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(54) An antenna device and a portable radio communication device comprising such antenna device

(57) The present invention relates to an antenna device for a portable radio communication device adapted for simultaneous operation at a first frequency band and a second frequency band. The antenna device comprises a first elongated radiating element (1), a second elongated radiating element (2) and filtering means (3) connected between the first and second elongated radiating elements, wherein the filtering means (3) is configured to pass operating frequencies of the first frequency band and to stop operating frequencies of the second frequency band.

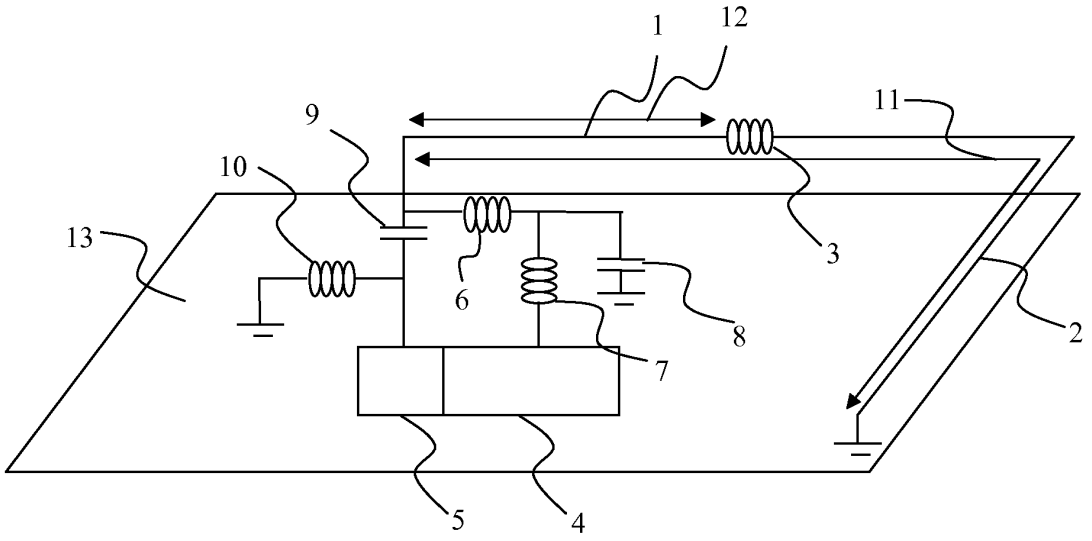

FIG. 1

EP 2 234 205 A1

Description

FIELD OF INVENTION

[0001] The present invention relates generally to antenna devices and more particularly to an antenna device for use in a portable radio communication device, such as a mobile phone.

BACKGROUND

[0002] Internal antennas have been used for some time in portable radio communication devices. There are a number of advantages connected with using internal antennas, of which can be mentioned that they are small and light, making them suitable for applications wherein size and weight are of importance, such as in mobile phones, PDA, portable computer or similar devices.

[0003] However, the application of internal antennas in a mobile phone puts some constraints on the configuration of the antenna element. In particular, in a portable radio communication device the space for an internal antenna device is limited. These constraints may make it difficult to find a configuration of the antenna device that provides for desired use. This is especially true for antennas intended for use with radio signals of relatively low frequencies as the desired physical length of such antennas are large compared to antennas operating with relatively high frequencies.

[0004] One specific application operating in a relatively low frequency band is the FM radio application. The FM operating band is defined as frequencies between 88-108 MHz in most of the world and frequencies between 76-90 MHz in Japan. Prior art conventional antenna configurations, such as loop antennas or monopole antennas, fitted within the casing of a portable radio communication device will result in unsatisfactory operation in that the antenna either has too bad performance over a sufficiently wide frequency band or sufficient performance over a too narrow frequency band.

[0005] Instead, a conventional FM antenna for portable radio communication devices is usually provided in the headset wire connected to the communication device. This configuration with a relatively long wire permits an antenna length that is sufficient also for low frequency applications. However, if no external antenna is permitted this solution is obviously not feasible.

[0006] Further, a portable radio communication device is today many times provided with frequency operational coverage for other frequency bands then FM, such as GSM900, GSM1800, GPS, Bluetooth, WLAN, WCDMA and GPS. A portable radio communication device has limited space and it is thus desirable to, if possible, add multiple functionality to an antenna device.

SUMMARY OF THE INVENTION

[0007] An object of the present invention is to provide an antenna device for a portable radio communication device, which efficiently utilizes available space of the portable radio communication device and provides for simultaneous operation for at least a first frequency band and a second frequency band.

[0008] This object, among others, is according to the present invention attained by an antenna device and a portable radio communication device, respectively, as defined by the appended claims.

[0009] By providing an antenna device for a portable radio communication device adapted for simultaneous operation at a first frequency band and a second frequency band, wherein the antenna device comprises a first elongated radiating element having a first end and a second end, a second elongated radiating element having a first end and a second end, and filtering means, wherein the first end of the first elongated radiating element comprises a feeding point for feeding the antenna device simultaneously with the first frequency band and the second frequency band, the second end of the first elongated radiating element is connected to the filtering means, and the first end of the second elongated radiating element is connected to the filtering means, and the filtering means is configured to pass operating frequencies of the first frequency band and to stop operating frequencies of the second frequency band, which antenna device efficiently utilizes available space, since two operating frequencies are provided by a single feed point without significant increases of space.

[0010] The first frequency band is preferably FM and the second frequency band is preferably BT.

[0011] The antenna device is preferably open-ended for FM operation, in order to provide an antenna device less affected by EMI. Alternatively, the second end of the second elongated radiating element is grounded, providing a loop structure for e.g. FM operation.

[0012] Advantageously the first filtering means is an inductor, providing effective blocking of open-ended structure for BT operation at the same time passing FM operation.

[0013] The antenna device preferably utilizes the whole length of the first and second elongated radiating element for FM operation.

[0014] The first elongated radiating element preferably has a length configured for BT operation, efficiently providing simultaneous FM and BT operation through a single feeding point.

[0015] Advantageously, the antenna comprises second filtering means connecting a first transceiver to the feeding point, the second filtering means configured to pass operating frequencies for the first frequency band and to block operating frequencies for the second frequency band, for efficient implementation of simultaneous operation. Further, third filtering means connecting a second transceiver to the feeding point, the third filtering means configured to pass operating frequencies for the second frequency band and to block operating frequencies for the first frequency band, is preferably provided

for efficient implementation of simultaneous operation.

[0016] Advantageously, the antenna device is adapted for simultaneous operation at a third frequency band and comprises a third elongated radiating element having a first end and a second end, and seventh filtering means connected between the second end of the second elongated radiating element and the first end of the third radiating element, and eighth filtering means connecting the second elongated radiating element to ground, whereby efficient implementation of simultaneous operation also for third operation is achieved.

[0017] By providing the eighth filtering means connected to the second elongated radiating element close to the seventh filtering means an antenna device having a single feeding point for simultaneous operation of FM, BT and GPS is achieved.

[0018] By providing the eighth filtering means connected to the second elongated radiating element close to the first filtering means, efficient utilization of the radiating elements for FM operation is achieved.

[0019] Advantageously, the antenna device comprises ninth filtering means connecting the second end of the third elongated radiating element to ground, wherein the ninth filtering means is configured to pass operating frequencies for the first frequency band and to block operating frequencies for the third frequency band, for efficient implementation simultaneous operation is achieved.

[0020] A portable radio communication device preferably comprises an antenna device, wherein the first and second elongated radiating elements are arranged over a ground plane device.

[0021] By preferably providing the antenna device with a dielectric carrier supporting the first and second elongated radiating element, a robust installation of the antenna device is provided. The dielectric carrier is preferably part of the back cover of the portable radio communication device, which provides for a cost efficient and robust solution.

[0022] By preferably providing the first filtering means as an inductor, the BT antenna efficiently is an ILA antenna.

[0023] By preferably providing filtering means as a capacitor, a simple, low cost and efficient filtering means is achieved.

[0024] By preferably providing the first elongated radiating element to have a length configured for the BT operation, BT operation can be configured without much interference for FM configuration.

[0025] Further preferred embodiments are defined in the dependent claims.

BRIEF DESCRIPTION OF DRAWINGS

[0026] The present invention will become more fully understood from the detailed description of embodiments given below and the accompanying figures, which are given by way of illustration only, and thus, are not limitative of the present invention, wherein:

FIG. 1 is a schematic diagram showing a first embodiment of an antenna device according to the present invention.

FIG. 2 is a perspective partially cut-away view of an antenna device according to the present invention mounted in a portable radio communication device.

FIG. 3 is a schematic diagram showing a second embodiment of an antenna device of the present invention.

FIG. 4 is a schematic diagram showing a third embodiment of an antenna device of the present invention.

FIG. 5 is a schematic diagram showing a fourth embodiment of an antenna device of the present invention.

FIG. 6 is a schematic diagram showing a fifth embodiment of an antenna device of the present invention.

FIG. 7 is a schematic diagram showing a sixth embodiment of an antenna device of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

[0027] In the following description, for purpose of explanation and not limitation, specific details are set forth, such as particular techniques and applications in order to provide a thorough understanding of the present invention. However, it will be apparent for a person skilled in the art that the present invention may be practiced in other embodiments that depart from these specific details. In other instances, detailed description of well-known methods and apparatuses are omitted so as not to obscure the description of the present invention with unnecessary details.

[0028] In the following description and claims, the term radiating element is used. It is to be understood that this term is intended to cover electrically conductive elements arranged for receiving and/or transmitting radio signals.

[0029] An antenna device for a portable radio communication device according to a first embodiment of the present invention will now be described with reference to Figs. 1 and 2.

[0030] The antenna device is configured to provide the portable radio communication device with simultaneous operation for a first and a second frequency band, FM and BT. The antenna device comprises a first elongated radiating element 1, having a first end and a second end, and a second radiating element 2, having a first end and a second end. The antenna device further comprises first

filter means 3 connected between the second end of the first elongated radiating element 1 and the first end of the second elongated radiating element 2.

[0031] The first end of the first elongated radiating element 1 comprises a feeding point for feeding of FM and BT band frequencies. The first end of the first elongated radiating element 1 is connected to second filtering means 6 and third filtering means 9. The second filtering means 6 is in turn connected to fourth filtering means 7 and ground through fifth filtering means 8. The fourth filtering means 7 is in turn connected to a first transceiver 4, a FM transceiver. The third filtering means 9 is in turn connected to a second transceiver 5, a BT (Bluetooth) transceiver, and to ground through sixth filtering means 10. The second end of the second elongated radiating element 2 is grounded.

[0032] The first and second elongated radiating elements 1 and 2 together have a length 11 configured for FM operation, about 90 mm. The first elongated radiating element 1 have a length 12 configured for BT operation, about 30 mm. The exemplary lengths given above are dependent on e.g. distance above a ground plane device 13, in this case based on the distance of about 5 mm.

[0033] The first and second radiating elements are preferably planar elements supported by a dielectric carrier. The dielectric carrier is e.g. a portion of the back cover of the portable radio communication device. Alternatively the dielectric carrier is e.g. a portion of the middle deck the portable radio communication device. Further, the first and second radiating elements are alternatively e.g. self-supported.

[0034] The first filtering means 3 is preferably provided as an inductor of about 20 nH, but could alternatively be provided as parallel resonant circuit. The first filtering means 3 is in such a way configured to pass FM operation and to block BT operation. The second filtering means 6 is preferably provided as an inductor of about 20 nH, but could alternatively be provided as parallel resonant circuit. The second filtering means 6 is in such a way configured to pass FM operation and to block BT operation. The third filtering means 9 is preferably provided as a capacitor of about 1 pF. The third filtering means 9 is in such a way configured to block FM operation and to match the BT transceiver 5. The fourth filtering means 7 is preferably provided as an inductor of about 56 nH, but could alternatively be provided as parallel resonant circuit. The fourth filtering means 7 is in such a way configured to low pass FM operation. The fifth filtering means 8 is preferably provided as a capacitor of about 30 pF. The fifth filtering means 8 is in such a way configured to tune the first and second elongated radiating elements for FM operation. The sixth filtering means 10 is preferably provided as an inductor of about 3 nH, but could alternatively be provided as parallel resonant circuit. The sixth filtering means 10 is in such a way configured to match the BT transceiver 5, together with the third filtering means 3. The antenna device is in such a way configured to simultaneously with FM frequencies operate at BT frequencies.

[0035] The antenna device thus effectively forms a half-loop radiating element for FM operation. A half-loop antenna is a virtual loop antenna, by being provided over a ground plane device 13. The antenna device thus effectively forms an ILA antenna for BT operation.

[0036] A second embodiment of an antenna device according to the present invention is illustrated in Fig. 3. The second embodiment of the antenna device is identical with the first embodiment of the antenna device described above apart from the following.

[0037] The second end of the second elongated radiating element 2 is open ended, i.e. without grounding. The second filtering means 6 is short-circuited, and the fifth filtering means 8 is preferably an inductor of about 470 nH, but could alternatively be provided as parallel resonant circuit. The fifth filtering means 8 is in such a way configured to tune the first and second elongated radiating elements for FM operation and to block BT operation.

[0038] The antenna device thus effectively forms an ILA antenna for FM operation and for BT operation, respectively.

[0039] Due to high magnetic EMI in portable radio communication devices, such as mobile phones, monopole FM solutions can provide superior performance compared to the half-loop type.

[0040] An antenna device for a portable radio communication device according to a third embodiment of the present invention will now be described with reference to Fig. 4.

[0041] The antenna device is configured to provide the portable radio communication device with simultaneous operation for a first, a second and a third frequency band, FM, BT and GPS. The antenna device comprises a first elongated radiating element 1, having a first end and a second end, and a second radiating element 2, having a first end and a second end, and a third elongated radiating element 14 having a first end and a second end. The antenna device further comprises first filter means 3 connected between the second end of the first elongated radiating element 1 and the first end of the second elongated radiating element 2, and seventh filtering means 15 connected between the second end of the second elongated radiating element 2 and the first end of the third elongated radiating element 14.

[0042] The first end of the first elongated radiating element 1 comprises a feeding point for feeding of FM and BT band frequencies. The first end of the first elongated radiating element 1 is connected to second filtering means 6 and third filtering means 9. The second filtering means 6 is in turn connected to fourth filtering means 7 and ground through fifth filtering means 8. The fourth filtering means 7 is in turn connected to a first transceiver 4, a FM transceiver. The third filtering means 9 is in turn connected to a second transceiver 5, a BT (Bluetooth) transceiver, and to ground through sixth filtering means 10.

[0043] The second elongated radiating element 2 is grounded through eighth filtering means 16. The grounding is close to the first filtering means 3.

[0044] The second end of the third elongated radiating element 14 is grounded through ninth filtering means 17 and connected to tenth filtering means 18. The tenth filtering means 18 is in turn grounded through eleventh filtering means 19 and connected to a third receiver 20, a GPS receiver.

[0045] The first, second and third elongated radiating elements 1, 2 and 14 together have a length 11 configured for FM operation, about 105 mm. The first elongated radiating element 1 have a length 12 configured for BT operation, about 30 mm. The connection point for the eighth filtering means 16 to the second radiating element 2 is about 5 mm from the first filtering means 3, for good GPS isolation. The third elongated radiating element 14 has a length configured for possible WCDMA_Rx operation, about 40 mm. The second and third elongated radiating elements 2 and 14 together have a length 21 configured for GPS operation, of about 70 mm. The exemplary lengths given above are dependent on e.g. distance above a ground plane device 13, in this case based on the distance of about 5 mm.

[0046] The first, second and third radiating elements are preferably planar elements supported by a dielectric carrier. The dielectric carrier is e.g. a portion of the back cover of the portable radio communication device. Alternatively the dielectric carrier is e.g. a portion of the middle deck the portable radio communication device. Further, the first, second and third radiating elements are alternatively e.g. self-supported.

[0047] The first filtering means 3 is preferably provided as an inductor of about 20 nH, but could alternatively be provided as parallel resonant circuit. The first filtering means 3 is in such a way configured to pass FM operation and to block BT operation. The second filtering means 6 is preferably provided as an inductor of about 20 nH, but could alternatively be provided as parallel resonant circuit. The second filtering means 6 is in such a way configured to pass FM operation and to block BT operation. The third filtering means 9 is preferably provided as a capacitor of about 1 pF. The third filtering means 9 is in such a way configured to block FM operation and to match the BT transceiver 5. The fourth filtering means 7 is preferably provided as an inductor of about 56 nH, but could alternatively be provided as parallel resonant circuit. The fourth filtering means 7 is in such a way configured to low pass FM operation. The fifth filtering means 8 is preferably provided as a capacitor of about 30 pF. The fifth filtering means 8 is in such a way configured to tune the first, second and third elongated radiating elements for FM operation. The sixth filtering means 10 is preferably provided as an inductor of about 3 nH, but could alternatively be provided as parallel resonant circuit. The sixth filtering means 10 is in such a way configured to match the BT transceiver 5, together with the third filtering means 3. The seventh filtering means 15 is preferably provided as an inductor of about 15 nH, but could alternatively be provided as parallel resonant circuit. The seventh filtering means 15 is in such a way configured to pass and tune for FM and GPS operation and to block possible WCDMA_Rx operation. The eighth filtering means 16 is preferably provided as a capacitor of about 5 pF. The eighth filtering means 16 is in such a way configured to together with first filtering means 3 block GPS operation. The ninth filtering means 17 is preferably provided as an inductor of about 10 nH, but could alternatively be provided as parallel resonant circuit. The ninth filtering means 17 is in such a way configured to short-circuit FM frequencies and to block GPS frequencies. The tenth filtering means 18 is preferably provided as a capacitor of about 1 pF. The tenth filtering means 18 is in such a way configured to block FM operation and to match the GPS receiver 20. The eleventh filtering means 19 is preferably provided as an inductor of about 3 nH, but could alternatively be provided as parallel resonant circuit. The eleventh filtering means 19is in such a way configured to match the GPS receiver 20. The antenna device is in such a way configured to simultaneously with FM frequencies operate at BT and GPS frequencies.

[0048] The antenna device thus effectively forms a half-loop antenna for FM operation. The antenna device thus effectively forms an ILA antenna for BT operation and a grounded ILA antenna for GPS operation.

[0049] It is further possible to add WCDMA operation to the antenna device, by feeding through the second end of the third elongated radiating element, i.e. sharing feeding with GPS feeding.

[0050] A fourth embodiment of an antenna device according to the present invention is illustrated in Fig. 5. The fourth embodiment of the antenna device is identical with the third embodiment of the antenna device described above apart from the following.

[0051] The second filtering means 6 and the ninth filtering means 17 are short-circuited. The fifth filtering means 8 is preferably provided as an inductor of about 470 nH. The fifth filtering means 8 is in such a way configured to block BT operation and to tune FM operation.

[0052] The antenna device thus effectively forms an ILA antenna for FM and BT operation and a grounded ILA for GPS operation.

[0053] An antenna device for a portable radio communication device according to a fifth embodiment of the present invention will now be described with reference to Fig. 6.

[0054] The antenna device is configured to provide the portable radio communication device with simultaneous operation for a first, a second and a third frequency band, FM, BT and GPS. The antenna device comprises a first elongated radiating element 1, having a first end and a second end, and a second radiating element 2, having a first end and a second end, and a third elongated radiating element 14 having a first end and a second end. The antenna device further comprises first filter means 3 connected between the second end of the first elongated

radiating element 1 and the first end of the second elongated radiating element 2, and seventh filtering means 15 connected between the second end of the second elongated radiating element 2 and the first end of the third elongated radiating element 14.

[0055] The first end of the first elongated radiating element 1 comprises a feeding point for feeding of FM, BT and GPS band frequencies. The first end of the first elongated radiating element 1 is connected to second filtering means 6 and third filtering means 9. The second filtering means 6 is in turn connected to fourth filtering means 7 and ground through fifth filtering means 8. The fourth filtering means 7 is in turn connected to a first transceiver 4, a FM transceiver. The third filtering means 9 is in turn grounded through sixth filtering means 10 and connected to a diplexer 22. The diplexer is in turn connected to a second transceiver 5, a BT transceiver, and to a third receiver 20, a GPS receiver.

[0056] The second elongated radiating element 2 is grounded through eighth filtering means 16. The grounding is close to the seventh filtering means 15.

[0057] The second end of the third elongated radiating element 14 is grounded.

[0058] The first, second and third elongated radiating elements 1, 2 and 14 together have a length 11 configured for FM operation, about 115 mm. The first elongated radiating element 1 have a length 12 configured for BT operation, about 30 mm. The connection point for the eighth filtering means 16 to the second radiating element 2 is about 5 mm from the seventh filtering means 15, for good GPS isolation. The third elongated radiating element 14 has a length configured for possible WCDMA_Rx operation, about 40 mm. The first and second elongated radiating elements 1 and 2 together have a length 23 configured for GPS operation, of about 70 mm. The exemplary lengths given above are dependent on e.g. distance above a ground plane device 13, in this case based on the distance of about 5 mm.

[0059] The first, second and third radiating elements are preferably planar elements supported by a dielectric carrier. The dielectric carrier is e.g. a portion of the back cover of the portable radio communication device. Alternatively the dielectric carrier is e.g. a portion of the middle deck the portable radio communication device. Further, the first, second and third radiating elements are alternatively e.g. self-supported.

[0060] The first filtering means 3 is preferably provided as an inductor of about 20 nH, but could alternatively be provided as parallel resonant circuit. The first filtering means 3 is in such a way configured to pass FM and GPS operation and to block BT operation. The second filtering means 6 is preferably provided as an inductor of about 20 nH, but could alternatively be provided as parallel resonant circuit. The second filtering means 6 is in such a way configured to pass FM operation and to block BT and GPS operation. The third filtering means 9 is preferably provided as a capacitor of about 1 pF. The third filtering means 9 is in such a way configured to block FM operation and to match the BT transceiver 5. The fourth filtering means 7 is preferably provided as an inductor of about 56 nH, but could alternatively be provided as parallel resonant circuit. The fourth filtering means 7 is in such a way configured to low pass FM operation. The fifth filtering means 8 is preferably provided as a capacitor of about 30 pF. The fifth filtering means 8 is in such a way configured to tune the first, second and third elongated radiating elements for FM operation. The sixth filtering means 10 is preferably provided as an inductor of about 3 nH, but could alternatively be provided as parallel resonant circuit. The sixth filtering means 10 is in such a way configured for BT and GPS matching, together with the third filtering means 3. The seventh filtering means 15 is preferably provided as an inductor of about 20 nH, but could alternatively be provided as parallel resonant circuit. The seventh filtering means 15 is in such a way configured to pass FM operation and to block GPS operation together with eighth filtering means 16 and to block possible WCDMA_Rx operation. The eighth filtering means 16 is preferably provided as a capacitor of about 5 pF. The eighth filtering means 16 is in such a way configured to together with seventh filtering means 15 block GPS operation. The ninth filtering means 17 is preferably provided as an inductor of about 10 nH, but could alternatively be provided as parallel resonant circuit. The ninth filtering means 17 is in such a way configured to short FM operation. The antenna device is in such a way configured to simultaneously with FM frequencies operate at BT and GPS frequencies.

[0061] The antenna device thus effectively forms a half-loop radiating element for FM operation. The antenna device thus effectively forms an ILA antenna for BT operation and a grounded ILA antenna for GPS operation.

[0062] It is further possible to add WCDMA operation to the antenna device, by feeding through the second end of the third elongated radiating element.

[0063] A sixth embodiment of an antenna device according to the present invention is illustrated in Fig. 7. The sixth embodiment of the antenna device is identical with the fifth embodiment of the antenna device described above apart from the following.

[0064] The second end of the third elongated radiating element 14 is open ended, i.e. without grounding. The second filtering means 6 is short-circuited, and the fifth filtering means 8 is preferably an inductor of about 470 nH, but could alternatively be provided as parallel resonant circuit. The fifth filtering means 8 is in such a way configured to tune the first, second and third elongated radiating elements for FM operation and to block BT and GPS operation.

[0065] The antenna device thus effectively forms an ILA antenna for FM operation and for BT operation, respectively, and a grounded ILA for GPS operation.

[0066] It will be obvious that the present invention may be varied in a plurality of ways. Such variations are not to be regarded as departure from the scope of the present

invention as defined by the appended claims. All such variations as would be obvious for a person skilled in the art are intended to be included within the scope of the present invention as defined by the appended claims.

Claims

1. An antenna device for a portable radio communication device adapted for simultaneous operation at a first frequency band and a second frequency band, **characterized in that**
said antenna device comprises a first elongated radiating element (1) having a first end and a second end, a second elongated radiating element (2) having a first end and a second end, and filtering means (3), wherein said first end of said first elongated radiating element (1) comprises a feeding point for feeding said antenna device simultaneously with said first frequency band and said second frequency band, said second end of said first elongated radiating element (1) is connected to said filtering means (3), and said first end of said second elongated radiating element (2) is connected to said filtering means (3), and
said filtering means (3) is configured to pass operating frequencies of said first frequency band and to stop operating frequencies of said second frequency band.

2. The antenna device according to claim 1, wherein said first frequency band is for FM operation.

3. The antenna device according to claim 1 or 2, wherein said second end of said second elongated radiating element (2) is grounded.

4. The antenna device according to any of claims 1-3, wherein said first filtering means (3) is an inductor.

5. The antenna device according to any of claims 1-4, wherein said first and second elongated radiating element together have a length (11) configured for FM operation.

6. The antenna device according to claim 5, wherein said first elongated radiating element have a length (12) configured for BT operation.

7. The antenna device according to any of claims 1-6, comprising fourth filtering means (7) connecting a first transceiver (4) to said feeding point, said fourth filtering means configured to pass operating frequencies for said first frequency band and to block operating frequencies for said second frequency band.

8. The antenna device according to any of claims 1-7, comprising third filtering means (9) connecting a second transceiver (5) to said feeding point, said third filtering means configured to pass operating frequencies for said second frequency band and to block operating frequencies for said first frequency band.

9. The antenna device according to any of claims 1-8, adapted for simultaneous operation at a third frequency band and comprising
a third elongated radiating element (14) having a first end and a second end, and seventh filtering means (15) connected between said second end of said second elongated radiating element and said first end of said third radiating element, and
eighth filtering means (16) connecting said second elongated radiating element to ground.

10. The antenna device according to claim 9, wherein said eighth filtering means is connected to said second elongated radiating element close to said seventh filtering means.

11. The antenna device according to claim 9, wherein said eighth filtering means is connected to said second elongated radiating element close to said first filtering means.

12. The antenna device according to claim 11, comprising ninth filtering means (17) connecting said second end of said third elongated radiating element to ground, wherein said ninth filtering means is configured to pass operating frequencies for said first frequency band and to block operating frequencies for said third frequency band.

13. The antenna device according to any of claims 1-12, wherein said antenna device is configured to exhibit a loop structure for said first frequency band.

14. The antenna device according to any of claims 1-12, wherein said antenna device is configured to exhibit an ILA structure for said first and second frequency bands.

15. A portable radio communication device, **characterized in that** it comprises an antenna device according to any of the preceding claims and a ground plane device (13), wherein said first (1) and second (2) elongated radiating elements are arranged over said ground plane device (13).

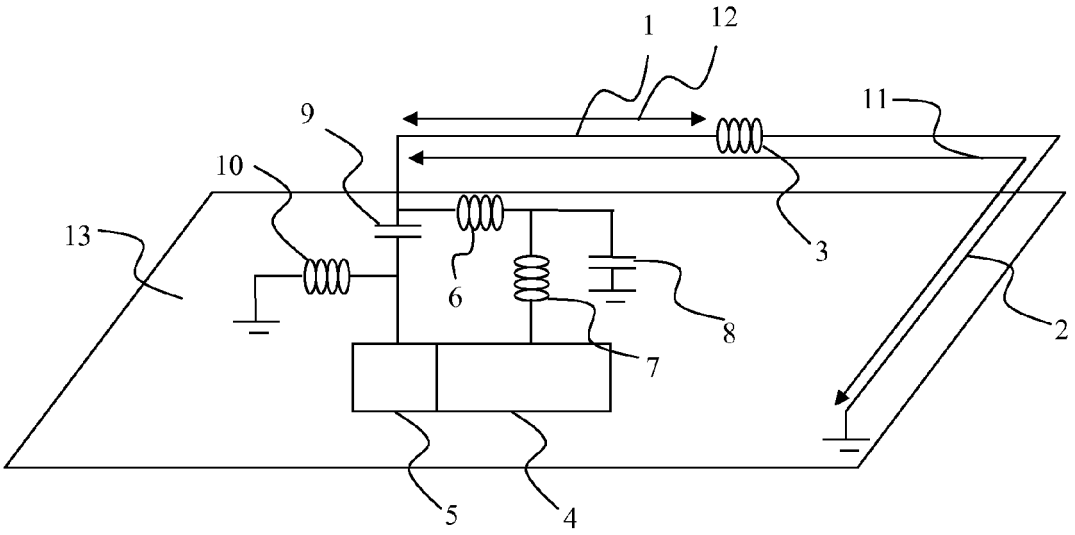

FIG. 1

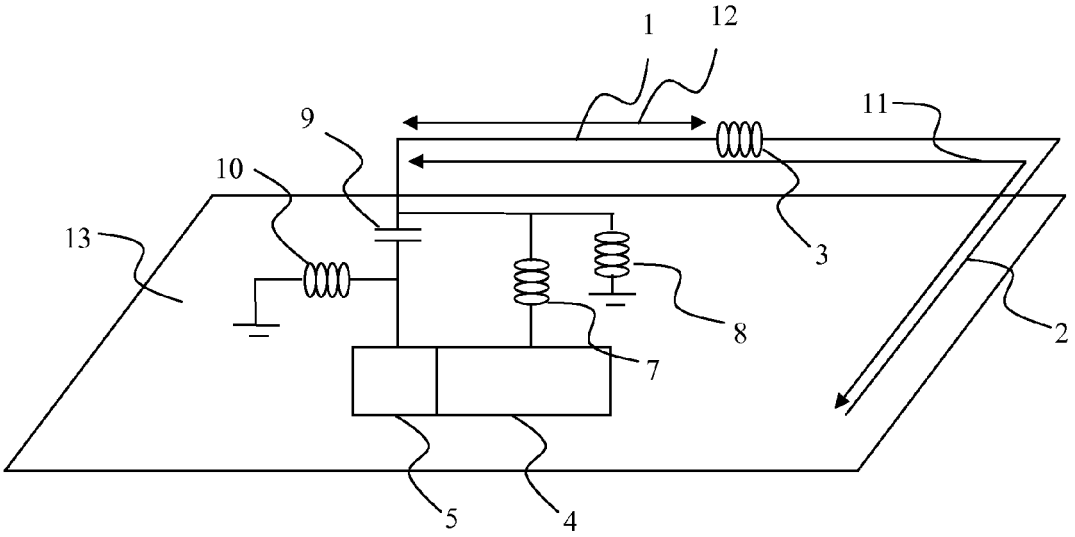

FIG. 3

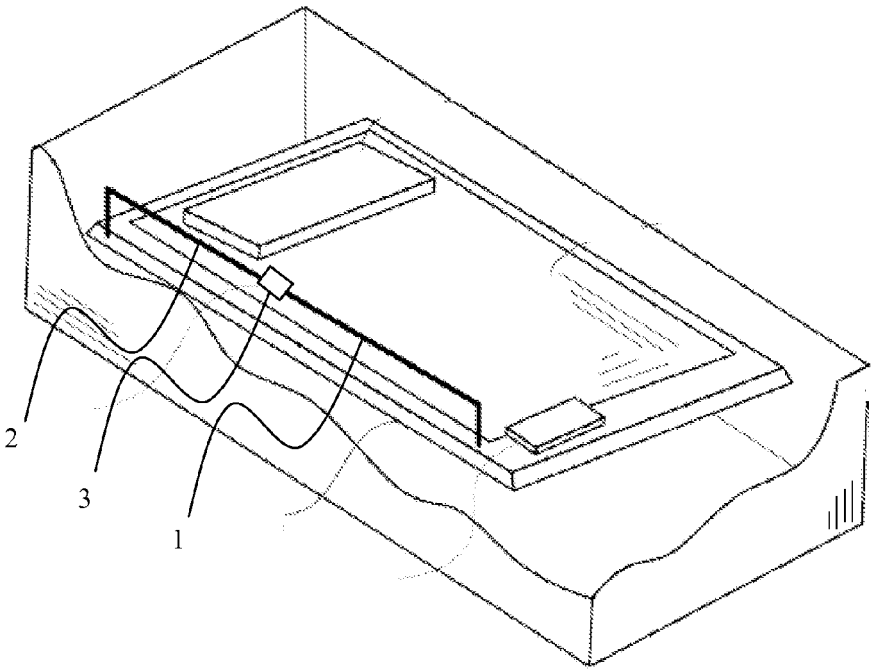

FIG. 2

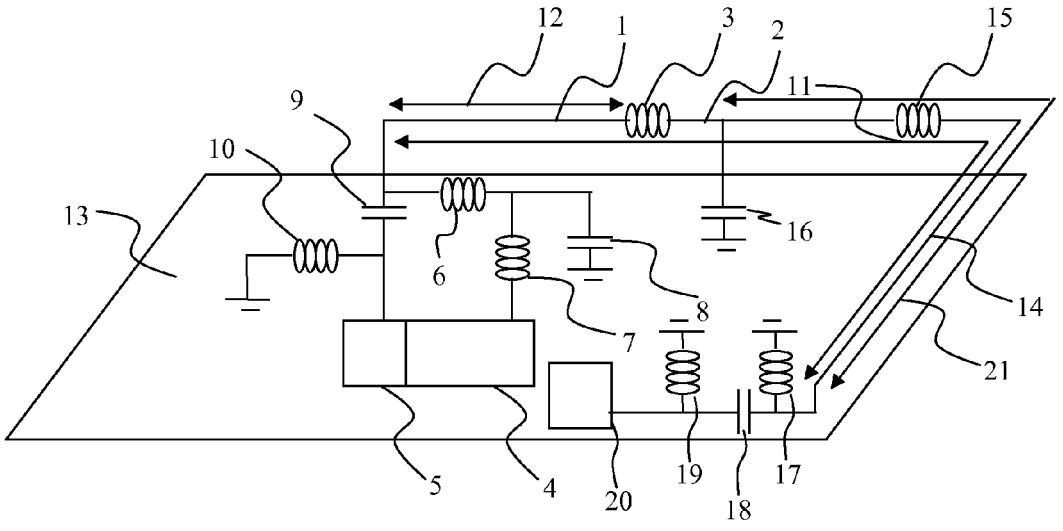

FIG. 4

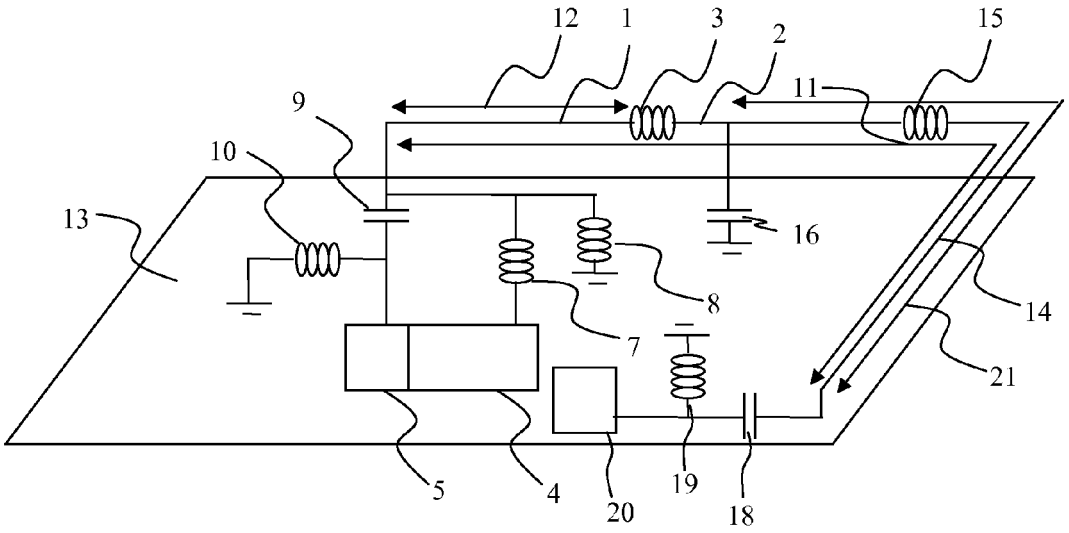
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FIG. 5

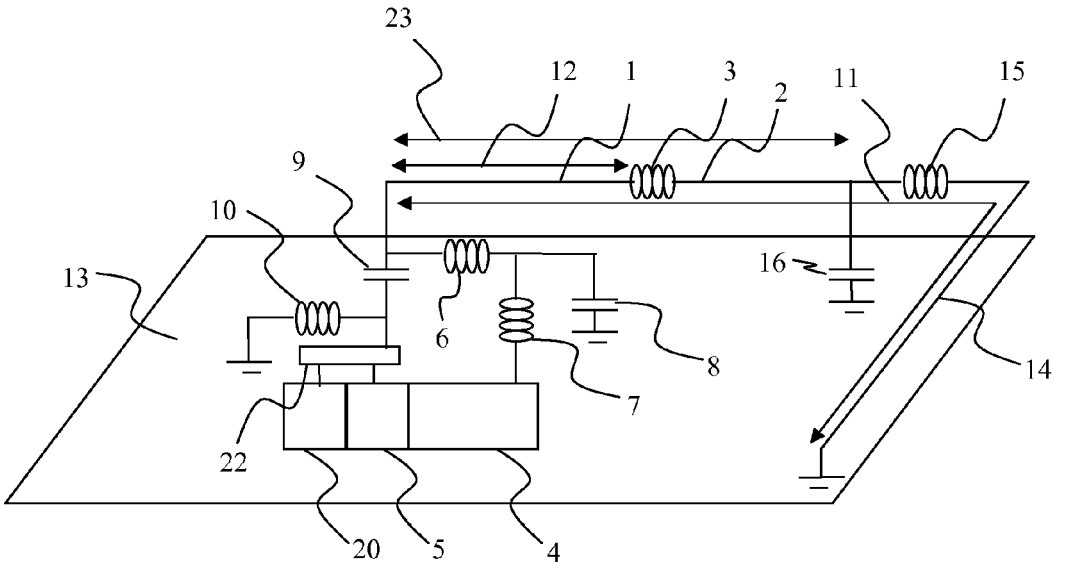
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FIG. 6

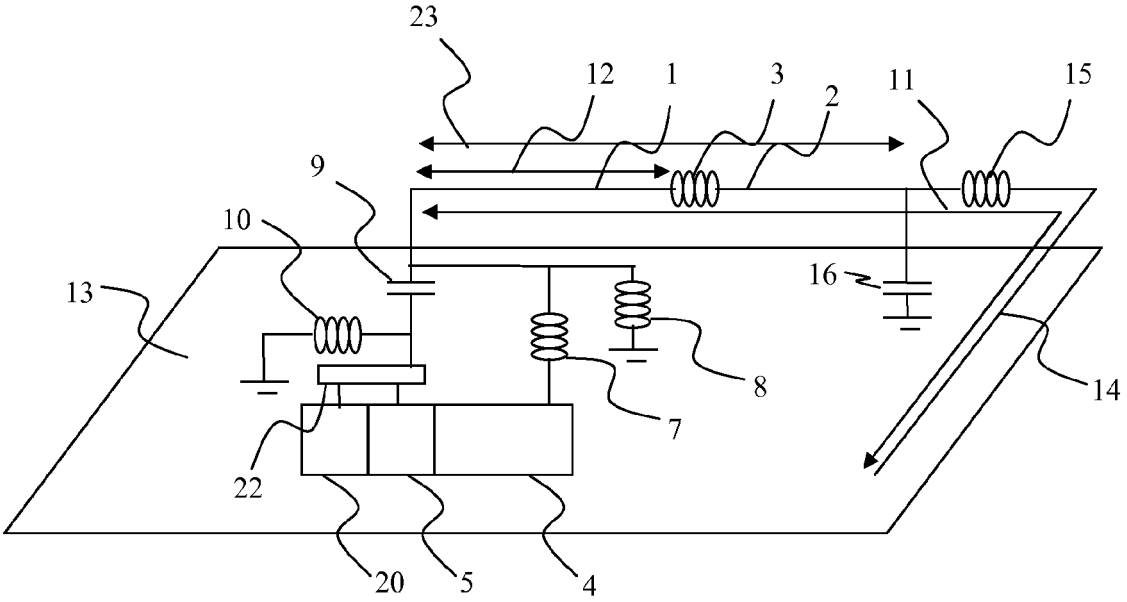

FIG. 7

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EUROPEAN SEARCH REPORT

Application Number
EP 09 15 6032

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	17 April 2009	Unterberger, Michael

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