CLAIMS

1. An antenna system comprising,

a base member having a cavity defined on a surface thereof;

a tunable material layer disposed within the cavity of the base member;

a substantially planar substrate coupled to the base member such that a first side of the substrate is in contact with the tunable material layer; and

a radiator coupled to a second side of the substrate such that the substrate is between the radiator and the base member, said radiator comprising an array of grid cells configured to generate a beam upon excitation thereof, wherein adjacent grid cells are staggered, and each grid cell comprising two short sides, at least one of the short sides comprising a radiating element, and two long sides, at least one of the long sides comprising a shared feeding element;

wherein the tunable material layer comprises a tunable material capable of changing its dielectric constant in response to a variable biasing voltage applied between the radiator and the base member, such that one or more properties of the beam changes according to the dielectric constant of the tunable material.

2. The antenna system according to claim 1, wherein the radiator further comprises a plurality of feeding points, wherein each feeding point of the plurality of feeding points is configured to receive an excitation signal for generating the beam.

3. The antenna system according to claim 2, wherein the plurality of feeding points are arranged to be equally spaced apart along a first direction which is parallel to the substrate.

4. The antenna system according to claim 2, wherein the plurality of feeding points are arranged in a lattice configuration having a first direction and a second direction, wherein the second direction is substantially perpendicular to the first direction.

5. The antenna system according to any one of claims 1 to 4, wherein the base member is made of metal and the tunable material layer is a liquid crystal layer.

6. The antenna system according to any one of claims 1 to 5, further comprising a processing module configured to provide the biasing voltage.

7. The antenna system according to any one of claims 1 to 6, wherein the dielectric constant of the tunable material is configured to vary from 2.4 to 3.4 in response to the biasing voltage.

8. The antenna system according to any one of claims 1 to 6, wherein the biasing voltage is configured to vary from 0 V to 20 V.

9. The antenna system according to any one of claims 1 to 8, wherein the cavity has a depth falling in the range of from 0.2 mm to 0.5 mm at the Ka-band.

10. The antenna system according to any one of claims 1 to 9, wherein the one or more properties of the beam comprises a steering angle of the beam and a steering resolution of the beam.

11. The antenna system according to claim 10, wherein the steering angle of the beam is configured to range from -28° to 28° with respect to a vertical axis which is perpendicular to the substantially planar substrate.

12. The antenna system according to any one of claims 1 to 11, wherein the antenna system is substantially devoid of a phase shifter.

13. A method of forming an antenna system, the method comprising,

providing a base member having a cavity defined on a surface thereof;

disposing a tunable material layer within the cavity of the base member;

coupling a substantially planar substrate to the base member such that a first side of the substrate is in contact with the tunable material layer; and

coupling a radiator to a second side of the substrate such that the substrate is between the radiator and the base member, the radiator configured to generate a beam upon excitation thereof, said radiator comprising an array of grid cells, wherein adjacent grid cells are staggered, and each grid cell comprising two short sides, at least one of the short sides comprising a radiating element, and two long sides, at least one of the long sides comprising a shared feeding element;

wherein the tunable material layer comprises a tunable material capable of changing its dielectric constant in response to a variable biasing voltage applied between the radiator and the base member, such that one or more properties of the beam changes according to the dielectric constant of the tunable material.

14. The method according to claim 13, further comprising providing a plurality of feeding points to the radiator, wherein each feeding point of the plurality of feeding points is configured to receive an excitation signal for generating the beam.

15. The method according to claim 14, further comprising arranging the plurality of feeding points to be equally spaced apart along a first direction which is parallel to the substrate.

16. The method according to claim 14, further comprising arranging the plurality of feeding points in a lattice configuration having a first direction and a second direction, wherein the second direction is substantially perpendicular to the first direction.

17. The method according to any one of claims 13 to 16, wherein the base member is made of metal and the tunable material layer is a liquid crystal layer.

18. The method according to any one of claims 13 to 17, further comprising providing a processing module configured to provide the biasing voltage.

19. The method according to any one of claims 13 to 18, wherein the antenna system is substantially devoid of a phase shifter.

20. A method of operating an antenna system comprising,

a base member having a cavity defined on a surface thereof;

a tunable material layer disposed within the cavity of the base member, said tunable material layer comprising a tunable material capable of changing its dielectric constant in response to a variable biasing voltage;

a substantially planar substrate coupled to the base member such that a first side of the substrate is in contact with the tunable material layer; and

a radiator comprising an array of grid cells coupled to a second side of the substrate such that the substrate is between the radiator and the base member, wherein adjacent grid cells are staggered, and each grid cell comprising two short sides, at least one of the short sides comprising a radiating element, and two long sides, at least one of the long sides comprising a shared feeding element;

wherein the method comprises exciting the radiator to generate a beam; and

applying a variable biasing voltage between the radiator and the base member to change the dielectric constant of the tunable material, such that one or more properties of the beam changes according to the dielectric constant of the tunable material.