

What is Claimed:

1. A transaction device comprising:
 - a metal layer having a front surface, a back surface, a periphery, an opening in the metal layer, and one or more discontinuities in the metal layer, each discontinuity
 - 5 comprising a gap in the metal layer extending from the front surface to the back surface, including at least one discontinuity that defines a path from the device periphery to the opening;
 - a transponder chip module disposed in the opening in the metal layer; and
 - a booster antenna in communication with the transponder chip module, the
 - 10 transponder chip module and the booster antenna comprising components in a circuit configured for wireless communication with a device reader, wherein the metal layer is neither part of the booster antenna nor a component in the circuit.
2. The device of claim 1, comprising at least two body discontinuities defining respective paths from the device periphery to the opening, wherein the at least
- 15 two body discontinuities and the opening collectively bisect the device body into at least two discrete portions.
3. The device of claims 1 or 2, further comprising a non-metal molding material in the one or more discontinuities in the metal layer.
4. The device of claim 3, wherein the non-metal molding material comprises
- 20 an adhesive or an epoxy.
5. The device of claim 3, further comprising a reinforcing layer disposed over the metal layer.
6. The device of claim 5, wherein the reinforcing layer comprises fiberglass.
7. The device of claim 6, wherein the reinforcing layer comprises a fiber-
- 25 reinforced epoxy laminate material.
8. The device of claim 6, comprising a fiber-reinforced epoxy laminate material layer disposed on at least one of the front surface and the back surface of the metal layer.
9. The device of claim 8, wherein the metal layer is sandwiched between
- 30 opposite fiber-reinforced epoxy laminate material layers.
10. The device of any one of claims 1-9, comprising at least one discontinuity in the metal layer extending from the device periphery to a location other than in the opening.
11. The device of any one of claims 1-10, wherein at least two of the
- 35 plurality of discontinuities in the metal layer intersect with one another.
12. The device of claim 11, wherein the intersecting discontinuities comprise a first discontinuity defining a path from the device periphery to the opening and a

second discontinuity extending from an intersection with the first discontinuity to an endpoint that is neither in the opening nor at the periphery.

13. The device of any one of claims 1-12, wherein the booster antenna comprises a booster antenna layer comprising a plurality of metallizations.

5 14. The device of claim 13, each of the plurality of metallizations is electrically isolated from the metal layer.

15. The device of any one of claims 1-14, comprising a magnetic stripe disposed on a back layer of the device.

10 16. The device of any one of claims 1-15, comprising a first fiber-reinforced epoxy laminate material layer over a top surface of the metal layer, but not over the transponder chip module in the opening.

17. The device of claim 16, comprising a second fiber-reinforced epoxy laminate material layer over a bottom surface of the metal layer, including over the opening and over the booster antenna.

15 18. The device of claim 17, further comprising a magnetic stripe disposed over the booster antenna.

19. The device of any one of claims 1-18, wherein the device comprises a transaction card conforming to at least one of CR80 or ISO/IEC 7810:2003 standards.

20 20. The device of any one of claims 1-18, further comprising a hole extending between a top surface and a bottom surface of the device, the hole sized to receive a ring member configured for holding one or more keys.

21. The device of claim 20, wherein the device comprises a component of a key ring or key chain, further comprising the ring member disposed in the hole.

25 22. The device of any one of claims 1-21, wherein the transponder chip module comprises a dual interface module.

23. The device of any one of claims 1-22, further comprising a layer of RF-friendly metal foil layer disposed over the metal layer.

24. The device of claim 9, further comprising a layer of RF-friendly metal foil layer disposed over one of the fiber-reinforced epoxy laminate material layers.

30 25. The device of claim 24, further comprising the booster antenna layer disposed over the other of the fiber-reinforced epoxy laminate material layers or disposed between the metal layer and the other of the fiber-reinforced epoxy laminate material layers.

35 26. The device of claim 25, further comprising ink on at least one of the outer surfaces of the device.

27. A transaction device comprising:

a metal layer having a front surface, a back surface, a periphery, and one or more discontinuities in the metal layer, each discontinuity comprising a gap in the metal layer extending from the front surface to the back surface, including at least one discontinuity extending to the periphery of the metal layer;

5 a first non-metal, reinforcing layer disposed over the front surface of the metal layer;

 a booster antenna disposed over the back surface of the metal layer, the booster antenna comprising a plurality of metallizations isolated from the metal layer;

 a second non-metal, reinforcing layer disposed over the back surface of the
10 metal layer;

 an opening in the metal layer extending through the first non-metal, reinforcing layer;

 a transponder chip module disposed in the opening, the transponder chip module in communication with the booster antenna and together with the booster
15 antenna comprising a payment circuit configured for wireless communication with a device reader.

28. The transaction device of claim 27, wherein at least a first one of the discontinuities extends from the periphery to the opening in the metal layer.

29. The transaction device of claim 28, wherein at least second one of the
20 discontinuities extends from the periphery to an endpoint not in the opening in the metal layer.

30. The transaction device of claim 29, wherein at least a third one of the discontinuities extends from an intersection with the first discontinuity to and endpoint that is neither in the opening nor at the periphery.

25 31. The transaction device of any one of claims 27 - 30, wherein the metal layer is electrically isolated from the payment circuit.

32. The transaction device of any one of claims 27 - 30, wherein the metal layer is part of the payment circuit.

33. The transaction card of any one of claims 27 - 30, wherein the first non-
30 metal layer and the second non-metal layer each comprise fiber-reinforced epoxy laminate material.

34. A transaction device comprising:

 a metal layer having a front surface, a back surface, and a periphery;

 an opening in the metal layer extending from the metal layer to a top surface of
35 the device;

 one or more discontinuities in the metal layer, each discontinuity comprising a gap in the metal layer extending from the front surface to the back surface, including

at least one discontinuity extending between the periphery of the metal layer and the opening in the metal layer;

a back fiber-reinforced epoxy laminate material layer disposed over the back surface of the metal layer;

5 a booster antenna;

a transponder chip module disposed in the opening and having a top surface accessible from the top surface of the device, the transponder chip module in communication with the booster antenna and together with the booster antenna comprising a payment circuit configured for wireless communication with a device

10 reader.

35. The device of claim 34, wherein the booster antenna comprises the metal layer.

36. The device of claim 34, comprising a booster antenna separate from the metal layer, wherein the metal layer is isolated from the payment circuit.

15 37. The device of any one of claims 34 - 36, further comprising a front fiber-reinforced epoxy laminate material layer disposed over the front side of the metal layer.

38. The device of claim 37, wherein the front and back fiber-reinforced epoxy laminate material layers are each bonded directly to the metal layer by the epoxy of
20 the front and back fiber-reinforced epoxy laminate material layers.

39. The device of any one of claims 34-38, wherein the metal layer is isolated from the payment circuit and the booster antenna and comprises a plurality of metallizations on or embedded in the back fiber-reinforced epoxy laminate material layer.

25 40. The device of claim 39, wherein the plurality of metallizations are disposed on a back surface of the back fiber-reinforced epoxy laminate material layer and the device includes a non-metal layer disposed over the plurality of metallizations.

41. The device of claim 37, wherein the respective fiber-reinforced epoxy laminate material layers disposed over the front side and back side of the metal layer
30 are discrete layers that are bonded to the metal layer by an adhesive other than the epoxy of the fiber-reinforced epoxy laminate material layers.

42. The device of claim 41, wherein the metal layer is electrically isolated from the payment circuit and the booster antenna comprises a plurality of metallizations on or embedded in the back fiber-reinforced epoxy laminate material
35 layer.

43. The device of claim 42, wherein at least a portion of the plurality of metallizations are disposed on a back surface of the back fiber-reinforced epoxy

lamine material layer and the device includes a non-metal layer disposed over the plurality of metallizations.

44. The device of claim 42, wherein at least a portion of the plurality of metallizations are disposed on a front surface of the back fiber-reinforced epoxy laminate material layer and separated from the metal layer by a non-metal layer disposed between the fiber-reinforced epoxy laminate material layer and the metal layer.

45. The device of claim 44, wherein the non-metal layer comprises a substrate of an adhesive layer.

46. A process for manufacturing a transaction device, the process comprising steps of:

(a) providing a metal layer having a front surface, a back surface, and a periphery;

(b) forming one or more discontinuities in the metal layer, each discontinuity comprising a gap in the metal layer extending from the front surface to the back surface, including at least one discontinuity extending to the periphery of the metal layer;

(c) disposing a booster antenna over the back surface of the metal layer, the booster antenna comprising a plurality of metallizations;

(d) disposing a first fiberglass layer over the front surface of the metal layer;

(e) disposing a second fiberglass layer over the back surface of the metal layer;

(f) forming an opening in the metal layer extending through the first fiberglass layer to a top surface of the device;

(h) disposing a transponder chip module in the opening.

47. The process of claim 46, comprising configuring the transponder chip module to be in electrical communication with the booster antenna to together form a portion of a payment circuit configured for wireless communication with a device reader.

48. The process of claim 46, including disposing the booster antenna layer over the back surface of the metal layer with the metallizations electrically isolated from the metal layer, and configuring the device with the metal layer not included in the payment circuit.

49. The process of claim 46, wherein the step of disposing the booster antenna over the back surface of the metal layer comprises forming the plurality of metallizations on or embedded in the second fiberglass layer.

50. The process of claim 49, further comprising disposing an additional non-metal layer over the metallizations.

51. The process of any one of claims 46-50, wherein the steps of disposing the first and second fiberglass layers over the front and back surfaces of the metal
5 layer comprise casting the first and second fiberglass layers with epoxy to form first and second fiber-reinforced epoxy laminate material layers bonded directly to the metal layer.

52. The process of any one of claims 46-50, wherein the steps of disposing the first and second fiberglass layers over the front and back surfaces of the metal
10 layer comprise attaching a first cured fiber-reinforced epoxy laminate material layer to the front surface of the metal layer with a first adhesive layer and attaching a second cured fiber-reinforced epoxy laminate material layer to the back surface of the metal layer with a second adhesive layer.

53. The process of claim 52, further comprising forming the booster antenna
15 over the back surface of the metal layer by forming a plurality of metallizations on or embedded in the second cured fiber-reinforced epoxy laminate material layer.

54. The process of claim 52, wherein forming the plurality of metallizations comprises embedding wire in the second cured fiber-reinforced epoxy laminate material.

55. The process of claim 52, wherein forming the plurality of metallizations
20 comprises printing metallized ink on a surface of the second cured fiber-reinforced epoxy laminate material.

56. The process of claim 52, wherein forming the plurality of metallizations comprises disposing a metal layer over the second cured fiber-reinforced epoxy
25 laminate material layer, and etching away a portion of the metal layer to leave the metallizations.

57. The process of claims 55 or 56, comprising forming the plurality of metallizations on an inside surface of the second cured fiber-reinforced epoxy laminate material layer facing the metal layer.

58. The process of claim 57, wherein the second adhesive layer includes a
30 non-metal substrate layer.

59. The process of claims 55 or 56, comprising forming the plurality of metallizations on an outside surface of the second cured fiber-reinforced epoxy laminate material layer facing away from the metal layer.

60. The process of claim 59, comprising disposing a non-metal layer over the
35 outside surface of the second cured fiber-reinforced epoxy laminate material and the plurality of metallizations disposed thereon.

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61. The process of any one of claims 46-60, wherein the opening in the metal layer is created in the same step as the discontinuities in the metal layer.

62. A process for manufacturing a transaction device, the process comprising steps of:

- 5 (a) providing a premade laminate comprising
a metal layer having a front surface, a back surface, and a periphery;
a first cured fiber-reinforced epoxy laminate layer bonded to the front
surface of the metal layer;
a second cured fiber-reinforced epoxy laminate layer bonded to the back
10 surface of the metal layer;
- (b) forming one or more discontinuities in the metal layer of the premade laminate, each discontinuity comprising a gap in the metal layer extending from the front surface to the back surface, including at least one discontinuity extending to the periphery of the metal layer, each of the one or more discontinuities also extending
15 through at least one of the first cured fiber-reinforced epoxy laminate layer or the second cured fiber-reinforced epoxy laminate layer;
- (c) disposing a booster antenna over an outer surface of one of the first cured fiber-reinforced epoxy laminate layer or the second cured fiber-reinforced epoxy laminate layer, the booster antenna comprising a plurality of metallizations;
- 20 (d) forming an opening in the metal layer extending through the first fiberglass layer to a top surface of the device;
- (h) disposing a transponder chip module in the opening.
63. The process of claim 62, further comprising forming the booster antenna by forming a plurality of metallizations on the outer surface of or embedded within one
25 of the first cured fiber-reinforced epoxy laminate layer or the second cured fiber-reinforced epoxy laminate layer.
64. The process of claim 62, wherein forming the plurality of metallizations comprises disposing a metal layer on the outside surface of the respective cured fiber-reinforced epoxy laminate material layer, and etching away a portion of the metal layer
30 to leave the metallizations.
65. The process of claim 62, comprising disposing a non-metal layer over the outside surface of the respective cured fiber-reinforced epoxy laminate material and the plurality of metallizations disposed thereon.
66. The process of claim 62, wherein forming the plurality of metallizations
35 comprises embedding wire in the respective first or second cured fiber-reinforced epoxy laminate layer.