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[54] **POLARIZATION DIVERSE ANTENNA FOR PORTABLE COMMUNICATION DEVICES**

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[*] Notice: This patent issued on a continued prosecution application filed under 37 CFR 1.53(d), and is subject to the twenty year patent term provisions of 35 U.S.C. 154(a)(2).

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[51] **Int. Cl.**[7] **H01Q 13/10**; H01Q 1/24

[52] **U.S. Cl.** **343/770**; 343/767; 343/702

[58] **Field of Search** ..... 343/770, 767, 343/702, 700 MS, 725, 795, 794, 727, 729, 730, 846; H01Q 13/10, 1/24

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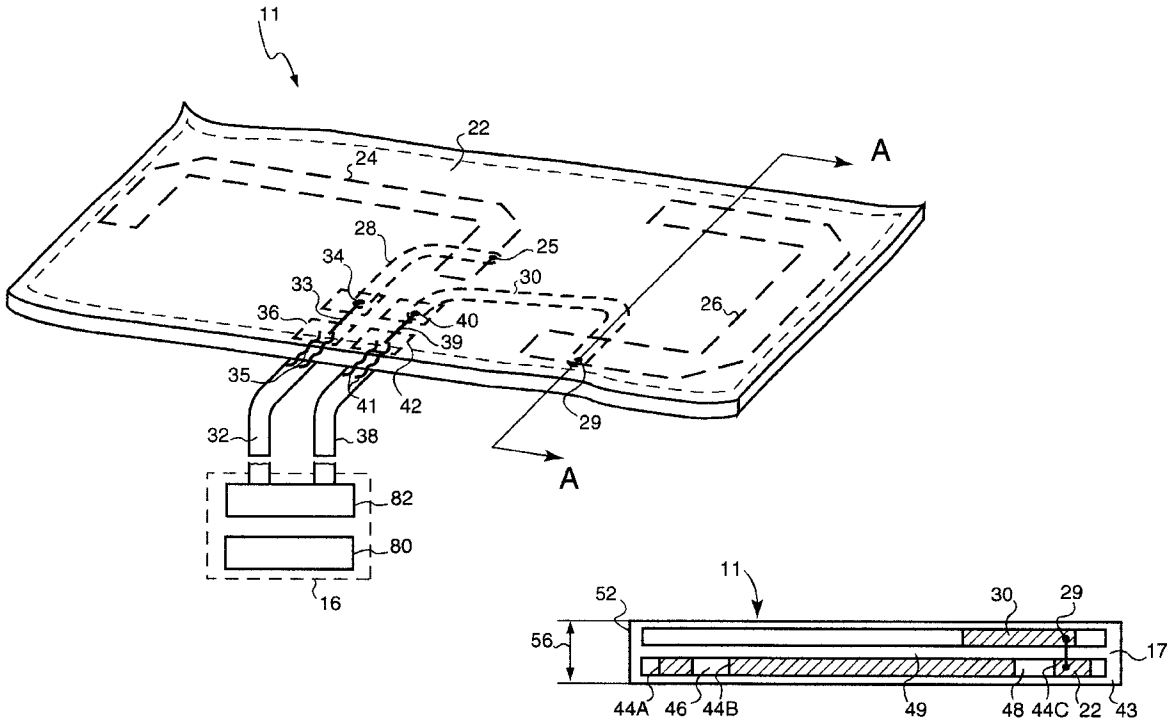
Primary Examiner—Hoanganh Le

[57] **ABSTRACT**

A communications card having an antenna assembly providing polarization diversity for use with a portable computer is provided. The antenna assembly comprises two folded antennas, which may be dipoles or slot radiators, that are disposed orthogonally to one another to provide polarization diversity. Signals are carried to and from the antenna by microstrip feed lines. The microstrip lines are placed off center along each antenna slot to establish an acceptable impedance match for the antenna. The feed lines are coupled to the communications card by way of coaxial cables. The antenna assembly is coupled with the communications card in a hinged arrangement thus allowing for spatial redirection of the antenna, if desired.

15 Claims, 3 Drawing Sheets



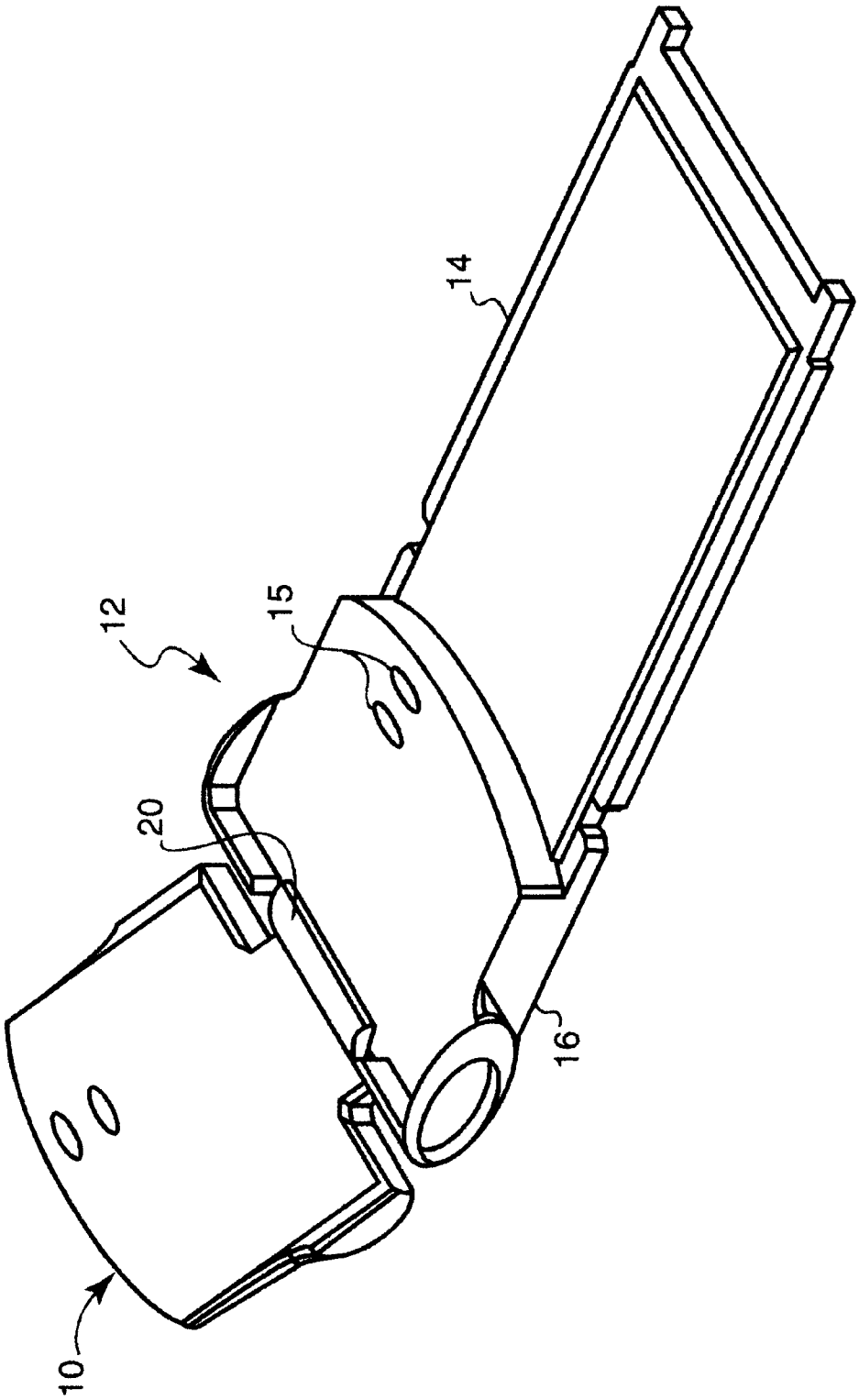


FIG. 1

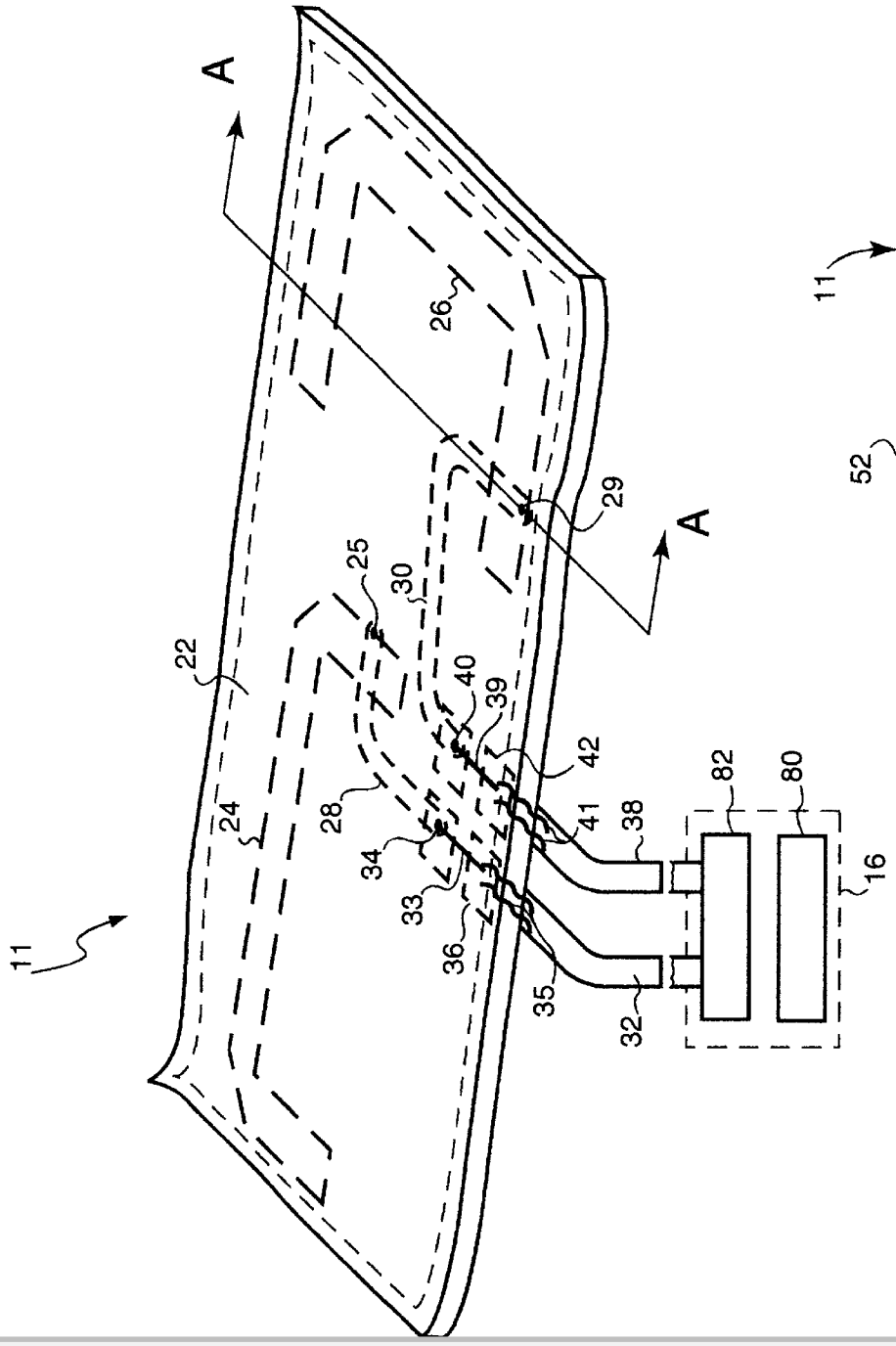


FIG. 2

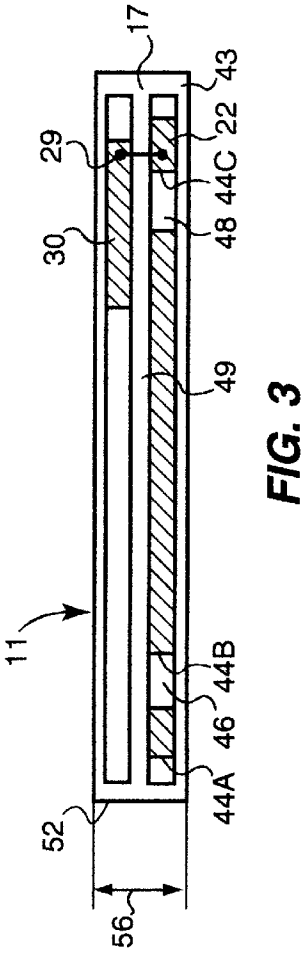


FIG. 3

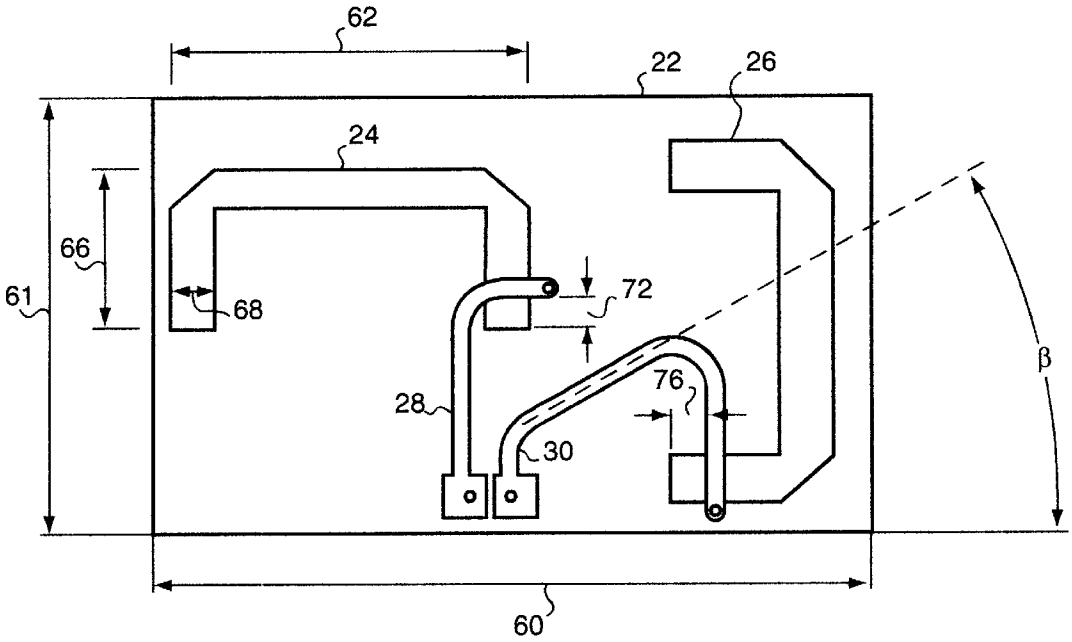


FIG. 4

POLARIZATION DIVERSE ANTENNA FOR PORTABLE COMMUNICATION DEVICES

FIELD OF THE INVENTION

This invention relates generally to an antenna assembly and, more specifically, it relates to a polarization diverse antenna assembly for use with small communication devices such as laptop computers.

BACKGROUND OF THE INVENTION

The development of wireless local area networks ("WLAN") for computers has facilitated the use of portable devices such as laptop computers for network communication. Such computers are small by design and, thus, present space constraints for communication units associated with them. For example, laptop computers are provided with slots in which accessory cards can be inserted. These slots and the associated circuitry generally have a prescribed standard configuration such as the PCMCIA standard. A communication device used with such a computer must conform to this standard.

Typically, a PCMCIA card used for wireless communications has been fitted with a transceiver and an antenna for communication by the computer. However, these cards have not been completely effective because portable computers are often used in complex radio frequency ("RF") environments such as office buildings and the like, where WLAN's are usually installed. These environments include physical barriers which give rise to multiple reflections of the signals transmitted or received by the computer. The signals travel over multiple paths, resulting in interference patterns and thus "dead spots". The radio frequency environment is further complicated by movement of persons or equipment within the environment. Additionally, the portable computers will be moved from location to location, thus changing the radio frequency environments in which they are to be operated.

It has been proposed to address these problems by using a tethered antenna which can be moved by the user to a position where signal strength is sufficient. Such tethered designs, however, present an inconvenience in that the tether requires the user to continually set up the antenna when moving the portable device to a different location. They can also give rise to mechanical stress, and resulting failure, of the wires used in the tether.

Another proposed solution is the use of multiple antennas to provide spatial diversity, so that if one of the antennas is in a dead spot, the other one is likely to encounter a usable signal. However, spatial diversity has not provided sufficient immunity to fading and, thus, such solutions have not been effective.

There remains a need for a low cost, more reliable antenna assembly which conforms to the available space in a portable communication device, the antenna of which allows maximum signal propagation while experiencing minimal fading in a dynamic RF environment.

SUMMARY OF THE INVENTION

The antenna assembly embodying the present invention includes a polarization diverse antenna incorporating two half-wavelength antennas encased in a plastic housing. The housing readily conforms to a communications card for use with a portable laptop computer. Specifically, one embodiment of the antenna assembly is designed for use with a transceiver incorporated into a PCMCIA communications

In its preferred form, the antenna assembly is configured to provide a pair of slot radiators. These antennas are preferably disposed at right angles to one another such that radiation by the respective antennas is orthogonally polarized. The slot radiators are folded so as to be compatible with the dimensions of a PCMCIA card. The card carries the appropriate electronics for the transceiver, i.e. the receiver and transmitter electronics.

Each antenna is coupled to the transceiver electronics by way of a microstrip feed line. More specifically, one portion of the microstrip line is passed across the slot at a selected feed point off the center of that slot. The other end of the microstrip line is connected from the slot radiator to the transceiver electronics by a flexible coaxial cable.

In operation, if a signal is of a polarization such that it is cross-polarized with one of the slot radiators, it will not be cross-polarized with respect to the other slot radiator because of the polarization diversity of the antennas. Thus, at least one of the slot radiators will typically carry a usable signal. Moreover, the user can adjust the orientation of the antenna by rotating the antenna assembly about a hinge that connects the assembly to the communications card.

Preferably, a switch automatically controls the selection of the antenna to be used, depending upon the signal received from each. As will be understood by those skilled in the art, the signal will be chosen based upon a predetermined parameter such as signal-to-noise ratio.

The antenna assembly provides a low cost, simply made antenna for use in a complex RF environment.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention description below refers to the accompanying drawings, of which:

FIG. **1** is an isometric view of an antenna assembly embodying the invention with the antenna attached to a communications card.

FIG. **2** is an isometric view of the antenna assembly of FIG. **1** with two, orthogonally placed slot radiators with microstrip feed lines depicted in phantom.

FIG. **3** is a cross section of the antenna assembly taken along line A—A of FIG. **2**.

FIG. **4** is a schematic illustration of the ground plane conductor of the antenna assembly of the present invention, and depicting the microstrip feed lines associated with each slot.

DETAILED DESCRIPTION OF AN ILLUSTRATIVE EMBODIMENT

As shown in FIG. **1**, an antenna housing **10**, which includes an antenna assembly **11** (FIG. **2**) embodying the invention, is incorporated into a communications card **12** used with a portable laptop computer (not shown). The card **12** is constructed in such a manner as to conform to the PCMCIA standard. It includes a digital electronics portion **14** which is connected to a bus in the computer. The card **12** also includes an RF electronics section **16** containing a suitable transceiver (not shown). The user may be a member of a local area network, which is a collection of computers that use a consistent protocol to communicate with one another. By means of the transceiver and the antenna assembly **11**, the user can communicate as a node on the network, either directly with another laptop computer which has wireless capability, or by way of a common access point to the network, even if the user is not in a fixed location.

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