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(54) PATIENT MONITORING DEVICE WITH MULTI-ANTENNA RECEIVER

PATIENTENÜBERWACHUNGSVORRICHTUNG MIT MEHRFACHANTENNEN-EMPFÄNGER

DISPOSITIF DE SURVEILLANCE DE MALADES DOTE D'UN RECEPTEUR A ANTENNES MULTIPLES

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Description

[0001] The invention relates to implantable medical devices and, more particularly, patient monitoring devices for communication with implantable medical devices. Implantable medical devices typically include a wireless telemetry link that permits communication between the implanted medical device and an external programmer or patient monitoring device. The wireless telemetry link may permit the transmission of commands from a programmer or patient monitoring device to the implantable medical device, e.g., to program new features or functionality into the implantable medical device. Also, the wireless telemetry link may permit the programmer or monitoring device to interrogate the implantable medical device to obtain stored operational information and sensed physiological parameters.

[0002] A transceiver and antenna typically are located within a housing associated with the implantable medical device. Conventional programmers and patient monitoring devices incorporate a transceiver head that is placed in close proximity to the implantable medical device for programming and interrogation. The transceiver head may be coupled to the programmer or monitoring device via a cord. More recently, telemetry systems for implantable medical devices have eliminated the need for a transceiver head in the programmer or monitoring device. Instead, various wireless communication techniques have been implemented to permit increased transmission distances between the implantable medical device and the programmer or patient monitoring device.

[0003] Improved wireless communication techniques may permit the implantable medical device to be located several meters from the programmer or monitoring device, providing the patient with increased mobility during programming and interrogation. In some cases, a patient monitoring device may be placed within the home of a patient, and configured to monitor the implantable medical device by wireless telemetry during the course of the patient's daily routine. In addition, some patient monitors may take the form of portable devices that can be carried with the patient, e.g., much like a personal digital assistant (PDA) or cell phone.

[0004] US 2001/0047314, WO 00/47109 and US 5,904,708 all teach systems enabling implantable medical devices to communicate with two or more external devices. US 6,490,487 teaches an implantable device which communicates via telemetry with a mobile device which can transmit messages over a fixed telecommunication network.

[0005] In general, the invention is directed to a patient monitoring device having a receiver capable of both single-antenna and multi-antenna operation. Multi-antenna operation permits the monitoring device to take advantage of spatial diversity for improved communication with an implantable medical device in the presence of fading. However, the small size of many patient monitoring devices can make the incorporation of multiple antennas difficult. To permit spatial diversity operation, the invention provides a base station having a second antenna that can be coupled to the patient monitoring device. Alternatively, the base station may have one or more high quality antennas that are used by patient monitoring device instead of the antenna in the patient monitoring device when the patient monitoring device is coupled to the base station.

[0006] The patient monitoring device may provide multi-antenna operation when it is coupled to the base station, and single-antenna operation when it is not coupled to the base station. Alternatively, the patient monitoring device may use a high quality antenna provided in the base station when it is coupled to the base station. The base station may take the form of a docking station, platform, cradle or the like that receives the patient monitoring device and couples an antenna to the patient monitoring device, e.g., for spatial diversity or increased antenna quality. The patient monitoring device may provide an adaptable receiver and transmitter capable of operating in either the single-antenna or multi-antenna mode. In this manner, the invention can achieve spatial diversity without consuming additional space within the monitoring device for a second antenna.

[0007] In one aspect, the invention provides a system comprising

an implantable medical device;

a monitoring device having a first antenna and;

a base station having a second antenna and adapted to be coupled to said monitoring device; characterized in that the monitoring device is adapted to receive the wireless signals from the implantable medical device via only the first antenna when the monitoring device is not coupled to the base station; and

the monitoring device is adapted to receive wireless signals from the implantable medical device via the second antenna when the monitoring device is coupled to the base station:

[0008] In another aspect, the invention provides a method comprising receiving, at a monitoring device having a first antenna, wireless signals from an implantable medical device via a second antenna associated with a base station when the monitoring device is coupled to the base station, and receiving the wireless signals via only the first antenna when the monitoring device is not coupled to the base station.

[0009] In yet another embodiment, the receiver receives the signals via a first antenna and a second antenna when the monitoring device is coupled to a second device and receives signals via only the first antenna when the monitoring device is not coupled to the second device.

[0010] The invention includes various aspects. For example, the invention may permit spatial diversity operation in a patient monitoring device without the need to incorporate an additional antenna in the device. Instead, the patient monitoring device may provide single-antenna operation when it is not coupled to the base station and multi-antenna operation when it is coupled to the base station. Alternatively, the patient monitoring device may use a high quality antenna provided in the base station instead of the device antenna.

[0011] When the patient monitoring device is not coupled to the base station, the patient is more likely to carry the monitoring device in closer proximity to the implantable medical device. In this case, single-antenna operation may be sufficient. When the patient monitoring device is not carried by the patient and, hence, may be further away from the implantable medical device, placing the patient monitoring device in the base station provides improved communication via spatial diversity techniques or via a higher quality antenna. In this manner, the invention may improve overall reliability of communication between the patient monitoring device and the implantable medical device.

[0012] The details of one or more embodiments of the invention are set forth in the accompanying drawings and the description below. Other aspects of the invention will be apparent from the description and drawings, and from the claims.

FIG. 1 is a block diagram illustrating a system including a patient monitoring device capable of multi-antenna operation in accordance with the invention.

FIG. 2 is a block diagram illustrating a patient monitoring device and a base station in accordance with the invention.

FIG. 3 is a block diagram illustrating connection of a patient monitoring device and a base station in accordance with an embodiment of the invention.

FIG. 4 is a block diagram illustrating connection of a patient monitoring device and a base station in accordance with another embodiment of the invention.

FIG. 5 is a block diagram illustrating spatial diversity circuitry associated with a patient monitoring device.

FIG. 6 is a flow diagram illustrating a process for selection of single-antenna or multi-antenna operation in a patient monitoring device.

FIG. 7 is a block diagram illustrating connection of a patient monitoring device and a base station in accordance with an added embodiment of the invention.

FIG. 1 is a block diagram illustrating a system 10 including a patient monitoring device 12 capable of multi-antenna operation in accordance with an embodiment of the invention. As shown in FIG. 1, system 10 may include monitoring device 12, an implantable medical device ("IMD") 14, and a base station 16. IMD 14 transmits signals via antenna 18 to patient monitoring device 12. Monitoring device 12 includes an antenna 20. Base station 16 includes an antenna 22. Monitoring device 12 may be used independently of base station 16 or coupled to the base station.

[0013] In accordance with the invention, monitoring device 12 is configured for single-antenna operation or multi-antenna operation. In particular, monitoring device 12 uses antenna 20 for communication with IMD 14 when the monitoring device is not coupled to base station 16. When monitoring device 12 is coupled to base station 16, however, the monitoring device uses not only antenna 20, but also antenna 22 provided in base station 16. In this manner, monitoring device 12 can take advantage of spatial diversity to communicate with IMD 14 when the monitoring device is coupled to base station 16.

[0014] As further shown in FIG. 1, base station 16 may be coupled to a host computer 23 that provides access to a network 26. Alternatively, base station 16 may be coupled directly to an access point 24 that provides to network 26. Network 26 may be a local area network, wide area network or global computer network, such as the World Wide Web, and provides communication between monitoring device 12 and one or more network clients 28. Monitoring device 12 or an application running on host computer 23 may gather and forward data obtained from IMD 14 to the clients 28. Clients 28 may be associated with monitoring physicians and may run automated applications to process information received from monitoring device 12 via network 26.

[0015] Base station 16 may serve multiple purposes. In addition to providing a second antenna for spatial diversity, base station 16 may operate as a docking station to permit wired or wireless communication of monitoring device 12 with host computer 23 or network access point 24. In some embodiments, base station 16 may facilitate synchronization of data stored within monitoring device 12 with data stored by host computer 23 or one or more of clients 28. In this sense, base station 16 may operate much like a "synch" cradle used with many conventional PDAs. Also, base station 16 may serve to charge a rechargeable battery within monitoring device 12 when the monitoring device is coupled to, e.g., docked within, the base station.

[0016] Monitoring device 12 may be used with a variety of different IMDs 14 including a cardiac stimulator, a neuro stimulator, a drug delivery device, and a physiological sensor device. One example of an implantable medical device 14 is a pacemaker. Another example of an implantable medical device is a pacemaker-cardioverter-defibrillator ("PCD"). Other examples include an implantable brain stimulator, an implantable gastric system stimulator, an implantable nerve stimulator or muscle stimulator, an implantable lower colon, an implantable drug or beneficial agent dispenser or pump, an implantable cardiac signal loop or other type of recorder or monitor, an implantable gene therapy delivery device, an implantable incontinence prevention or monitoring device; an implantable insulin pump or monitoring device, and so on. IMD 14 may continuously collect operational information and physiological information. The physiological information may include heart rate, heart rate variability, blood glucose levels, oxygen saturation, partial pressure of oxygen in the blood, blood pressure, baro-reflex measures, electrogram morphologies, lung wetness, and the like.

[0017] Antenna 20 of monitoring device 12 is coupled to a wireless receiver to process signals received from IMD 14. In addition, antenna 20 may be coupled to a wireless transmitter. Accordingly, monitoring device 12 may be designed for one-way or two-way communication with IMD 14. A transmitter may be used by monitoring device 12 to program IMD 14. Also, in accordance with the invention, monitoring device 12 may provide either single-antenna or multiple-antenna operation. In this manner, monitoring device 12 may be configured to provide a spatial diversity mode in which the receiver processes signals received via both antenna 20 and antenna 22.

[0018] Monitoring device 12 may take a variety of forms. For example, monitoring device 12 may be a dedicated monitoring device. Alternatively, monitoring device 12 may be integrated with other device functionality. In particular, monitoring device 12 may be integrated with a cell phone, a PDA, or the like. The monitoring device 12 may receive wireless signals from IMD 14 via only antenna 20 when it is not coupled to base station 16. Additionally, the monitoring device 12 may receive signals from IMD 14 via both antenna 20 and antenna 22 when it is coupled to base station 16.

[0019] FIG. 2 is a block diagram illustrating a patient monitoring device 12 and a base station 16 in accordance with one embodiment of the invention. As shown in FIG. 2, base station 16 may define a cradle, platform or other support to receive monitoring device 12 and provide engagement between contact terminals associated with the base station and the monitoring device. In particular, monitoring device 12 may include a contact terminal to couple the receiver to a second antenna 22 provided in base station 16. Base station 16 may include a reciprocal terminal that engages the contact terminal in monitoring device 12 to couple antenna 22 to the monitoring device. Alternatively, in other embodiments, antenna 22 of base station 16 may be coupled to monitoring device 12 via a cable.

[0020] In the example of FIG. 2, monitoring device 12 includes antenna 20, a display screen 32 and user input media such as an array of buttons 34. Base station 16 includes antenna 22, and a cradle-like receptacle 30 to receive monitoring device 12 and facilitate engagement of reciprocal contact terminals in the monitoring device and the base station. Base station 16 may be coupled to a source of power via a power cord (not shown in FIG. 2). In addition, base station 16 may include communication links to host computer 23 or access point 24. FIG. 2 depicts antenna 22 is shown as protruding from base station 16. In other embodiments, however, antenna 22 could be a dedicated, free-standing antenna that is coupled to base station 16 via a cable. Alternatively, antenna 22 could be integrated with a power cord associated with base station 16, or embedded within the housing of the base station.

[0021] In some embodiments, base station 16 may further include radio circuitry to process wireless signals received via antenna 22. In other words, base station 12 may provide some of the circuitry necessary to process one of the spatial diversity channels involved in transmitting or receiving signals via multiple antennas 20, 22. In this manner, base station 16 may further reduce the size, power consumption and complexity of monitoring device 12. Alternatively, such circuitry may be provided in monitoring device 12, with base station 16 providing a simple electrical pass-through from antenna 22 and the monitoring device.

[0022] In accordance with the invention, a monitoring device 12 that is capable of single-antenna or multi-antenna communication can provide more reliable communication between IMD 14 and the monitoring device. Monitoring device 12 can take advantage of spatial diversity without the need to incorporate an additional antenna in the monitoring device. Instead, monitoring device 12 cooperates with its own base station 16 to provide spatial diversity, thereby reducing the size, cost and complexity of the monitoring device. The space required for the second antenna 22, and perhaps radio circuitry for processing signals received and transmitted by the second antenna, can be provided by base station 16.

[0023] FIG. 3 is a block diagram illustrating connection of patient monitoring device 12 and base station 16 in accordance with an embodiment of the invention. As shown in FIG. 3, monitoring device 12 includes transmitter/receiver (TX/RX) circuitry 36 to process signals received and transmitted by antenna 20 in monitoring device 12 and antenna 22 in base station 16. In particular, TX/RX 36 may be coupled to antenna 20 and a terminal 38. In addition, TX/RX 36 may be coupled to a modem 41 that modulates and demodulates signals transmitted and received via antenna 20 or both antennas 20, 22.

[0024] When monitoring device 12 rests in or on base station 16, terminal 38 contacts a terminal 40 in base station 16. Terminal 40 may be coupled to antenna 22 or, alternatively, radio circuitry with base station 16 that processes signals transmitted and received by antenna 22. Additional terminals 42, 44 may be provided on monitoring device 12 and base station 16, respectively, for exchange of data and battery charging current. Monitoring device 12 processes signals exchanged with IMD 14. TX/RX 46 in monitoring device 12 may include a spatial diversity receiver and transmitter to process signals received and transmitted via antenna 20, 22. In other embodiments, monitoring device 12 may not include a transmitter and instead serves only to gather data from IMD 14. When monitoring device 12 is not coupled to base station 16, it receives signals via antenna 20. When monitoring device 12 is coupled to base station 16, however, it receives signals via both antennas 20, 22. Accordingly, TX/RX 44 may provide an auto-detection feature that automatically detects the connection of antenna 22 via contact terminals 38, 40.

[0025] FIG. 4 is a block diagram illustrating connection of patient monitoring device 12 and base station 16 in accordance with another embodiment of the invention.

FIG. 4 conforms substantially to FIG. 3 but illustrates incorporation of TX/RX circuitry within base station 16 to process signals for antenna 22. In particular, first TX/RX circuitry 36A is provided in monitoring device 12 to process signals for antenna 20, and second TX/RX circuitry 36B is provided in base station 16 to process signals for antenna 22. TX/RX circuitry 36A, 36B may perform filtering, amplification, upconversion or downconversion of signals transmitted or received by antennas 20, 22, respectively. Accordingly, each of TX/RX circuitry 36A, 36B may be coupled to modem 41. However, TX/RX circuitry 36B is coupled to modem 41 via terminals 38,40 upon coupling of monitoring device 12 with base station 16.

[0026] FIG. 5 is a block diagram illustrating spatial diversity circuitry associated with a patient monitoring device 12. As shown in FIG. 5, monitoring device may include separate channels for processing signals transmitted or received by antennas 20, 22 to spatial diversity. One channel includes radio frequency (RF) circuitry 46A and analog-to-digital (ADC)/digital-to-analog (DAC) circuitry 48A to process signals for antenna 20. A second channel includes RF circuitry 46B and ADC/DAC circuitry 48B to process signals for antenna 22. RF circuitry 46A, 46B may include conventional filtering, amplification, downconversion, and upconversion circuitry to process signals transmitted and received by antennas 20, 22, respectively. Also, ADC/DAC circuitry 48A, 48B converts digital signals generated by modem 41 into analog signals for transmission on antennas 20, 22, and converts analog signals received by antennas 20, 22 to digital signals for demodulation by modem 41.

[0027] FIG. 6 is a flow diagram illustrating a process for selection of single-antenna or multi-antenna operation in a patient monitoring device. As shown in FIG. 6, if monitoring device 12 is in an operating mode that supports receive/transmit (RX/TX) diversity (50). If RX/TX diversity is not supported, monitoring device 12 processes signals received and transmitted by a single antenna (58). If RX/TX diversity is supported, however, monitoring device 12 determines whether it is coupled to base station 16 (60). Monitoring device 12 may detect whether it is coupled to base station 16 by sensing signals on one or more contact terminals that engage contact terminals on the base station. If monitoring device 12 is coupled to base station 16, the monitoring device processes signals received and transmitted by multiple antennas (62). In other words, monitoring device 12 provides spatial diversity when it is coupled to base station 16. In this case, monitoring device may offer enhanced communication with IMD 14.

[0028] FIG. 7 is a block diagram illustrating connection of a patient monitoring device and a base station in accordance with an added embodiment of the invention. The example of FIG. 7 conforms substantially to that of FIG. 3. Instead of providing spatial diversity operation, however, patient monitoring device 12 includes a switch 58 that permits operation using either antenna 20 associated with the patient monitoring device, or antenna 22 associated with base station 16. Antenna 22 of base station 16 may be a higher quality antenna relative to antenna 20 of patient monitoring device 12. For example, antenna 22 may have larger or more favorable dimensions, or be made of more favorable materials, than antenna 20 due to size, space, complexity or cost limitations associated with patient monitoring device 12.

[0029] Switch 58 may be configured to select one of antennas 20, 22 for used by RX/TX circuitry 36. If patient monitoring device 12 is not coupled to base station 16, switch 58 selects antenna 20. On the other hand, if patient monitoring device 12 is coupled to base station 16, switch 58 selects the higher quality antenna 22 for enhanced communication with IMD 14. In other words, in the exemplary embodiment of FIG. 7, patient monitoring device 12 may be configured to use antenna 22 instead of antenna 20 when antenna 22 is available for use. As a further alternative, antenna 22 may incorporate two more antennas for spatial diversity operation. In this case, switch 58 may couple multiple antennas from base station 16 to RX/TX circuitry 36, enabling spatial diversity communication by patient monitoring device 12 when it is coupled to base station 16.

[0030] Various embodiments of the invention have been described. These and other embodiments are within the scope of the following claims.

Claims

1. A system comprising
an implantable medical device (14);
a monitoring device (12) having a first antenna (20) and;
a base station (16) having a second antenna (22) and adapted to be coupled to said monitoring device;
characterized in that the monitoring device is adapted to receive the wireless signals from the implantable medical device via only the first antenna when the monitoring device is not coupled to the base station; and
the monitoring device is adapted to receive wireless signals from the implantable medical device via the second antenna (22) when the monitoring device is coupled to the base station.

2. The system of claim 1, wherein the monitoring device is adapted to receive the wireless signals from the implantable medical device via both the first antenna (20) and the second antenna (22) when the monitoring device (12) is coupled to the base station (16).

3. The system of claim 1 or 2, wherein the base station includes a cradle (30) to receive the monitoring device.

4. The system of claim 1, wherein the monitoring device includes a spatial diversity receiver to process the

signals received via the first antenna and the second antenna.

5. The system of claim 4, wherein the monitoring device includes a first terminal, and the base station includes a cradle (30) to receive the monitoring device and a second terminal to mate with the first terminal and thereby connect the first antenna to the receiver.

6. The system of any preceding claim, wherein the base station includes a communication link to a network (26).

7. The system of any preceding claim, wherein the implantable medical device includes one of a cardiac stimulator, a neuro stimulator, a drug delivery device, and a physiological sensor device.

8. The system of any preceding claim, wherein the base station includes radio circuitry to process wireless signals received via the first antenna.

9. The system of any preceding claim, further comprising a network access point (24) to connect the monitoring device to a network.

10. The system of any preceding claim, wherein the monitoring device further includes a transmitter (36) to transmit wireless signals to program the implantable medical device.

11. A method comprising:

receiving wireless signals at a monitoring device (12) having a first antenna (20), from an implantable medical device (14) via a second antenna (22) associated with a base station (16) when the monitoring device is coupled to the base station; and receiving the wireless signals via only the first antenna when the monitoring device is not coupled to the base station.

12. The method of claim 11, further comprising coupling the monitoring device to the second antenna by placing the monitoring device in a cradle (30) defined by the base station.

13. The method of clam 11, wherein the monitoring device includes a spatial diversity receiver, the method further comprising processing the wireless signals received via the first antenna and the second antenna using the spatial diversity receiver.

14. The method of claim 11, wherein the implantable medical device includes one of a cardiac stimulator, a neuro stimulator, a drug delivery device, and a physiological sensor device.

15. The method of claim 1.1, further comprising transmitting wireless signals from the monitoring device to program the implantable medical device.

Patentansprüche

1. System mit:

einer implantierbaren medizinischen Vorrichtung (14);
einer Überwachungsvorrichtung (12), die eine erste Antenne (20) aufweist; und
einer Basisstation (16), die eine zweite Antenne (22) aufweist, und die dafür eingerichtet ist, mit der Überwachungsvorrichtung verbunden zu werden; **dadurch gekennzeichnet, dass** die Überwachungsvorrichtung dafür eingerichtet ist, die Drahtlossignale von der implantierbaren medizinischen Vorrichtung über nur die erste Antenne zu empfangen, wenn die Überwachungsvorrichtung nicht mit der Basisstation verbunden ist; und
die Überwachungsvorrichtung dafür eingerichtet ist, Drahtlossignale von der implantierbaren medizinischen Vorrichtung über die zweite Antenne (22) zu empfangen, wenn die Überwachungsvorrichtung mit der Basisstation verbunden ist.

2. System nach Anspruch 1, bei dem die Überwachungsvorrichtung dafür eingerichtet ist, die Drahtlossignale von der implantierbaren medizinischen Vorrichtung über die erste Antenne (20) und die zweite Antenne (22) zu empfangen, wenn die Überwachungsvorrichtung (12) mit der Basisstation (16) verbunden ist.

3. System nach Anspruch 1 oder 2, bei dem die Basisstation eine Aufnahme bzw. Station (30) zur Aufnahme der Überwachungsvorrichtung aufweist.

4. System nach Anspruch 1, bei dem die Überwachungsvorrichtung einen Raum-Diversity-Empfänger zur Verarbeitung der über die erste Antenne und die zweite Antenne empfangenen Signale beinhaltet.

5. System nach Anspruch 4, bei dem die Überwachungsvorrichtung einen ersten Anschluss aufweist und die Basisstation eine Station (30) zur Aufnahme der Überwachungsvorrichtung und einen zweiten Anschluss zur Beaufschlagung des ersten Anschlusses und hierdurch zur Verbindung der ersten Antenne mit dem Empfänger aufweist.

6. System nach einem der vorstehenden Ansprüche, bei dem die Basis eine Kommunikationsverbindung

mit einem Netzwerk (26) aufweist.

7. System nach einem der vorstehenden Ansprüche, bei dem die implantierbare medizinische Vorrichtung einen Herzstimulator, einen Neurostimulator, eine Medikamentenabgabevorrichtung oder eine physiologische Sensorvorrichtung beinhaltet.

8. System nach einem der vorstehenden Ansprüche, bei dem die Basisstation eine Funkschaltung zum Verarbeiten von über die ersten Antenne empfangenen Drahtlossignalen beinhaltet.

9. System nach einem der vorstehenden Ansprüche, die ferner einen Netzwerkzugangspunkt (24) zur Verbindung der Überwachungsvorrichtung mit einem Netzwerk aufweist.

10. System nach einem der vorstehenden Ansprüche, bei dem die Überwachungsvorrichtung ferner einen Sender (36) zum Senden von Drahtlossignalen zur Programmierung der implantierbaren medizinischen Vorrichtung aufweist.

11. Verfahren, das beinhaltet:

Empfangen von Drahtlossignalen in einer Überwachungsvorrichtung (12), die eine erste Antenne (20) aufweist, von einer implantierbaren medizinischen Vorrichtung (14) über eine zweite Antenne (22), die einer Basisstation (16) zugeordnet ist, wenn die Überwachungsvorrichtung mit der Basisstation verbunden ist; und Empfangen der Drahtlossignale über nur die erste Antenne, wenn die Überwachungsvorrichtung nicht mit der Basisstation verbunden ist.

12. Verfahren nach Anspruch 11, das ferner beinhaltet, die Überwachungsvorrichtung mit der zweiten Antenne durch Anordnen der Überwachungsvorrichtung in einer Station (30), die durch die Basisstation definiert ist, zu verbinden.

13. Verfahren nach Anspruch 11, bei dem die Überwachungsvorrichtung einen Raum-Diversity-Empfänger beinhaltet, wobei das Verfahren ferner beinhaltet, die von über die erste Antenne und die zweite Antenne empfangenen Drahtlossignale unter Verwendung des Raum-Diversity-Empfängers zur verarbeiten.

14. Verfahren nach Anspruch 11, bei dem die implantierbare medizinische Vorrichtung einen Herzstimulator, einen Neurostimulator, eine Medikamentenabgabevorrichtung oder eine physiologische Sensorvorrichtung beinhaltet.

15. Verfahren nach Anspruch 11, das ferner das Übertragen von Drahtlossignalen von der Überwachungsvorrichtung zur Programmierung der implantierbaren medizinischen Vorrichtung beinhaltet.

Revendications

1. Système comportant :

un dispositif médical implantable (14) ;
un dispositif de surveillance (12) ayant une première antenne (20) et ;
une station de base (16) ayant une seconde antenne (22) et adaptée pour être couplée audit dispositif de surveillance ; **caractérisé en ce que** le dispositif de surveillance est adapté pour recevoir les signaux sans fil en provenance du dispositif médical implantable via uniquement la première antenne lorsque le dispositif de surveillance n'est pas couplé à la station de base ; et
le dispositif de surveillance est adapté pour recevoir des signaux sans fil en provenance du dispositif médical implantable via la seconde antenne (22) lorsque le dispositif de surveillance est couplé à la station de base.

2. Système selon la revendication 1, dans lequel le dispositif de surveillance est adapté pour recevoir les signaux sans fil en provenance du dispositif médical implantable via à la fois la première antenne (20) et la seconde antenne (22) lorsque le dispositif de surveillance (12) est couplé à la station de base (16).

3. Système selon la revendication 1 ou 2, dans lequel la station de base inclut un châssis (30) pour recevoir le dispositif de surveillance.

4. Système selon la revendication 1, dans lequel le dispositif de surveillance inclut un récepteur de diversité spatiale pour traiter les signaux reçus via la première antenne et la seconde antenne.

5. Système selon la revendication 4, dans lequel le dispositif de surveillance inclut une première borne, et la station de base inclut un châssis (30) pour recevoir le dispositif de surveillance et une seconde borne pour s'accoupler à la première borne et ainsi connecter la premier antenne au récepteur.

6. Système selon l'une quelconque des revendications précédentes, dans lequel la station de base inclut une liaison de communication à un réseau (26).

7. Système selon l'une quelconque des revendications précédentes, dans lequel le dispositif médical implantable inclut l'un parmi un stimulateur cardiaque, un neurostimulateur, un dispositif d'administration

de médicaments, et un dispositif de détection physiologique.

8. Système selon l'une quelconque des revendications précédentes, dans lequel la station de base inclut un circuit radio pour traiter des signaux sans fil reçus via la première antenne.

9. Système selon l'une quelconque de revendications précédentes, comportant en outre un point d'accès à un réseau (24) pour connecter le dispositif de surveillance à un réseau.

10. Système selon l'une quelconque des revendications précédentes, dans lequel le dispositif de surveillance inclut en outre un émetteur (36) pour transférer des signaux sans fil afin de programmer le dispositif médical implantable.

11. Procédé comportant les étapes consistant à :

recevoir des signaux sans fil dans un dispositif de surveillance (12) ayant une première antenne (20), en provenance d'un dispositif médical implantable (14) via une seconde antenne (22) associée à une station de base (16) lorsque le dispositif de surveillance est couplé à la station de base ; et recevoir les signaux sans fil via uniquement la première antenne lorsque le dispositif de surveillance n'est pas couplé à la station de base.

12. Procédé selon la revendication 11, comportant en outre l'étape consistant à coupler le dispositif de surveillance à la seconde antenne en plaçant le dispositif de surveillance dans un châssis (30) défini par la station de base.

13. Procédé selon la revendication 11, dans lequel le dispositif de surveillance inclut un récepteur de diversité spatiale, le procédé comportant en outre l'étape consistant à traiter des signaux sans fil reçus via la première antenne et la seconde antenne en utilisant le récepteur de diversité spatiale.

14. Procédé selon revendication 11, dans lequel le dispositif médical implantable inclut l'un parmi un stimulateur cardiaque, un neurostimulateur, un dispositif d'administration de médicaments et un dispositif de détection physiologique.

15. Procédé selon la revendication 11, comportant en outre l'étape consistant à transmettre des signaux sans fil depuis le dispositif de surveillance pour programmer le dispositif médical implantable.

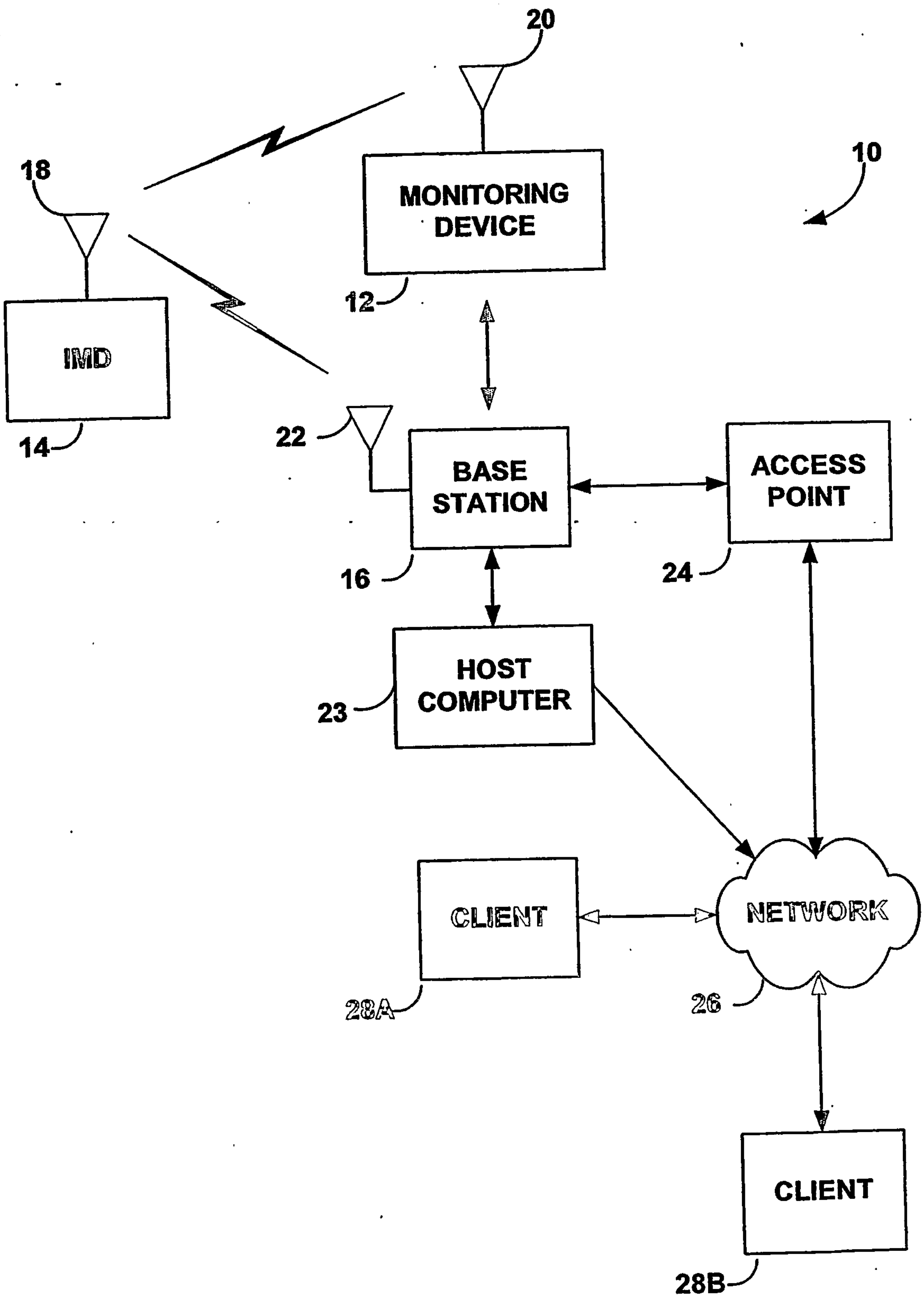
20
10
18
MONITORING DEVICE
12
IMD
14
22
BASE STATION
ACCESS POINT
16
24
HOST COMPUTER
23
CLIENT
NETWORK
28A
26
CLIENT
28B

FIG. 1

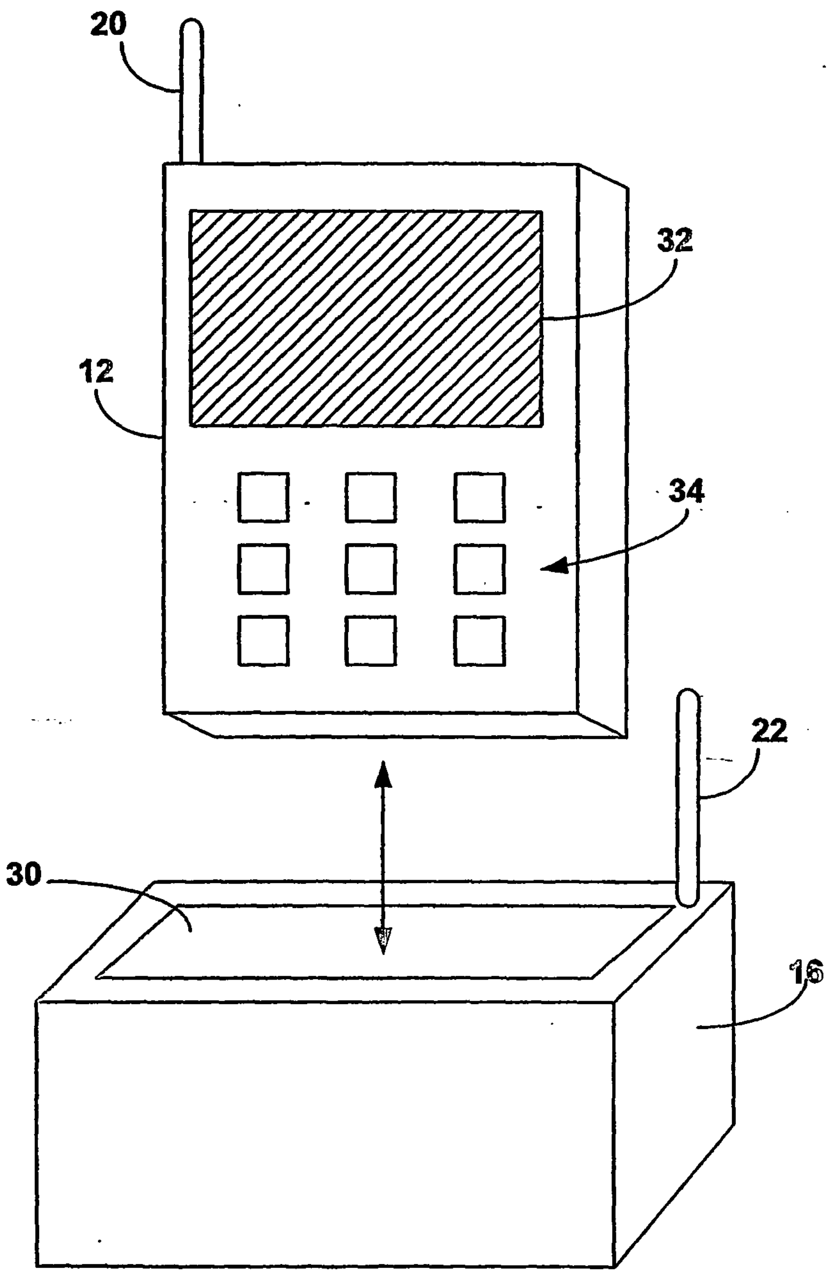

FIG. 2

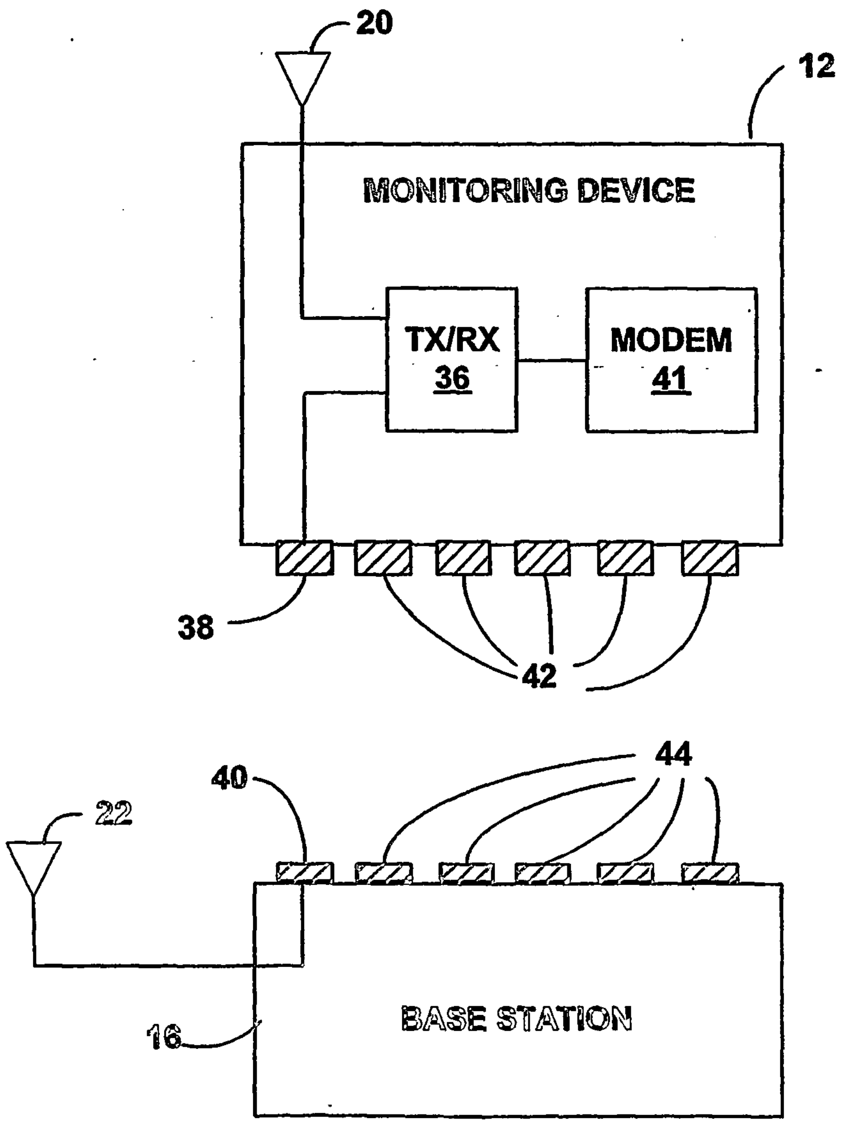
20
12
MONITORING DEVICE
TX/RX
36
MODEM
41
38
42
44
40
22
BASE STATION
16

FIG. 3

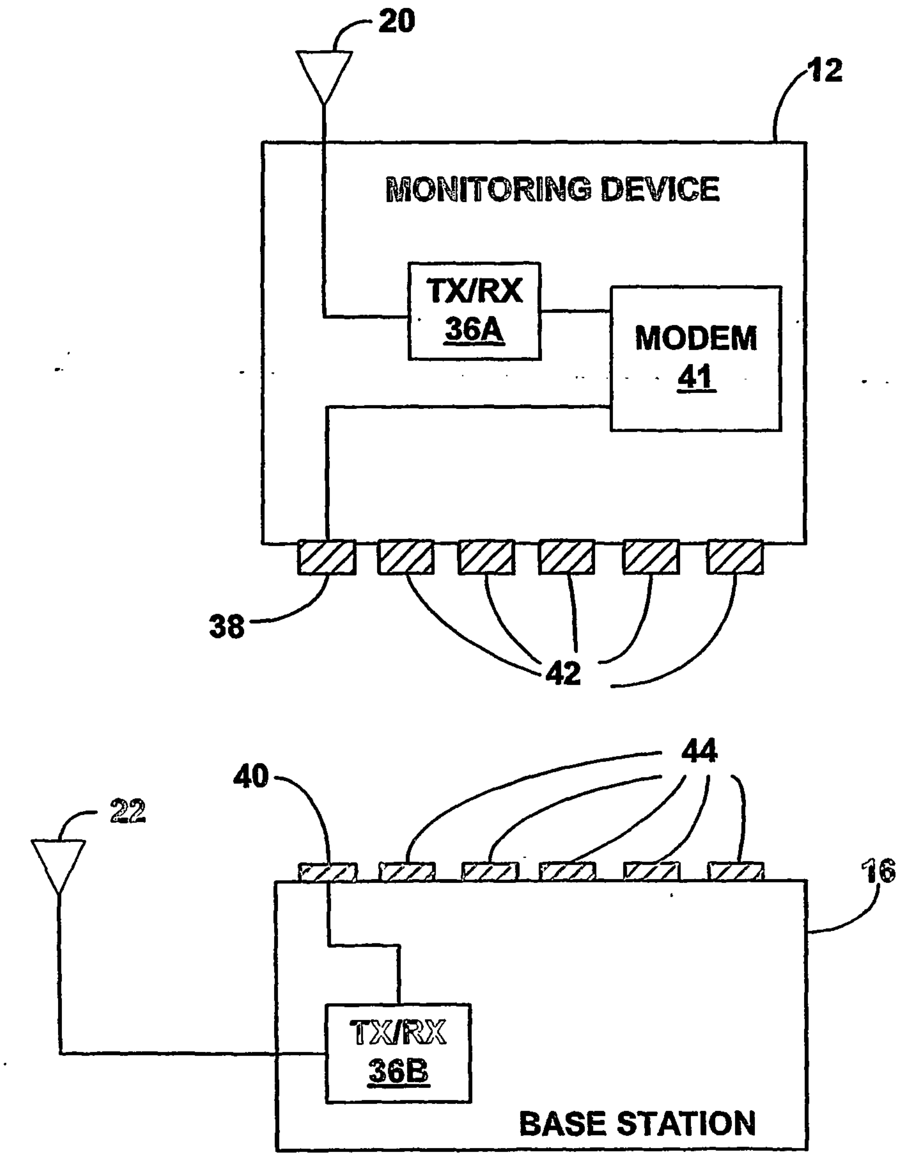
20
12
MONITORING DEVICE
TX/RX
36A
MODEM
41
38
42
44
40
22
16
TX/RX
36B
BASE STATION

FIG. 4

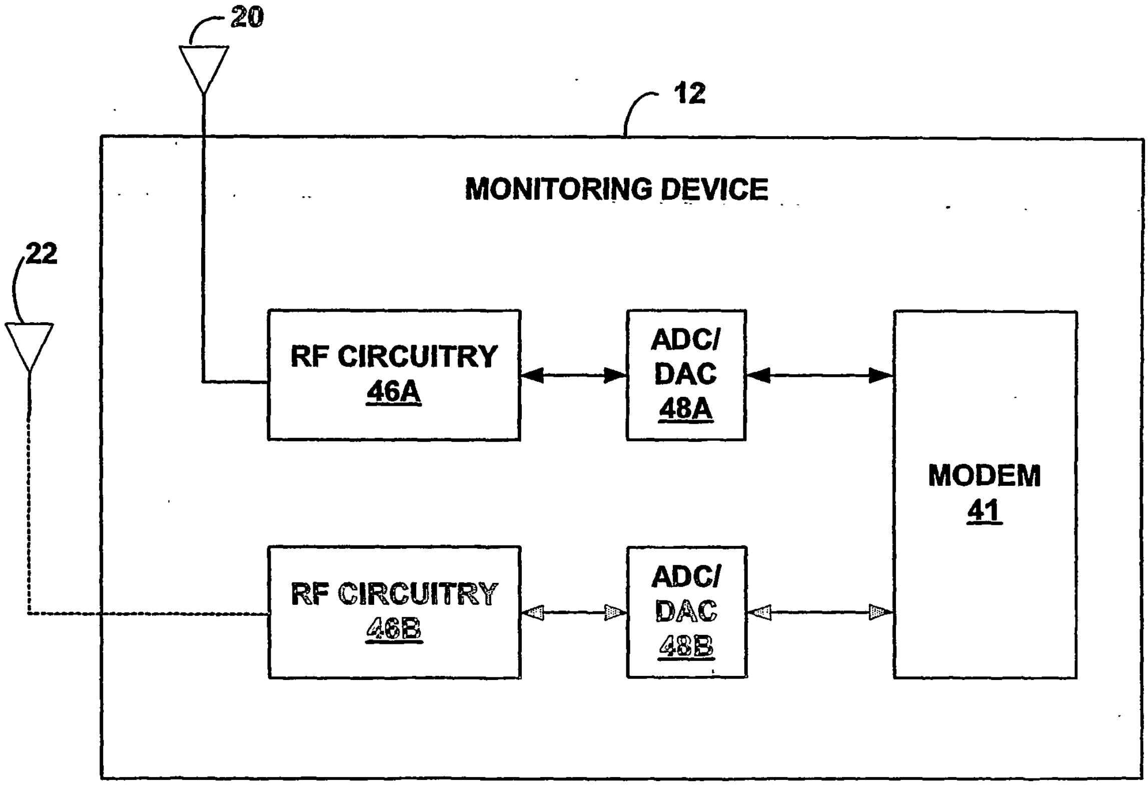
20
12
MONITORING DEVICE
22
RF CIRCUITRY
46A
ADC/
DAC
48A
MODEM
41
RF CIRCUITRY
46B
ADC/
DAC
48B

FIG. 5

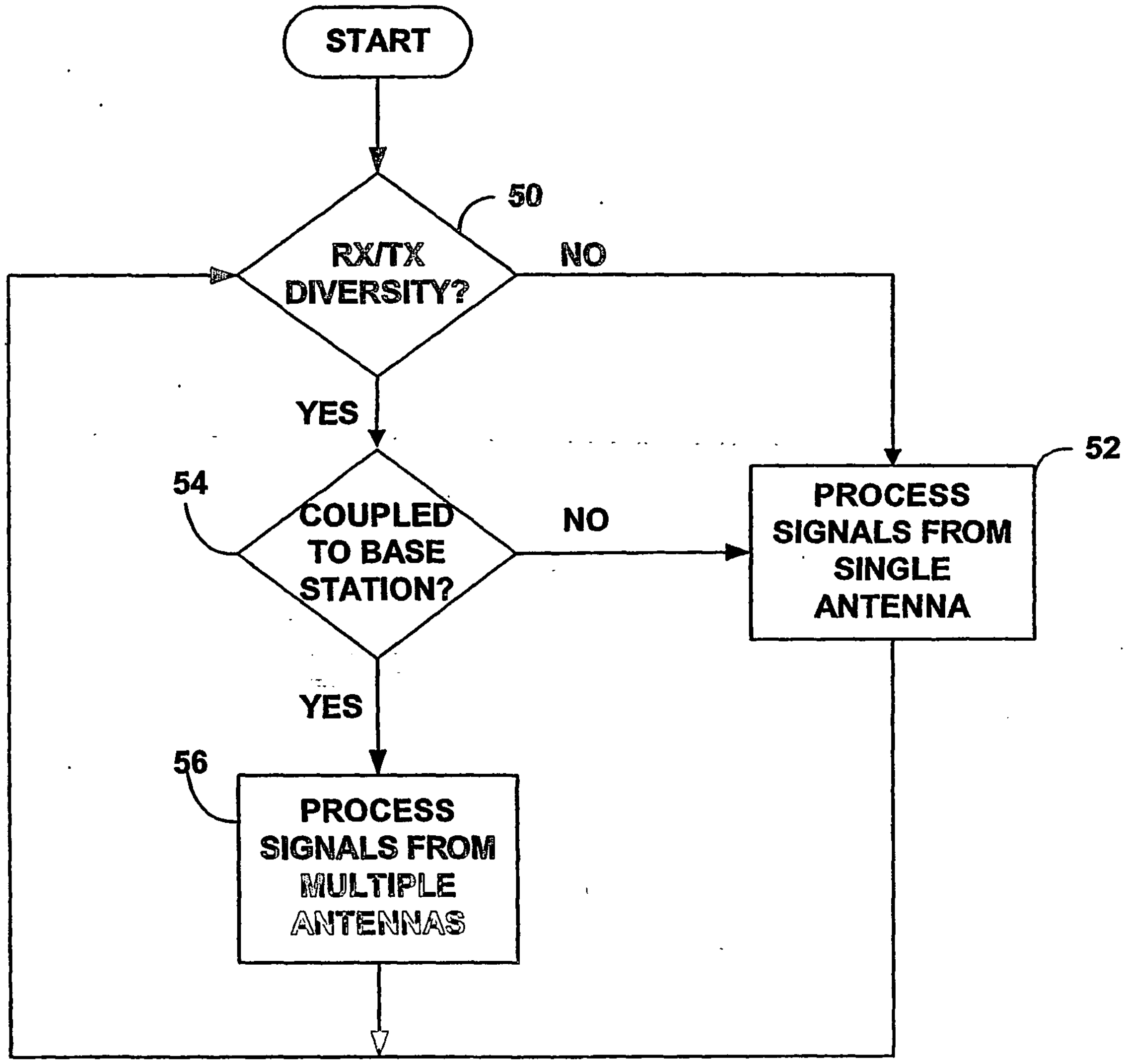
START
50
RX/TX DIVERSITY?
NO
YES
52
PROCESS SIGNALS FROM SINGLE ANTENNA
54
COUPLED TO BASE STATION?
NO
YES
56
PROCESS SIGNALS FROM MULTIPLE ANTENNAS

FIG. 6

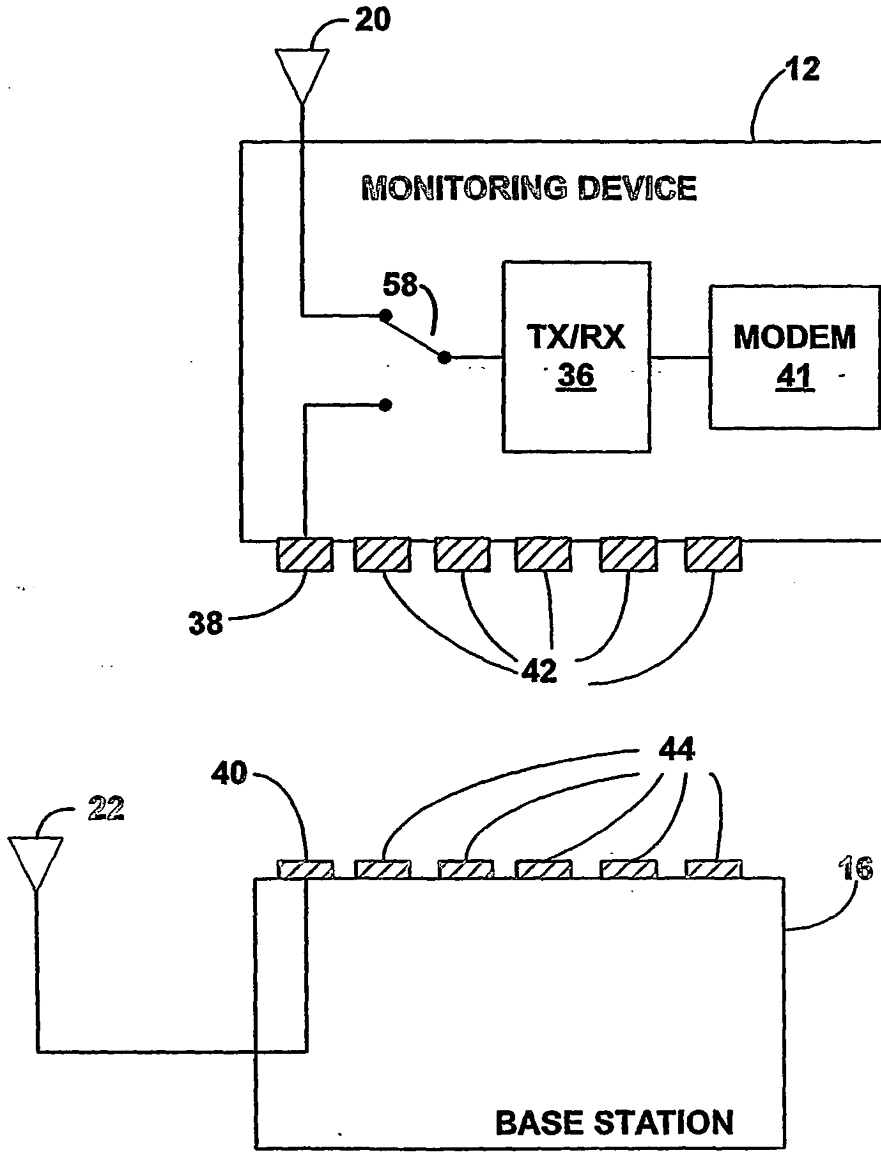
20
12
MONITORING DEVICE
58
TX/RX
36
MODEM
41
38
42
44
40
22
16
BASE STATION

FIG. 7

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- US 20010047314 A **[0004]**
- WO 0047109 A **[0004]**
- US 5904708 A **[0004]**
- US 6490487 B **[0004]**

专利名称(译)	具有多天线接收器的患者监测设备
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[标]申请(专利权)人(译)	美敦力公司
申请(专利权)人(译)	美敦力公司，INC.
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优先权	10/355855 2003-01-31 US
其他公开文献	EP1594396A1
外部链接	Espacenet

摘要(译)

患者监测设备包括能够进行单天线或多天线操作的接收器。多天线操作允许监视设备利用空间分集来改善在存在衰落的情况下与可植入医疗设备的通信。然而，许多患者监测设备的小尺寸可能使得难以并入多个天线。为了允许空间分集操作，基站包括至少第二天线，其可以耦合到患者监测设备。或者，当患者监测设备耦合到基站时，基站可以具有一个或多个高质量天线，其由患者监测设备使用而不是患者监测设备中的天线。

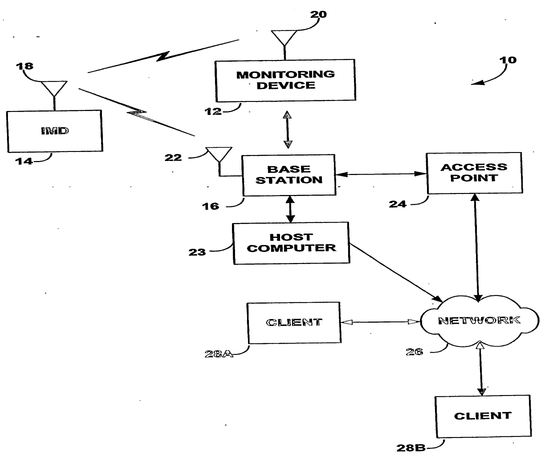

FIG. 1