

A DIRECTIONAL ANTENNA HAVING SELECTIVE BEAM DIRECTIVITY

FIELD OF THE INVENTION

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This invention relates to a directional antenna having selective beam directivity. The invention is particularly suitable for, but not necessarily limited to, slim pagers or other portable communication devices.

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BACKGROUND ART

Portable communication devices are becoming widely accepted as a form of communication. One type of communication device is known as a selective call receiver, often referred to as a pager, which receives paged information transmitted from one or more transmitters in a system. In this specification, selective call receivers will be referred to by way of example, however the invention is not necessarily limited to selective call receivers.

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Conventional pagers are not ideally suited to fit in a jacket or trouser pocket as their shape and size may cause an unsightly bulge in such clothing. Accordingly, slim pagers, often called credit card pagers, have been developed. Slim pagers generally use a plate-loop or plate-plate antenna. Unfortunately, the plate of such antennas makes their sensitivity dependent upon orientation relative to an associated transmitter. Antenna sensitivity can be improved by, for example, increasing the size of the loop, but this will affect the size of the pager and the sensitivity is still dependent upon orientation.

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One approach to alleviate the problems of antenna sensitivity being dependant upon orientation is to use

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unbalanced phase or amplitude rotation techniques. However, these techniques when used at frequencies below 900 Mhz require relatively large transmission line geometries that are impractical for pagers.

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SUMMARY OF THE INVENTION

It is an aim of the invention to overcome or alleviate at least one of the problems associated with antennas for pagers or other communication devices.

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According to one aspect of the invention there is provided a directional antenna having selective beam directivity, said directional antenna comprising:

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a common receiving element;

at least two spaced selectable Radio Frequency antennas oriented laterally to a plane of said common receiving element,

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wherein a first one of said antennas and said common receiving element are electrically coupled to effectively form a selectable first combination of two loop antennas having a resultant first beam directivity,

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and wherein a second one of said antennas and said common receiving element are electrically coupled to effectively form a selectable second combination of two loop antennas having a resultant second beam directivity.

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Preferably, said antenna may be integrally formed from an electrically conductive sheet.

Preferably, said spaced selectable Radio Frequency antennas may be located adjacent opposite edges of said common Radio Frequency receiving element.

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Suitably, said spaced selectable Radio Frequency antennas may each have a free end in close proximity to each other and may be couplable by respective connectors to receiving circuitry.

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Preferably, said common receiving element may have a common connector for connecting to said receiving circuitry, said common connector being in close proximity to each said free end.

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Suitably, each of said spaced selectable Radio Frequency antennas may have a portion with a longitudinal axis is normal to said plane.

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Preferably, said spaced selectable Radio Frequency antennas may be parallel to each other.

Preferably, said common Radio Frequency receiving element may be a planar conductive sheet.

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Suitably, said directional antenna can be symmetrical about an axis of said common receiving element.

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Suitably, each said spaced selectable Radio Frequency antennas may be selectively coupled to said receiving circuitry by a switch and said common receiving element may be also coupled to said receiving circuitry.

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Preferably, said switch can be controllable by a controller adapted to select either said first combination of two loop antennas or said second combination of two loop antennas, the selection of which being dependent upon a comparison of detected signal strengths received from said first and said second combinations. Alternatively, said switch may be manually controllable.

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BRIEF DESCRIPTION OF THE DRAWINGS

5 In order that the invention may be readily understood and put into practical effect, reference will now be made to a preferred embodiment as illustrated with reference to the accompanying drawings in which:

10 FIG. 1 is a perspective view of a directional antenna in accordance with an embodiment of the invention;

15 FIG. 2 is a front view of the of the directional antenna FIG. 1;

FIG. 3 is a schematic diagram of the directional antenna of FIG. 1 coupled to receiving circuitry by a switch;

20 FIG. 4 and Fig 5 illustrate the effects of selecting a first one of two spaced antenna forming part of the directional antenna of Fig. 1; and

25 Fig. 6 and Fig. 7 illustrates the effects of selecting a second one of two spaced antenna forming part of the directional antenna of Fig. 1.

30 DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT OF THE INVENTION

With reference to Fig. 1 and Fig. 2 there is illustrated a directional antenna (1) having directional beam sensitivity. The directional antenna (1) is
35 integrally formed from an electrically conductive sheet, typically copper, and comprises a common receiving element 2 and two spaced selectable Radio Frequency

antennas 3,4. The common receiving element 2 is planar and the two spaced selectable Radio Frequency antennas 3,4 each have a portion with a longitudinal axis L that is normal to a planar surface 5 of common receiving element 2.

The antennas 3,4 are parallel to each other and are located at respective opposite edges 6,7 of the common receiving element 2. Respective free ends 8,9 of antennas 3,4 are positioned in close proximity to each other and have connectors 10,11 for coupling to receiving circuitry. Further, the common receiving element 2 has a common connector 12 which is also in close proximity to free ends 8,9. The shape and size of both spaced selectable Radio Frequency antennas 3,4 are identical and the directional antenna 1 is symmetrical about an axis A of the common receiving element 2.

As illustrated in Fig. 3, directional antenna 1 is selectively coupled to a receiving circuitry 21 by a switch 20. In this regard, connectors 10, 11 are coupled to respective electrodes of impedance matching capacitors C1,C3 and common connector 12 is coupled to ground by a capacitor C2. Connectors 10 and 11 are also coupled to common connector 12 by respective resonator capacitors Cres1 and Cres2.

The switch 20 comprises two PIN diodes PIN1 and PIN2 the anodes of which are coupled to capacitors C1 and C3 respectively. The anode of the PIN diode PIN1 is also coupled to an output OUT1 of a processor 22 by a series resistor and choke network R1, RFC1. Similarly, the anode of the PIN diode PIN2 is also coupled to an output OUT2 of the processor 22 by a series resistor and choke network R2, RFC2. The cathodes of the PIN diodes PIN1, PIN2 are directly coupled to each other, they are also coupled to an input IN of the receiving circuitry 21 and

are DC coupled to ground by a choke RFC2. The receiving circuitry is coupled to the processor 22 each having modules, components and functionality that will be apparent to a person skilled in the art.

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In use, for example, processor 22 may send a DC signal of 5 Volts to output OUT1 whilst the signal at output OUT2 is set to 0 Volts. Accordingly, PIN diode PIN1 is forward biased PIN diode PIN2 is negative biased, therefore an RF signal (S1) received by common receiving element 2 and the first RF antenna 3 is supplied to the input IN of receiving circuitry 21. This signal (s1) is processed and sent to processor 22 as will be apparent to a person skilled in the art.

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The processor 22 determines the strength of the RF signal S1 by using one of the conventional techniques and the processor may decide to switch to receive a signal (S2) from common receiving element 2 and the second RF antenna 4. This will result in, a DC signal of 5 Volts being sent to output OUT2 whilst the signal at output OUT1 is set to 0 Volts. Accordingly, PIN diode PIN2 is forward biased and PIN diode PIN1 is negative biased, therefore the RF signal (S2) received by common receiving element 2 and the second RF antenna 4 is supplied to the input IN of receiving circuitry 21.

As illustrated in Fig. 4 and Fig. 5 the effect of selecting the combination of common receiving element 2 and the first RF antenna 3 to provide a signal (s1) is that effectively two loop antennas are formed. In this regard, current flows in two loops L1 and L2 and a resultant beam directivity BR1 which is effectively a vector addition of a beam B1 (the first RF antenna 3) and beam B2 (resulting from common receiving element 2).

As illustrated in Fig. 6 and Fig. 7 the effect of selecting the combination of common receiving element 2 and the second RF antenna 4 to provide a signal (s2) is that effectively two loop antennas are formed. In this regard, current flows in two loops L3 and L4 and a resultant beam directivity BR5 which is effectively a vector addition of a beam B4 (resulting from antenna 4) and beam B3 (resulting from common receiving element 2).

10 From the above, it will be apparent that the present invention allows for the selection of beam directivity which overcomes or alleviates at least one of the problems associated with antennas for pagers or other communication devices. Although the invention has been described with reference to a preferred embodiment it is to be understood that the invention is not restricted to the embodiment described herein. For instance, the receiving element 2 need not be planar and it may have an aperture therein or it may cut to any desired shape.

15 Furthermore, the antennas 3,4 need not have a longitudinal axis L that is normal to a planar surface 5 of common receiving element 2 and the antennas 3,4 do not necessarily have to be parallel to each other. Finally, the switch 20 can be a manually actuated mechanical

20 switch if so desired.

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WE CLAIM:

1. A directional antenna having selective beam
5 directivity, said directional antenna comprising:

a common receiving element;

10 at least two spaced selectable Radio Frequency
antennas oriented laterally to a plane of said common
receiving element,

wherein a first one of said antennas and said common
receiving element are electrically coupled to effectively
form a selectable first combination of two loop antennas
15 having a resultant first beam directivity,

and wherein a second one of said antennas and said
common receiving element are electrically coupled to
effectively form a selectable second combination of two
loop antennas having a resultant second beam directivity.

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2. A directional antenna as claimed in claim 1, wherein
said antenna is integrally formed from an electrically
conductive sheet.

25 3. A directional antenna as claimed in claim 1 or claim
2, wherein said spaced selectable Radio Frequency
antennas are located adjacent opposite edges of said
common Radio Frequency receiving element.

30 4. A directional antenna as claimed in any one
preceding claim, wherein said spaced selectable Radio
Frequency antennas each have a free end in close
proximity to each other and are couplable by respective
connectors to receiving circuitry.

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5. A directional antenna as claimed in claim 4, wherein
said common receiving element has a common connector for

connecting to said receiving circuitry, said common connector being in close proximity to each said free end.

5 6. A directional antenna as claimed in any one preceding claim, wherein each of said spaced selectable Radio Frequency antennas has a portion with a longitudinal axis is normal to said plane.

10 7. A directional antenna as claimed in any one preceding claim, wherein said spaced selectable Radio Frequency antennas are parallel to each other.

15 8. A directional antenna as claimed in any one preceding claim, wherein, said directional antenna is symmetrical about an axis of said common receiving element.

20 9. A directional antenna as claimed in any one preceding claim, wherein said common receiving element is a planar conductive sheet.

25 10. A directional antenna as claimed in any one preceding claim, wherein each said spaced selectable Radio Frequency antennas is selectively coupled to said receiving circuitry by a switch and said common receiving element is also coupled to said receiving circuitry.

30 11. A directional antenna as claimed in claim 10, wherein said switch is controllable by a controller adapted to select either said first combination of two loop antennas or said second combination of two loop antennas, the selection of which being dependent upon a comparison of detected signal strengths received from said first and said second combinations.

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12. A directional antenna as claimed in claim 10, wherein said switch is manually controllable.