



US007382319B2

(12) **United States Patent**
Kawahata et al.

(10) **Patent No.:** **US 7,382,319 B2**
(45) **Date of Patent:** **Jun. 3, 2008**

(54) **ANTENNA STRUCTURE AND
COMMUNICATION APPARATUS
INCLUDING THE SAME**

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(73) Assignee: **Murata Manufacturing Co., Ltd.** (JP)

(*) Notice: Subject to any disclaimer, the term of this
patent is extended or adjusted under 35
U.S.C. 154(b) by 0 days.

(21) Appl. No.: **10/581,803**

(22) PCT Filed: **Nov. 30, 2004**

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§ 371 (c)(1),
(2), (4) Date: **Jan. 8, 2007**

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(65) **Prior Publication Data**

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(30) **Foreign Application Priority Data**

Dec. 2, 2003 (JP) 2003-402544

(51) **Int. Cl.**

H01Q 1/38 (2006.01)

H01Q 1/24 (2006.01)

H01Q 13/10 (2006.01)

(52) **U.S. Cl.** **343/700 MS; 343/702;**
343/770

(58) **Field of Classification Search** **343/700 MS,**
343/702, 767, 770, 846, 893

See application file for complete search history.

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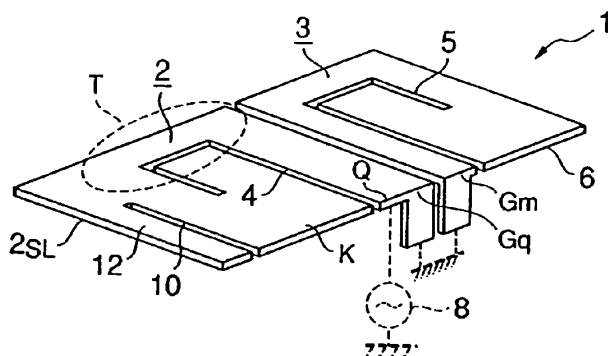
Primary Examiner—Shih-Chao Chen

(74) *Attorney, Agent, or Firm*—Ostrolenk, Faber, Gerb &
Soffen, LLP

(57) **ABSTRACT**

In an antenna structure including a feeding radiation electrode and a non-feeding radiation electrode that are electromagnetically coupled to each other, due to formation of a main slit, the feeding radiation electrode includes a U-turn portion in the middle of a path circumventing the main slit from a feeding end to an open end. A sub-slit for forming an open stub that is connected to the U-turn portion and that provides the U-turn portion with electrostatic capacitance is formed in the feeding radiation electrode. By changing a value of the electrostatic capacitance to be provided by the open stub to the U-turn portion of the feeding radiation electrode, variable control of a higher-order resonant frequency F2 of the feeding radiation electrode 2 can be achieved while suppressing fluctuations in a resonant state (for example, a fundamental resonant frequency F1 and a Q-value) of a fundamental resonant frequency band of the feeding radiation electrode, in an electromagnetic coupling state between the feeding radiation electrode and the non-feeding radiation electrode, and in an impedance matching state.

9 Claims, 7 Drawing Sheets



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US007382321B1

(12) **United States Patent**
Qin

(10) **Patent No.:** **US 7,382,321 B1**
(45) **Date of Patent:** **Jun. 3, 2008**

(54) **BROADBAND ANTENNA**

(56) **References Cited**

(75) Inventor: **Xiang-Hong Qin**, Shenzhen (CN)

U.S. PATENT DOCUMENTS

(73) Assignees: **Hong Fu Jin Precision Industry (ShenZhen) Co., Ltd.**, Shenzhen, Guangdong Province (CN); **Hon Hai Precision Industry Co., Ltd.**, Tu-Cheng, Taipei Hsien (TW)

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

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Primary Examiner—Shih-Chao Chen

(74) *Attorney, Agent, or Firm*—Wei Te Chung

(21) Appl. No.: **11/616,900**

(22) Filed: **Dec. 28, 2006**

(57) **ABSTRACT**

(30) **Foreign Application Priority Data**

Nov. 10, 2006 (CN) 2006 1 0063580

(51) **Int. Cl.**

H01Q 1/38 (2006.01)

H01Q 13/12 (2006.01)

H01Q 1/48 (2006.01)

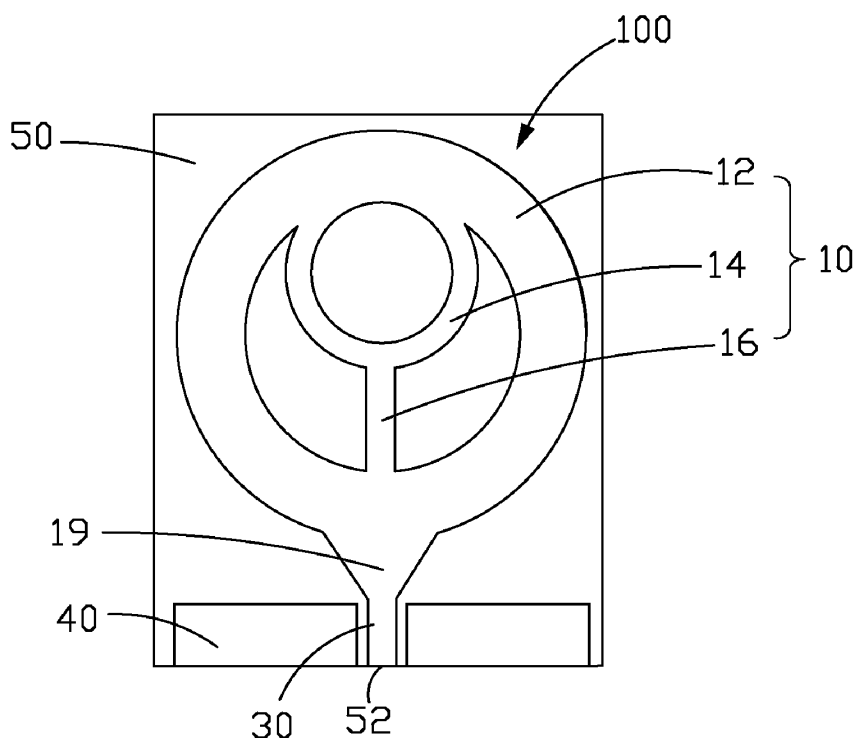
(52) **U.S. Cl.** **343/700 MS; 343/769; 343/848**

(58) **Field of Classification Search** **343/700 MS; 343/769, 846, 848**

See application file for complete search history.

A broadband antenna includes a radiation part (10) for radiating and receiving electromagnetic signals, a feed portion (30) for feeding the electromagnetic signals, and a pair of ground planes (40) respectively disposed on sides of the feed portion. The radiation part comprises an annular first radiation segment (12) and an annular second radiation segment (14) being inscribed within a space defined by the annular shape of the first radiation segment. The feed portion is electrically connected to the radiation part.

12 Claims, 18 Drawing Sheets



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US007382322B1

(12) **United States Patent**
Yang et al.

(10) **Patent No.:** **US 7,382,322 B1**
(45) **Date of Patent:** **Jun. 3, 2008**

(54) **CIRCULARLY POLARIZED PATCH
ANTENNA ASSEMBLY**

(75) Inventors: **Tsai-Yi Yang**, Tainan Hsien (TW);
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(73) Assignee: **Cirotech Technology Corp.**, Tainan
Hsien (TW)

(*) Notice: Subject to any disclaimer, the term of this
patent is extended or adjusted under 35
U.S.C. 154(b) by 0 days.

(21) Appl. No.: **11/688,937**

(22) Filed: **Mar. 21, 2007**

(51) **Int. Cl.**
H01Q 1/38 (2006.01)

(52) **U.S. Cl.** **343/700 MS**

(58) **Field of Classification Search** **343/700 MS,**
343/846

See application file for complete search history.

(56) **References Cited**

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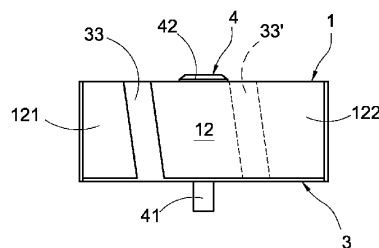
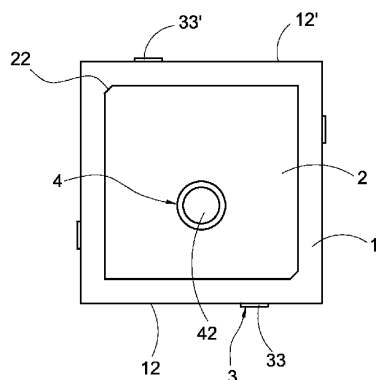
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Primary Examiner—Michael C Wimer

(57) **ABSTRACT**

A circularly polarized patch antenna assembly having a relatively compact volume includes a substrate, a radiation metal piece, a grounded metal piece and a signal-inputting body. A plurality of frequency down-conversion metal pieces in a form of elongate stripe extends from four sides of the grounded metal piece, thereby to reduce the resonant frequency. The frequency down-conversion metal pieces are adhered on the side face of the substrate, so that the frequency down-conversion metal piece on one side face is arranged diagonally with respect to the frequency down-conversion metal piece on the opposite side face. When the resonant frequency of the antenna is to be reduced, the position and the area of the frequency down-conversion metal piece can be adjusted but the increased area of the frequency down-conversion metal piece cannot be larger than a half area of the side face of the substrate. Alternatively, the length of the frequency down-conversion metal piece can be increased.

13 Claims, 9 Drawing Sheets



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US007382323B2

(12) **United States Patent**
Hu et al.

(10) **Patent No.:** **US 7,382,323 B2**
(45) **Date of Patent:** **Jun. 3, 2008**

(54) **MICRO CHIP ANTENNA**

(56) **References Cited**

U.S. PATENT DOCUMENTS

(75) Inventors: **Chuan Ling Hu**, Taipei Hsien (TW);
Meng Chiu Pan, Taipei Hsien (TW);
Shun Tian Lin, Taipei (TW); **Chang**
Fa Yang, Taipei (TW); **Kao Chung**
Cheng, Taipei (TW); **Sea Fue Wang**,
Taipei (TW); **Lisen Chang**, Taipei
(TW); **Chang Lun Liao**, Taipei (TW);
Chia Hung Chen, Taipei (TW)

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(73) Assignee: **Chant Sincere Co., Ltd.**, Taipei Hsien
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Primary Examiner—Huedung Mancuso

(74) *Attorney, Agent, or Firm*—Bacon & Thomas, PLLC

(*) Notice: Subject to any disclaimer, the term of this
patent is extended or adjusted under 35
U.S.C. 154(b) by 0 days.

(57) **ABSTRACT**

A method for manufacturing microchip antenna comprises a dielectric substrate having antenna radiation conductor paths composing of at least one feeding point and multiple-curved paths; a dielectric substrate having the antenna radiation conductor paths being packaged by the material capable of adjusting easily dielectric constant; and an antennal object including antenna radiation conductor paths, feeding ends, welding spots and packaging materials. The main body of the antenna has multi-folded paths, feeding ends, welding spots, and a packaging body. The radiation wires of the antenna is built on a single or a multiple input ends on a dielectric substrate and is multi-folded wires and it is packaged by another dielectric material. The radiation wires of the antenna can be designed and manufactured in three dimension so as to reduce the area occupied by the antenna and reduce the coupling interference between the elements.

(21) Appl. No.: **11/036,015**

(22) Filed: **Jan. 18, 2005**

(65) **Prior Publication Data**

US 2006/0158377 A1 Jul. 20, 2006

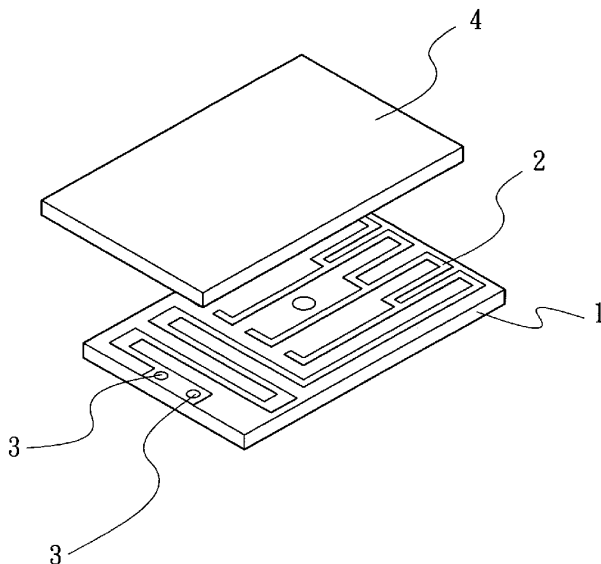
(51) **Int. Cl.**
H01Q 1/24 (2006.01)

(52) **U.S. Cl.** **343/702**

(58) **Field of Classification Search** **343/702,**
343/700 MS, 895, 873

See application file for complete search history.

9 Claims, 5 Drawing Sheets



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(12) **United States Patent**
Lin et al.

(54) **MULTI-BAND ANTENNA**

(75) Inventors: **Ching-Chi Lin**, Taipei Hsien (TW); **Kai Shih**, Taipei Hsien (TW); **Yu-Yuan Wu**, Taipei Hsien (TW)

* cited by examiner

(73) Assignee: **Cheng Uei Precision Industry**, Taipei
Hsien (TW)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 19 days.

A multi-band antenna configured in a portable electrical device capable of operating in a low frequency bandwidth and a high frequency bandwidth has an elongated radiating body and a feeding conductor connecting the elongated radiating body. The feeding conductor has opposite side arms respectively connecting the elongated radiating body and a connecting portion connecting the side arms. A feeding point is arranged at a corner where one of the side arms connects to the connecting portion. The elongated radiating body and the feeding conductor are located on different planes of the portable electronic device. According to the position where the feeding conductor connects to the elongated radiating body and the position where the feeding point is arranged at, the multi-band antenna has a preferred low frequency bandwidth and a preferred high frequency bandwidth. Therefore, the portable electrical device can operate at different wireless bandwidths.

(21) Appl. No.: 11/613,260

(51) **Int. Cl.**
H01Q 1/24 (2006.01)
H01Q 1/38 (2006.01)

(58) **Field of Classification Search** 343/702,
343/700 MS

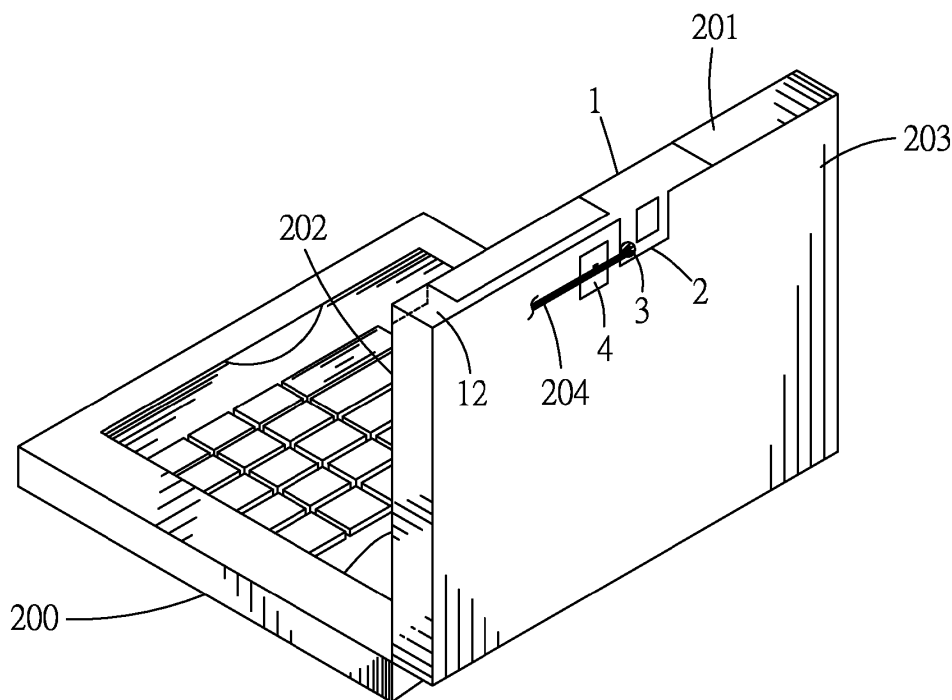
See application file for complete search history.

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12 Claims, 2 Drawing Sheets



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US007382331B2

(12) **United States Patent**
Kurashima et al.

(10) **Patent No.:** **US 7,382,331 B2**

(45) **Date of Patent:** **Jun. 3, 2008**

(54) **ANTENNA DEVICE**

(75) Inventors: **Shigemi Kurashima**, Shinagawa (JP);
Masahiro Yanagi, Shinagawa (JP);
Hideki Iwata, Shinagawa (JP); **Takashi**
Yuba, Shinagawa (JP); **Masahiro**
Kaneko, Shinagawa (JP); **Yuriko**
Segawa, Shinagawa (JP); **Takashi**
Arita, Shinagawa (JP)

(73) Assignee: **Fujitsu Component Limited**, Tokyo
(JP)

(*) Notice: Subject to any disclaimer, the term of this
patent is extended or adjusted under 35
U.S.C. 154(b) by 0 days.

(21) Appl. No.: **11/585,902**

(22) Filed: **Oct. 25, 2006**

(65) **Prior Publication Data**

US 2007/0229363 A1 Oct. 4, 2007

(30) **Foreign Application Priority Data**

Mar. 29, 2006 (JP) 2006-091605

(51) **Int. Cl.**
H01Q 15/08 (2006.01)
H01Q 1/38 (2006.01)
H01Q 1/48 (2006.01)

(52) **U.S. Cl.** **343/911 L**; 343/700 MS;
343/846

(58) **Field of Classification Search** 343/700 MS,
343/753, 840, 911 L, 846, 911 R
See application file for complete search history.

(56) **References Cited**

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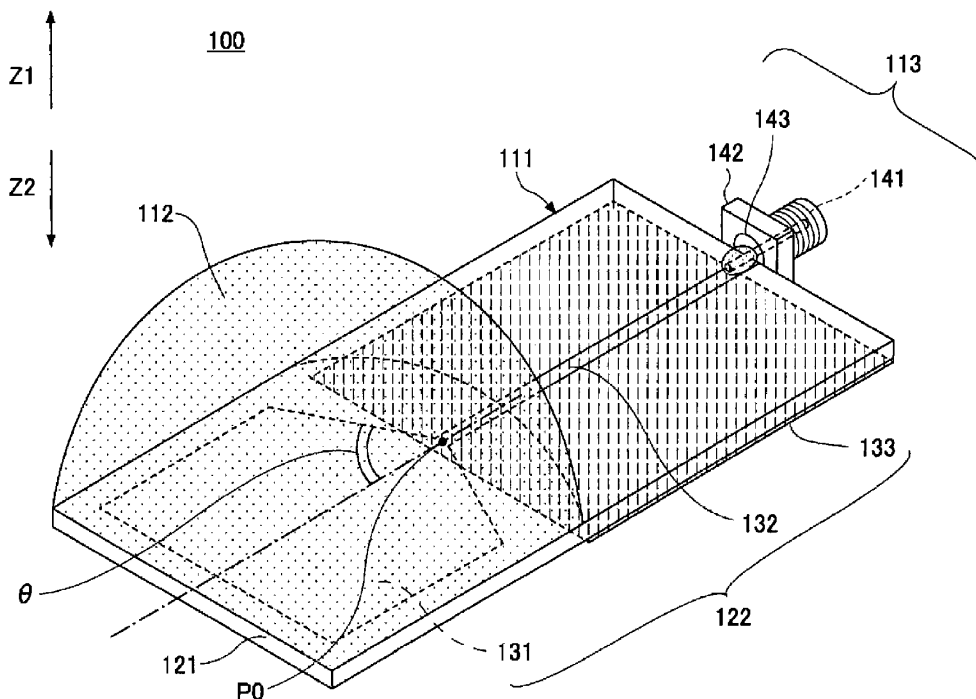
Primary Examiner—Shih-Chao Chen

(74) *Attorney, Agent, or Firm*—Staas & Halsey LLP

(57) **ABSTRACT**

An antenna device includes an antenna part and a dielectric
formed on the antenna part. The dielectric is formed to be
thicker in a direction of directivity that the antenna part is to
be made to have, than in another direction.

10 Claims, 9 Drawing Sheets



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US007383060B2

(12) **United States Patent**
Su et al.

(10) **Patent No.:** **US 7,383,060 B2**

(45) **Date of Patent:** **Jun. 3, 2008**

(54) **MOBILE PHONE WITH FM ANTENNA**

(75) Inventors: **Jia-Hung Su**, Chung Ho (TW);
Hong-Ren Chen, Chung Ho (TW);
Huang-Tse Peng, Chung Ho (TW);
Yu-Yuan Wu, Chung Ho (TW)

(73) Assignee: **Darts Technologies Corp.**, Taipei
County (TW)

(*) Notice: Subject to any disclaimer, the term of this
patent is extended or adjusted under 35
U.S.C. 154(b) by 374 days.

(21) Appl. No.: **11/220,775**

(22) Filed: **Sep. 6, 2005**

(65) **Prior Publication Data**

US 2007/0054693 A1 Mar. 8, 2007

(51) **Int. Cl.**
H04M 1/00 (2006.01)

(52) **U.S. Cl.** **455/550.1**; 455/556.1;
455/553.1; 455/557.7; 343/700 MS; 343/702

(58) **Field of Classification Search** 455/550.1,
455/556.1, 553.1, 557.7, 129; 343/700 MS;
343/702

See application file for complete search history.

(56) **References Cited**

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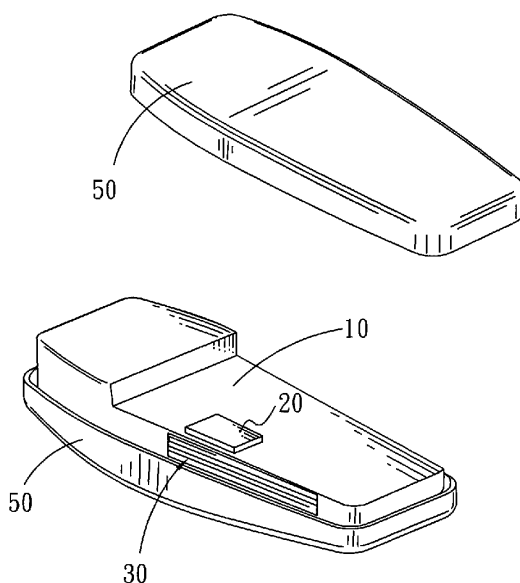
Primary Examiner—Matthew Anderson

Assistant Examiner—Minh D Dao

(57) **ABSTRACT**

A mobile phone with FM antenna includes a mobile phone body, an FM antenna, an FM microchip and a phone case. The FM antenna is fixed to an outer side of the mobile phone body. One end of the FM antenna has a feed point, and the other end of the FM antenna is an opening end. The FM antenna resonates at FM radio frequencies so as to receive FM radio signals. The FM microchip is disposed on the mobile phone body and coupled with the feed point of the FM antenna for processing the FM radio signals. The phone case encloses the mobile phone body, the FM antenna and the FM microchip. Thus the FM antenna is embedded in the mobile phone to enable the mobile phone to receive FM radio without extra external earphones.

3 Claims, 5 Drawing Sheets



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US007385556B2

(12) **United States Patent**
Chung et al.

(10) **Patent No.:** **US 7,385,556 B2**
(45) **Date of Patent:** **Jun. 10, 2008**

(54) **PLANAR ANTENNA**

(75) Inventors: **Cho-Ju Chung**, Taipei Hsien (TW);
Teng-Huei Chu, Taipei Hsien (TW)

(73) Assignee: **Hon Hai Precision Industry Co., Ltd.**,
Tu-Cheng, Taipei Hsien (TW)

(*) Notice: Subject to any disclaimer, the term of this
patent is extended or adjusted under 35
U.S.C. 154(b) by 0 days.

(21) Appl. No.: **11/615,019**

(22) Filed: **Dec. 22, 2006**

(65) **Prior Publication Data**

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(51) **Int. Cl.**
H01Q 1/38 (2006.01)

(52) **U.S. Cl.** **343/700 MS; 343/895;**
343/846; 343/829

(58) **Field of Classification Search** None
See application file for complete search history.

(56) **References Cited**

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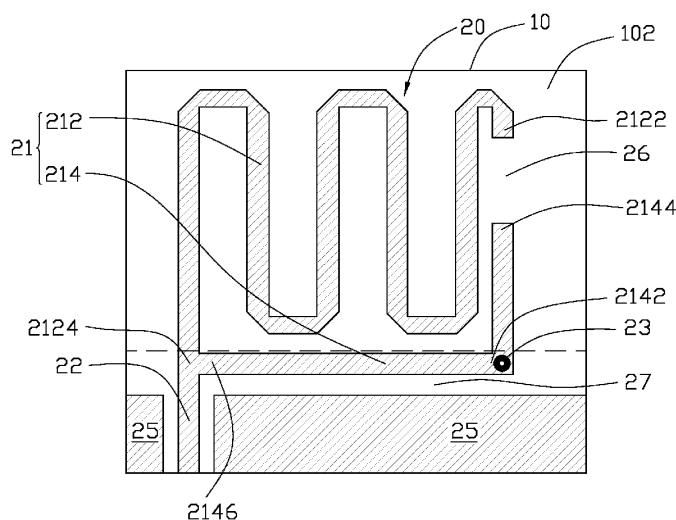
Primary Examiner—Trinh V Dinh

(74) *Attorney, Agent, or Firm*—Wei Te Chung

(57) **ABSTRACT**

A planar antenna (20) includes a radiating body (21), a feeding portion (22), and a first metallic ground plane (24). The radiating body includes a first radiating portion (212) extending away from the feeding portion and a second radiating portion (214) extending away from the feeding portion next to the first radiating portion. The first radiating portion includes an open end (2122) disposed at an extending end of the first radiating portion to point toward the second radiating portion, and a connecting portion (2124). The second radiating portion includes a free end (2144) disposed at an extending end of the second radiating portion to point toward the first radiating portion, and an end (2146) connected to the connecting portion. A first gap (26) is formed between the open end and the free end. The open end, the first gap and the free end are aligned with one another.

18 Claims, 11 Drawing Sheets



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US007385558B2

(12) **United States Patent**
Krupa

(10) **Patent No.:** **US 7,385,558 B2**
(45) **Date of Patent:** **Jun. 10, 2008**

(54) **CAPACITIVE FEED ANTENNA**
(75) Inventor: **Steve Krupa**, Cambridge (GB)
(73) Assignee: **Galtronics Ltd.**, Tiberias (IL)
(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

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(21) Appl. No.: **11/357,371**

(22) Filed: **Feb. 16, 2006**

(65) **Prior Publication Data**

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Related U.S. Application Data

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H01Q 1/38 (2006.01)

(52) **U.S. Cl.** **343/702; 343/700 MS; 343/833; 343/834**

(58) **Field of Classification Search** **343/702, 343/700 MS, 833, 834, 846, 850**
See application file for complete search history.

(56) **References Cited**

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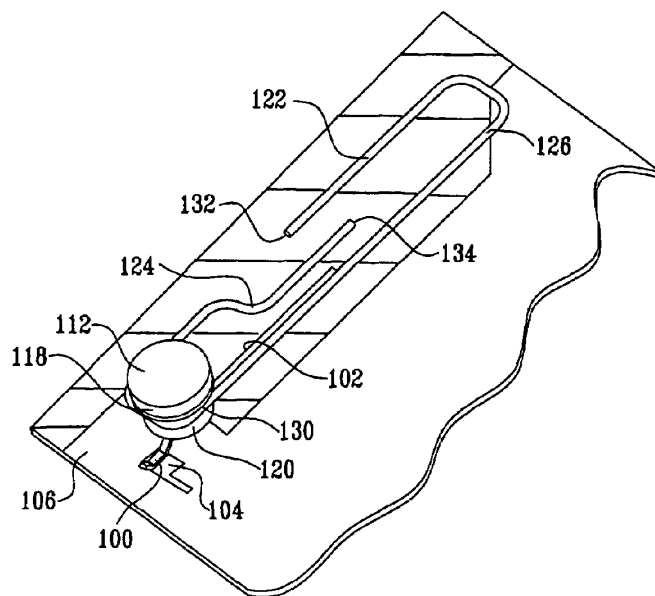
Primary Examiner—Hoang V Nguyen

(74) *Attorney, Agent, or Firm*—Darby & Darby PC

(57) **ABSTRACT**

An antenna including a first monopole radiating element having a galvanic connection to an antenna feed and second and third monopole radiating elements having a capacitive connection to the antenna feed.

20 Claims, 4 Drawing Sheets



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US007385561B2

(12) **United States Patent**
Krupa

(10) **Patent No.:** **US 7,385,561 B2**
(45) **Date of Patent:** **Jun. 10, 2008**

(54) **MULTIPLE MONOPOLE ANTENNA**

(75) Inventor: **Steve Krupa**, Cambridge (GB)

(73) Assignee: **Galtronics Ltd.**, Tiberias (IL)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **11/346,791**

(22) Filed: **Feb. 3, 2006**

(65) **Prior Publication Data**

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Related U.S. Application Data

(60) Provisional application No. 60/654,013, filed on Feb. 17, 2005, provisional application No. 60/673,588, filed on Apr. 21, 2005.

(51) **Int. Cl.**
H01Q 21/00 (2006.01)

(52) **U.S. Cl.** **343/728**; 343/725; 343/741;
343/743; 343/866

(58) **Field of Classification Search** 343/866,
343/870, 741, 700 MS, 713, 702, 725, 728,
343/743

See application file for complete search history.

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U.S. Appl. No. 60/673,588, filed Apr. 12, 2005.

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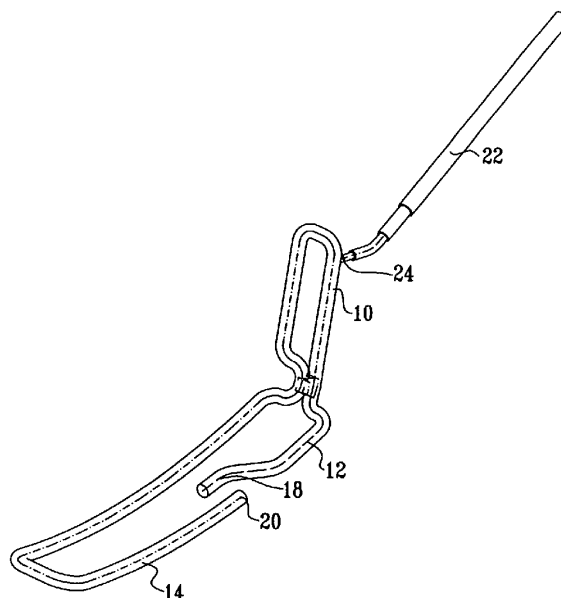
Primary Examiner—Hoang V Nguyen

(74) *Attorney, Agent, or Firm*—Darby & Darby PC

(57) **ABSTRACT**

The present invention seeks to provide a multiple monopole antenna including a looped conductor having at least two conductive arms extending therefrom and a common feed point located on the looped conductor.

13 Claims, 2 Drawing Sheets



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US00D570800S

(12) **United States Design Patent** (10) **Patent No.:** **US D570,800 S**
Chen et al. (45) **Date of Patent:** **** Jun. 10, 2008**

(54) **ISM-BAND PRINTED ANTENNA FOR A PORTION OF A CIRCUIT BOARD**

(75) Inventors: **Hui-Mei Chen**, Tainan County (TW);
Wei-Hsiu Hsu, Taipei County (TW);
Huan-Ping Su, Hsinchu (TW);
Chien-Hsin Su, Hsinchu (TW)

(73) Assignee: **Uniband Electronic Corp.** (TW)

(**) Term: **14 Years**

(21) Appl. No.: **29/250,640**

(22) Filed: **Nov. 27, 2006**

(51) **LOC (8) Cl.** **13-03**

(52) **U.S. Cl.** **D13/182**

(58) **Field of Classification Search** D13/182;
D14/230; 343/700 MS, 795, 895

See application file for complete search history.

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Primary Examiner—Selina Sikder

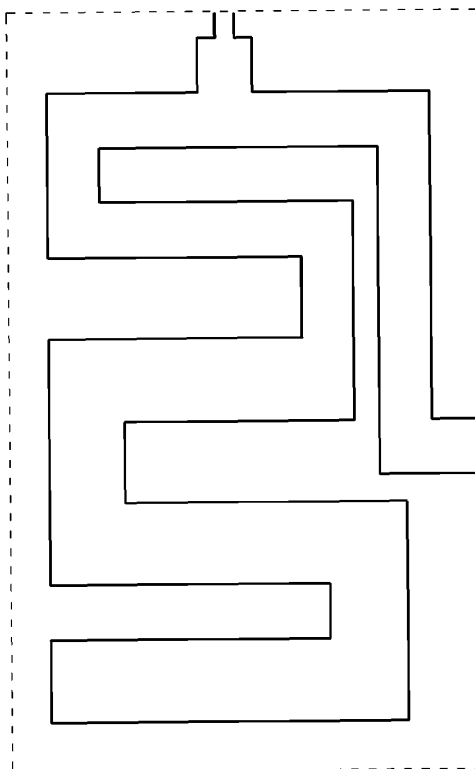
(57) **CLAIM**

The ornamental design for an ISM-band printed antenna for a portion of a circuit board, as shown and described.

DESCRIPTION

The single FIGURE is a front view of an ISM-band printed antenna for a portion of a circuit board showing the new design. The broken line drawing of an undefined portion of a circuit board is for illustrative purposes only and forms no part of the claimed design.

1 Claim, 1 Drawing Sheet



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US007388543B2

(12) **United States Patent**
Vance

(10) **Patent No.:** **US 7,388,543 B2**

(45) **Date of Patent:** **Jun. 17, 2008**

(54) **MULTI-FREQUENCY BAND ANTENNA
DEVICE FOR RADIO COMMUNICATION
TERMINAL HAVING WIDE HIGH-BAND
BANDWIDTH**

(75) Inventor: **Scott Vance**, Staffanstorp (SE)

(73) Assignee: **Sony Ericsson Mobile
Communications AB** (SE)

(*) Notice: Subject to any disclaimer, the term of this
patent is extended or adjusted under 35
U.S.C. 154(b) by 228 days.

(21) Appl. No.: **11/274,557**

(22) Filed: **Nov. 15, 2005**

(65) **Prior Publication Data**

US 2007/0109202 A1 May 17, 2007

(51) **Int. Cl.**
H01Q 1/24 (2006.01)

(52) **U.S. Cl.** **343/700 MS**

(58) **Field of Classification Search** 343/700 MS,
343/702, 895

See application file for complete search history.

(56) **References Cited**

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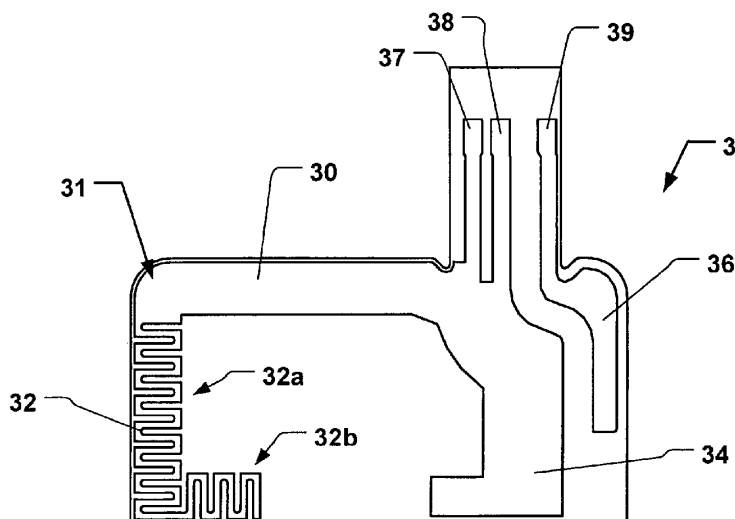
Primary Examiner—Huedung Mancuso

(74) *Attorney, Agent, or Firm*—Myers Bigel Sibley &
Sajovec, P.A.

(57) **ABSTRACT**

A multi-band radio antenna device for a radio communication terminal is disclosed. The antenna has an integral feed and ground structure electrically connected to a first radiating antenna element and a second radiating element. The first radiating element comprises a first continuous trace of conductive material and has a continuous trace has a first branch tuned to radiate at first frequencies in a first frequency band, and a second branch, which is tuned to radiate in a second frequency band at second frequencies approximately equal to or less than two times the first frequencies. The second radiating antenna element comprises a second continuous trace of conductive material, wherein the second continuous trace has a third branch, which is tuned to resonate in a third frequency band at third frequencies that are higher than the second frequencies, and which is capacitively coupled to the feed and ground structure and arranged substantially adjacent to the second branch. The first branch comprises a first section, composing approximately $\frac{1}{3}$ to $\frac{2}{3}$ of the total length of the first branch, wherein the first section is essentially straight and connected to said feed and ground structure at a first end thereof, and a second section in direct connection to a second end of said first section that is tightly meandered.

19 Claims, 8 Drawing Sheets



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US007388553B2

(12) **United States Patent**
Yuanzhu

(10) **Patent No.:** **US 7,388,553 B2**

(45) **Date of Patent:** **Jun. 17, 2008**

(54) **ANTENNA DEVICE FOR VEHICLE**

(75) Inventor: **Dou Yuanzhu**, Fukushima-ken (JP)

(73) Assignee: **Alps Electric Co., Ltd**, Tokyo (JP)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **11/247,094**

(22) Filed: **Oct. 6, 2005**

(65) **Prior Publication Data**

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(30) **Foreign Application Priority Data**

Oct. 12, 2004 (JP) 2004-297736

(51) **Int. Cl.**
H01Q 13/10 (2006.01)

(52) **U.S. Cl.** 343/770

(58) **Field of Classification Search** 343/770,
343/767, 700 MS, 702, 846-848
See application file for complete search history.

(56) **References Cited**

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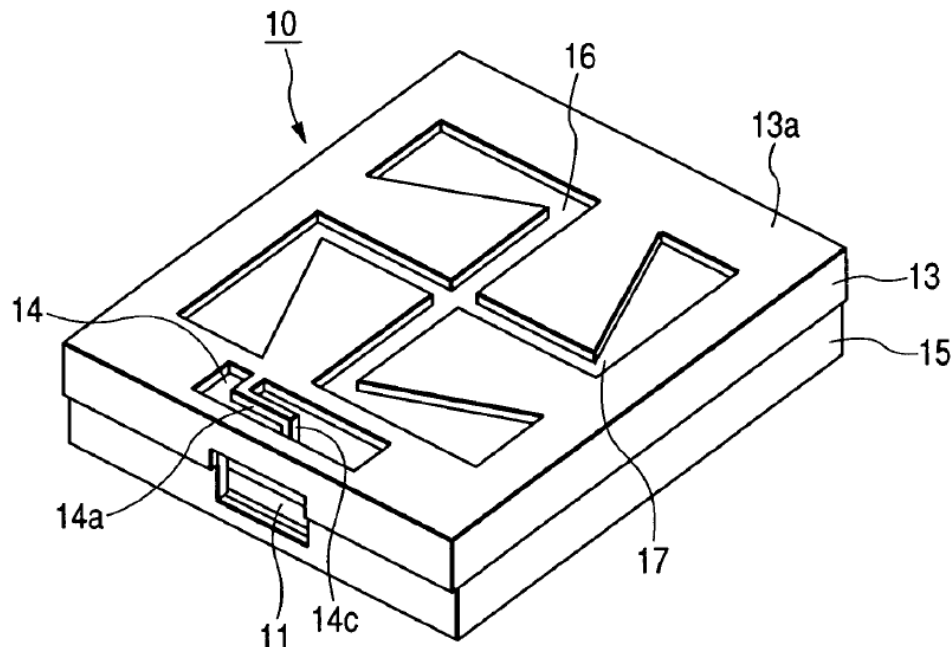
Primary Examiner—Huedung Mancuso

(74) *Attorney, Agent, or Firm*—Brinks Hofer Gilson & Lione

(57) **ABSTRACT**

An antenna device includes a circuit board, an upper shield case, a lower shield case, and a power feeding member. The circuit board has high frequency circuits arranged thereon. The upper shield case and the lower shield case cover the circuit board. The power feeding member extends from an upper plate of the upper shield case. Radiation slots and are formed in the upper plate. The power feeding member includes a horizontal portion, a bent portion, and a drooping portion, and a front end of the drooping portion is mounted on a land of the circuit board and soldered thereto. The horizontal portion protrudes from a base end which is continuous to the upper plate in a horizontal direction. The bent portion is formed by bending a front end of the horizontal portion at a right angle. The drooping portion extends downward from the bent portion.

1 Claim, 2 Drawing Sheets



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US007391375B1

(12) **United States Patent**
Lin et al.

(10) **Patent No.:** **US 7,391,375 B1**

(45) **Date of Patent:** **Jun. 24, 2008**

(54) **MULTI-BAND ANTENNA**

(75) Inventors: **Ching-Chi Lin**, Taipei Hsien (TW);
Jia-Hung Su, Taipei Hsien (TW); **Kai Shih**, Taipei Hsien (TW); **Yu-Yuan Wu**, Taipei Hsien (TW)

(73) Assignee: **Cheng Uei Precision Industry Co., Ltd.**, Taipei Hsien (TW)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **11/675,803**

(22) Filed: **Feb. 16, 2007**

(51) **Int. Cl.**
H01Q 1/38 (2006.01)
H01Q 1/24 (2006.01)
H01Q 1/48 (2006.01)

(52) **U.S. Cl.** **343/700 MS; 343/702; 343/846**

(58) **Field of Classification Search** **343/700 MS, 343/702, 767, 846, 893**
See application file for complete search history.

(56) **References Cited**

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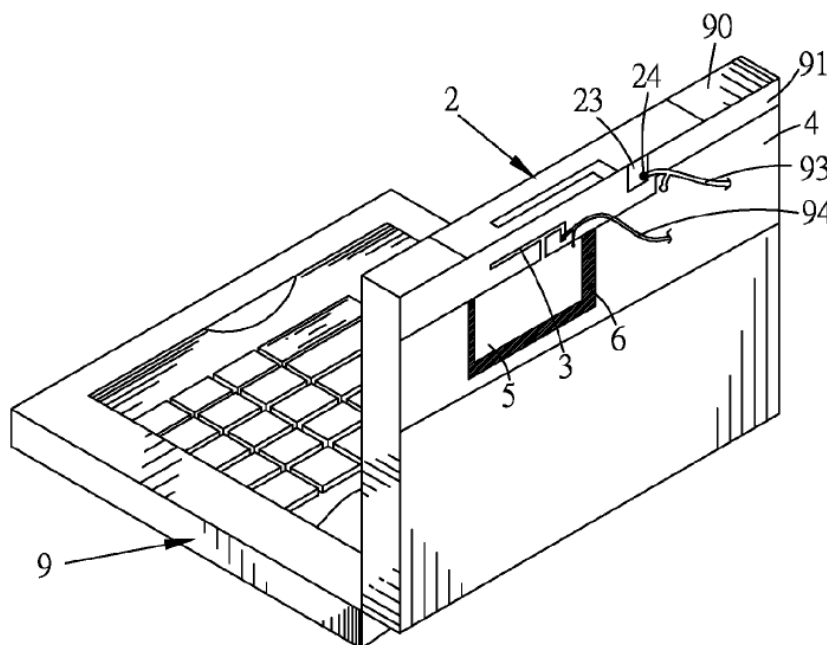
Primary Examiner—Shih-Chao Chen

(74) Attorney, Agent, or Firm—WPAT, P.C.; Anthony King

(57) **ABSTRACT**

A multi-band antenna operates at a low frequency and a wider high frequency bands, which is formed as an elongated shape defining opposite ends. The multi-band antenna has a slot opened at a long edge and being extending to one end thereon. The wide range of the opening of the slot is larger than the extension length of the slot. A feeding conductor with a feeding point is arranged to adjoin the opening of the slot. The multi-band antenna resonates the low frequency band and a first high frequency. The slot obtains a second high frequency band higher than and partially overlapped the first high frequency. So the multi-band antenna has the low frequency bands and the better high frequency which includes several high frequency bands.

20 Claims, 4 Drawing Sheets



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US007391376B2

(12) **United States Patent**
Yeh et al.

(10) **Patent No.:** **US 7,391,376 B2**
(45) **Date of Patent:** **Jun. 24, 2008**

(54) **WIRELESS APPARATUS CAPABLE OF CONTROLLING RADIATION PATTERNS OF ANTENNA**

(75) Inventors: **Shih-Huang Yeh**, Tou-Liu (TW);
Zih-Hao Lu, Taichung Hsien (TW);
Chia-Lun Tang, Miao-Li Hsien (TW)

(73) Assignee: **Industrial Technology Research Institute**, Hsinchu (TW)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **11/762,763**

(22) Filed: **Jun. 13, 2007**

(65) **Prior Publication Data**
US 2007/0236401 A1 Oct. 11, 2007

Related U.S. Application Data
(62) Division of application No. 11/221,148, filed on Sep. 7, 2005, now Pat. No. 7,352,327.

(30) **Foreign Application Priority Data**
May 5, 2005 (TW) 94114506 A

(51) **Int. Cl.**
H01Q 1/24 (2006.01)

(52) **U.S. Cl.** **343/700 MS; 343/846**

(58) **Field of Classification Search** 343/700 MS,
343/702, 767, 829, 846
See application file for complete search history.

(56) **References Cited**

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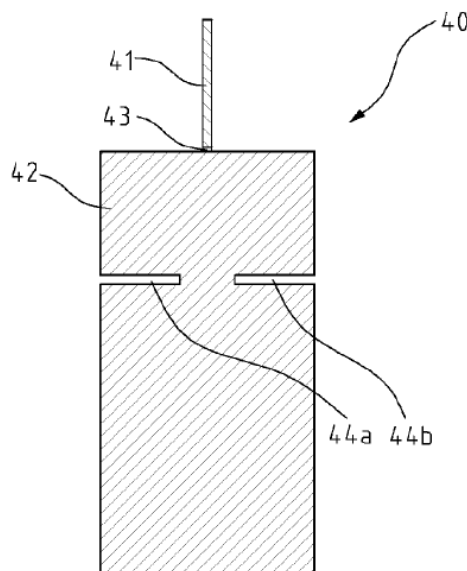
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Primary Examiner—Tho G Phan

(57) **ABSTRACT**

A wireless apparatus capable of controlling radiation patterns and directions of antenna is provided. It comprises an antenna element, a ground plane, an antenna feed-point, and at least one slot or slit formed on the ground plane. The inclusion of such slots or slits in the wireless apparatus improves the radiation directivity of antenna, and greatly enhances the antenna gain on the horizontal plane. It also resolves the problems caused by shift of radiation patterns of antenna and the poor antenna gains for a conventional antenna apparatus. The wireless apparatus of the present invention has the advantages of simple structure and easy fabrication. The invention can be applied to various kinds of antennas, such as monopole antenna, shorted-monopole antenna, dipole antenna, loop antenna, and planar inverted-F antenna, etc.

3 Claims, 9 Drawing Sheets



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US007391378B2

(12) **United States Patent**
Mikkola et al.

(10) **Patent No.:** **US 7,391,378 B2**
(45) **Date of Patent:** **Jun. 24, 2008**

(54) **ANTENNA ELEMENT FOR A RADIO DEVICE**

FOREIGN PATENT DOCUMENTS

(75) Inventors: **Jyrki Mikkola**, Kaustinen (FI); **Petteri Annamaa**, Oulunsalo (FI); **Esa Kalistaja**, Oulu (FI)

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EP 1 067 627 A1 1/2001

(73) Assignees: **Filtronic LK Oy**, Kempele (FI); **LK Products Oy**, Kempele (FI); **Pulse Finland Oy**, Kempele (FI)

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 464 days.

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(21) Appl. No.: **10/753,887**

(Continued)

(22) Filed: **Jan. 7, 2004**

Primary Examiner—Tan Ho

(65) **Prior Publication Data**

(74) Attorney, Agent, or Firm—Darby & Darby P.C.

US 2004/0147297 A1 Jul. 29, 2004

(30) **Foreign Application Priority Data**

(57) **ABSTRACT**

Jan. 15, 2003 (FI) 20030059
Feb. 7, 2003 (FI) 20030193

(51) **Int. Cl.**

H01Q 1/24 (2006.01)
H01Q 1/40 (2006.01)

(52) **U.S. Cl.** **343/702**; 343/872; 343/873

(58) **Field of Classification Search** 343/702,
343/872, 873

See application file for complete search history.

A radiating antenna element intended to be used in small-sized radio devices, and a radio device having an antenna element according to the invention. The antenna element is part of the covers of a radio device. The antenna element may be conductive throughout, or it may comprise a dielectric portion and a conductive portion, which constitute a single integral component. The radiating portion of the antenna element is relatively large, e.g. in a foldable phone (20) the antenna element (200) may comprise the whole cover of a foldable part (21) except for the front side. The radiating element is advantageously fed electromagnetically through a feed element. As the radiating element is relatively large and is located on the outer surface of the device, the radiation characteristics of the antenna are good, and the space required by the antenna inside the device is relatively small.

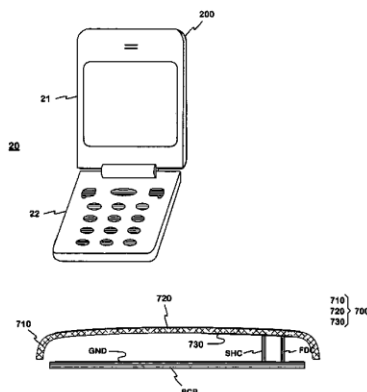
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(Continued)

17 Claims, 5 Drawing Sheets



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US007391379B1

(12) **United States Patent**
Bit-Babik et al.

(10) **Patent No.:** **US 7,391,379 B1**
(45) **Date of Patent:** **Jun. 24, 2008**

(54) **COMMUNICATION DEVICE WITH A WIDEBAND ANTENNA**

(75) Inventors: **Giorgi G. Bit-Babik**, Sunrise, FL (US);
Carlo Dinallo, Plantation, FL (US);
Antonio Faraone, Plantation, FL (US)

(73) Assignee: **Motorola, Inc.**, Schaumburg, IL (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **11/567,430**

(22) Filed: **Dec. 6, 2006**

(51) **Int. Cl.**
H01Q 1/24 (2006.01)

(52) **U.S. Cl.** **343/702**; 343/700 MS;
343/846

(58) **Field of Classification Search** 343/700 MS,
343/702, 846
See application file for complete search history.

(56) **References Cited**

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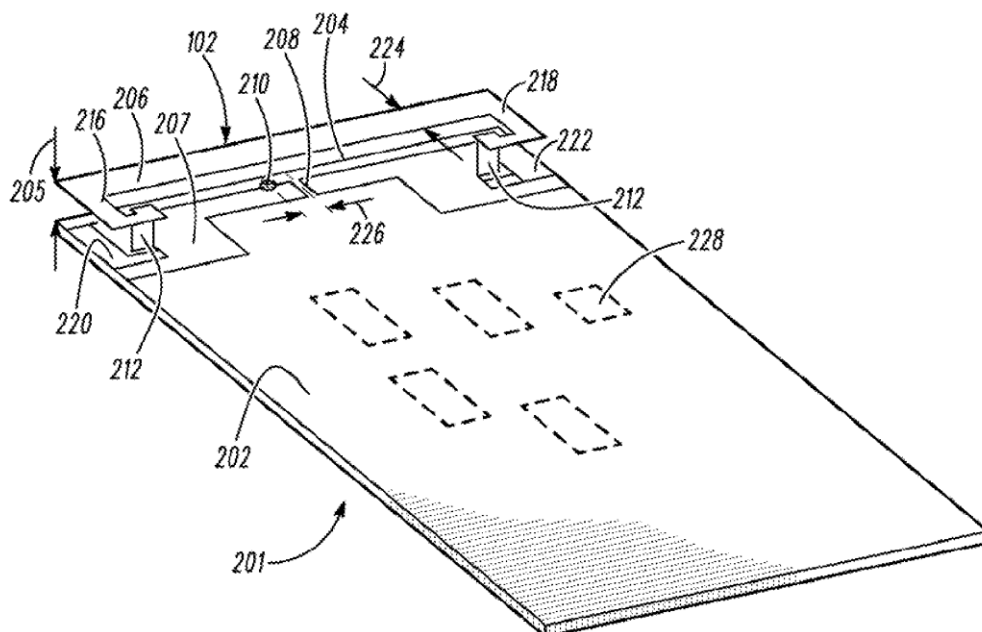
Primary Examiner—Tan Ho

(74) *Attorney, Agent, or Firm*—James Lamb; Anthony P. Curtis

(57) **ABSTRACT**

An apparatus is disclosed for a communication device (100) with a wideband antenna (102) supporting at least two common and one differential resonant modes. An apparatus that incorporates teachings of the present invention may include, for example, the communication device having an antenna (102) that includes a ground structure (202), a first elongated conductor (204) spaced from the ground structure, a second elongated conductor (206) separated from the first elongated conductor, third and fourth conductors (212) each coupled to the first and second elongated conductors forming a gap (205), a ground conductor (208) coupling the ground structure to one among the first and second elongated conductors, and a signal feed conductor (210) coupling to one among the first and second elongated conductors spaced from the ground conductor. Additional embodiments are disclosed. A -10 dB bandwidth of at least 0.5 can be realized using electrical non-congruence.

20 Claims, 4 Drawing Sheets



200



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US007391380B2

(12) **United States Patent**
Nevermann

(10) **Patent No.:** **US 7,391,380 B2**
(45) **Date of Patent:** **Jun. 24, 2008**

(54) **TELECOMMUNICATION ANTENNA**

(75) Inventor: **Peter Nevermann**, Langenfeld (DE)

(73) Assignee: **Lumberg Connect GmbH & Co. KG**,
Schalksmühle (DE)

(*) Notice: Subject to any disclaimer, the term of this
patent is extended or adjusted under 35
U.S.C. 154(b) by 0 days.

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(21) Appl. No.: **11/655,045**

(22) Filed: **Jan. 18, 2007**

(65) **Prior Publication Data**

US 2007/0164915 A1 Jul. 19, 2007

(30) **Foreign Application Priority Data**

Jan. 19, 2006 (DE) 10 2006 002 817

(51) **Int. Cl.**
H01Q 1/24 (2006.01)

(52) **U.S. Cl.** 343/702; 343/700 MS;
343/745; 342/361

(58) **Field of Classification Search** 342/361,
342/368; 455/295; 343/745, 700 MS, 702,
343/829, 846

See application file for complete search history.

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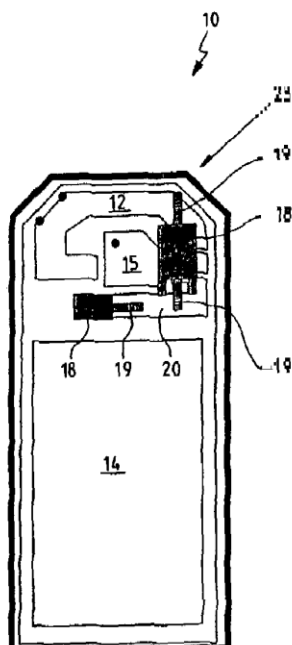
Primary Examiner—Tho G Phan

(74) *Attorney, Agent, or Firm*—Andrew Wilford

(57) **ABSTRACT**

A telecommunication device has a permanently mounted antenna tuned to a predetermined resonant frequency and a housing formed of a plurality of parts one of which is removable. The one removable part, which may be an original element or an aftermarket add-on, changes the resonant frequency of the antenna when fitted to the housing. An electrically conductive passive correction element fixed in the one removable housing part is positioned therein and dimensioned such that when the one removable housing part is fitted to the housing the passive correction element cancels out the effect on the resonant frequency of the antenna by the one removable housing part.

17 Claims, 3 Drawing Sheets



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US007391383B2

(12) **United States Patent**
Schantz

(10) **Patent No.:** **US 7,391,383 B2**
(45) **Date of Patent:** **Jun. 24, 2008**

(54) **CHIRAL POLARIZATION ULTRAWIDEBAND
SLOT ANTENNA**

(75) Inventor: **Hans Gregory Schantz**, Huntsville, AL
(US)

(73) Assignee: **Next-RE, Inc.**, Huntsville, AL (US)

(*) Notice: Subject to any disclaimer, the term of this
patent is extended or adjusted under 35
U.S.C. 154(b) by 128 days.

(21) Appl. No.: **11/235,259**

(22) Filed: **Sep. 26, 2005**

(65) **Prior Publication Data**

US 2006/0028388 A1 Feb. 9, 2006

Related U.S. Application Data

(63) Continuation-in-part of application No. 10/714,046,
filed on Nov. 14, 2003, now Pat. No. 6,950,064.

(60) Provisional application No. 60/438,724, filed on Jan.
8, 2003, provisional application No. 60/433,637, filed
on Dec. 16, 2002.

(51) **Int. Cl.**
H01Q 1/10 (2006.01)

(52) **U.S. Cl.** **343/767; 343/770**

(58) **Field of Classification Search** **343/767,**
343/770, 895

See application file for complete search history.

(56) **References Cited**

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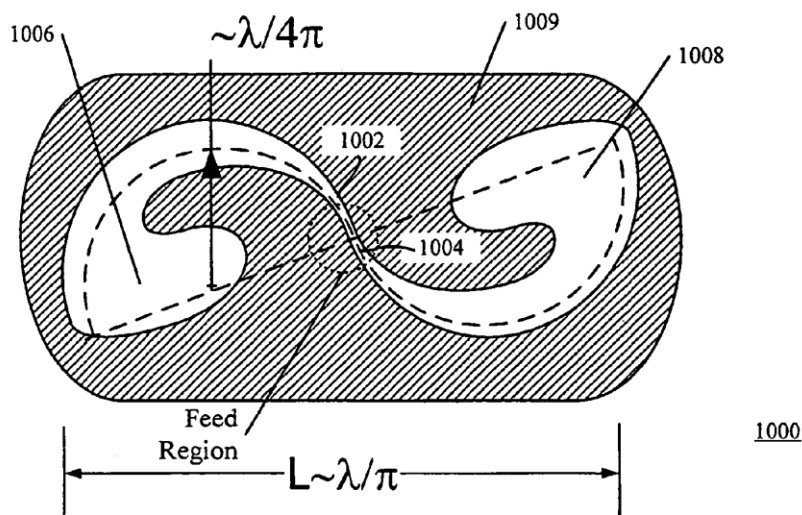
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Primary Examiner—Tan Ho

(57) **ABSTRACT**

A chiral polarization UWB slot antenna comprises a feed region and opposing tapered slot lines along an arcuate path of angle measure 360° or less. Opposing tapered slot lines may terminate in bulbous ends and may be characterized by an impedance profile such as an exponential or a Klopfenstein impedance profile. In alternate embodiments, an arcuate path has an arc length substantially equal to a half wavelength at a frequency of interest and an angle measure substantially equal to 180° . In still further alternate embodiments an arcuate path is substantially described by a radial variation with respect to angle of $r(\phi) = R \sin \phi$ where R is a constant that in some embodiments is substantially equal to $\frac{1}{2}\pi$ times wavelength ($R = \lambda/(2\pi)$) at a particular frequency of interest. In some embodiments, a frequency of interest lies substantially within the range defined by 3.1 GHz to 10.6 GHz.

16 Claims, 12 Drawing Sheets



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US007391384B2

(12) **United States Patent**
Wong et al.

(10) **Patent No.:** **US 7,391,384 B2**
(45) **Date of Patent:** **Jun. 24, 2008**

(54) **DIGITAL-TELEVISION RECEIVING ANTENNA**

(75) Inventors: **Kin-Lu Wong**, Kao-Hsiung (TW);
Yun-Wen Chi, Taipei (TW); **Saou-Wen Su**, Taipei (TW)

(73) Assignees: **Lite-On Technology Corp.**, Neihu, Taipei (TW); **National Sun Yat-Sen University**, Kaoshiung (TW)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **11/464,498**

(22) Filed: **Aug. 15, 2006**

(65) **Prior Publication Data**

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(30) **Foreign Application Priority Data**

Feb. 22, 2006 (TW) 95105844 A

(51) **Int. Cl.**

H01Q 9/28 (2006.01)

H01Q 9/16 (2006.01)

H01Q 13/10 (2006.01)

H01Q 1/38 (2006.01)

(52) **U.S. Cl.** **343/795**; 343/793; 343/767;
343/700 MS

(58) **Field of Classification Search** 343/795,
343/700 MS, 793, 767
See application file for complete search history.

(56) **References Cited**

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Primary Examiner—Hoang V Nguyen

Assistant Examiner—Robert Karacsony

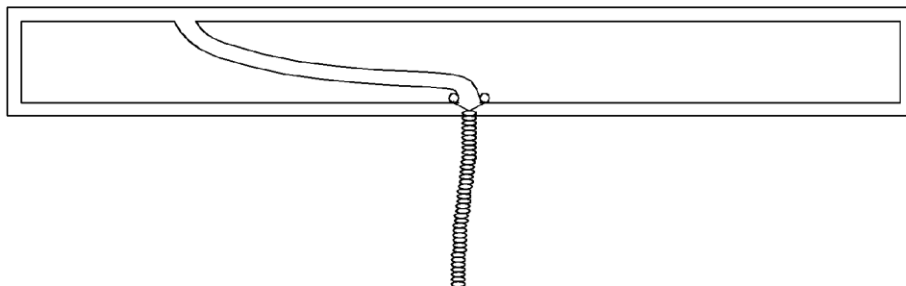
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(57) **ABSTRACT**

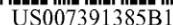
A receiving antenna for digital television signal reception includes a dielectric substrate, a radiating plate formed on the dielectric substrate with a bar shape, having a first long edge and a second long edge corresponding to the first long edge, a slit formed on the radiating plate with a length at least two times the width of the radiating plate, having a terminal at about the center of the first long edge and a terminal at the second long edge, and separating the radiating plate into a first sub-plate and a second sub-plate, a first feeding point formed on the first sub-plate, a second feeding point formed on the second sub-plate, and a feeding coaxial cable having a core conductor connected to the first feeding point and a grounding conductor connected to the second feeding point.

9 Claims, 10 Drawing Sheets

9



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(12) **United States Design Patent**
Wu et al.

(10) **Patent No.:** **US D571,793 S**
(45) **Date of Patent:** **** Jun. 24, 2008**

(54) **ANTENNA**

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(**) Term: **14 Years**

(21) Appl. No.: **29/293,616**

(22) Filed: **Dec. 4, 2007**

(30) **Foreign Application Priority Data**

Sep. 29, 2007 (CN) 2007 3 0189262

(51) **LOC (8) Cl.** **14-03**

(52) **U.S. Cl.** **D14/230; D14/238**

(58) **Field of Classification Search** D14/138,
D14/230-238, 299, 358; D12/42, 43; 343/700 R-705,
343/871, 908, 795, 840, 711-713, 819, 846;
455/90.2, 90.3, 91, 128, 269, 344, 347, 562.1;
D8/395, 72; D28/40; 24/97.3

See application file for complete search history.

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(57) **CLAIM**

The ornamental design for an antenna, as shown.

DESCRIPTION

FIG. 1 is a perspective view of an antenna showing our new design;

FIG. 2 is a front elevational view thereof;

FIG. 3 is a rear elevational view thereof;

FIG. 4 is a left side elevational view thereof;

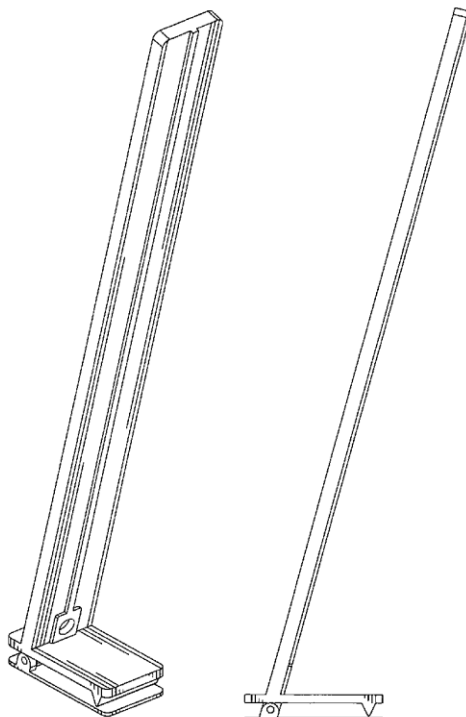
FIG. 5 is a right side elevational view thereof;

FIG. 6 is a top plan view thereof; and,

FIG. 7 is a bottom plan view thereof.

The broken line showing of rectangular shapes in FIGS. 3 and 6 illustrates environment only and forms no part of the claimed design.

1 Claim, 7 Drawing Sheets



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