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**Smart card blank with at least one interface for
contactless transmission of information**

Description

10 The invention relates to a smart card blank having at least one interface for a contactless transmission of information, comprising a support body with a recess into which an electronic component such as a microchip can be inserted, an antenna provided in the support body which is electrically connected with an electronic component being received in the recess, the antenna having at least one contact
15 element for establishing an electrically conducting connection with said electronic component, which is arranged in a first plane of the support body of the smart card blank, which is interspaced from a second plane being defined by the electronic component, so that between the electronic component and the contact element a difference in height is given, as well as a smart card using said smart card
20 blank and method for its production.

Such a smart card is widely used. It has often a support body of the size of a cheque card, which is provided with a recess, in which a microchip is inserted. This microchip comprises, for providing a first interface, a contact-bound contact
25 element or is connected with such a contact element of the smart card, so that by means of a mechanical contact between said contact element and a corresponding contact element of a peripheral device cooperating with said smart card an electrically conducting contact between the microchip of the smart card and, e. g. a card reader of a peripheral device, e. g. a terminal, an automatic vending machine or an automatic transaction machine or the like, using said smart card can
30 be established and the peripheral device can access the data, information and/or programs, in particular software applications, being stored on the microchip.

Modern smart cards furthermore comprise, as a second interface, an antenna being electrically conductive connected with the microchip, which serves for provid-

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5 ing a contactless connection between the peripheral device using said smart card and the microchip, e. g. by means of a RFID- or NFC-technique.

For that purpose the microchip being received in the recess of the card body has got to be connected with connecting elements of the antenna. In general the antenna is arranged in a first plane of the support body and is surrounding the recess receiving the microchip, which lies below a second plane being defined by the microchip. Therefore, a difference in height between the microchip and the connecting elements of the antenna is given, which must be bridged by an electrically conductive connection.

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Up to now such a connection is formed in such that an electrically conductive adhesive is used for establishing a connection between the microchip and the connecting elements of the antenna. The manufacturer of the final smart cards obtains a smart card blank in which it then inserts the microchip having the respective data and/or programs. For the completion of a smart card it not only has got to insert said chip in the recess of the card body of the smart card blank and to connect it with a conductive frame, usually called lead frame, bearing the microchip, but even has got to apply in a further process step before or together with the insertion of the microchip in the recess the electrically conductive adhesive in order to form the afore-described electrically conducting connection between the microchip and the antenna being provided in the smart card blank.

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It is the object of the present invention to further develop a smart card blank of the kind mentioned at the beginning as well as a method for its manufacturing in such that the production of a functioning smart card is simplified.

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This object is solved by the invention in that in the smart card blank at least one connector element is provided, which extends between the first plane being defined by the one or the connecting elements of the antenna and a second plane being defined by the electronic component, wherein at least one connector ele-

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5 ment has got a heights which corresponds essentially to the difference in heights between the afore-mentioned planes.

The inventive method provides that by means of a connector element being arranged in the support body of the smart card blank a difference in heights be-
10 tween a first plane being defined by a connecting element of the antenna and a second plane being defined by the electronic component is bridged.

By virtue of the inventive measurements in an advantageous way a smart card blank for a smart card as well as a method for its production are achieved, which
15 are characterized in that the mounting of the electronic component to be inserted in the smart card blank is simplified, since for connecting said electronic component with the antenna being arranged in the support body of the smart card no external connecting means like an electrically conducting adhesive or the like needs to be applied. Since the contactor element being provided according to the
20 invention in the smart card blank is used for bridging the difference in heights between the antenna and the electronic component has got the advantage that the connecting of the electronic component being inserted in the smart card blank, in particular a microchip, with the antenna is easy to achieve.

25 An advantageous further development of the invention provides that the inventive connector element is formed as a tongue or tongue-like and comprises an area protruding from a base body of said connector element, the height of which is essentially equal to the difference in height between the first plane, which is defined by the one or the connecting elements of the antenna, and the second plane,
30 which is defined by the electronic component. This protrusion can, in particular, be formed by bending and/or stamping of the connector element or by providing a wave-shaped or a ball-shaped structure. Such a measure effects that the inventive connecting element is easy and simple to manufacture.

5 A further advantageous development of the invention provides that one or at least one of the connector elements is part of an antenna frame, which is provided in the inventive smart card blank. In this way once more a simple manufacturing can be achieved.

10 A further advantageous development of the invention provides that the antenna frame and a lead frame bearing the electronic component are mechanically connected with each other. Such a measure has got the advantage that in this way the antenna frame and the lead frame can be simultaneously inserted into the support body of the smart card blank in a simple way.

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A further advantageous development of the invention provides that the smart card blank is provided with a further interface, by which a contact-bound contacting of the electronic device can be achieved. Such a measure has got the advantage that in this way a dual contacting of the electronic component is provided, so that
20 the smart card using the inventive smart card blank can communicate contact-bound as well as contactless with a peripheral device using said smart card.

Further advantageous embodiments of the invention are the subject matter of the dependent claims.

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Further details and advantages of the invention are disclosed in the exemplary embodiment, which is described in the following by means of the figures. It shows:

Figure 1 a schematic representation of a smart card,

30 Figure 2 a systematic representation of a smart card blank, whereby its cover face is shown transparent,

Figure 3 an enlarged representation of a recess of the support body of the support body of the smart card blank,

Figure 4 an enlarged representation of a partial area IV of figure 3,

- 5 Figure 5 a cross section (in part) through the preferred embodiment,
Figure 6 an extract of the cross section of figure 5,
Figure 7 a representation of a connecting element,
Figures 8-11 a schematic representation of the manufacturing of a support
structure for an electronic component from an antenna frame and
10 a lead frame.

In figure 1 an exemplary embodiment of a smart card generally designated with 1 is shown. The smart card exhibits a smart card blank 1', which has a recess 3, in which in a manner known per se and hence not described an electronic component 10', e. g. a microchip 10, is received. The electronic component 10' is born
15 by a lead frame 40 (see figure 2), which is electrically conductive connected with it.

The smart card blank 1' comprises, in a manner known per se and hence not described, a support body 2, in which the recess 3 is provided, in which the electronic component 10' only schematically shown in figure 1, as, e. g. the microchip 10 shown in this figure, is inserted. This electronic component 10' has on its first surface 11a a number of contact elements 12. They serve for establishing an electrically conductive connection between a peripheral device using the described
25 smart card 1, e. g. a card reader or a terminal or a dispensing device like an automatic vending machine or an automatic transaction machine, and the microchip 10 of the smart card 1, by which, by means of a mechanical contact between the contact elements 12 of the microchip 10 and corresponding contact elements of the peripheral device, a mechanical contact is established. Via these contact elements 12 of the microchip 10 it is possible for the peripheral device to access information like data and/or programs stored in the microchip 10. The contact elements 12 therefore form a first, contact-bound interface for an exchange of information between the electronic component 10', here the microchip 10, and the pe-
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5 peripheral device. For the sake of a more concise description the expression "information" is to comprise data as well as programs, in particular application programs, which are implemented or stored in the electronic component 10', in particular the microchip 10. Furthermore, in the following the expression microchip 10 is used instead of electronic component 10', but it is understood that the microchip
10 10 serves only as an example for an electronic component 10'. Such a design of a smart card 1 as well as its manufacturing from a smart card blank 1 by inserting an electronic component 10' in the recess 3 and an appropriate contacting of the electronic component 10' with the lead frame 40 is known and hence needs not to be described any further.

15 Figure 2 now shows the smart card blank of figure 1, whereby in the representation of figure 2 the surface of the smart card blank 1' is shown in a transparent way, so that its general internal structure can be seen from said figure. Not shown is the microchip 10 which can be seen in figure 1, so that figure 2 shows the lead
20 frame 40 being arranged below and supporting the microchip 10.

In order to achieve a contactless contacting of the smart card 1 too, in the support body 2 of the smart card blank 1' an antenna 20 is arranged, which is in an electrically conducting contact with the microchip 10 being inserted in the recess 3, so
25 that an appropriately equipped peripheral device can access via said second interface of the smart card 1 the microchip 10 by means of an appropriate technique, e. g. a RFID-technique or a NFC-technique. The antenna 20 comprises antenna bonds 21, which lead to the recess 3 and run, at least in a certain area, under it. Such a smart card blank 1 as well as a smart card 1 with a dual interface
30 using it are known and consequently need not to be described in detail.

Figure 3 now shows the area of the recess 3 of the smart card 1 of figure 2 in an enlarged representation and figure 4 shows an enlarged representation of area II of figure 3, but without the microchip 10 shown in figure 1 and the lead frame 40
35 carrying it, whereby, for the sake of an more clear representation the antenna 20

5 is not shown outside of the area of the recess 3. One sees the antenna frame 30 being arranged, in the mounted state, below the lead frame 40, the antenna frame 30 serving – as described – for electrically contacting of the microchip 10, in general the electronic component 10', with the antenna 20. Furthermore, one sees in figure 3, that a bottom 3' of the recess 3 has got two through openings 3a and 3b,
10 under which bonds 21 of the antenna 20 are provided. This can be particularly seen from figure 4. The bonds 21 arranged under the through openings 3a and 3b of the recess 3 of the support body 2 form connecting elements 22a, 22b of the antenna 20, by which the antenna 20 – as described below – can be electrically connected with the microchip 10 which is inserted (later) in the recess 3. Further-
15 more, one can see from figures 3 and 4 that the bonds 21 of the antenna 20 are impacted by connector elements 31a, 31b of the antenna frame 30, which is in electrically conducting contact with the microchip 10.

Figure 5 now shows – in part – a cross section through the preferred embodiment and figure 6 is an enlarged representation of area VI of figure 5. One can see the
20 support body 2 of the smart card blank 1 as well as the antenna frame 30 and the lead frame 40. Furthermore the bonds 21 of the antenna 20, which lie in a first plane, an "antenna plane", of the support body 2 are shown. In general all bonds 21 of the antenna 20 lie in said first plane, but this is not mandatory. It is sufficient
25 that those areas of the bonds 21, which form connecting elements 22a and 22b, lie under the opening 3a and 3b of the recess 3, i. e. lie in said first plane.

In particular figure 6 shows that said first plane is spaced distant from a second plane of the support body 2 being defined by the microchip 10 and the lead frame
30 40 bearing it. In the preferred embodiment described here this difference in heights between these two planes is bridged by connector elements 31a and 31b of the antenna frame 30, so that an electrically conductive connection between the antenna frame 30, which is electrically conductive connected with the micro-
chip 10, and the antenna 20 is established. In this way an interface for a contact-
35 less exchange of information is provided. The antenna frame 30 is already provid-

5 ed in the smart card blank 1', so that the smart card manufacturer using said smart card blank 1' for manufacturing of a ready to use smart card 1 only has got to insert the electronic component 10', here the microchip 10, into the recess 3 and has to connect it in a known manner with the lead frame 40 electrically conductive, e. g. by bonding, in order to manufacture from the smart card blank 1' and
10 the electronic component 10 a functioning smart card 1. The conventional applying of a conductive adhesive during the inserting of a microchip 10 in a smart card blank 1' for producing an electrically conductive connection between said electronic component 10' and the antenna 20 therefore can be omitted, so that the manufacturing of the smart card 1 is substantially simplified.

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As it can be seen from the figures, in the case described here it is provided that the connector elements 31a and 31b are formed as tongues 31 protruding from the plane of the antenna frame 30 and having a protrusion 33, so that by this protrusion 33 the difference in heights between the first plane being defined by the
20 antenna connecting elements 22a, 22b and the second plane of the microchip 10 is bridged and the connector elements 31a, 31b can enter into an electrically conductive contact with the connecting elements 22a, 22b.

It is preferred that – as it can be seen best from figure 7 – the connector elements
25 31a and 31b have got a base body 32 with a bent, preferably bump-like shape, so that the bump-like protrusion 33 protruding from the plane of the antenna frame 30 extends to the connecting elements 22a and 22b of the antenna 20 and enters into an electrically conductive contact with them. Such a tongue-like design is not mandatory. A wave- and/or sphere-like form of the connector elements 31a, 31b
30 is possible too, as well as the provision of an embossing. In general each design of the connector elements 31a, 31b is possible, by which a bridging of the difference in heights between the connecting elements 22a, 22b of the antenna 20, i. e. the bonds 21 running below the through openings 3a, 3b, and the second plane being defined by the lead frame 40. But the afore-described design of the connector elements 31a, 31b is preferred, whereby it is furthermore preferred that the
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5 connector elements 31a, 31b are formed resilient. In this way manufacturing tolerances can be compensated.

Figure 7 shows the contact side of the lead frame 40, on which connecting areas 41 are provided, which serve for an electrically conductive connection of the lead
10 frame 40 with the electronic component 10', in this case the microchip 10. Figure 8 shows the back side of the lead frame 40. One can see bond openings 42. Figures 9 and 10 now show a strip having several antenna frames 30. One once more sees that each antenna connection of the frame 30 comprises two connector elements 31a, 31b which are shown in figure 10 in an enlarged scale.

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Figures 8 to 11 now show the manufacturing of a support structure 50 comprising the antenna frame 30 and the lead frame 40 for the electronic component 10' like the microchip 10. For that purpose connecting frames 40 are formed, e. g. by means of a stamping, edging or laminating technique, which are applied on a
20 support foil 51 (see figure 8). The manufacturing of such lead frames 40 is known and hence needs not to be described in detail.

Figure 9 now shows the back side of the support foil 51, on which the lead frames 40 are arranged. One can see bond openings 41 of the lead frame 40.

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The antenna frame 30 is formed in a known manner by stamping, edging, and the like from a flat material. One can see in figure 10 four antenna frames 30 with two connector elements 31a, 31b each.

30 As it can be seen from figure 11, then the antenna frame 30 and the lead frame 40 are mechanically connected, e. g. by means of an appropriate adhesive bonding. The such formed support structure 50 then is inserted into the support body 2 of the smart card 1, comparable with the inserting of a conventional lead frame.

5 Preferably the antenna frame 30 is formed such that when surrounding ("potting") the support structure 50 and the electronic component 10' received in it by an appropriate resin or a like means, i. e. by a potting material, the flow of said potting material is restricted. This simplifies in an advantageous way the manufacturing of the electronic component 10' using said smart card blank.

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A further advantage of the measures described is that it is no longer mandatory to use rings, in particular copper rings, around the bond openings 42. A short circuiting of the bond leads inserted in the bond openings 42 and the electronic component 10' is counteracted in this way.

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The afore description assumes that the smart card blank 1' and hence the smart card 1 formed from it comprises two interfaces for an exchange of information between the smart card 1 and a peripheral device using it, namely a first interface for a contact-bound connection and a second interface for a contactless connection.

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It is evident for a person skilled in the art that in this way a smart card with a dual interface arrangement is formed. But this is not mandatory. It can be sufficient for certain applications that the smart card 1 only has got one interface for a contactless connection. In this case the first interface, namely the contact-bound interface, can be omitted.

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Summarizingly it is got to be stated that by means of the measures described a smart card blank 1' as well as a method for its production are provided, which substantially simplify the manufacturing of a smart card 1 having at least a contactless interface, since by means of the connector elements 31a, 31b being provided in the support body 2 of the smart card blank 1', which are preferably
30 formed as parts of the antenna frame 30, a direct contacting between the electronic component 10' being received in the recess 3 of the support body 2, in particular a microchip 10, and the connecting elements 22a, 22b of the antenna 20, being spaced in respect to said electronic component 10', is facilitated, in that by

- 5 means of the one or the connector elements 31a, 31b the difference in heights between these two planes is bridged.

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Claims

1. Smart card blank having at least one interface for a contactless transmission of information, having a support body (2) with a recess (3), in which an electronic component (10') like a microchip (10) can be inserted, whereby in the support body (2) an antenna (20) is provided, which is electrically connected with the electronic component being received in the recess (3), whereby the antenna (20) comprises at least one connecting element (22a, 22b) for establishing an electrically conductive connection with said electronic component (10'), which is arranged in a first plane of the support body (2) of the smart card blank (1'), which is spaced distant from a second plane being defined by the electronic component (10'), so that between these two planes a difference in heights is given, characterized in that in the smart card blank (1) at least one connector element (31a; 31b) is provided, which extends between the first plane being defined by the one or the connecting elements (22a; 22b) of the antenna (20) and a second plane being defined by the electronic component, whereby at least one connector element (31a; 31b) has got a heights which essentially corresponds to the difference in heights between the afore-mentioned planes.
2. Smart card blank according to claim 1, characterized in that the at least one connector element (31a; 31b) is part of the antenna frame (30).
3. Smart card blank according to one of the claims 1 or 2, characterized in that at least one connector element (31a, 31b) is formed as a tongue or tongue-like and has got a protrusion (33).
4. Smart card blank according to one of the previous claims, characterized in that the recess (3) of the support body (2) comprises at least one through opening (3a; 3b) for said connector element (31a; 31b).

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- 5 5. Smart card blank according to one of the previous claims, characterized in that the smart card blank (1) comprises a lead frame (40), by which an electronic component (10') being insertable in the recess (3) of the support body (2) can be electrically contacted.
- 10 6. Smart card blank according to one of the previous claims, characterized in that the lead frame (40) and the antenna frame (30) are joined to a support structure.
- 15 7. Smart card blank according to one of the previous claims, characterized in that the smart card blank (1) has got at least one contact-bound contact element (21).
- 20 8. Smart card, having a smart card blank (1) as well as an electronic component (10'), which can be inserted in a recess (3) thereof, characterized in that the smart card blank (1) according to one of the claims 1 to 7 is used.
- 25 9. Method for the production of a smart card (1) from a smart card blank (1') and an electronic component (10'), whereby the smart card blank (1') has got a recess (3), in which said electronic component (10') can be inserted, characterized in that for the manufacturing of the smart card (1) a smart card blank (1') according to one of the claims 1 to 7 is used.
- 30 10. Method for the manufacturing of a smart card blank (1'), characterized in that by means of a connector element (31a; 31b) being provided in a support body (2) of the smart card blank (1') a difference in heights between a first plane being defined by a connecting element (22a; 22b) of an antenna (20) and a second plane being defined by the electronic component (10') is bridged.