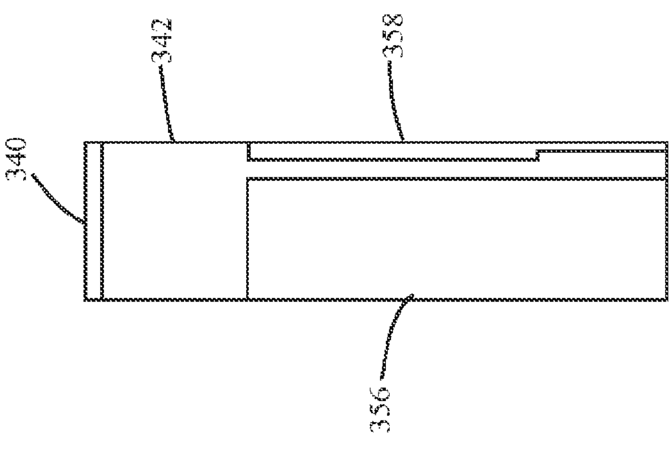


FIGURE 3A

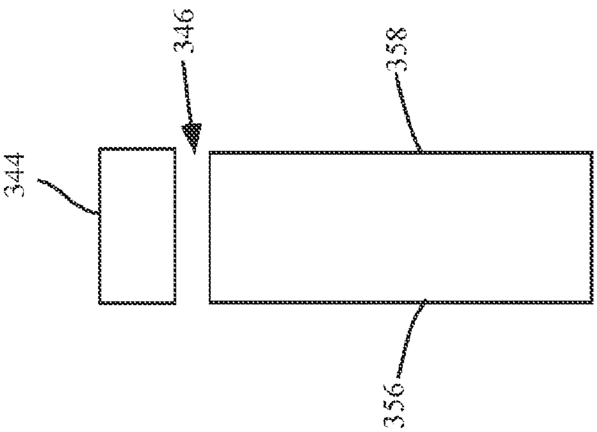


FIGURE 3B

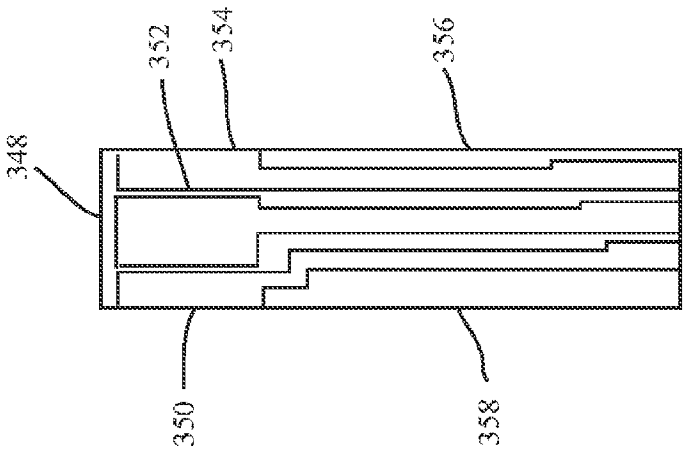


FIGURE 3C

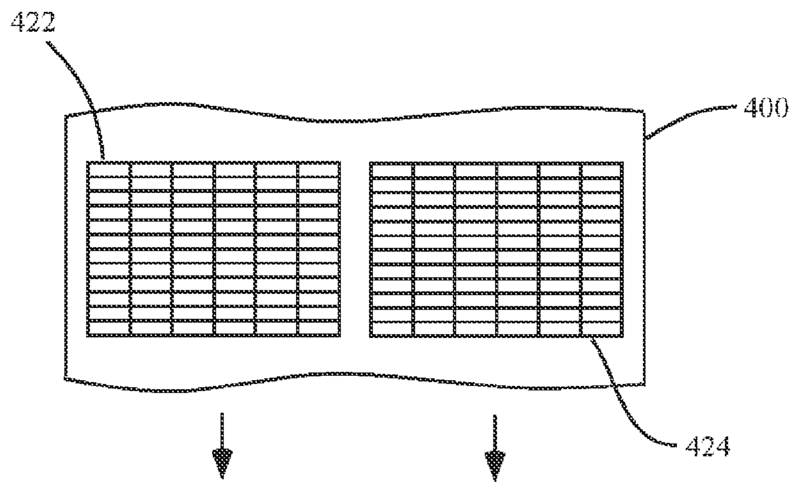


FIGURE 4A

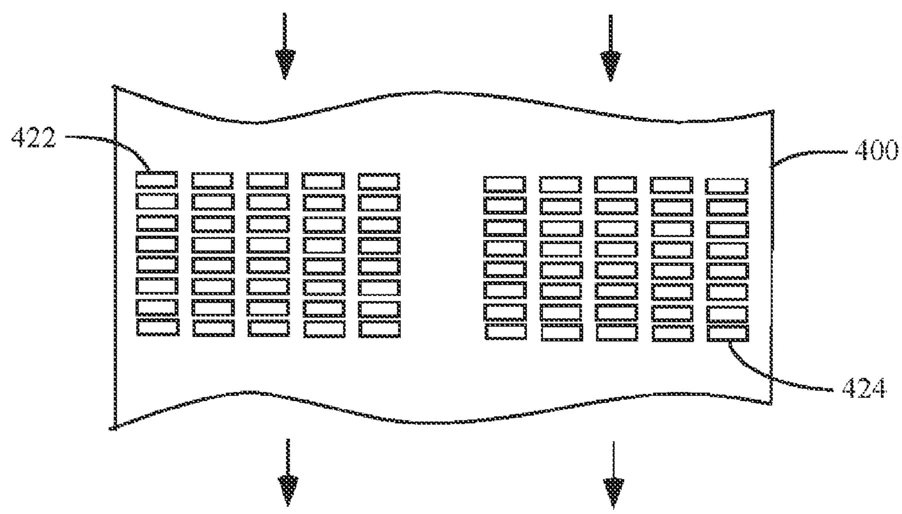


FIGURE 4B

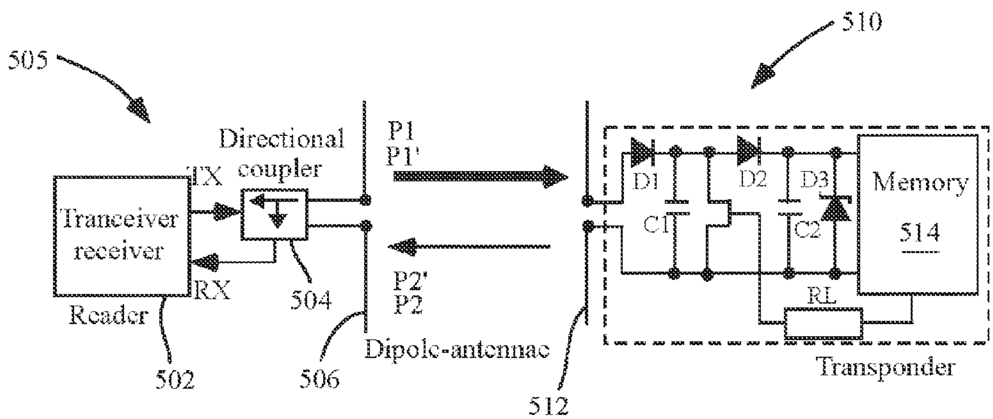

505
510
Directional coupler
TX
Tranceiver receiver
RX
Reader
502
504
506
P1
P1'
P2'
P2
Dipole-antennae
512
D1
D2
D3
C1
C2
Memory
514
RL
Transponder

FIGURE 5

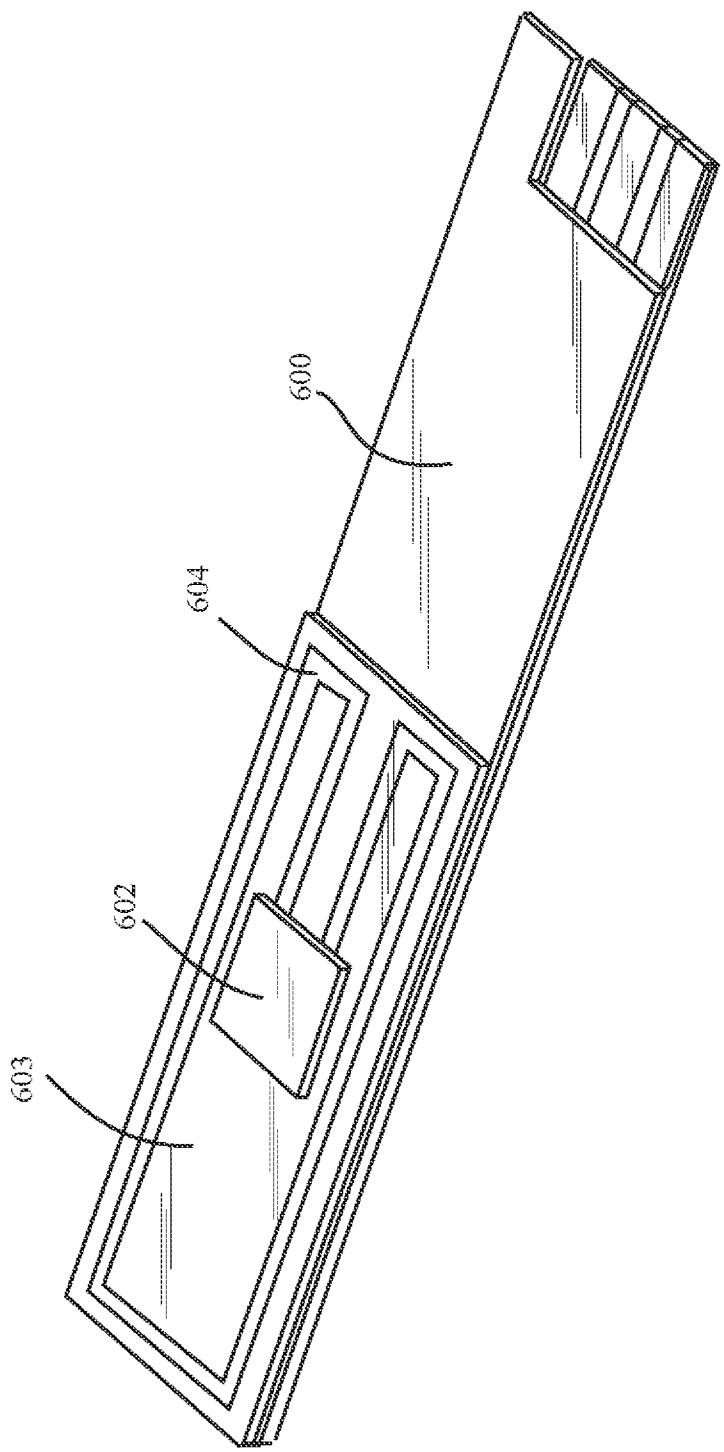


FIGURE 6

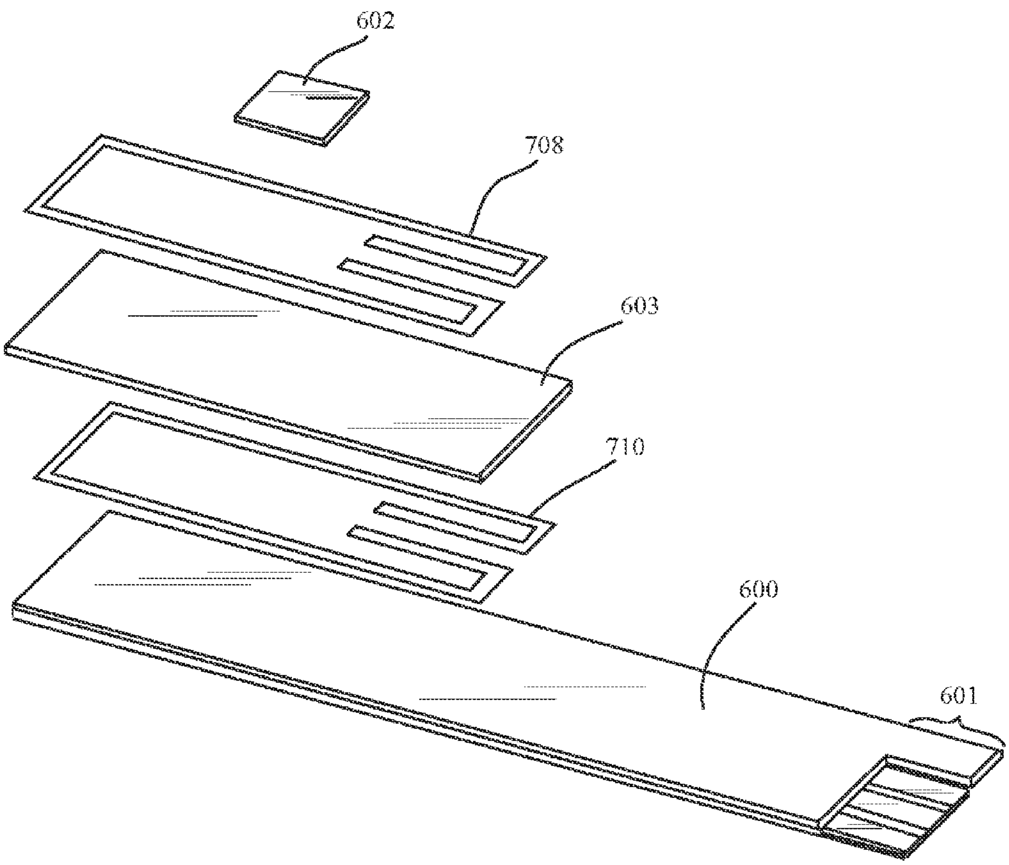


FIGURE 7

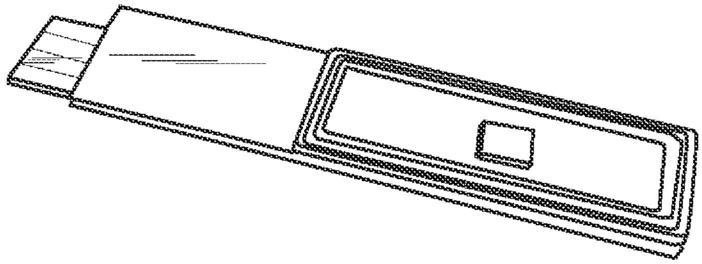


FIGURE 8

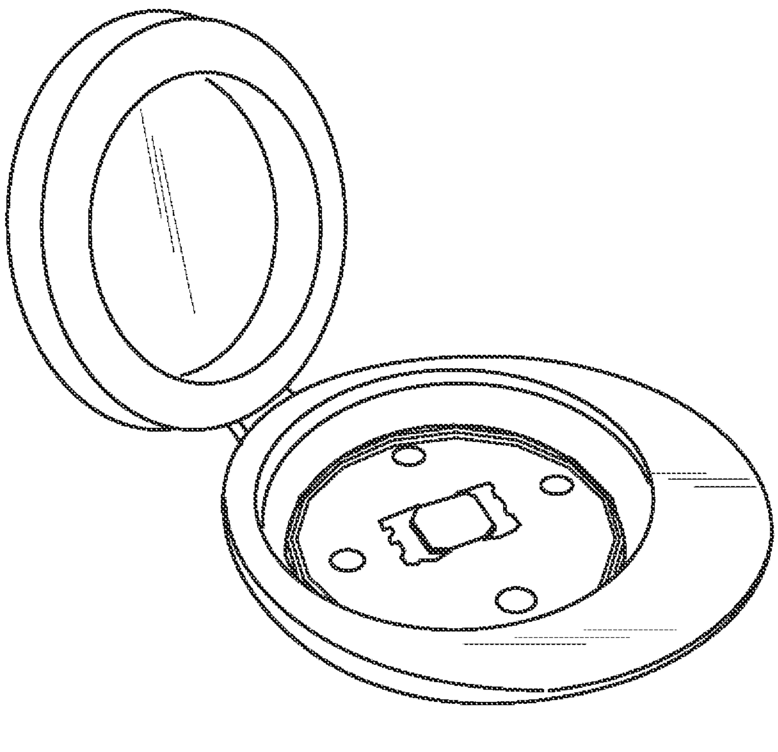


FIGURE 10

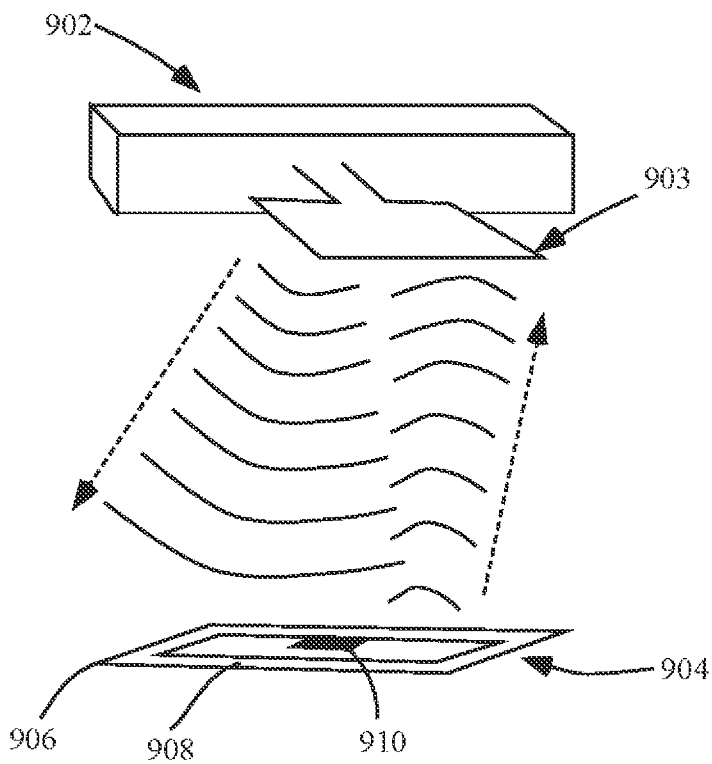


FIGURE 9

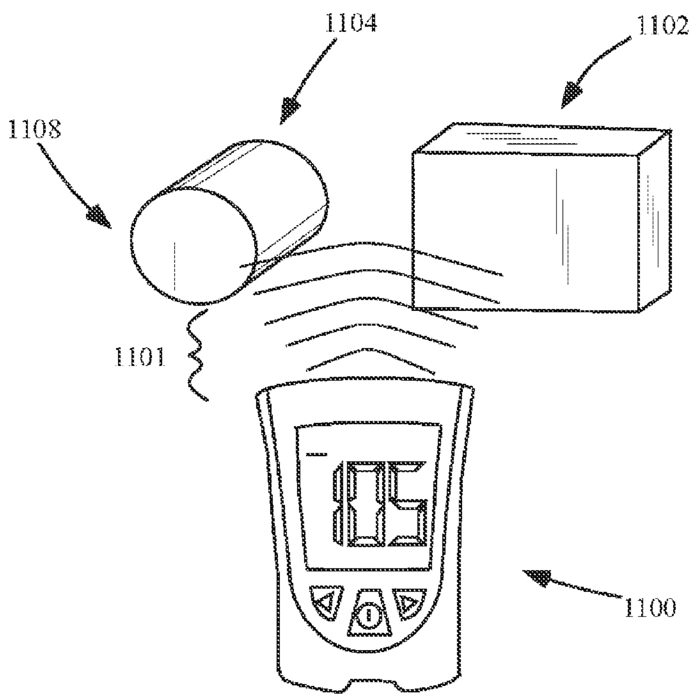


FIGURE 11

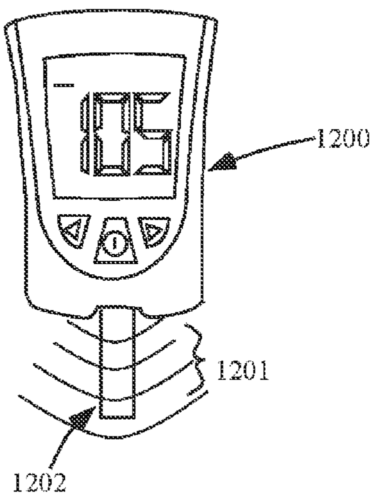


FIGURE 12

GLUCOSE MEASUREMENT DEVICE AND METHODS USING RFID

RELATED APPLICATION

[0001] The present application is a continuation of U.S. patent application Ser. No. 14/017,166, filed Sep. 3, 2013, which is a continuation of U.S. patent application Ser. No. 13/744,322, filed Jan. 17, 2013, now U.S. Pat. No. 8,542,122, which is a continuation of U.S. patent application Ser. No. 12/625,525 filed Nov. 24, 2009, now U.S. Pat. No. 8,358,210, which is a continuation of U.S. patent application Ser. No. 12/476,921 filed Jun. 2, 2009, now U.S. Pat. No. 8,106,780, which is a continuation of U.S. patent application Ser. No. 11/350,398 filed Feb. 7, 2006, now U.S. Pat. No. 7,545,272, which claims priority to U.S. provisional application Nos. 60/701,654 filed Jul. 21, 2005 and 60/650,912 filed Feb. 8, 2005, the disclosures of each of which are incorporated herein by reference for all purposes.

BACKGROUND

[0002] Diabetes care involves periodically checking the blood glucose level of a bodily fluid such as blood. Based on the measured bodily fluid level, a diabetic may take one or more steps such as injecting insulin or consuming carbohydrates to bring the level back to a desired level.

[0003] Glucose Meters

[0004] FIG. **1** illustrates a conventional blood glucose meter **100** (see U.S. Design Pat. No. D393,313, which is hereby incorporated by reference). The meter **100** includes a test strip slot **102**, a display **104** and one or more operational buttons **106**. Although not shown in FIG. **1**, the meter **100** also includes component circuitry for receiving signals that depend on the glucose level of a fluid applied to a strip that is inserted into the slot **102**, and component circuitry for determining the glucose level based on the received signals. FIG. **2** illustrates a blood glucose meter **200** with display **104** and operational buttons **106**, and also having a glucose test strip **202** inserted into a slot **102** for testing a body fluid sample applied to the strip **202**.

[0005] Glucose Sensors

[0006] Small volume (e.g., less than 0.5 microliter), in vitro, electrochemical sensors are used with Freestyle® and Freestyle Flash™ glucose meters (see http://abbottdiabetes-care.com, which is hereby incorporated by reference). These test strip sensors generally include a working electrode on a first substrate, a counter (or counter/reference) electrode on a second substrate, and a sample chamber. The sample chamber is configured so that when a sample (e.g., of blood) is provided in the chamber, the sample is in electrolytic contact with both the working electrode, the counter electrode and any reference electrodes or indicator electrodes that may be present. This allows electrical current to flow between the electrodes to affect the electrolysis (electrooxidation or electroreduction) of the analyte. A spacer is generally positioned between first substrate and second substrate to provide a spacing between electrodes and to provide the sample chamber in which the sample to be evaluated is housed.

[0007] FIGS. **3**A-**3**C illustrate one of these test strips (see U.S. Pat. No. 6,942,518, which is assigned to the same assignee as the present application, and is hereby incorporated by reference). This configuration is used for side-filling, and end-filling is an alternative. FIG. **3**A illustrates a first substrate **340** with a working electrode **342**. FIG. **3**B illustrates a spacer **344** defining a channel **346**. FIG. **3**C (inverted with respect to FIGS. **3**A and **3**B) illustrates a second substrate **348** with three counter (or counter/reference) electrodes **350**, **352**, **354**. This multiple counter electrode arrangement can provide a fill indicator function, as described below. The length of the channel **346** is typically defined by the two parallel cuts along the sides **356**, **358** of the sensors.

[0008] Glucose test strip sensors can be manufactured adjacent to one another, as illustrated in FIGS. **4**A-**4**B. Such positioning during manufacture produces less waste material. This often results in better efficiency as compared to other techniques, such as individually placing components within the individual channels of test strip sensors.

[0009] General Method for Manufacturing Glucose Sensors

[0010] FIGS. **4**A-**4**B illustrate the processing of a sheet of test strips. Referring now to FIGS. **4**A and **4**B, one example of a method for making thin film sensors is generally described, and can be used to make a variety of sensor arrangements. When the three layers of the test strips of FIGS. **3**A-**3**C, e.g., are assembled, a sensor is formed.

[0011] In FIGS. **4**A and **4**B, a substrate **400**, such as a plastic substrate, is moving in the direction indicated by the arrows. The substrate **400** can be an individual sheet or a continuous roll on a web. Multiple sensors can be formed on a substrate **400** as sections **422** that have working electrodes thereon and sections **424** that have counter electrodes and indicator electrodes thereon. These working, counter and indicator electrodes are electrically connected to corresponding traces and contact pads. Typically, working electrode sections **422** are produced on one half of substrate **400** and counter electrode sections **424** are produced on the other half of substrate **400**. In some embodiments, the substrate **400** can be scored and folded to bring the sections **422**, **424** together to form the sensor. In some embodiments, as illustrated in FIG. **4**A, the individual working electrode sections **422** can be formed next to or adjacent each other on the substrate **400**, to reduce waste material. Similarly, individual counter electrode sections **424** can be formed next to or adjacent each other. In other embodiments, the individual working electrode sections **422** (and, similarly, the counter electrode sections **424**) can be spaced apart, as illustrated in FIG. **4**B.

[0012] Radio Frequency Identification (RFID)

[0013] RFID provides an advantageous technology for remotely storing and retrieving data using devices called RFID tags. An RFID tag is a small object, such as an adhesive sticker, that can be attached to or incorporated into a product. There are passive and active RFID tags. Passive RFID tags are small devices that are generally used at shorter range and for simpler tracking and monitoring applications than active tags. Passive tags generally act over ranges up to 3-5 meters, and a few hundred are typically readable simultaneously within three meters of a reader. Because they are powered by radio waves from RFID tag reader, passive tags do not use a battery. Therefore these devices are generally inexpensive and smaller than active tags, and can last long. Active RFID tags have a power source, such as a battery, and generally have longer range and larger memories than passive tags. For example, active tags generally act over ranges up to 100 meters, and thousands of tags are typically readable simultaneously within 100 meters of a reader. For more details on passive and active RFID tags, see http://RFID-Handbook.com, which is hereby incorporated by reference.

[0014] RFID System

[0015] An RFID system generally includes an RFID tag and RFID reader. An RFID tag includes an antenna and digital memory chip. An RFID reader, also called an interrogator, includes an antenna and a transceiver, and emits and receives RF signals. RFID readers can read tags and can typically write data into the tags. For example, FIG. **5** schematically illustrates component circuitry of a passive RFID tag. A transceiver/receiver **502** of an RFID reader **505** is directionally coupled **504** to an antenna **506** of the reader **505**. An RFID transponder **510** includes an antenna **512** (e.g., a dipole antenna) and memory **514**.

[0016] It is desired to incorporate RFID tag technology into glucose test strips, test strip vials and/or boxes of strips. It is also desired to incorporate RFID reader into glucose meters.

SUMMARY OF THE INVENTION

[0017] A glucose monitoring system includes a glucose sensor strip or package of strips. The strip includes a substrate and a glucose monitoring circuit that has electrodes and a bodily fluid application portion of selected chemical composition. An antenna is integrated with the glucose sensor strip. An RFID sensor chip is coupled with the glucose sensor strip and the antenna. The chip has a memory containing digitally-encoded data representing calibration and/or expiration date information for the strip.

[0018] The antenna may be a loop antenna that has a conducting loop extending around substantially a perimeter of the substrate and has two ends coupled with the chip. An RFID reader may read, power and/or program the chip. The RFID reader may be integrated with a glucose meter that has a port for inserting the strip and measuring a glucose level. Alternatively, a glucose meter may include an RFID reader as a component. The calibration and/or expiration date data may be automatically read when the strip is inserted into the port of the glucose meter. The chip may include a battery or other power source, or may be a passive chip. The memory may also contain data representing a lot number of the strip, manufacture date for the strip, a type of strip, and/or a calibration code. The RFID sensor chip may operate at 13.56 MHz. The calibration data may include chemical composition information for the strip for accurately computing a glucose level based on the chemical composition.

BRIEF DESCRIPTION OF THE DRAWINGS

[0019] FIG. **1** illustrates a conventional blood glucose meter.

[0020] FIG. **2** illustrates a blood glucose meter having a strip inserted into a slot for testing a body fluid sample applied to the strip.

[0021] FIGS. **3**A-**3**C illustrate a conventional test strip.

[0022] FIGS. **4**A-**4**B illustrate the processing of a sheet of test strips.

[0023] FIG. **5** illustrates a conventional passive RFID tag.

[0024] FIG. **6** illustrates a glucose test strip including an RFID chip and antenna in accordance with a preferred embodiment.

[0025] FIG. **7** is an exploded view of a glucose test strip in accordance with a preferred embodiment.

[0026] FIG. **8** illustrates an RFID chip mounted on a glucose test strip in accordance with a preferred embodiment.

[0027] FIG. **9** illustrates a communication system including a glucose test strip and an RFID reader in accordance with a preferred embodiment.

[0028] FIG. **10** illustrates an RFID chip mounted on a package for holding glucose test strips in accordance with a preferred embodiment.

[0029] FIG. **11** illustrates a glucose meter communicating with an RFID tag that is mounted on a package or box of glucose test strips in accordance with a preferred embodiment.

[0030] FIG. **12** illustrates a glucose meter communicating with an RFID tag that is mounted on a glucose test strip in accordance with a preferred embodiment.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0031] An RFID sensor is advantageously coupled with a blood glucose test strip or with a group of strips in accordance with a preferred embodiment. The RFID sensor preferably includes calibration and/or expiration date information for the strips. The calibration information preferably includes information relating to the chemical composition of the strip, so that a blood glucose reading can be accurately computed from a reading obtained using the strip with the particular chemical composition.

[0032] In one embodiment, an individual strip includes an RFID sensor. FIG. **6** illustrates a glucose test strip **600**, e.g., a Freestyle® test strip manufactured by Abbott Diabetes Care of Alameda, Calif., that includes an RFID chip **602**, which is mounted on a PCB substrate **603** or other suitable substrate, and an antenna **604**, in accordance with a preferred embodiment. The antenna **604** may be a loop antenna, or a dipole antenna, or another antenna configuration.

[0033] FIG. **7** is an exploded view of a Freestyle® or other glucose test strip **600** including a sample application end **601**, with sample chamber and electrodes, an RFID chip **602** in accordance with a preferred embodiment. The RFID chip **602** is mounted on a PCB substrate **603** that is attached to, integral with or part of the strip **600**. There is a top-side loop antenna **708** and a bottom side loop antenna **710**. FIG. **8** illustrates an RFID chip **602** mounted on a glucose test strip **600** in accordance with another embodiment.

[0034] Preferably an RFID reader programs the RFID sensor with the calibration data and/or powers the RFID sensor. The RFID reader may be integrated with a blood glucose meter, or the meter may include an RFID reader as a component. FIG. **9** illustrates a communication system including an RFID reader **902** and a tag **904** in accordance with a preferred embodiment. The reader **902** includes a reader antenna **903**. The tag **904** may be coupled with a glucose test strip or with a package or box of strips. The tag **904** includes a substrate **906**, tag antenna **908** and RFID chip **910**. The reader **902** sends a radio wave that impinges upon the tag **904**. A backscattering radio wave is propagated back from the tag **904** as a result.

[0035] FIG. **10** illustrates an RFID chip mounted on a package for holding glucose test strips in accordance with a preferred embodiment. The package illustrated is a lid of a vial container of several tens of test strips. Preferably, each of the test strips in the vial was manufactured on a same sheet of strips, such that the chemical compositions of the strips are very similar and that the strips have a common expiration date.

[0036] Meters Equipped with an RFID Tag Reader (or Vice-Versa)

[0037] In accordance with another advantageous embodiment, an RFID tag reader or interrogator may be adapted for providing glucose testing. As such, a test strip receptacle and glucose measurement circuitry and/or programming may be provided in a glucose meter module that plugs into an RFID reader device or is integrated therein or otherwise communicates data and/or power by cable or multi-pin connection, or wirelessly (at least for the data communication) with the RFID reader. The glucose meter module can use the power and processing capabilities of the reader, thus streamlining the meter module compared with a stand-alone meter. Even data storage for both the reader and meter may be combined into one location or otherwise synchronized.

[0038] In another embodiment, a glucose meter may be adapted for providing RFID reading and/or writing. An RFID reader may be provided that plugs into a glucose meter or is integrated therein or otherwise communicates data and/or power by cable, or multi-pin connection, or wirelessly (at least for the data communication) with the glucose meter. The RFID reader can use the power and processing capabilities of the meter, thus streamlining the RFID reader module compared with a stand-alone reader. Even data storage for both the reader and meter may be combined into one location or otherwise synchronized.

[0039] Human errors are advantageously prevented by automatically retrieving a calibration code of one or more test strips stored in an RFID tag. Expiration date information for the test strip can also be detected from the tag. Different types of test strips can also be detected, which is advantageous particularly for different strips that appear alike and/or that may be used with a same piece of diabetes care equipment. Several other possible types of data may be stored in and read from an RFID tag, which may be used alone and/or may be combined with other diabetes care data to enhance the reliability of a diabetes treatment regimen, including the recording, retrieval and/or use of relevant data (see, e.g., U.S. patent application Ser. Nos. 10/112,671 and 11/146,897, which are assigned to the same assignee and are hereby incorporated by reference). Embodiments disclosed in the Ser. No. 10/112,671 application, and in U.S. Pat. Nos. 5,899,855; 5,735,285; 5,961,451; 6,159,147 and 5,601,435, which are hereby incorporated by reference, describe alternative arrangements for combining functionalities of devices that may be modified for use with an advantage glucose meter and RFID reader combination in accordance with a preferred embodiment.

[0040] FIG. **11** illustrates a glucose meter **1100** sending radio waves **1101** for communicating with an RFID tag (not specifically shown) that is mounted on a package such as a vial **1104** or a box **1102** of glucose test strips in accordance with preferred embodiments. In a first embodiment, an RFID sensor is coupled with a package or vial container **1104** of glucose test strips. The container **1104** may have a lid **1108** with the RFID sensor attached on its inside surface, or embedded therein, or mounted on the outside with a protective layer affixed over it, or alternatively on the bottom of the container **1104** or otherwise. In another embodiment, the strips are contained within a box **1102** having an RFID tag mounted preferably on the inside of the box to protect the tag, or alternatively on the outside having a protective layer over it.

[0041] Containers **1102** or **1104** preferably include only strips from a same sheet of strips having same or similar chemical compositions and expiration dates. One strip may be tested from the sheet, while the remaining strips are placed into the container. The rest of the strips that are placed in the container and not tested will reliably have the same or very similar chemical composition as the tested strip. The RFID sensor may be read only, or may also be write programmable. The data contained within the memory of the RFID sensor preferably includes calibration data regarding the chemical compositions of the strips in the container **1102**, **1104** which are each estimated to have the same chemical composition as the test strip, and expiration date data for the strips, which should be the same for all of the strips that were manufactured on the same sheet at the same time. In accordance with another embodiment, FIG. **12** illustrates a glucose meter **1200** communicating with an RFID tag using radio waves **1201** that is mounted on a glucose test strip **1202** in accordance with a preferred embodiment.

[0042] RFID Frequency Band Allocation

[0043] Multiple frequency bands are available for RFID communication in accordance with preferred embodiments. For example, there is a low frequency band around 125 kHz-134 kHz. There is a worldwide standard high frequency band around 13.56 MHz. There are also UHF frequency bands around 868 MHz for European Union countries, and around 902 MHz-928 MHz for the United States. There is also a microwave frequency band around 2.45 GHz.

[0044] It is preferred to use the worldwide standard around 13.56 MHz as the frequency band of operation in accordance with a preferred embodiment. This is the most popular frequency band, and a silicon-based RFID chip operating at this frequency band may be provided at low cost. This frequency band has a high efficiency RF energy transition, and complies with a world-wide RF standard.

[0045] Test Strip Coding and Meter Calibrating

[0046] Test strip coding and meter calibrating are the processes by which a blood glucose meter is matched with the reactivity of the test strips. A glucose meter will calculate a glucose level of a fluid applied to a strip based on a predetermined chemical composition of the strip. If the predetermined composition varies from the actual composition, then glucose test results provided by the meter will also vary from actual glucose levels.

[0047] Even test strips intended to be manufactured with a same chemical composition can vary based on uncertainties in the manufacturing process. Although this variance may be only very small when great care is taken in the manufacturing process, these very small variances can alter glucose measurement results that are output by a glucose meter from actual values unless the meter is properly calibrated. As illustrated in FIGS. **4A-4B** and described briefly above, multiple test strips are advantageously manufactured together on a same sheet. Test strips that are manufactured on a same sheet have reduced variances in chemical composition compared with test strips manufactured separately. Therefore, one strip from a sheet is advantageously tested in accordance with a preferred embodiment to determine its precise composition. Then, blood glucose meters are calibrated according to that composition when utilizing other strips from that same sheet for testing. As a consequence, glucose testing results are more reliably precise and accurate.

[0048] To ensure this precision and accuracy of glucose test results using blood glucose meters in accordance with a preferred embodiment, the strips may be coded, e.g., by the strip manufacturer before they are shipped out. In addition, the glucose meter is calibrated. Calibration of the meter can be performed by inserting a code strip into the meter and executing a calibration routine. The Precision™ meter of Abbott Diabetes Care® preferably uses this technique. Another method of calibration can be performed by entering a code number into the meter. This technique is preferred for use with the Freestyle® meter also of Abbott Diabetes Care®. Advantageously, the encoded calibration data can be stored in the RFID chip described above that is affixed to a strip, or a vial, box or other container of strips. Enhanced efficiency and reliability is achieved whether an RFID chip is mounted to each strip or to a vial, box or other container of strips. However, when the RFID chip from which the encoded calibration data is read is affixed to the vial, box or other container of strips, and preferably all of the strips within that vial, box or other container were manufactured from the same sheet of strips, as described above, then even greater efficiency, i.e., programming and use of a reduced number of RFID chips, is achieved. Advantageously, one RFID chip may be used for initially programming and for later obtaining calibration data for multiple strips. Moreover, expiration date data may be stored and obtained in RFID chips with the same efficiencies and advantages.

[0049] It is preferred to provide passive RFID tags on test strips, vials, boxes and/or other containers of strips. The preferred passive RFID tags can store approximately two kilobytes of data or more. The memory of the passive tag can be read and written repeatedly. In the memory, the following are preferably stored: test strip calibration codes, lot number, manufacture date, expiration date, other calibration information, or type of strip, or combinations thereof.

[0050] By using RFID tags, a test strip manufacturing process is advantageously upgraded. In this embodiment, test strips are manufactured and preferably packed directly into final packages in vials or boxes or other containers, instead of waiting, e.g., for two weeks, for labeling of calibration codes. The calibration codes are preferably written into the RFID tags after the codes are determined. A lot group size of the test strips can be broken into a smaller geometry to achieve a more precise uniformity of chemical reactivity code. Further data can be stored into RFID tags, as desired.

[0051] The calibration, expiration date and/or other diabetes care information may be provided in an RFID chip or module associated with glucose sensors other than test strips and test strip containers. For example, continuous glucose sensors that may be implanted or partially in vivo or otherwise can include RFID features described otherwise herein. In addition, diabetes care devices other than glucose sensors such as insulin pumps can use the RFID communication of data such as pump calibration data, insulin infusion data, computed or received dose data or glucose data available at the pump. As to the latter feature, glucose data may be communicated to a pump by a glucose meter, and then read by an RFID reader.

[0052] The present invention is not limited to the embodiments described above herein, which may be amended or modified without departing from the scope of the present invention as set forth in the appended claims, and structural and functional equivalents thereof.

[0053] In methods that may be performed according to preferred embodiments herein and that may have been described above and/or claimed below, the operations have been described in selected typographical sequences. However, the sequences have been selected and so ordered for typographical convenience and are not intended to imply any particular order for performing the operations.

[0054] In addition, all references cited above herein, in addition to the background and summary of the invention sections, are hereby incorporated by reference into the detailed description of the preferred embodiments as disclosing alternative embodiments and components.

What is claimed is:

1. A radio frequency identification (RFID) reader for use in diabetes management with a partially or fully implantable in vivo analyte sensor, comprising:

a housing with a display; and

a transceiver and an antenna that are adapted to transmit a first radio wave to an RFID sensor associated with the partially or fully implantable in vivo analyte sensor and receive a second radio wave containing diabetes information of the in vivo analyte sensor from the RFID sensor;

wherein the RFID reader has processing capability and is adapted to read the diabetes information from the second radio wave and use the diabetes information to determine an analyte level of a bodily fluid.

2. The RFID reader of claim **1**, wherein the transceiver and antenna are adapted to supply power to the RFID sensor with the first radio wave.

3. The RFID reader of claim **1**, wherein the diabetes information includes calibration information, expiration information, data representing a lot number, data representing a manufacture date, or data representing a sensor type.

4. The RFID reader of claim **1**, wherein the second radio wave is a backscattered radio wave.

5. The RFID reader of claim **1**, wherein the transceiver and an antenna are adapted to transmit a third radio wave to the RFID sensor, the third radio wave including information to be written to the RFID sensor.

6. The RFID reader of claim **1**, capable of programming the RFID sensor.

7. The RFID reader of claim **1**, further comprising an analyte meter and test strip port.

8. The RFID reader of claim **7**, further comprising circuitry adapted to determine the analyte level of a bodily fluid sample on a test strip inserted into the port.

9. The RFID reader of claim **1**, wherein the antenna is a loop antenna.

10. The RFID reader of claim **1**, wherein the antenna is a dipole antenna.

11. The RFID reader of claim **1**, further comprising a directional coupler that couples the transceiver to the antenna.

12. The RFID reader of claim **1**, wherein the analyte is glucose.

13. The RFID reader of claim **1**, further comprising a pump.

14. The RFID reader of claim **1**, wherein the RFID reader is integrated with an analyte meter.

15. The RFID reader of claim **1**, further comprising a modular analyte meter.

16. The RFID reader of claim **1**, wherein the RFID reader is adapted to communicate data with an analyte meter by way of a cable, multi-pin connection, or wireless connection.

17. The RFID reader of claim **1**, wherein the RFID reader shares processing capability with an analyte meter.

18. The RFID reader of claim **1**, wherein the RFID reader shares memory with an analyte meter.

19. The RFID reader of claim **1**, wherein data storage for the RFID reader and an analyte meter are combined into one location.

20. The RFID reader of claim **1**, wherein the RFID reader is a component of another device.

21. The RFID reader of claim **1**, wherein the first radio wave is in a frequency band around 13.56 MHz.

22. The RFID reader of claim **1**, wherein the first radio wave is in a frequency band around 2.45 GHz.

23. A radio frequency identification (RFID) reader for use in diabetes management with a partially or fully implantable in vivo glucose sensor, comprising:

a housing with a display; and

a transceiver and an antenna that are adapted to transmit a first radio wave to an RFID sensor associated with the partially or fully implantable in vivo glucose sensor and receive a second radio wave containing diabetes information of the in vivo glucose sensor from the RFID sensor;

wherein the RFID reader has processing capability and is adapted to read the diabetes information from the second radio wave and use the diabetes information to determine an glucose level of a bodily fluid.

24. The RFID reader of claim **23**, wherein the transceiver and antenna supply power to the RFID sensor with the first radio wave.

25. The RFID reader of claim **23**, wherein the diabetes information includes calibration information, expiration information, data representing a lot number, data representing a manufacture date, or data representing a sensor type.

26. The RFID reader of claim **23**, wherein the second radio wave is a backscattered radio wave.

27. The RFID reader of claim **23**, wherein the transceiver and an antenna are adapted to transmit a third radio wave to the RFID sensor, the third radio wave including information to be written to the RFID sensor.

28. The RFID reader of claim **23**, wherein the RFID reader is capable of programming the RFID sensor.

29. The RFID reader of claim **23**, further comprising a glucose meter and test strip port.

30. The RFID reader of claim **29**, further comprising circuitry adapted to determine the glucose level of a bodily fluid sample on a test strip inserted into the port.

31. The RFID reader of claim **23**, wherein the antenna is a loop antenna.

32. The RFID reader of claim **23**, wherein the antenna is a dipole antenna.

33. The RFID reader of claim **23**, further comprising a directional coupler that couples the transceiver to the antenna.

34. The RFID reader of claim **23**, further comprising a pump.

35. The RFID reader of claim **23**, wherein the RFID reader is integrated with a glucose meter.

36. The RFID reader of claim **23**, further comprising a modular glucose meter.

37. The RFID reader of claim **23**, wherein the RFID reader is adapted to communicate data with a glucose meter by way of a cable, multi-pin connection, or wireless connection.

38. The RFID reader of claim **23**, wherein the RFID reader shares processing capability with a glucose meter.

39. The RFID reader of claim **23**, wherein the RFID reader shares memory with a glucose meter.

40. The RFID reader of claim **23**, wherein data storage for the RFID reader and a glucose meter are combined into one location.

41. The RFID reader of claim **23**, wherein the RFID reader is a component of another device.

42. The RFID reader of claim **23**, wherein the first radio wave is in a frequency band around 13.56 MHz.

43. The RFID reader of claim **23**, wherein the first radio wave is in a frequency band around 2.45 GHz.

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