CLAIMS:

~~1. An antenna element (10) comprising:~~

a waveguide (11) configured for operating in a below-cutoff mode and having a cavity (13);

an exciter (12) configured for exciting the waveguide (11); and

a shield (17) including:

a holder (171) arranged within the cavity (13); and

a front plate (172) mounted on the holder and disposed over at least a part of the exciter (12).

2. The antenna element of claim 1, wherein the exciter (12) includes:

a printed-circuit antenna (15) arranged within the cavity (13) and configured for feeding the waveguide (11); and

a feed arrangement (16) coupled to the printed-circuit antenna (15) at a feed point (161) for providing radio frequency energy thereto.

3. The antenna element of claim 2, wherein said printed-circuit antenna (15) has a layered structure and includes:

a thin layer (152) of a dielectric material having an underside (153) and an upper side (154);

a patch (151) printed on the underside (153) of the thin layer (152), and

a substrate (155) arranged between the patch (151) and a bottom of the cavity (13).

4. The antenna element of claim 3, wherein the patch (151) includes an orifice (156) defining the location of the feed point (161).

5. The antenna element of claim 4, wherein the orifice (156) is arranged at a verge (157) of the patch, which is the distant edge from the center of the patch (151).

6. The antenna element of claim 4, wherein the orifice (156) is arranged within the solid portion of the patch (151).

7. The antenna element of claim 4, wherein said printed-circuit antenna (15) includes a pad (158) and a stub (159) coupled to the pad (158), the pad (158) and the stub (159) are printed on the upper side (154) of the thin layer (152) and arranged under the ~~orifice (156) of the patch (151).~~

~~8. The antenna element of claim 3, wherein the waveguide (11) is a circular~~ waveguide, and wherein the patch (151), the thin layer (152) and the substrate (155) all have ring shapes hollowed out in the ring center to define a lumen.

9. The antenna element of claim 8, wherein the holder (171) of the shield (17) is inserted through the lumen in the center of the layered structure formed by the patch (151), the thin layer (152) and the substrate (155).

10. The antenna element of claim 2, wherein the holder (171) has a tubular shape and includes a tapered portion (173) and a uniform portion (174), said tapered portion (173) is tapered with contraction from the front plate (172) towards a uniform portion (174) located at a bottom (131) of the cavity (13).

11. The antenna element of claim 10, wherein the contraction of the holder (171) extends from the front plate (172) until the location of the printed-circuit antenna (15).

12. The antenna element of claim 10, wherein the uniform portion (174) has a base (175) threaded into the bottom of the cavity (13).

13. The antenna element of claim 7, wherein the feed arrangement (16) includes an electrically conductive pin (163), and an electrically conductive sleeve (162) arranged within the substrate (155) between the patch (151) and the bottom (131) of the cavity (13) and surrounding the pin (163).

14. The antenna element of claim 13, wherein the pin (163) passes through a common hole (164) arranged within the waveguide (11) at the bottom of the cavity (13), the electrically conductive sleeve (162) and the thin layer (152).

15. The antenna element of claim 14, wherein the pin (163) is connected to the pad (158) at the feed point (161) of the printed-circuit antenna (15).

16. The antenna element of claim 13, wherein the pin (163) is surrounded with an isolator layer (165).

17. The antenna element of claim 1 further comprising a radome mounted on the top of the antenna element over the aperture (14).

18. A phased array antenna (20) comprising:

a plurality of the antenna elements (10) of any one of the preceding claims having waveguides (11) arranged in a common conductive ground plane (21) and spaced apart at a predetermined distance from each other; and

a beam steering system coupled to said a plurality of the antenna elements (10) ~~and configured for steering an energy beam produced by said phased array antenna.~~

19. The phased array antenna of claim 18, wherein the waveguides (11) of said plurality of the antenna elements are arranged in a common conductive ground plane (21).

20. The phased array antenna of claim 18, wherein at least one waveguide (11) of said plurality of the antenna elements is arranged in an individual conductive ground plane.

CLAIMS

1. An antenna element comprising:

a waveguide including a cavity having an aperture;

an exciter mounted at a bottom of the cavity and configured for exciting the waveguide; and

a shield formed from a hard and strong material to provide protection to the exciter from predetermined damaging actions, the shield including:

a holder arranged within the cavity and extending from the bottom of the cavity along the cavity depth; and

a front plate mounted on the holder, and being substantially flush with the aperture and disposed over at least a part of the exciter, thereby providing said protection from predetermined damaging actions.

2. The antenna element of claim 1, wherein the exciter includes:

a printed-circuit antenna arranged at the bottom of the cavity and configured for feeding the waveguide; and

a feed arrangement coupled to the printed-circuit antenna at a feed point for providing radio frequency energy thereto.

3. The antenna element of claim 2, wherein said printed-circuit antenna has a layered structure and includes:

a thin layer of a dielectric material having an underside and an upper side;

a patch printed on the underside of the thin layer, and

a substrate arranged between the patch and a bottom of the cavity.

4. The antenna element of claim 3, wherein the patch includes an orifice defining the location of the feed point.

5. The antenna element of claim 4, wherein the orifice is arranged at a verge of the patch, which is the distant edge from the centre of the patch.

6. The antenna element of claim 4, wherein the orifice is arranged within the solid portion of the patch.

7. The antenna element of claim 4, wherein said printed-circuit antenna includes a pad and a stub coupled to the pad, the pad and the stub are printed on the upper side of the thin layer and arranged under the orifice of the patch.

8. The antenna element of claim 7, wherein the feed arrangement includes an electrically conductive pin, and an electrically conductive sleeve arranged within the substrate between the patch and the bottom of the cavity and surrounding the pin.

9. The antenna element of claim 8, wherein the pin passes through a common hole arranged within the waveguide at the bottom of the cavity, the electrically conductive sleeve and the thin layer.

10. The antenna element of claim 8, wherein the pin is surrounded with an isolator layer.

11. The antenna element of claim 3, wherein the waveguide is a circular waveguide, and wherein the patch, the thin layer and the substrate all have ring shapes hollowed out in the ring centre to define a lumen.

12. The antenna element of claim 11, wherein the holder of the shield is inserted through the lumen in the centre of the layered structure formed by the patch, the thin layer and the substrate.

13. The antenna element of claim 2, wherein the holder has a tubular shape and includes a tapered portion and a uniform portion, said tapered portion is tapered with contraction from the front plate towards a uniform portion located at a bottom of the cavity;

14. The antenna element of claim 13, wherein the contraction of the holder extends from the front plate until the location of the printed-circuit antenna.

15. The antenna element of claim 1 further comprising a radome mounted on the top of the antenna element over the aperture.

16. The antenna element of claim 1, wherein the holder has a tubular shape and includes a tapered portion having a varied diameter, and a uniform portion having a uniform diameter.

17. The antenna element of claim 16, wherein the tapered portion is tapered with contraction from the front plate towards the uniform portion that is located at a bottom of the cavity.

18. A phased array antenna comprising:

a plurality of the antenna elements of claim 1 having waveguides arranged in a common conductive ground plane and spaced apart at a predetermined distance from each other; and

a beam steering system coupled to said a plurality of the antenna elements and configured for steering an energy beam produced by said phased array antenna.

19. The phased array antenna of claim 18, wherein the waveguides of said plurality of the antenna elements are arranged in a common conductive ground plane.

20. The phased array antenna of claim 18, wherein at least one waveguide of said plurality of the antenna elements is arranged in an individual conductive ground plane.