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(54) **Wideband antenna arrangement**

Breitbandige Antennenanordnung

Disposition d'antenne à large bande

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Description

[0001] This invention relates to an antenna arrangement, particularly suitable for use in wideband telephone applications.

[0002] A coil antenna (sometimes referred to as a "helical antenna") offers a relatively compact configuration suitable for use with portable radio telephones where size and weight are important considerations. US patent No. 4,868,576 discloses a retractable antenna arrangement for a portable radio transceiver, including a fixed antenna coil and a retractable whip antenna extending through the antenna coil. European patent application EP-A-0,467,822 relates to a retractable antenna arrangement for a CT2 cordless telephone, and includes an antenna coil carried by an extendable antenna rod. In the extended position a switching device causes the antenna coil to be disconnected so that only the antenna rod is operative, but in the retracted position the antenna rod is disconnected in favour of the antenna coil. Also, our co-pending British patent application no. 9115134 relates to an antenna assembly comprising an elongate antenna element mounted in a support and movable between a retracted position and an extended position. A helical antenna element is carried by one end of the elongate element. The elongate antenna element is automatically rendered inactive as a radiating element by movement to the retracted position.

[0003] However, the bandwidth of a coil antenna is relatively narrow. This may not be a problem in analogue systems where the total operating bandwidth is relatively narrow, i.e. where the duplex separation (between the transmit and receive bands) is low, e.g. 45 MHz. By contrast the digital cellular system proposed for Japan, for example, has a much higher duplex separation of 130 MHz. In this case a single helical antenna cannot be used because of its limited bandwidth.

[0004] According to the present invention there is provided an antenna arrangement for a wideband transceiver, the antenna arrangement comprising a first antenna coil tuned to operate across the receive frequency band of the transceiver, and a second antenna coil tuned to operate across the transmit frequency band of the transceiver, wherein the first and second antenna coils share a common feed point, the receive frequency band,and the transmit frequency band do not overlap, characterised in that the second antenna coil does not load the first antenna coil when the first antenna coil is operating in the receive frequency band.

[0005] An antenna arrangement according to the preamble of claim 1 is known from patent document AU-D-2284 370.

[0006] An antenna arrangement in accordance with the invention has the advantage that it permits coil antennas to be used, even in a wideband system. Even though two separate coils are required, the overall arrangement may nevertheless be relatively compact. To this end both coils are preferably enclosed within a common housing.

[0007] Suitably, one of the antenna coils is used for reception and is tuned to the receive frequency, and the other is used for transmission and is tuned to the transmit frequency.

[0008] The two antenna coils may be disposed in various configurations, preferably on a common axis. Thus, the two coils may be disposed in line. In this case the diameter of the two coils may be the same or different.

[0009] Alternatively, the two coils may be arranged concentrically, one within the other. In this case the inner coil would have a smaller diameter than the outer coil. In another arrangement the two coils may be interwound, in which case they would both have substantially the same diameter.

[0010] It is noted here that one or both of the antenna coils need not have a uniform diameter, but may instead have a gradually increasing diameter. In this case the antenna coil(s) would be in the form of a helix.

[0011] Embodiments of the invention will now be described, by way of example, with reference to the accompanying drawings, in which:

Figure 1 is a schematic illustration of a radio telephone incorporating an antenna arrangement in accordance with the invention;

Figure 2 is a cross-section of alternative antenna arrangement in accordance with the invention; and

Figure 3 is a cross-section of another antenna arrangement in accordance with the invention.

[0012] The portable two-way radio in Figure 1 is a cellular telephone for use in a wideband cellular system such as the digital cellular system currently proposed for Japan. As is conventional, the telephone has a main housing 1 enclosing a transceiver 2.

[0013] In accordance with the invention a pair of antenna coils 3,4 are provided in a common housing 10 outside the main housing 1 on the top wall thereof. The housing 10 may for example be a plastics encapsulation, and may be formed either as a discrete housing or integrally with the main housing 1.

[0014] The two antenna coils are disposed in line (i.e. one above the other) on a common axis.

[0015] The upper antenna coil 3 is coupled to the transmitter 5 of the transceiver 2 via a duplex filter 7, and the lower antenna coil 4 is coupled to the receiver 6 of the transceiver 2 via the duplex filter 7.

[0016] The electrical length of the two antenna coils 3,4 is chosen so that the upper antenna coil 3 is a quarter-wavelength at the transmission frequency of the transceiver 2, and the lower antenna coil 4 is a quarter-wavelength at the receive frequency of the transceiver

2.

[0017] In the proposed Japanese digital system the transmission band is 940-856 MHz and the receive band is 810-826 MHz. In this case the upper antenna coil 3 may be tuned to 948 MHz, this being the centre frequency of the transmission band; and the lower antenna coil may be tuned to 818 MHz, this being the centre frequency of the receive band.

[0018] In the arrangement shown the transmitting antenna coil 3 is above the receiving antenna coil 4, because the Applicant at present believes this will give better transmission performance since the antenna coil 3 is further removed from the metal ordinarily found within the telephone. However it is possible for the two antenna coils to be interchanged so that the receive antenna coil is disposed above the transmit antenna coil.

[0019] In the present embodiment the two antenna coils 3,4 have a common feed 8 to and from the duplex filter 7. The length of the portion 8a of the transmission feed for the antenna coil 3, which extends through the receive antenna coil 4, is selected to present an open circuit to the transmission antenna 3. Thus when the lower antenna coil 4 is being used, the upper antenna coil 3 does not load the connection point, so that only the lower antenna coil is driven. THe antenna coils 3,4 can be designed to match to 50 ohms so that impedance matching may not be required.

[0020] In the proposed Japanese digital cellular system there is a requirement for diversity reception, and to this end the telephone may comprise a second, receive antenna 9. The second receive antenna 9 may have any suitable form and is disposed within the main housing 1. The second receive antenna 9 is coupled to the receiver section 6 of the transceiver 2.

[0021] Alternative arrangements for the pair of antenna coils are shown in Figures 2 and 3. In Figure 2, the transmit antenna 30 has a larger diameter than the receive antenna 40 and the two antenna coils are disposed concentrically with the receive antenna coil 40 within the transmit antenna coil 30. The electrical length of the inner (receive) antenna 40 is greater than that of the outer (transmit) antenna coil 30, and so the axial length of the inner coil is greater than the outer coil 30. In other words the inner coil 40 extends beyond the outer coil 30. In an alternative arrangement the transmission antenna coil may be disposed within the receive antenna coil in which case the diameters may be selected so that the axial length of the two coils is substantially the same.

[0022] In Figure 3, the shorter transmission antenna coil 300 is interwound with the larger receive antenna coil 400.

[0023] In view of the foregoing description it will be evident to a person skilled in the art that various modifications may be made within the scope of the invention. For example, as mentioned above, one or both of the antenna coils need not have a uniform diameter, but may instead be in the form of a helix, i.e. with a gradually increasing diameter.

[0024] Moreover, it is not necessary for the two antenna coils to be fixedly mounted on the main housing 2. In an alternative embodiment the dual coil assembly may be carried by a retractable antenna rod in a manner analogous to that disclosed in the aforementioned European patent application EP-A-0,467,822 or British patent application no. 9115134. In this case both of the antenna coils would be decoupled when the antenna rod is extended, but coupled to the transceiver when the antenna rod is retracted. In a further embodiment both antenna coils may be provided inside rather than outside the main housing of the radiotelephone.

Claims

1. An antenna arrangement for a wideband transceiver (2), the antenna arrangement comprising a first antenna coil (4) tuned to operate across the receive frequency band of the transceiver (2), and a second antenna coil (3) tuned to operate across the transmit frequency band of the transceiver, wherein the first and second antenna coils share a common feed point (8), the receive frequency band and the transmit frequency band do not overlap, characterised in that the second antenna coil (3) does not load the first antenna coil (4) when the first antenna coil (4) is operating in the receive frequency band.

2. An antenna arrangement as claimed in Claim 1, wherein the first and second antenna coils are disposed in a common housing (10).

3. An antenna arrangement as claimed in any of the preceding claims, wherein the first and second antenna coils are disposed on a substantially common axis.

4. An antenna arrangement as claimed in Claim 3, wherein the first and second antenna coils are disposed substantially in line.

5. An antenna arrangement as claimed in Claim 3, wherein the first and second antenna coils have different diameters and are disposed substantially concentrically, one within the other.

6. An antenna arrangement as claimed in Claim 3, wherein the first and second antenna coils are interwound.

7. A wideband transceiver apparatus including an antenna arrangement as claimed in any of the preceding claims, including means (6) for receiving signals having a first frequency, and means (5) for transmitting signals having a second frequency substantially different to the first frequency, wherein

the first antenna coil (4) is coupled to the receiving means (6) and the second antenna coil (3) is coupled to the transmitting means (5).

8. A wideband transceiver apparatus as claimed in Claim 7, including a main housing (1) enclosing the transmitting means (5) and the receiving means (6), wherein the first and second antenna coils are external to the main housing (1).

9. A wideband transceiver apparatus as claimed in claim 7, including a main housing (1) enclosing the transmitting means (5) and the receiving means (6), wherein the first and second antenna coils are present within the main housing (1).

Patentansprüche

1. Antennenanordnung für einen Breitband-Sendeempfänger (2), die eine erste Antennenspule (4), die abgestimmt ist, um über dem Empfangsfrequenzband des Sendeempfängers (2) betrieben zu werden, und eine zweite Antennenspule (3) umfaßt, die abgestimmt ist, um über dem Sendefrequenzband des Sendeempfängers betrieben zu werden, wobei die erste und die zweite Antennenspule einen gemeinsamen Speisepunkt (8) gemeinsam benutzen und das Empfangsfrequenzband und das Sendefrequenzband sich nicht überlappen, dadurch gekennzeichnet, daß die zweite Antennenspule (3) die erste Antennenspule (4) nicht belastet, wenn die erste Antennenspule (4) im Empfangsfrequenzband betrieben wird.

2. Antennenanordnung nach Anspruch 1, wobei die ersten und zweiten Antennenspulen in einem gemeinsamen Gehäuse (10) angeordnet sind.

3. Antennenanordnung nach einem der vorangehenden Ansprüche, wobei die ersten und zweiten Antennenspulen auf einer im wesentlichen gemeinsamen Achse angeordnet sind.

4. Antennenanordnung nach Anspruch 3, wobei die ersten und zweiten Antennenspulen im wesentlichen hintereinander angeordnet sind.

5. Antennenanordnung nach Anspruch 3, wobei die ersten und zweiten Antennenspulen unterschiedliche Durchmesser aufweisen und im wesentlichen konzentrisch, eine innerhalb der anderen, angeordnet sind.

6. Antennenanordnung nach Anspruch 3, wobei die ersten und zweiten Antennenspulen zusammengewickelt sind.

7. Breitband-Sendeempfängervorrichtung mit einer Antennenanordnung nach einem der vorhergehenden Ansprüche, die Mittel (6) zum Empfangen von Signalen, die eine erste Frequenz aufweisen, und Mittel (5) zum Senden von Signalen umfaßt, die eine zweite Frequenz aufweisen, die sich im wesentlichen von der ersten Frequenz unterscheidet, wobei die erste Antennenspule (4) mit den Empfangsmitteln (6) verbunden ist und die zweite Antennenspule (3) mit den Sendemitteln (5) verbunden ist.

8. Breitband-Sendeempfängervorrichtung nach Anspruch 7, die ein Hauptgehäuse (1) umfaßt, das die Sendemittel (5) und die Empfangsmittel (6) umschließt, wobei sich die ersten und zweiten Antennenspulen außerhalb des Hauptgehäuses (1) befinden.

9. Breitband-Sendeempfängervorrichtung nach Anspruch 7, die ein Hauptgehäuse (1) umfaßt, das die Sendemittel (5) und die Empfangsmittel (6) umschließt, wobei die ersten und zweiten Antennenspulen im Hauptgehäuse (1) vorhanden sind.

Revendications

1. Disposition d'antenne pour un émetteur-récepteur à large bande (2), la disposition d'antenne comprenant une première bobine d'antenne (4) accordée pour fonctionner a travers la bande de fréquence de réception de l'émetteur-récepteur (2) et une deuxième bobine d'antenne (3) accordée pour agir à travers la bande de fréquence de transmission de l'émetteur-récepteur, dans lequel les première et deuxième bobines d'antenne partagent un point d'alimentation commun (8), la bande de fréquence de réception et la bande de fréquence de transmission ne se chevauchent pas, caractérisée en ce que la deuxième bobine d'antenne (3) ne charge pas la première bobine d'antenne (4) lorsque la première bobine d'antenne (4) est en fonctionnement dans la bande de fréquence de réception.

2. Disposition d'antenne selon la revendication 1, dans laquelle les première et deuxième bobines d'antenne sont disposées dans un logement commun (10).

3. Disposition d'antenne selon l'une quelconque des revendications précédentes, dans laquelle les première et deuxième bobines d'antenne sont disposées sur un axe sensiblement commun.

4. Disposition d'antenne selon la revendication 3, dans laquelle les première et deuxième bobines d'antenne sont disposés sensiblement en ligne.

5. Disposition d'antenne selon la revendication 3,

dans laquelle les première et deuxième bobines d'antenne présentent différents diamètres et sont disposés sensiblement concentriques, l'une à l'intérieur de l'autre.

6. Disposition d'antenne selon la revendication 3, dans laquelle les première et deuxième bobines d'antenne sont inter-enroulées.

7. Appareil émetteur-récepteur à large bande incluant une disposition d'antenne selon l'une quelconque des revendications précédentes, incluant un moyen (6) destiné à recevoir des signaux comportant une première fréquence, et un moyen (5) destiné à transmettre des signaux comportant une deuxième fréquence sensiblement différente de la première fréquence, dans lequel la première bobine d'antenne (4) est couplée au moyen de réception (6) et la deuxième bobine d'antenne (3) est couplée au moyen de transmission (5).

8. Appareil émetteur-récepteur à large bande selon la revendication 7, incluant un logement principal (1) enfermant le moyen de transmission (5) et le moyen de réception (6) dans lequel les première et deuxième bobines d'antenne sont externes au logement principal (1).

9. Appareil émetteur-récepteur à large bande selon la revendication 7, incluant un logement principal (1) enfermant le moyen de transmission (5) et le moyen de réception (6), dans lequel les première et deuxième bobines d'antenne sont présentes à l'intérieur du logement principal (1).

Fig.1.

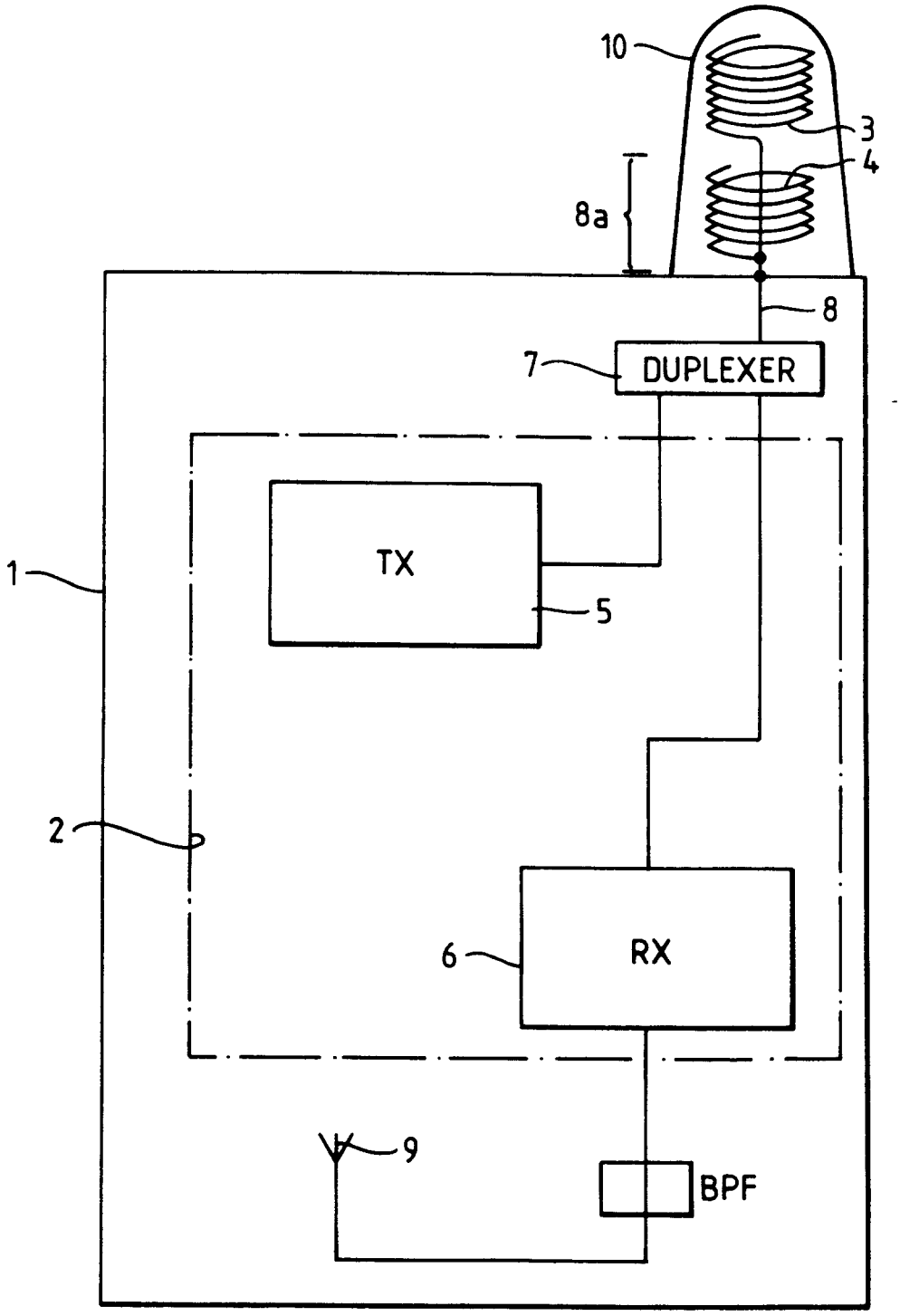

Fig. 2.

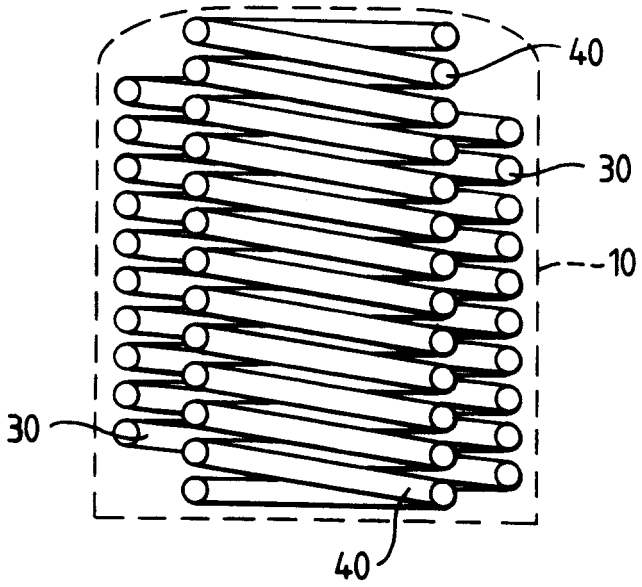

Fig. 3.