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Remarks:
Amended claims in accordance with Rule 137(2) EPC.

(54) **Communication device antenna**

(57) The present invention relates to a communication device antenna including a metal housing (12) and an excitation component (22). The metal housing (12) has a first lateral side (14a), a second lateral side (14b) and a connection side (16) extended and connected between the first lateral side (14a) and the second lateral side (14b). An opening (18) is formed and located adjacent to the connection side (16). A coupling gap (38) is

defined between the excitation component (22) and the connection side (16) of the metal housing (12). The excitation component (22) is connected to the signal feed point (24) and the ground point (26). The excitation component (22) is configured to perform electromagnetic energy excitation, such that the metal housing (12) can be utilized as a radiation unit.

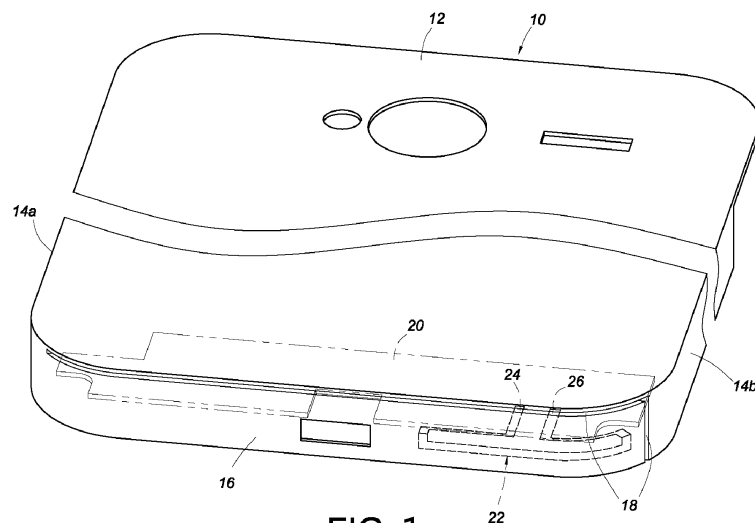


FIG. 1

Description

Field of the Invention

[0001] The present invention is related to a communication device antenna utilizing a metal housing for emitting and receiving radio signals of a communication device according to the pre-characterizing clause of claim 1.

Background of the Invention

[0002] During product development processes of conventional communication devices, such as mobile communication products, plastic housings are mainly used by manufacturers due to cost concerns, in order to maintain basic radiation characteristics of an antenna. However, a trend of metal housing is currently brought by Apple iPhones and Macbooks. Since the metal housing has light weight, good heat dissipation, high strength, high impact resistance, good looking, anti-electromagnetic and recyclable characteristics, the metal housing is getting more and more popular. Therefore, the metal housings are mainly used in development of new generations of the mobile communication products. For example, US patent No. 8,054,231 B2 disclosed by Ahn et al. teaches a metal case having a slot, which can be used as a slot antenna of a mobile device. But the slot may obviously ruin appearance of the metal case, and the slot needs to be arranged at a position corresponding to a specific area of the metal case. Therefore, it is important to design a proper antenna to allow electromagnetic waves to penetrate the metal case for achieving communication purposes without obviously ruining the appearance of the metal case.

Summary of the Invention

[0003] This in mind, the present invention aims at providing a communication device antenna utilizing a metal housing for emitting and receiving radio signals of a communication device.

[0004] This is achieved by a communication device antenna according to claim 1. The dependent claims pertain to corresponding further developments and improvements.

[0005] As will be seen more clearly from the detailed description following below, the claimed communication device antenna comprises a metal housing, a signal feed point, a ground point and an excitation component. The metal housing has a first lateral side, a second lateral side corresponding to the first lateral side, and a connection side extended and connected between the first lateral side and the second lateral side, wherein an opening is formed and located adjacent to the connection side. The excitation component is connected to the signal feed point and the ground point, wherein a coupling gap is defined between the excitation component and the connection side of the metal housing.

Brief Description of the Drawings

[0006] In the following, the invention is further illustrated by way of example, taking reference to the accompanying drawings thereof:

FIG. 1 is a diagram showing arrangement of a communication device according to an embodiment of the present invention,

FIG. 2 is a diagram showing opening arrangement of the communication device according to the embodiment of the present invention,

FIG. 3 is a diagram showing antenna arrangement of the communication device according to the embodiment of the present invention, and

FIG. 4 is an enlarged view of an area A in FIG. 3.

Detailed Description

[0007] Fig. 1 to FIG. 4 are diagrams showing a communication device 10 having a metal housing 12 according to an embodiment of the present invention. The metal housing 12 has a first lateral side 14a, a second lateral side 14b located at a position corresponding to the first lateral side 14a, and a connection side 16 extended and connected between the first lateral side 14a and the second lateral side 14b.

[0008] Antenna arrangement of the communication device 10 comprises at least a printed circuit board 20 and an excitation component 22, wherein the printed circuit board 20 comprises a signal feed point 24 and a ground point 26. Please note that the printed circuit board 20 can be arranged in other size relative to the communication device 10. In other words, the size of the printed circuit board 20 is not limited by the figures.

[0009] The excitation component 22 comprises a first metal part 28, a second metal part 30, a third metal part 32, a fourth metal part 34 and a fifth metal part 36, wherein the first metal part 28 is connected to the signal feed point 24 of the printed circuit board; the second metal part 30 is connected to the ground point 26 of the printed circuit board 20; the third metal part 32 is located adjacent to the connection side 16 of the metal housing 12, and a coupling gap 38 is defined between the third metal part 32 and the connection side 16 of the metal housing 12. In a preferred embodiment, the fourth metal part is substantially extended and connected between the first metal part 28 and the third metal part 32 perpendicularly, and the fifth metal part 36 is substantially extended and connected between the second metal part 30 and the third metal part 32 perpendicularly.

[0010] The first metal part 28, the second metal part 30, the third metal part 32, the fourth metal part 34 and the fifth metal part 36 of the excitation component 22 form an approximate circular path.

[0011] In a preferred embodiment, an opening 18 is formed and located adjacent to the connection side 16 of the metal housing 12. The opening 18 comprises a

first slit 40 and a second slit 42 substantially perpendicular to the first slit 40, wherein the first slit 40 is formed straight along the adjacent connection side 16 of the metal housing 12, and the second slit 42 is located adjacent to the second lateral side 14b of the metal housing 12. In a preferred embodiment, the first slit 40 and the second slit 42 together form an L-shaped opening, but the opening 18 is not limited by the shape and arrangement disclosed in the embodiment of the present invention.

[0012] According to the above arrangement, when the communication device 10 is turned on, power at the signal feed point 24 of the printed circuit board 20 is fed into the excitation component 22, and the power is further coupled to the connection side 16 of the metal housing 12 through the coupling gap 38, such that the metal housing 12, especially the connection side 16 of the metal housing 12 can be utilized as a radiating strip, for transmitting and receiving radio signals of the communication device 10. Therefore, the excitation component 22 can work as a feeding strip for performing electromagnetic energy excitation. Please note that arrangement of the excitation component 22 in the figures is one of preferred embodiments, the present invention can utilize other types of excitation components for performing electromagnetic energy excitation.

[0013] According to the above illustration, efficacies and advantages of the present invention are listed as follows:

- a. appearance of the metal housing is not obviously ruined, and in contrast to the prior art, the metal housing has better appearance; and
- b. the antenna is arranged at an edge of the metal housing, and in contrast to the prior art, the antenna occupies less space.

Claims

1. A communication device antenna, **characterized by:**

a metal housing (12) having a first lateral side (14a), a second lateral side (14b) corresponding to the first lateral side (14a), and a connection side (16) extended and connected between the first lateral side (14a) and the second lateral side (14b), wherein an opening (18) is formed and located adjacent to the connection side (16);
a signal feed point (24);
a ground point (26); and
an excitation component (22) connected to the signal feed point (24) and the ground point (26), wherein a coupling gap (38) is defined between the excitation component (22) and the connection side (16) of the metal housing (12).

2. The communication device antenna of claim 1, **characterized in that** the excitation component (22)

comprises a first metal part (28), a second metal part (30), a third metal part (32), a fourth metal part (34) and a fifth metal part (36); wherein the first metal part (28) is connected to the signal feed point (24), the second metal part (30) is connected to the ground point (26), the third metal part (32) is located adjacent to the connection side (16) of the metal housing (12), the fourth metal part (34) is extended and connected between the first metal part (28) and the third metal part (32), and the fifth metal part (36) is extended and connected between the second metal part (30) and the third metal part (32).

3. The communication device antenna of claim 1 or 2, **characterized in that** the opening (18) comprises a first slit (40) and a second slit (42), the second slit (42) is substantially perpendicular to the first slit (40), the first slit (40) is formed straight along the adjacent connection side (16) of the metal housing (12), and the second slit (42) is located adjacent to the second lateral side (14b) of the metal housing (12).

4. The communication device antenna of claim 3, **characterized in that** the first slit (40) and the second slit (42) together form an L-shaped opening.

Amended claims in accordance with Rule 137(2) EPC.

1. A communication device antenna, **characterized by:**

a metal housing (12) having a first lateral side (14a), a second lateral side (14b) corresponding to the first lateral side (14a), a connection side (16) extended and connected between the first lateral side (14a) and the second lateral side (14b), and a main surface connected to the first lateral side (14a), the second lateral side (14b) and the connection side (16), wherein the main surface is perpendicular to the first lateral side (14a), the second lateral side (14b) and the connection side (16), an area of the main surface is greater than an area of any one of the first lateral side (14a), the second lateral side (14b) and the connection side (16), an opening (18) comprises a first slit (40) and a second slit (42) substantially perpendicular to the first slit (40), the first slit (40) is formed at a position adjacent to a junction area between the main surface and the connection side (16), the second slit (42) is formed at a position adjacent to a junction area between the second lateral side (14b) and the connection side (16), and the opening (18) is not formed on the main surface;
a signal feed point (24);

a ground point (26); and
an excitation component (22) connected to the
signal feed point (24) and the ground point (26),
wherein a coupling gap (38) is defined between
the excitation component (22) and the connec- 5
tion side (16) of the metal housing (12).

2. The communication device antenna of claim 1, **characterized in that** the excitation component (22) 10
comprises a first metal part (28), a second metal part (30), a third metal part (32), a fourth metal part (34)
and a fifth metal part (36); wherein the first metal part (28) is connected to the signal feed point (24), the
second metal part (30) is connected to the ground point (26), the third metal part (32) is located adjacent 15
to the connection side (16) of the metal housing (12), the fourth metal part (34) is extended and connected
between the first metal part (28) and the third metal part (32), and the fifth metal part (36) is extended
and connected between the second metal part (30) 20
and the third metal part (32).
3. The communication device antenna of claim 1 or 2,
characterized in that the first slit (40) and the sec- 25
ond slit (42) together form an L-shaped opening.

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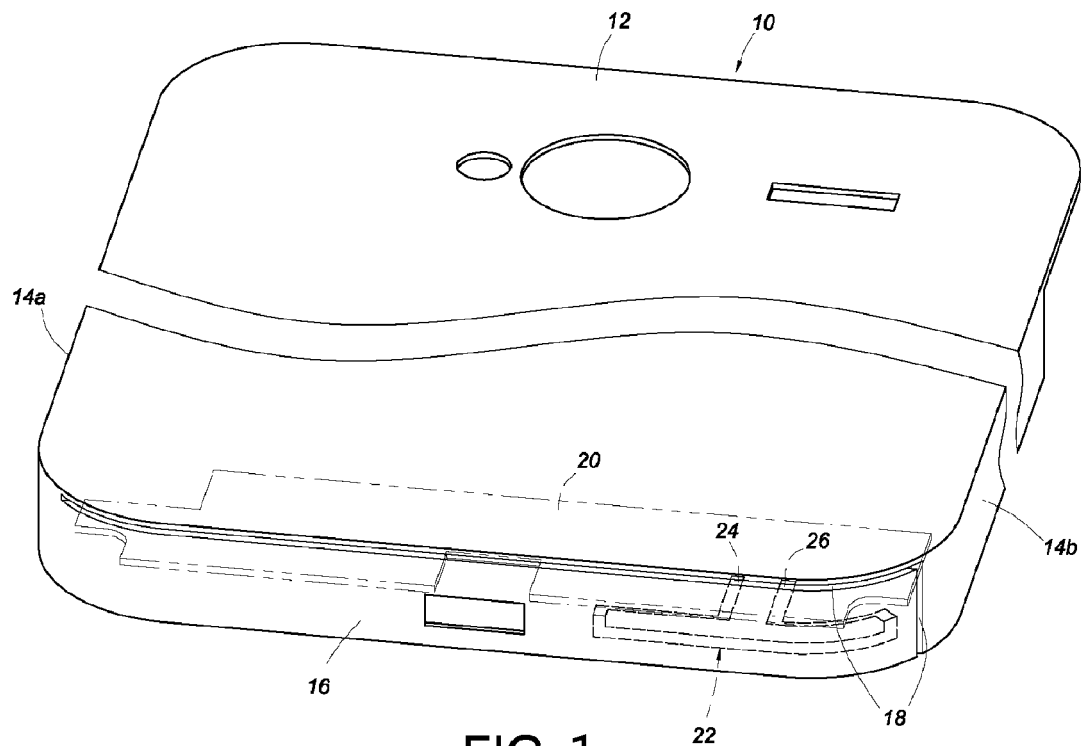


FIG. 1

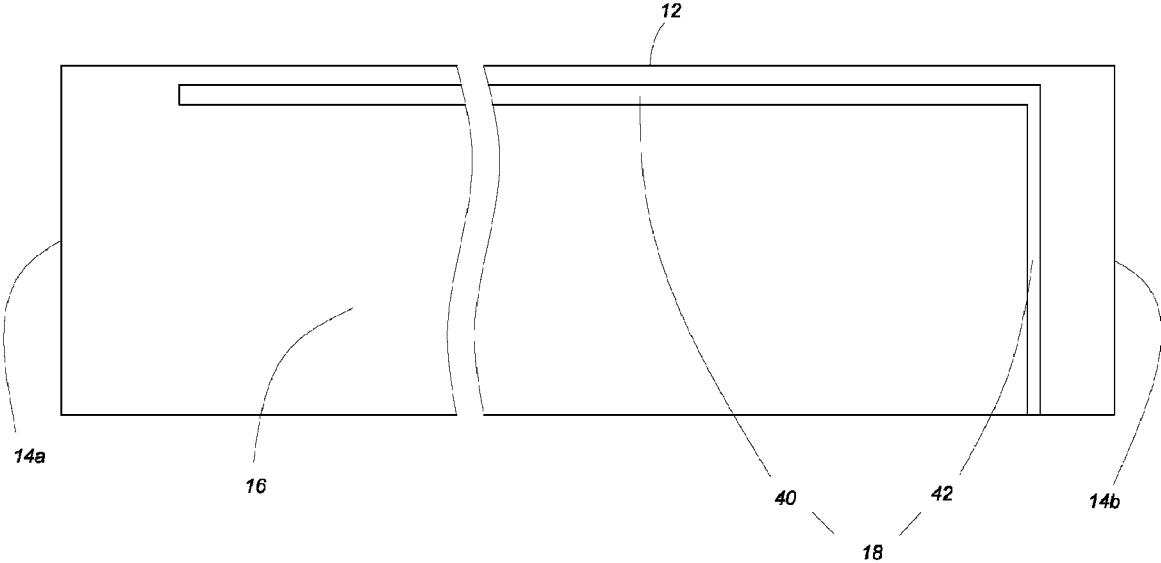
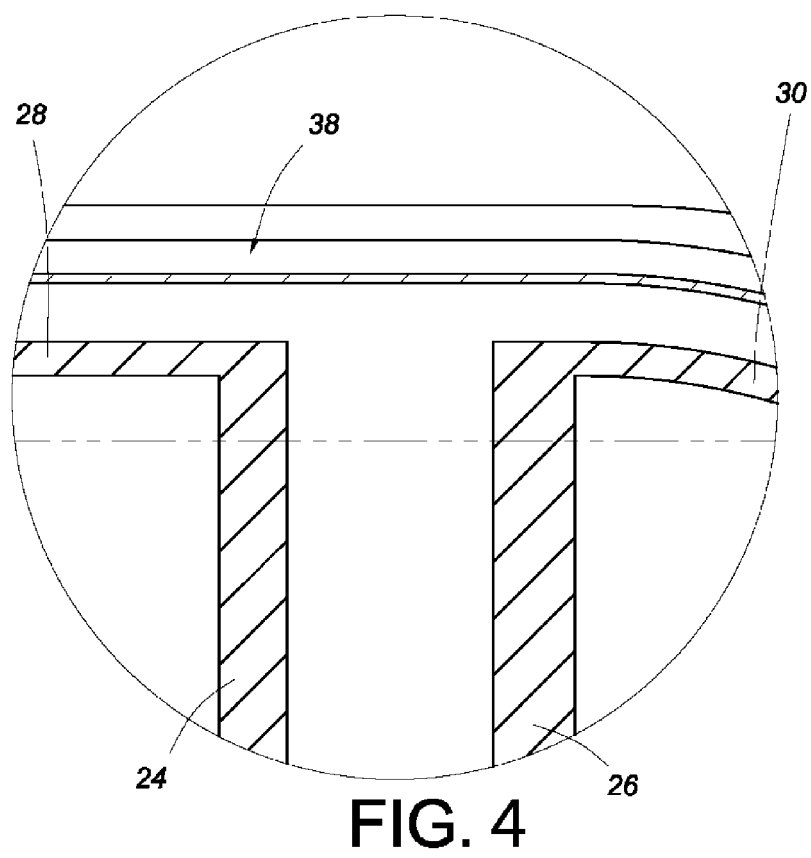
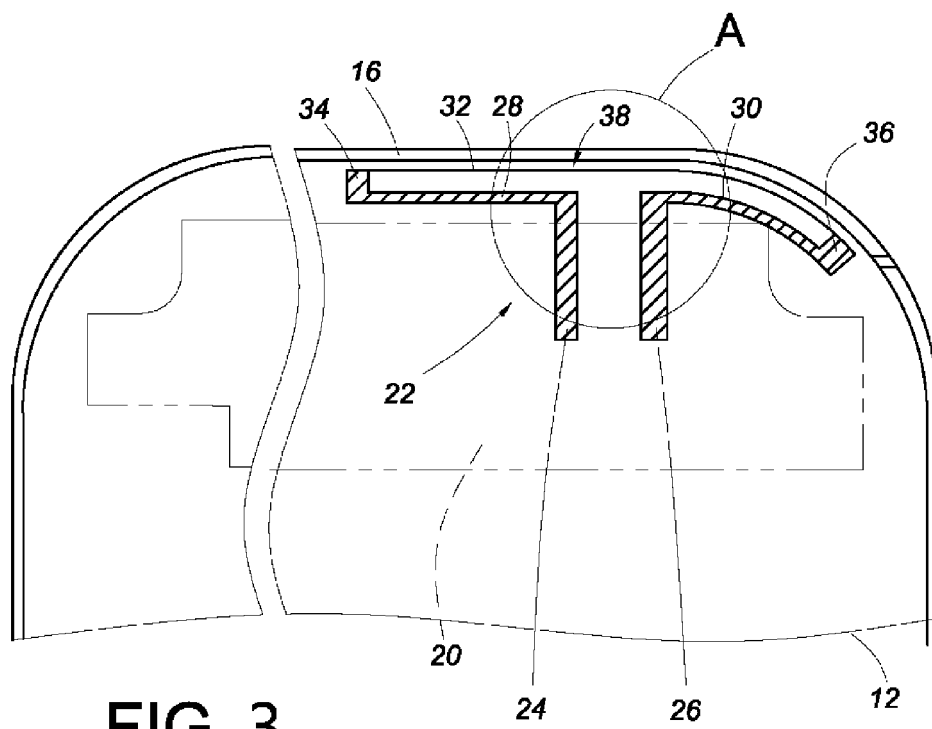


FIG. 2





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 Application Number
EP 14 16 6273

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The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 15 October 2014	Examiner Unterberger, Michael
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
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