What is Claimed:

1. A card having a card length, a card width, and a card thickness, the card comprising:

a metal layer having a top surface and a bottom surface extending parallel to each other;

an opening in said metal layer (a) extending from said top surface to said bottom surface or (b) defined by a first cut out region in said top surface of said metal layer and a second cut out region extending from said bottom surface of said metal layer and extending vertically below the first cut out region and generally in a symmetrical manner with respect to the first cut out region;

an integrated circuit (IC) module having a depth D1, a first area, and a first perimeter disposed within the opening or the first cut out region, the IC module having contacts positioned along the top surface of the metal layer and configured to communicate using RF transmission to enable contactless operation;

a plug comprising non-RF-impeding material disposed within said opening or said second cut out region, the plug having a second area and a second perimeter which are equal to or greater than the first area and the first perimeter, respectively;

a ferrite layer disposed below the metal layer;

a vertical hole in the plug and extending through the ferrite layer, the vertical hole having a third area and a third perimeter less than the first area and the first perimeter, respectively; and

a booster antenna attached to the ferrite layer and physically connected to the IC module for enhancing RF transmission with the IC module.

2. The card of claim 1, wherein the first cut out region has dimensions nominally equal to, but slightly greater than D1, the first area, and the first perimeter, to facilitate a snug fit of the IC module disposed within the first cut out region, the second cut out region having a second area and second perimeter that are greater than the first area and first perimeter, respectively, extending vertically until a distance D1 from the top surface, with the plug disposed within the second cut out region.

3. The card of claim 1, wherein said metal layer has a thickness D greater than D1, and the opening in said metal layer extends for a full thickness of said metal layer in which is located said IC module mounted on said plug, said IC module and said plug extending between the top and bottom surfaces of the metal layer.

4. The card of claim 3, wherein the second area and the second perimeter of the opening in the metal layer are respectively greater than the first area

and the first perimeter, respectively, and the plug is attached to the metal layer and fills the opening within the metal layer, and wherein the plug has a first cut out region having an area and a perimeter nominally equal to but slightly greater than the first area and the first perimeter, respectively, extending for a depth nominally equal to but slightly greater than D1 below the top surface for accommodating the IC module with a snug fit, and a second region below the first region which extends until the bottom surface of the metal layer.

5. The card of claim 4, further comprising a masking layer disposed over the top metal surface and any exposed portion of the plug.

6. A method of making the card of claim 1, the method comprising the steps of:

selecting the metal layer;

cutting out the second cut out region in said metal layer starting from said bottom surface of said metal layer;

securely attaching the plug within said second cut out region, said plug designed to fit in and fill the second cut out region;

cutting out the first cut out region in said top surface of said metal layer overlying said second cut out region, said first cut out region disposed symmetrically with respect to the second cut out region;

inserting and securely attaching said IC module within said first cut out region with the contacts of the IC module positioned along the same horizontal plane as the top surface of the metal layer;

attaching the ferrite layer to the bottom surface of the metal layer;

attaching said booster antenna layer to the ferrite layer;

physically connecting the booster antenna to the IC module;

forming the vertical hole in the plug and said ferrite layer.

7. The method of claim 6, further comprising laminating the metal layer, the ferrite layer and the booster antenna layer.

8. A method for making the card of claim 3, the method comprising the steps of:

selecting the metal layer;

forming the opening;

securely attaching the plug within said opening; and

inserting said IC module within and securely attaching said IC module within said plug first cut out region;

attaching the ferrite layer to the bottom surface of the metal layer;

attaching said booster antenna layer to the ferrite layer; and

forming the vertical hole in the plug and said ferrite layer.

9. The method of claim 8, further comprising forming a masking layer formed over the top metal surface and any exposed portion of the plug.

10. The method of claim 8, further comprising laminating the metal layer, the ferrite layer and the booster antenna layer.

11. A metal smart card with dual interface capability comprising:

a metal layer of thickness D having a top surface and a bottom surface extending parallel to each other, the top surface defining a horizontal plane;

an integrated circuit (IC) module having a top region with contacts configured for physical contact with a card reader, said IC module also configured for contactless radio frequency (RF) communication with a card reader, said IC module having a first periphery, a first area, and a thickness D1, wherein D1 is less than D;

a plug of non-RF-impeding material having a second periphery and a second area which are equal to or greater than the first periphery and a first area, respectively;

an opening in said metal layer extending for a full thickness of said metal layer, said IC module mounted on said plug disposed in said opening, said IC module and said plug extending in the vertical direction between the top and bottom surfaces of the metal layer, with the contacts of the IC module positioned along the same horizontal plane as the top surface of the metal layer, the opening in the metal layer having a first region at and just below the top surface for accommodating the IC module and a second region below the first region which extends until the bottom surface of the metal layer, the opening in the first region having lateral dimensions nominally equal to but slightly greater than the first area and the first periphery for a depth nominally equal to but slightly greater than D1 and the second region having a second area and a second periphery for a depth of a remaining thickness of the card beneath the first region, wherein the IC module fits in and fills the opening in the first region and the plug fits in and fills the opening in the second region, wherein the second area and the second periphery are respectively greater than the first area and the first periphery; and

a masking layer disposed over the top metal surface and any exposed portion of the plug;

a ferrite layer disposed below the metal layer;

a vertical hole formed in the plug and through the ferrite layer, the vertical hole having a third area and a third periphery less than the first area and the first periphery, respectively; and

a booster antenna attached to the ferrite layer and physically connected to the IC module for enhancing RF transmission with the IC module.

12. A card comprising:

a metal layer having a top surface and a bottom surface extending parallel to each other;

a first region cut out in said top surface of said metal layer, said first region having a first depth, a first perimeter and a first area;

an integrated circuit (IC) module snugly secured within the first cut out region, said IC module having contacts positioned along the top surface of the metal layer and configured to communicate using RF transmission to enable contactless operation;

a second cut out region extending from said bottom surface of said metal layer until the first depth from the top surface, said second cut out region extending vertically below the first cut out region and generally in a symmetrical manner with respect to the first cut out region, said second cut out region having a second area and a second perimeter greater than the first area and the second perimeter; and

a plug formed of non RF impeding material snugly secured within said second cut out region;

a ferrite layer disposed below the metal layer;

a vertical hole formed in the plug and through the ferrite layer, the vertical hole having a third area and a third periphery less than the first area and the first periphery, respectively; and

a booster antenna attached to the ferrite layer and physically connected to the IC module for enhancing RF transmission with the IC module.

13. A card, the card comprising:

a metal layer having a top surface and a bottom surface extending parallel to each other, and a thickness extending between the top surface and the bottom surface;

a ferrite layer disposed below the metal layer;

a booster antenna disposed below the ferrite layer for enhancing RF transmission with the IC module

an opening in said metal layer and the ferrite layer extending to the booster antenna layer;

an integrated circuit (IC) module having a first area, a first perimeter, and a first depth that is less than the thickness of the metal layer, the IC module disposed within the opening and having contacts positioned along the top surface of the metal layer and configured to communicate using RF transmission to enable contactless operation; and

a physical electrical connection between the booster antenna and the IC module extending through the opening.

14. The card of claim 13, further comprising a non-conductive liner in the opening in the metal layer.

15. The card of claim 14, wherein the non-conductive liner comprises a plug of non-conductive material, wherein the plug has a second area and a second perimeter greater than the first area and the first perimeter, respectively.

16. The card of claim 15, wherein the plug has the second area and the second perimeter for a depth that extends for a full thickness of the metal layer and further comprises a cut out region in the plug nominally equal to but slightly greater than the first area, the first perimeter, and the first depth for receiving the IC module in the cut-out region, the plug further having a through-hole extending from the cut-out region for a remaining depth of the plug and connecting to the opening in the ferrite layer, the through-hole in the plug and the opening in the ferrite layer having a third area and a third perimeter less than the first area and the first perimeter, respectively.

17. The card of claim 15, wherein the opening is a stepped opening having a first region nominally equal to but slightly greater than the first area, the first perimeter, and the first depth so as to fit the IC module snugly therein, and a second region having the second area and the second perimeter for a depth that extends from the bottom surface of the metal layer for a distance less than a full thickness of the metal layer, wherein the plug is disposed only in the second region, the plug having a through-hole connecting to the opening in the ferrite layer, the through-hole in the plug and the opening in the ferrite layer having a third area and a third perimeter less than the first area and the first perimeter, respectively.

18. The card of claim 13, wherein the opening has an area and a perimeter that is nominally equal to but slightly greater than the first area and the second area, and the physical electrical connection between the booster antenna and the IC module comprises a connection module disposed between the booster antenna and the IC module.

19. The card of claim 18, wherein the booster antenna has first and second connection nodes and the IC module has third and fourth connection nodes, and the connection module has mating first and second connection nodes on a first surface thereof and third and fourth connection nodes on a second surface thereof, a first conductive trace connecting the first and third nodes and a second conductive trace connecting the second and fourth nodes.

20. A method of making the card of claim 13, the method comprising the steps of:

selecting the metal layer;

attaching the ferrite layer beneath the metal layer;

attaching said booster antenna layer beneath the ferrite layer;

forming the opening in the metal layer extending through the ferrite layer to the booster antenna; and

inserting and securely attaching said IC module in the opening with the contacts of the IC module positioned along the same horizontal plane as the top surface of the metal layer and the IC module physically connected to the booster antenna layer.

21. The method of claim 20, wherein the method comprises first forming the opening in the metal layer and disposing a plug in at least a portion of the opening in the metal layer, at least a portion of the plug having a second area and a second perimeter greater than the first area and the first perimeter, respectively, and creating a through-hole in the plug and the opening in the ferrite layer, the through-hole in the plug and the opening in the ferrite layer having a third area and a third perimeter less than the first area and the first perimeter, respectively.

22. The method of claim 21, wherein the method comprises first forming a bottom portion of the opening in the metal layer for less than a full thickness of the metal layer, the bottom portion having the second area and a second perimeter, and disposing the plug in the bottom portion of the metal layer, then creating through-hole in the plug and the opening in the ferrite layer, the through-hole in the plug and the opening in the ferrite layer having a third area and a third perimeter less than the first area and the first perimeter, respectively.

23. The method of claim 20, wherein the method comprises first laminating the metal layer, the ferrite layer beneath the metal layer, and the booster antenna layer together, then forming the opening in the metal layer extending through the ferrite layer to the booster antenna, wherein the opening has an area and a perimeter nominally equal to but slightly greater than the first area and the first perimeter, respectively.

24. The method of claim 23, further comprising disposing a liner in the opening prior to inserting and securely attaching said IC module in the opening and connecting the IC module to the booster antenna layer.

25. The method of claim 23, wherein the booster antenna layer has a plurality of connection nodes and the IC module has a plurality of connection nodes, further comprising disposing a connector in the opening prior to inserting the IC module in the opening, the connector having mating nodes for connecting to the booster antenna connection nodes and the IC module connection nodes.

26. The card of claim 16, further comprising a masking layer disposed over the top metal surface and any exposed portion of the plug.

27. The method of claim 24, wherein the liner is a non-conductive liner comprising a plug of non-conductive material, wherein the plug has a second area and a second perimeter greater than the first area and the first perimeter, the method comprising forming a masking layer over the top metal surface and any exposed portion of the plug.

28. The card of claim 1, further comprising a liner for facilitating the physical connection between the booster antenna and the IC module.

29. The card of claim 28, wherein the liner comprises non-conductive material and has a length extending from said top surface of metal layer to said bottom surface of metal layer.

30. The card of claim 28, wherein the liner comprises non-conductive material and has a length extending from the booster antenna until the depth D1 from the top surface.

31. The method of claim 6, further comprising a step of disposing a nonconductive liner within the first cut out region and the second cut out region, prior to the step of inserting and securely attaching said IC module and the step of physically connecting the booster antenna to the IC module.

32. The card of claim 11, further comprising a non-conductive liner extending from the booster antenna until depth D1 from the top surface, for facilitating the physical connection between the booster antenna and the IC module.

33. The card of claim 12, further comprising a non-conductive liner extending from the booster antenna until the first depth from the top surface, for facilitating the physical connection between the booster antenna and the IC module.