The present invention relates to a smart card system equipped with an external portable electronic component. This system can be utilized in the field of smart card applications.

The diverse new applications of smart cards show that this type of card must perform more and more complex functions if it is desired to widen its field of applications. This then leads to the need to use increasingly large surface areas of chips to be integrated in such cards in order to perform the said functions. Such is the case for example for two known applications of the smart card, namely relating to telephone cards and banking cards. The chip used in a telephone card is a simple memory. It occupies a surface area of the order of mm^2. The chip used in a banking card is a processor integrated in the memory. It occupies a surface area of about $20mm^2$. This applies for the given state of the art of integrating semiconductors. It is well known in fact that progress continues to be made in the field of integration of semiconductors. In other words, for a constant size of integrated circuit it will be possible to integrate more and more functions.

It should be recalled briefly that a smart card is a relatively thin plastic card within which are encased, within the thickness of the card, a semiconductor chip and a network of conductors. The chip is assembled on an upper surface of the network, for example by adhesion. Conductive wires are then soldered on the one hand to the output terminals of the chip and on the other hand to metallizations of the network. This is the technique for assembling a smart card which is called "chip on board" in English publications. A lower surface of the network is flush with one of the two surfaces of the card and constitutes the connector of the smart card. When this card is inserted in a reader, the reader forms a connection with this connector.

Standard readers, such as those used for public telephones and for banking systems, have imposed a standardization of smart cards. First of all a standardization of the card itself as an object may be distinguished. This standardization of shape and thickness has been

imposed by the antecedence of magnetic cards, in order to use the already existing readers of magnetic cards. A standardization of the connector may then be distinguished, relating to the shape, the number and the connection step between the contact zones of the connector and to the attribution of a given signal to each contact zone, in accordance with a communication protocol. Lastly, a standardization of the relative position of the connector on the card may be distinguished. A French standard necessitates positioning of the connector in a corner of the card. A German standard necessitates positioning of the connector in the middle.

In particular the standardization of the connector imposes a defined distribution of the contact zones of the connector which restricts the extent to which the free surface can be utilized. This surface limits the possible surface of the chip which it is desired to assemble on the connector employing the technology used for assembling a smart card. In fact the width of the chip must be completely contained within that occupied by the connector.

A second limitation is added to this first technological limitation to the surface area of the chip which can be integrated in a smart card. In practice the conventional support of the smart card is not well adapted to a chip having a large surface area. Although the said support is flexible, the chip itself is very rigid. The larger the chip is, the more susceptible it is to deformations and the greater the chance that it will be damaged. The effect of this in practice is to decrease the reliability of the smart card when a large chip is integrated in it. This is not acceptable in some smart card applications, in particular in banking applications.

Various known techniques have been used to overcome this problem. In particular attempts have been made to decrease the size of the deformations of the chip and of the wires which join it to its network of connectors. Mention may be made, for example, of the known use of a plate of cobalt positioned beneath the substrate of the chip to make the chip

more rigid. In another example the process for forming the cavity in the card for receiving the chip has been modified in order to make the surroundings of the chip more rigid. However these solutions do not make it possible to assemble, using this smart card assembly technology, chips having large surface areas - greater than 20mm^2 for example. And in the case of such surface areas, a number of problems arise, in particular that relating to the reliability of the chip thus assembled.

Furthermore, the plastic material constituting the card is not sealed against the various inorganic and organic pollutants to which the chips in the integrated circuit are very sensitive. The deterioration in the reliability induced is greater the larger the chip is. This is a third technological limitation.

The assembly technique used is in the end a hybrid technique. It is not optimized in manufacturing terms. In practice, in the semiconductor assembling process, a standard line is used for a product which is made in very large numbers. This product is one or more chips assembled in a standard casing and called an electronic component. Besides these electronic components produced in large numbers there is therefore a specific product - for example the chip assembled on a conductor network for the smart card.

This specific product is produced in much smaller numbers. However it, too, requires a specific production line. This considerably increases the production costs and the amortization costs of the said line relative to standard product production lines. In addition, the rejection rate of this specific product is much higher than that of standard products because of the technology used. In practice the attachment of the conductive wires is a delicate operation, the reliability of which has a direct effect on the final product. It is necessary to provide a specific protection of these wires to ensure that they are not damaged. In order to avoid these difficulties attempts have also been made in a technology called "tape automatic bonding" to connect, in particular by heat transfer, tails of metallizations of the network to terminals of the

chip. However this technology also suffers from the manufacturing precision which it requires. It, too, does not lead to a sufficient reliability of assembly.

The aim of the invention is to overcome these disadvantages and to make it possible for the smart card to be developed for new, more complex applications. It uses the smart card as an intermediate means.

The document US-A-4 277,837 describes a system for connecting a portable electronic module which comprises the characteristics stated in the preamble of claims 1 or 5.

Thus an object of the invention is a connection system for a portable electronic module, the said module comprising at least one electronic component, the system comprising a reader for interacting with this module, an intermediate means interacting directly with said reader, and a means for transmitting information interacting directly with the said module, the means for transmitting information being electrically connected to the intermediate means and serving to provide the transmission of information between the intermediate means and the module and vice versa, characterized in that the module, the means for transmitting information and the intermediate means are physically connected, in that the intermediate means consist of a card having the shape and the dimensions of a smart card but without a processing chip and being equipped with a connector compatible with the reader, and in that the transmitting means are flexible.

Another object of the invention is a connection system for a portable electronic module, said module comprising at least one electronic component, the system comprising a reader for interacting with this module, an intermediate means interacting directly with said reader, and a means for transmitting information interacting directly with said module, the means for transmitting information serving to provide the transmission of information between the intermediate means and the module and vice versa, the intermediate means being equipped with a

transmitter-receiver for communicating with the transmitting means and the transmitting means comprising a transmitter-receiver for communicating with the intermediate means, characterized in that the intermediate means consist of a card having the shape and the dimensions of a smart card but without a processing chip and being equipped with a connector compatible with the reader.

The characteristics of a system in accordance with the invention are described in the following description which is made with reference to the attached Figures. The said description and the said Figures are given only by way of non-limiting illustration of the invention. In the Figures:

- Figure 1 shows the different functional components of a system in accordance with the invention,

- Figure 2 is a representative view of the module in accordance with the invention,

- Figure 3 is a set of views in cross-section of a transmitting means formed by a flexible ribbon,

- Figure 4 is a representation of a system in accordance with the invention.

Figure 1 shows a module 1, a transmitting means 2, an intermediate means 3 and a reader 4. The module 1 is powered from the reader 4 through the intermediate means 3 and the transmitting means 2. It includes a connection support 10. In the example shown in Figures 1 and 2 this connection support is a multi-layer printed circuit. On one of its surfaces 11 is or are mounted one or more electronic components. For example two electronic components 12 and 13 are mounted on the surface 11. A connector 15 is mounted flush on this same surface 11, or on an opposite surface 14. In the example shown in Figures 1 and 2 the connector 15 is flush with the surface 11. The connector 15 connects the pins 16 of the electronic components 12 and 13 to the outputs of the

module 1. These outputs of the module are the external contact zones 17 of the connector 15. They are flush with the surface 11. They are connected to the pins of the electronic components by means of the interior of the connector.

The intermediate means 3 is completely inserted in the slot 40 in a reader 4. The intermediate means 3 is, for example, a smart card or any other means which can be read by a reader 4. The reader 4 is shown partially in Figure 1. When the reader 4 communicates with the smart card 3 it forms connections on the external contact zones of a connector 30 which is flush with a surface 31 of the smart card 3. The connector 30 is designed to conform with the shape of the connection with the reader 4. The smart card may integrate one or more connectors on which are assembled zero or more chips. In a preferred example it comprises a single connector on which no chip is assembled. Nevertheless, in the following it will be still be called a smart card. In the example all the electronic operations are performed in the module 1 which can integrate a plurality of functions.

Details of the transmitting means 2 are shown in the different cross-sectional views shown in Figure 3. In this Figure the transmitting means has two ends 20 and 21. At the end 20 a connector 22 is flush with an upper surface 23 of the transmitting means 2. This connector is compatible with an inter-connection with the connector 30 of the smart card 3. At the end 21 a connector 24 is flush with a lower surface 25 of the transmitting means 2. This connector is compatible with an inter-connection with the connector 15 of the module 1. In a preferred example the transmitting means is flexible ribbon of material the interior of which is insulated and/or on which conduction zones have been etched. These conduction zones are, in the example shown in Figure 3, the two connectors 22 and 24 and conductive wires 26. The conductive wires are formed inside the ribbon. The contact zones of the connector are external, that is to say they are etched on a surface of the band. Each conductive wire connects a contact zone of the connector 22 to a contact zone of the connector 24. The connection between the end of a wire and an external contact zone of the connectors 22 or 24 is formed by a

metallized hole 27 below the external contact zone, between the surface with which the contact zone is aligned and the plane in which the conductive wires are formed.

The end 20 of the transmitting means 2 is fixed in the intermediate means 3. Each contact zone of the connector 22 is in contact with a contact zone of the connector 30. The contact is made through the interior of the connector 30. Fixing is performed for example by soldering the connector 22 to the inside of the connector 30. The transmitting means is positioned so that it is applied on the smart card 3 from the side 32 opposite to that side of the smart card 3 which is inserted first in the slot 40 in the reader 4. All the portion of the transmitting means 2 from the side 32 to the end 20 is contained in the coating material of the smart card 3.

The end 21 of the transmitting means 2 is fixed to the surface 11 of the module 1. Fixing is performed for example by a soldered joint 16. The end 21 is fixed in such a manner that each contact zone of the connector 24 is in contact with a contact zone of the connector 15. In this case the contact is made on the external contact zones of the connector 15.

In the preferred example the superficial portion of the connector 15 of the module 1 is identical to that of a smart card and consequently to the superficial portion of the connector 30 of the smart card 3. The superficial portion of the connectors 22 and 24 of the transmitting means 2 is identical to the interior part of a connector of a smart card. Therefore it is easy to assemble together the connectors 15 and 24 and the connectors 30 and 22 because they are the standard external (15 and 30) and internal (24 and 22) parts of a smart card connector.

In fact it is equally possible to have a single support comprising the connector 30 of the smart card and providing the interconnection of this connector 30 with an external electronic device of the kind described above. It is known in practice to form a single support comprising a plurality of materials, for example a printed circuit and a

flexible connector, the flexible connector then being a layer of the printed circuit. In this case the interconnecting support is common to the module 1, the transmitting means 2 and the smart card 3. There is no longer any soldering or fixing to perform in order to connect the module 1 to the transmitting means 2 and the transmitting means 2 to the smart card 3.

Figure 4 shows a module 1, a transmitting means 2 and a smart card 3 in accordance with the description which has just been given. The module 1 is encased in a material which is or is not dielectric. If it is not dielectric the metallic connections of the electronic components will be protected by an insulating material. Because the module includes electronic components, the thickness of the assembly is greater than the thickness of a smart card in the current state of the art of electronic components.

Use of a flexible ribbon makes it possible to bend the module back on the smart card. The assembly can then easily be put into a pocket. It would also be possible to use a rigid transmitting means, for example a printed circuit. In this case it would also be possible to encase the assembly formed by the module 1, the transmitting means 2 and the smart card 3. A relatively rigid product would then be obtained, for example rectangular in shape, having two thicknesses: the rather smaller one of the smart card (about 0.8mm) and the greater one of the module (from about 1.5mm).

In the example shown in Figure 1, in the connection between the connector 15 and the connector 30 only the connector 30 is not protected so that the reader can be connected above it. In contrast all the rest of this connection is insulated so that no electrical disturbance can be superimposed on the transmitted signals.

The transmission of data between the intermediate means and the module may be performed by a means of quite a different nature to an inter-connecting support such as a flexible ribbon or a printed circuit. For example it may be performed by hertzian transmission. In this case

the transmitting means comprises a transmitter and a receiver with an antenna in the module 1 and in the card. The module 1 and the smart card are then two distinct portable objects. For convenience, however, they may be attached to one another, for example by a flexible wire. However in this case it is necessary to provide an energy amplifier integrated in the module 1 if the supply to the module is transmitted by hertzian waves from the reader 4 through the smart card 3. Integration of a rechargeable battery in the module 1 may be preferred.

There are many advantages with the system which has just been described relative to the conventional smart card. This is because the electronic part, the module 1, is dissociated from the connecting part, the smart card 3. In practice first of all it makes it possible to produce a complex electronic device by the assembly of one or more electronic components interconnected together or not. There is no longer any limitation to the surface area of the electronic device as there is for a smart card. In addition the electronic components may themselves be complex, integrating for example in their casing a plurality of chips assembled on a multi-layer printed circuit.

It will be recalled that a multi-layer printed circuit makes it possible on the one hand to form inter-connections between electronic elements, chips or components to perform a function. On the other hand it makes it possible to form a connection to the outside, in other words outputs of the function performed. When the printed circuit in which a plurality of chips is assembled in integrated in a casing, the outputs of the function performed are then the terminals of the casing of the electronic component thus formed. In the present state of the art of assembling chips in a smart card there is no equivalent to a multi-layer printed circuit.

In the system described, the reliability of the electronic device is considerably improved relative to that obtained with conventional smart card technology. In practice a casing, for example made of plastic or ceramic, of an electronic component is rigid. It is also sealed, in

particular against various attacks by inorganic or organic substances. It is this which improves the reliability. Furthermore, the module itself may be more rigid than the smart card because it is not the module itself which is inserted in the reader. In conclusion, with the invention there is now sufficient reliability to develop complex applications, in particular banking applications. This could not be envisaged with the conventional technology using smart cards for reasons explained hereinabove.

There is a choice of different technologies for assembling electronic components in the module 1. It may be any standard technology such as for example insertion or surface mounting. In the example shown in Figures 1 and 2 the components are surface mounted. This makes it possible to have a greater density of integration on the printed circuit. It is also possible to assemble such components on each of two surfaces of the printed circuit. This is not possible using an insertion technique. There is also a diverse choice of casing. What is important is the optimization of the production cost of the module, which depends on the density of integration required for the application envisaged, the manufacturing cost and the rejection rate with each of the different technologies.

The manufacturing cost is in fact very important in the field of smart cards. In practice a very low cost price to users is aimed for. Because of this, as has been seen already, the production cost and the amortization costs caused by the use of a specific production line in conventional smart card technology is a major disadvantage of this technology with regard to the manufacturing cost. To this must be added the high rejection rate, which is higher than that obtained with conventional semiconductor technologies. The use of electronic components overcomes all these disadvantages. In fact the production lines are then standard semiconductor assembly lines. Moreover when the electronic components are assembled on the printed circuit, if the final test is not satisfactory it is possible to unsolder a defective component and replace it by another. It is possible to change a defective printed circuit and

to retain the component: the module is not discarded completely. This is a significant advantage relative to the smart card: if the latter is defective nothing can be recovered.

Use of a smart card as an intermediate means resolves the problem of normalization and/or standards. That is the only reason why it is of interest. In the preferred example the smart card comprises a standard connector compatible with the connecting device of a reader. The smart card is a standard intermediate means for reading directly by a reader. Its manufacture is not very expensive because no assembly of chips is involved.

In summary, the invention makes it possible to observe the standards or norms of smart card readers without being restricted by them. It makes possible all new complex applications. It considerably improves the reliability of the electronic part. It decreases the manufacturing costs and the amortization costs, by using an electronic device made by a standard technology of which only the application is specific, relative to the conventional smart card, the electronic part of which is specific both with regard to the application and to the technology employed.

CLAIMS

1. A connection system for a portable electronic module (1), the said module comprising at least one electronic component, the system comprising a reader (4) for interacting with this module, an intermediate means (3) interacting directly with said reader, and a means for transmitting information (2) interacting directly with the said module (1), the means for transmitting information (2) being electrically connected to the intermediate means (3) and serving to provide the transmission of information between the intermediate means and the module and vice versa, characterized in that the module, the means for transmitting information and the intermediate means are physically connected, in that the intermediate means consist of a card having the shape and the dimensions of a smart card but without a processing chip and being equipped with a connector compatible with the reader, and in that the transmitting means are flexible.

2. A system as claimed in claim 1, characterized in that the conduction zones of the module and of the transmitting means are insulated electrically from any contact with the physical outside of the system.

3. A system as claimed in either one of claims 1 or 2, characterized in that the transmitting means also comprise means for transmitting the energy required to supply the module, this transmission occurring from the reader through the intermediate means.

4. A system as claimed in either one of claims 1 or 2, characterized in that the module comprises an integrated supply means.

5. A connection system for a portable electronic module (1), said module comprising at least one electronic component, the system comprising a reader (4) for interacting with this module, an intermediate means (3) interacting directly with said reader, and a means for transmitting information (2) interacting directly with said module, the

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means for transmitting information serving to provide the transmission of information between the intermediate means and the module and vice versa, the intermediate means being equipped with a transmitter-receiver for communicating with the transmitting means and the transmitting means comprising a transmitter-receiver for communicating with the intermediate means, characterized in that the intermediate means consist of a card having the shape and the dimensions of a smart card but without a processing chip and being equipped with a connector compatible with the reader.

6. A system as claimed in claim 5, characterized in that the conduction zones of the module and of the transmitting means are insulated electrically from any contact with the physical outside of the system.

7. A system as claimed in either one of claims 5 or 6, characterized in that the module comprises an integrated supply means.