helix. A first end of the coil may be connected to a first plate of the capacitor and a second end of the coil may be connected to a second plate of the capacitor. In this regard, the capacitor may comprise two parallel plates that are formed on either side of a dielectric layer. According to some example embodiments, the capacitor may include a deactivation spot.

[0009] Also described herein is a foldable label comprising a core, a capacitor comprising a dielectric layer disposed between a top plate and a bottom plate, a coil folded around the core and connected to the capacitor to form a resonant circuit and a liner, wherein the resonant circuit is disposed above the liner. The coil may be formed of angled traces folded around the core to form turns such that each turn is electrically and physically connected in series to an adjacent angled turn by welding to form a helical structure of the coil. The core may comprise at least one ferrite layer and may comprise a spacer layer. The spacer layer may comprise a non-conductive or ferrous flexible member. In some examples, the foldable label may comprise a liner, wherein the resonant circuit is disposed above the liner. At least one metal layer may be disposed between the liner and the resonant circuit. The at least one metal layer may comprise a thickness between about 40-80 microns. At least one spacer layer may be disposed between the liner and the resonant circuit. The at least one spacer layer may comprise a mass per unit area of between about 160 to 500 g/m^2. It is noted that the foldable label may comprise at least one spacer layer disposed between the liner and the resonant circuit independent of a metal layer. For instance, wherein a space between the resonate circuit and the liner may be free of metal. Moreover, a space between the resonate circuit and the liner may be free of metal and the core may be free of metal, such that the label comprises no metal other than the coil. For instance at least a portion of the top plate may be

disposed between the core and the liner. Moreover, the resonate circuit may comprise a laser tuned resonant circuit.

[0010] In some embodiments, a foldable label may comprise a core, a capacitor comprising a dielectric layer disposed between a top plate and a bottom plate, a coil having angled traces that are folded and welded around the core and connected to the capacitor to form a resonant circuit and to form a generally helical shaped coil, a liner disposed beneath the resonant circuit, and at least one metal layer disposed between the liner and the resonant circuit, wherein the at least one metal layer comprises a thickness between 40-80 microns. In at least one example, the bottom plate is generally coplanar with a bottom of the coil. In another aspect, the capacitor is horizontally adjacent to the coil.

[0011] In another aspect, a foldable label may comprise a resonant circuit comprising, a core comprising a ferrite material, a capacitor comprising a dielectric layer disposed between a top plate and a bottom plate, a coil comprising angled traces that wrap around the core, and welds operatively coupled adjacent angles traces together to form a generally helical shaped coil, a liner disposed beneath the resonant circuit, and at least one metal layer disposed between the liner and the resonant circuit. The top plate may be disposed at least partially below the core. In another aspect, the bottom plate is disposed at least partially below the core. It is noted that the dielectric layer may form at least a portion of the coil.

[0012] The following description and the drawings disclose various illustrative aspects. Some improvements and novel aspects may be expressly identified, while others may be apparent from the description and drawings.

DESCRIPTION OF THE DRAWINGS

[0013] The present teachings may be better understood by reference to the following detailed description taken in connection with the following illustrations, wherein:

adhered to a product, such as a metal product, and may be detectable by an EAS device. By resonating in the field, the foldable label 600 may be excited by a signal emitted by an EAS device at the particular frequency so that it may be detected by an antenna. As such, the foldable label 600 triggers an alarm to sound due to an apparent theft event.

[0057] FIGs. 7A-7C illustrate a foldable label 700 comprising a ferrite core that is extended, in comparison to some other disclosed embodiments, and a capacitor plate located underneath the ferrite core. It is noted that like named components of foldable label 700 and various other disclosed labels (e.g., foldable label 10, 500, 600 etc.) may comprise similar aspects In an aspect the foldable label 700 may minimize or reduce the length of the repeat direction even when a spacer and metal layer are disposed underneath a coil and capacitor.

[0058] The coil 730 may be formed of turns 731 (which may be welded together at welds 732) that define a metal layer 751 of the foldable label 700. A ferrite core 720 is disposed within a dielectric layer 724 and the metal layer 751. As described herein, the capacitor 740 may be disposed generally beneath the ferrite core 720. For instance, a top plate 743 of the capacitor 740 may be disposed underneath or at a bottom of the ferrite core 720. The top plate 743 is disposed above a portion of the dielectric layer 724 and the bottom plate 744. As such, the capacitor 740 and coil 720 may form an LC circuit. The LC circuit may be disposed on a back film 749. The back film 749 may be attached to a bottom spacer 762. A metal layer 760 (e.g., aluminum layer) may be disposed beneath the spacer 762. The metal layer 760 may be adhered to a liner 756 via a hotmelt 750 or other adhesive.

[0059] The spacer 762 provides a greater distance of separation of the coil 730 or core 720 from a metal surface, such as the metal layer 760 or a metal product. In an aspect,

the thickness of the spacer 762 may be selected based on cost, function, or both cost and function. In examples, the spacer may comprise a synthetic paper having a mass per unit area of between about 160 to 500 g/m^2 (such as 160-300, or 300-500 g/m^2). It is noted that the specifications of the spacer 762 and arrangement of the other components of the foldable label 700 may be selected to allow for an improved detectable label when adhered to a metal item.

[0060]

[0061] What has been described above includes examples of the present specification. It is, of course, not possible to describe every conceivable combination of components or methodologies for purposes of describing the present specification, but one of ordinary skill in the art may recognize that many further combinations and permutations of the present specification are possible. Each of the components described above may be combined or added together in any permutation to define embodiments disclosed herein. Accordingly, the present specification is intended to embrace all such alterations, modifications and variations that fall within the spirit and scope of the appended claims. Furthermore, to the extent that the term “includes” is used in either the detailed description or the claims, such term is intended to be inclusive in a manner similar to the term “comprising” as “comprising” is interpreted when employed as a transitional word in a claim.

CLAIMS

What is claimed is:

1. A foldable label comprising:

a core;

a capacitor comprising a dielectric layer disposed between a top plate and a bottom plate;

a coil folded around the core and connected to the capacitor to form a resonant circuit;

a liner, wherein the resonant circuit is disposed above the liner; and

wherein the coil is formed of angled traces folded around the core to form turns such that each turn is electrically and physically connected in series to an adjacent angled turn by welding to form a helical structure of the coil.

2. The foldable label of claim 1, wherein the core comprises at least one ferrite layer.

3. The foldable label of claim 2, wherein the core comprises a spacer layer.

4. The foldable label of claim 3, wherein the spacer layer comprises a non-conductive or ferrous flexible member.

5. The foldable label of claim 1, further comprising at least one metal layer disposed between the liner and the resonant circuit.

6. The foldable label of claim 5, wherein the at least one metal layer comprises a thickness between 40-80 microns.

7. The foldable label of claim 5, further comprising at least one spacer layer disposed between the liner and the resonant circuit.

8. The foldable label of claim 7, wherein the at least one spacer layer comprises a mass per unit area of between 160 to 500 g/m^2.

9. The foldable label of claim 1, further comprising at least one spacer layer disposed between the liner and the resonant circuit.

10. The foldable label of claim 1, wherein at least a portion of the top plate is disposed between the core and the liner.

11. The foldable label of claim 1, wherein a space between the resonant circuit and the liner is free of metal.

12. The foldable label of claim 1, wherein a space between the resonant circuit and the liner is free of metal and the core is free of metal, such that the label comprise no metal other than the coil.

13. The foldable label of claim 1, wherein the resonant circuit comprises a laser tuned resonant circuit.

14. A foldable label comprising:

a core;

a capacitor comprising a dielectric layer disposed between a top plate and a bottom plate;

a coil having angled traces that are folded and welded around the core and connected to the capacitor to form a resonant circuit and to form a generally helical shaped coil;

a liner disposed beneath the resonant circuit; and

at least one metal layer disposed between the liner and the resonant circuit, wherein the at least one metal layer comprises a thickness between 40-80 microns.

15. The foldable label of claim 14, wherein the bottom plate is generally coplanar with a bottom of the coil.

16. The foldable label of claim 14 or 15, wherein the capacitor is horizontally adjacent to the coil.

17. A foldable label comprising:

a resonant circuit comprising:

a core comprising a ferrite material;

a capacitor comprising a dielectric layer disposed between a top plate and a bottom plate;

a coil comprising angled traces that wrap around the core, and welds operatively coupled adjacent angles traces together to form a generally helical shaped coil;

a liner disposed beneath the resonant circuit; and

at least one metal layer disposed between the liner and the resonant circuit.

18. The foldable label of claim 17, wherein the top plate is disposed at least partially below the core.

19. The foldable label of claim 17, wherein the bottom plate is disposed at least partially below the core.

20. The foldable label of claim 17, wherein the dielectric layer forms at least a portion of the coil.