

Claims

1. A card-type information substrate, comprising

a substrate material made of plastic;

an electronic module embedded in said substrate material;

a frame formed around a perimeter of said substrate material, said frame imparting at least one of increased weight and superior appearance to said card-type information substrate;
and

an antenna positioned within an outline of said frame and operatively connected said electronic module to perform wireless communication.
2. The card-type information substrate of claim 1, further comprising an eddy current restriction component configured and arranged so as to restrict eddy currents in said frame.
3. The card-type information substrate of claims 1 or 2, wherein at least a portion of said frame is formed of a conductive material.
4. The card-type information substrate of claim 1, wherein said frame is formed of a non-conductive material.
5. The card-type information substrate of claims 2 or 3, wherein said eddy current restriction component comprises a slit formed in said frame.
6. The card-type information substrate of claims 2 or 3, wherein said eddy current restriction component comprises a resistive portion connected to said frame and having a lower specific conductivity compared to a conductivity of a base material of said frame.
7. The card-type information substrate of claim 6, wherein said resistive portion comprises a slit and a fill material of reduced conductivity.
8. The card-type information substrate of claim 6, wherein said resistive portion is provided as part of said frame.

9. The card-type information substrate of claims 7 or 8, wherein said frame in combination with said slit and said fill material forms a closed loop.
10. The card-type information substrate of any of claim 1 to 9, wherein said frame is at least partially conductive and has a total conductivity that corresponds to a conductivity of 50 S/m or less.
11. The card-type information substrate of claim 10, wherein said frame is made of a base material having a conductivity of 50 S/m or less.
12. The card-type information substrate of claim 10, wherein said frame is conductive and includes at least one portion of reduced conductivity so as to obtain said total conductivity.
13. The card-type information substrate of claim 12, wherein said at least one portion of reduced conductivity includes a region of reduced material thickness.
14. The card-type information substrate of any of the preceding claims, wherein said antenna is a planar antenna formed of metal traces formed on a carrier material.
15. The card-type information substrate of any of claims 1 to 13, wherein said antenna is formed of a wire embedded in a carrier material.
16. The card-type information substrate of any of the preceding claims, wherein said operative coupling between said electronic module and said antenna is established by a direct electrical connection between said antenna and said electronic module.
17. The card-type information substrate of any of the preceding claims, wherein said operative coupling between said electronic module and said antenna is established by inductive coupling between said antenna and said electronic module.
18. The card-type information substrate of any of the preceding claims, wherein said card-type information substrate has two opposing long sides and wherein said antenna is arranged symmetrically with respect to said two opposing long sides.
19. The card-type information substrate of claim 18, wherein a distance of said antenna from said two opposing long sides is at least 6 mm.

20. The card-type information substrate of any of the preceding claims, wherein said card-type information substrate is a payment card having standard dimensions.
21. A pre-form of a card-type information substrate, comprising
- a frame formed around a perimeter of a base material, said frame imparting increased weight to said pre-form;
- a metal containing plate provided within an outline of said frame and imparting increased weight to said pre-form; and
- an antenna positioned within said outline of said frame and configured to enable wireless communication.
22. The pre-form of claim 21, wherein said frame contains a metal material.
23. The pre-form of any of claims 21 or 22, further comprising a first disconnecting layer covering, at a first surface of said pre-form, said frame, said base material, said metal containing plate and said antenna.
24. The pre-form of claim 23, wherein said first disconnecting layer is attached by a first adhesive layer.
25. The pre-form of any of claims 23 or 24, further comprising a second disconnecting layer covering, at a second surface of said pre-form opposite to said first surface, said frame, said base material and said metal containing plate.
26. The pre-form of claim 25, wherein said second disconnecting layer is attached by a second adhesive layer.
27. The pre-form of any of claims 21 to 26, wherein at least a portion of said frame is formed of a conductive material, in particular stainless steel.
28. The pre-form of any of claims 21 to 26, wherein said frame is formed of a non-conductive material.

29. The pre-form of any of claims 21 to 27, further comprising an eddy current restriction component configured and arranged so as to restrict eddy currents in at least one of said frame and said metal containing plate.
30. The pre-form of claim 29, wherein said eddy current restriction component comprises one or more slits formed in at least one of said frame and said metal containing plate.
31. The pre-form of claim of any of claims 29 or 30, wherein said eddy current restriction component comprises a resistive portion connected to at least one of said frame and said metal containing plate and having a lower specific conductivity compared to a conductivity of a remaining material of said at least one of the frame and the metal containing plate.
32. The pre-form of claim 31, wherein said resistive portion comprises a slit and a fill material of reduced conductivity.
33. The pre-form of claim 31, wherein said resistive portion is provided as part of said at least one of the frame and the metal containing plate.
34. The pre-form of any of claims 21 to 33, wherein said frame forms a closed loop.
35. The pre-form of any of claims 21 to 34, wherein said metal containing plate is a continuous single piece of material.
36. The pre-form of any of claims 21 to 34, wherein said metal containing plate comprises two or more metal containing plates.
37. The pre-form of any of claims 21 to 27, or 29 to 36, wherein at least one of said frame and said metal containing plate is conductive and includes at least one portion of reduced conductivity.
38. The pre-form of claim 37, wherein said at least one portion of reduced conductivity includes a region of reduced material thickness.
39. The pre-form of any of claims 21 to 38, wherein said metal containing plate contains tungsten.
40. A card-type information substrate, comprising

a substrate material made of plastic;

an electronic module provided in said substrate material; and

a pre-form according to any of claims 21 to 39 attached to said substrate material, wherein said antenna of said pre-form is operatively connected to said electronic module to perform wireless communication.

41. A method of forming a card-type information substrate that comprises a frame, an antenna for wireless communication and an electronic module operatively connected to said antenna, the method comprising

determining at least one metric that represents a desired radio frequency performance of said antenna; and

selecting at least one of a total conductivity of said frame, a position of said antenna within an outline of said frame and a performance of said electronic module on the basis of said at least one metric so as to achieve said desired radio frequency performance.

42. The method of claim 41, wherein selecting at least one of a total conductivity of said conductive frame, a position of said antenna within an outline of said frame and a performance of said electronic module comprises: forming at least one slit in said frame.

43. The method of claims 41 or 42, further comprising selecting, on the basis of said at least one metric, at least one of a conductivity of a base material of said frame and a conductivity of a fill material to be formed within a slit that is formed in said frame.

44. The method of any of claims 41 to 43, further comprising selecting at least one of a size and a shape of a metal containing plate to be provided with the outline of said frame so as to achieve said desired radio frequency performance.