CLAIMS

~~WHAT IS CLAIMED IS:~~

1.——A vertical inductor structure, comprising:

a first laminate substrate ~~forming~~having a ground plane layer internal to the first laminate substrate; a first portion of the vertical inductor structure~~;~~ formed within the first laminate substrate, spaced apart from the ground plane layer, and

~~a second~~ located between the ground plane layer and an exterior surface of the first laminate substrate; a second laminate substrate mounted on the first laminate substrate ~~and forming;~~ a second portion of the vertical inductor structure~~,~~

~~each~~ formed within the second laminate substrate, each respective laminate substrate of the first laminate substrate and the second laminate substrate including:

a plurality of first traces embedded in a layer of the respective laminate substrate;

a plurality of first vertical columns, each of which is coupled to a first end of a respective one of the plurality of first traces; and

a plurality of second vertical columns, each of which is coupled to a second end of ~~a~~the respective one of the plurality of first traces,

wherein the second laminate substrate is mounted on the first laminate substrate such that each of the plurality of first vertical columns of the first laminate substrate is coupled to a respective one of the plurality first vertical columns of the second laminate substrate, and each of the plurality of second vertical columns of the first laminate substrate is coupled to a respective one of the plurality of second vertical columns of the second laminate substrate~~.~~; and wherein the exterior surface of the first laminate substrate faces the second laminate substrate.

2.——The vertical inductor structure of claim 1, wherein each of the first laminate substrate and the second laminate substrate includes a plurality of second traces, the plurality of second traces are parallel with the plurality of first traces and embedded in a second layer of the substrate.

3.——The vertical inductor structure of claim 2, wherein each of the first laminate substrate and the second laminate substrate further includes a plurality of metal-filled vias disposed along each of the plurality of first traces between the first end and the second end, the plurality of metal-filled vias coupling each of the plurality of first traces to a respective one of the plurality of second traces.

4.——The vertical inductor structure of claim 2, wherein each of the first laminate substrate and the second laminate substrate further includes:

a plurality of third vertical columns, each of which is coupled to a respective one of the plurality of first traces proximate the first end; and

a plurality of fourth vertical columns, each of which is coupled to a respective one of the plurality of first traces proximate the second end,

wherein each of the plurality of third vertical columns of the first laminate substrate is coupled to a respective one of the plurality of third vertical columns of the second laminate substrate, and each of the plurality of fourth vertical columns of the first laminate substrate is coupled to a respective one of the plurality of fourth vertical columns of the second laminate substrate.

5.——The vertical inductor structure of claim 1, wherein each of the plurality of first and second vertical columns includes a plurality of stacked, metal-filled vias embedded in the respective laminate substrate.

6.——The vertical inductor structure of claim 5, wherein each of the plurality of first and second vertical columns further includes a plurality of capture pads embedded in the respective laminate substrate, each of the plurality of capture pads disposed between each of the plurality of stacked, metal-filled vias.

7.——The vertical inductor structure of claim 1, wherein the first laminate substrate is coupled to the second laminate substrate using connections selected from the group consisting of flip-chip bumps, ball grid arrays, solder on pad (SOP), and copper pillars.

8.——The vertical inductor structure of claim 1, further comprising a shield layer and a molding, the molding separating the second laminate substrate from the shield layer.

9.——The vertical inductor structure of claim 8, wherein the molding is comprised of a polymer material.

10.——The vertical inductor structure of claim 1, wherein the first laminate substrate includes a first number of layers, and the second laminate substrate includes a second number of layers.

11.—— The vertical inductor of claim 10, wherein each of the first number of layers and the second number of layers is in the range of 2 layers to 10 layers.

12.—— The vertical inductor structure of claim 10, wherein the first number of layers equals the second number of layers.

13.—— The vertical inductor structure of claim 10, wherein the plurality of first traces are comprised of copper.

14.—— The vertical inductor structure of claim 1, integrated into a radio frequency (RF) front-end module, the RF front-end module incorporated into at least one of a music player, a video player, an entertainment unit, a navigation device, a communications device, a personal digital assistant (PDA), a fixed location data unit, a mobile phone, and a portable computer.

~~15. A method of fabricating a vertical inductor structure, comprising:~~

~~providing a first laminate substrate forming a first portion of the vertical inductor structure; and~~

~~mounting a second laminate substrate on the first laminate substrate, the second laminate substrate forming a second portion of the vertical inductor structure,~~

~~each of the first laminate substrate and the second laminate substrate including:~~

~~a plurality of first traces embedded in a layer of the laminate substrate;~~

~~a plurality of first vertical columns, each of which is coupled to a first end of a respective one of the plurality of first traces; and~~

~~a plurality of second vertical columns, each of which is coupled to a second end of a respective one of the plurality of first traces,~~

~~wherein mounting the second laminate substrate on the first laminate substrate includes coupling each of the plurality of first vertical columns of the first laminate substrate to a respective one of the plurality of first vertical columns of the second laminate substrate, and coupling each of the plurality of second vertical columns of the first laminate substrate to a respective one of the plurality of second vertical columns of the second laminate substrate.~~

16. The method of claim 15, wherein each of the first laminate substrate and the second laminate substrate includes a plurality of second traces, the plurality of second traces are parallel with the plurality of first traces and embedded in a second layer of the substrate.

17. The method of claim 16, wherein each of the first laminate substrate and the second laminate substrate further includes a plurality of metal-filled vias disposed along each of the plurality of first traces between the first end and the second end, the plurality of metal-filled vias coupling each of the plurality of first traces to a respective one of the plurality of second traces.

18. The method of claim 16, wherein each of the first laminate substrate and the second laminate substrate further includes:

a plurality of third vertical columns, each of which is coupled to a respective one of the plurality of first traces proximate the first end; and

a plurality of fourth vertical columns, each of which is coupled to a respective one of the plurality of first traces proximate the second end,

wherein mounting the second laminate substrate on the first laminate substrate includes coupling each of the plurality of third vertical columns of the first laminate substrate to a respective one of the plurality of third vertical columns of the second laminate substrate, and coupling each of the plurality of fourth vertical columns of the first laminate substrate to a respective one of the plurality of fourth vertical columns of the second laminate substrate.

19. The method of claim 15, wherein mounting the second laminate substrate on the first laminate substrate involves using connections selected from the group consisting of flip-chip bumps, ball grid arrays, solder on pad (SOP), and copper pillars.

20. The method of claim 15, further comprising:

molding over the second laminate substrate; and

providing a module shield layer over the molding.

21. A radio-frequency (RF) front-end module, comprising:

a vertical inductor structure, comprising a first laminate substrate forming a first portion of the vertical inductor structure, and a second laminate substrate forming a second

portion of the vertical inductor structure, each of the first laminate substrate and the second laminate substrate including:

a plurality of first traces embedded in a layer of the laminate substrate;

a plurality of first vertical columns, each of which is coupled to a first end of a respective one of the plurality of first traces; and

a plurality of second vertical columns, each of which is coupled to a second end of a respective one of the plurality of first traces,

wherein the second laminate substrate is mounted on the first laminate substrate such that each of the plurality of first vertical columns of the first laminate substrate is coupled to a respective one of the plurality of first vertical columns of the second laminate substrate, and each of the plurality of second vertical columns of the first laminate substrate is coupled to a respective one of the plurality of second vertical columns of the second laminate substrate; and

a RF circuit supported by the vertical inductor structure.

22. The RF front-end module of claim 21, wherein each of the first laminate substrate and the second laminate substrate includes a plurality of second traces, the plurality of second traces are parallel with the plurality of first traces and embedded in a second layer of the substrate.

23. The RF front-end module of claim 22, wherein each of the first laminate substrate and the second laminate substrate further includes a plurality of metal-filled vias disposed along each of the plurality of first traces between the first end and the second end, the plurality of metal-filled vias coupling each of the plurality of first traces to a respective one of the plurality of second traces.

24. The RF front-end module of claim 22, wherein each of the first laminate substrate and the second laminate substrate further includes:

a plurality of third vertical columns, each of which is coupled to a respective one of the plurality of first traces proximate the first end; and

a plurality of fourth vertical columns, each of which is coupled to a respective one of the plurality of first traces proximate the second end,

wherein each of the plurality of third vertical columns of the first laminate substrate is coupled to a respective one of the plurality of third vertical columns of the second laminate

substrate, and each of the plurality of fourth vertical columns of the first laminate substrate is coupled to a respective one of the plurality of fourth vertical columns of the second laminate substrate.

25. The RF front-end module of claim 21, wherein each of the plurality of first and second vertical columns includes a plurality of stacked, metal-filled vias.

26. The RF front-end module of claim 25, wherein each of the plurality of first and second vertical columns further includes a plurality of capture pads, each of the plurality of capture pads disposed between each of the plurality of stacked, metal-filled vias.

27. The RF front-end module of claim 21, wherein the first laminate substrate is coupled to the second laminate substrate using connections selected from the group consisting of flip-chip bumps, ball grid arrays, solder on pad (SOP), and copper pillars.

28. The RF front-end module of claim 21, further comprising a shield layer and a molding, the molding separating the second laminate substrate from the shield layer.

29. The RF front-end module of claim 21, incorporated into at least one of a music player, a video player, an entertainment unit, a navigation device, a communications device, a personal digital assistant (PDA), a fixed location data unit, a mobile phone, and a portable computer.