

A METHOD OF FABRICATING A SIM CARD

Field of the Invention

5 The present invention relates to a method of fabricating a subscriber identification module (SIM) card of the type wherein a relatively small format SIM card is selectively engageable in and disengageable from a relatively large format SIM card body. The present invention also relates
10 to a SIM card fabricated according to the method.

Background of the Invention

It is known to provide a versatile SIM card that has a
15 relatively small format SIM card engageable in and disengageable from a relatively large format SIM card body. Such a small format SIM card is often referred to as a re-pluggable SIM card and is typically fabricated by machining or stamping an aperture in the larger format SIM
20 card body, and separately fabricating a small SIM card that fits in and frictionally engages with the aperture formed in the larger SIM card body.

However, this method of fabricating a re-pluggable SIM
25 card is cumbersome, time consuming and expensive.

Summary of the Invention

In accordance with a first aspect of the present
30 invention, there is provided a method of fabricating a SIM card, the method comprising:

- moulding a first SIM card portion;
- moulding a second SIM card portion on the first SIM card portion;
- 35 the first SIM card portion being shaped such that when the second SIM card portion is moulded around the first SIM card portion, the first SIM card portion is

engageable with and disengageable from the second SIM card portion.

In an embodiment, the method comprises:

5 providing a first mould part, a second mould part and a third mould part;

 disposing the first mould part and the third mould part adjacent each other so as to define a first mould for moulding the first SIM card portion;

10 moulding the first SIM card portion using the first mould;

 disposing the second mould part and the third mould part adjacent each other so as to define a second mould for moulding a second SIM card portion, the second mould containing the first moulded SIM card portion; and

 moulding the second SIM card portion using the second mould and the first SIM card portion contained in the second mould such that the second SIM card portion is moulded around the first SIM card portion.

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In an embodiment, the first mould is configured such that the first SIM card portion includes an engagement portion arranged such that when the second SIM card portion is moulded around the first SIM card portion, the first SIM card portion engages with the second SIM card portion and is disengageable from the second SIM card portion by application of manual force.

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In an embodiment, the engagement portion comprises at least one trough or at least one ridge.

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In an embodiment, the step of moulding the first SIM card portion includes the step of injecting a first mouldable material into the first mould, and the step of moulding the second SIM card portion includes the step of injecting a second mouldable material into the second mould, the first mouldable material not adhering to the second

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mouldable material. One of the first and second mouldable materials may be an ABS material and the other of the first and second mouldable materials may be a non-ABS material.

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In an embodiment, the non-ABS material comprises polycarbonate material.

10 In an embodiment, at least one of the first and second mouldable materials includes an adhesion prevention additive material.

15 In an embodiment, the method further comprises the step of coating the first SIM card portion with an adhesion prevention material.

In an embodiment, the method comprises the step of adding a lubricant material to or coating a lubricant material on the first and/or second mouldable material.

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The step of disposing the first mould part and the third mould part adjacent each other may comprise moving the first mould part into contact with the third mould part.

25 In an embodiment, the third mould part is formed on a rotatable mould member, the rotatable mould member including a fourth mould part, and the method comprising the step of rotating the third mould part such that the third mould part aligns with the second mould part and the first mould part aligns with the fourth mould part after the step of moulding the first SIM card portion.

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The step of disposing the second mould part and the third mould part adjacent each other may comprise moving the third mould part into contact with the second mould part after the step of rotating the third mould part.

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In an embodiment, the second SIM card portion is incorporated into a third SIM card portion larger than the second SIM card portion. The second SIM card portion may be disconnectable from the third SIM card portion, for
5 example by providing frangible portions between the second and third SIM card portions.

In an embodiment, the first SIM card portion is a 3ff type SIM card, the second SIM card portion is a 2ff type SIM
10 card, and the third SIM card portion is a 1ff type SIM card.

In an alternative embodiment, the first SIM card portion is a 4ff type SIM card and the second SIM card portion is
15 a 3ff type SIM card.

In an embodiment, the method further comprises:

moulding a third SIM card portion on the second SIM card portion;

20 the second SIM card portion being shaped such that when the third SIM card portion is moulded around the second SIM card portion, the second SIM card portion is engageable with and disengageable from the third SIM card portion.

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In an embodiment, the method comprises the step of disposing SIM circuitry on the first SIM card portion.

In an embodiment, the method comprises the step of
30 disposing indicia on the SIM card.

In accordance with a second aspect of the present invention, there is provided a SIM card fabricated according to the above first aspect.

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Brief Description of the Drawings

The present invention will now be described, by way of example only, with reference to the accompanying drawings, in which:

Figure 1 is a diagrammatic perspective view of a SIM card fabricated according to a method in accordance with an embodiment of the present invention;

Figure 2 is a diagrammatic plan view of the SIM card shown in Figure 1;

Figure 3 is a diagrammatic perspective view of a first SIM card portion of the SIM card shown in Figures 1 and 2;

Figure 4 is a diagrammatic cross sectional view taken along the line IV - IV in Figure 2;

Figures 5 to 12 are diagrammatic perspective views of moulds used by the method of fabricating a SIM card according to an embodiment of the invention; and

Figure 13 is a flow diagram illustrating steps of a method of fabricating a SIM card in accordance with an embodiment of the present invention.

Description of an Embodiment of the Invention

Referring to the drawings, in Figures 1 to 4 a SIM card is shown of the type conventionally referred to as a 1ff SIM card or a full size SIM card, the full size SIM card including a de-pluggable SIM card of the type conventionally referred to as a 2ff SIM card or mini SIM card, and the mini SIM card including a re-pluggable SIM card of the type conventionally referred to as a 3ff SIM card or micro SIM card. Incorporated on the micro SIM card is conventional SIM circuitry.

However, while the present invention is described in relation to a re-pluggable SIM card of 3ff type, it will be understood that the invention is applicable to any shape and/or size of SIM card. For example the re-pluggable SIM card may be a 4ff type SIM card or nano SIM

card.

It will be understood that the SIM card 10 shown in Figures 1 and 2 is versatile because the form of the SIM
5 card can be selected depending on the device with which the SIM circuitry 16 is intended to be used, that is, a relatively large 1ff type SIM card 10, a smaller 2ff type SIM card 12 by disengaging the 2ff type SIM card 12 from the 1ff type SIM card 10, or a smaller still 3ff type SIM
10 card by disengaging the 3ff type SIM card 14 from the 2ff type SIM card 12.

In this example, the 1ff and 2ff type SIM cards 10, 12 are moulded together, and in order to facilitate disengagement
15 of the 2ff type SIM card 12 from the 1ff type SIM card 10, frangible portions 18 are provided between the 2ff type SIM card 12 and the 1ff type SIM card 10. This may be provided during the SIM card fabrication process by ensuring that the 2ff type SIM card 12 is connected to the
20 1ff type SIM card 10 at a small number of spaced locations only, and for example ensuring that the thickness of material at the connection locations is relatively thin.

In order to enable the 3ff type SIM card 14 to be re-
25 pluggable, that is, selectively engageable with and disengageable from the 2ff type SIM card 12, the 2ff type SIM card 12 is moulded directly on the 3ff type SIM card 14 during the manufacturing process, as discussed in more detail below.

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In order to prevent the 2ff type SIM card 16 from fusing with the 3ff type SIM card 14 when the 2ff type SIM card is moulded around the 3ff type SIM card 14, different materials that do not readily adhere to each other may be
35 used to form the 2ff and 3ff SIM cards 12, 14, an adhesion prevention material may be mixed with the 3ff SIM card moulding material, or an adhesion prevention coating may

be applied to the 3ff type SIM card 14 after moulding and prior to moulding the 2ff type SIM card 12 over the 3ff type SIM card 14. For example, the combined 1ff and 2ff SIM card 10, 12 may be formed using acrylonitrile

5 butadiene styrene (ABS) resin material and the 3ff SIM card formed using a non-ABS material, such as a non-ABS resin or a resin with added adhesion prevention material. In one embodiment, the non-ABS material may be polycarbonate material.

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The SIM card may also be provided with a lubricant material, either mixed with or coated onto one or both of the materials from which the SIM card is fabricated. For example, with the present embodiment a lubricant may be
15 mixed with or coated onto the 3ff SIM card and/or the combined 1ff/2ff SIM card.

The 3ff type SIM card 14 includes an edge portion 20 that is shaped such that the 3ff type SIM card 14 engages with
20 an adjacent edge portion of the 2ff type SIM card 12 after the 2ff type SIM card 12 is moulded around the 3ff type SIM card 14. In this example, the edge portion 20 of the 3ff type SIM card 14 positively engages with the an edge of the 2ff type SIM card and for this purpose includes a
25 trough portion 22 that mates with a complementary ridge portion 24 formed on the 2ff type SIM card 12 after moulding.

It will be appreciated that the shape of the edge portion
30 20 is configured such that sufficient engagement is achieved between the 2ff type SIM card 12 and the 3ff type SIM card 14 to retain the 3ff type SIM card 14 relative to the 2ff type SIM card 12, but the 3ff type SIM card 14 can still be readily disengaged from the 2ff type SIM card 12
35 by application of minimal manual force. Accordingly, any suitable complementary edge shapes that achieve this purpose are envisaged.

Referring to Figures 5 to 12 an apparatus 28 for moulding a SIM card 10 is shown diagrammatically.

5 The example apparatus 28 includes a first mould member 30 having a first mould part 32, a second mould member 34 having a second mould part 36, and a third mould member 38 having third and fourth mould parts 39, 41. The first
10 mould part 32 and the third and fourth mould parts 39, 41 are configured such that when the first and third mould parts 32, 39 are disposed adjacent each other, or the first and fourth mould parts 32, 41 are disposed adjacent each other, a mould is defined for fabricating a 3ff type
15 SIM card. Similarly, the second mould part 36 is configured such that when the second and third mould parts 36, 39 are disposed adjacent each other or the second and fourth mould parts 36, 41 are disposed adjacent each other with a 3ff type SIM card 14 formed in the third or fourth
20 mould part 39, 41, a mould is defined for fabricating a 1ff type SIM card 10 with incorporated de-pluggable 2ff type SIM card 14 onto the 3ff type SIM card 14.

In the present example, the third and fourth mould parts 39, 41 are each used with the first mould part 32 to
25 fabricate the 3ff type SIM card 14, and the third and fourth mould parts 39, 41 are each used with the second mould part to fabricate the combined 1ff/2ff type SIM card 10, 12 over the 3ff type SIM card. In order to enable this to occur, the apparatus 28 is arranged to facilitate
30 relative movement between the third mould member 38 and the first and second mould members 30, 34.

In this embodiment, the apparatus 28 is arranged such that the first mould member 30 is reciprocally movable relative
35 to the third mould member 38, and the third mould member 38 is rotatable about a generally vertical axis and reciprocally movable relative to the second mould member

34. In this way, the first and third mould parts 32, 39, the first and fourth mould parts 32, 41, the second and third mould parts 36, 39, and the second and fourth mould parts 36, 41 can be selectively disposed adjacent each other by appropriate movement of the first, second and third mould members 30, 32, 38.

An example method of fabricating a SIM card 10 will now be described with reference to Figures 5 to 12, and the flow diagram 40 shown in Figure 13.

Figure 5 shows the first, second and third mould members 30, 34, 38 prior to commencement of a moulding operation, with the first and third mould parts 32, 39 facing each other and the second mould part 36 facing the fourth mould part 41.

After initialisation of the moulding operation, the first mould member 30 is moved towards the third mould member 38, and the third mould member 38 is moved towards the second mould member 34 until the first mould member 30 contacts the third mould member 38 and the third mould member 38 contacts the second mould member 34, as indicated at step 42. At this position, the first mould part 32 is disposed adjacent the third mould part 39 and the fourth mould part 41 is disposed adjacent the second mould part 36, as shown in Figure 6.

Suitable material from which it is desired to form the re-pluggable 3ff SIM card 14 is then injected into the mould defined by the first and third mould parts 32, 39, as indicated at step 44 and shown in Figure 7. After moulding is complete, the first mould member 30 is moved away from the third mould member 38 and the third mould member 38 is moved away from the second mould member 34, whilst retaining the moulded 3ff SIM card 14 attached to the third mould member 38, as indicated at step 46 and

shown in Figure 8.

The third mould member 38 is then rotated about a generally vertical axis until the 3ff SIM card 14 moulded in the third mould part 39 is aligned with the second mould part 36, as shown in Figure 9 and indicated at step 48. The third mould member 38 is then moved towards the second mould member 34, and the first mould member 30 is moved towards the third mould member 34 until the second mould part 36 is disposed adjacent the third mould part 39, and the fourth mould part 41 is disposed adjacent the first mould part 32, as indicated at step 50 and shown in Figure 10. Suitable material from which it is desired to form the combined 1ff/2ff SIM cards 10, 12 is then injected into the mould defined by the moulded 3ff SIM card 14 and the second mould part 36. At the same time, suitable material from which it is desired to form a re-pluggable 3ff SIM card 14 is injected into the mould defined by the first and fourth mould parts 32, 41, as indicated at step 52 and shown in Figure 11. In this way, a 3ff type SIM 14 card for subsequent moulding with a 1ff/2ff SIM card is moulded at the same time as the combined 1ff/2ff SIM card is moulded around the previously moulded 3ff SIM card 14.

After moulding is complete, the third mould member 38 is moved away from the second mould member 34 and the first mould member 30 is moved away from the third mould member 38, as indicated at step 54, and the 1ff SIM card 10, with incorporated de-pluggable 2ff SIM card 12 and re-pluggable 3ff SIM card is removed from the third mould member 38, as indicated at step 56.

The third mould member 38 is then rotated about a generally vertical axis until the 3ff SIM card 14 moulded in the fourth mould part 41 is aligned with the second mould part 36, as indicated at step 58, and the moulding

process repeats.

After fabrication of the SIM card body, SIM circuitry 16 is attached to the 3ff SIM card 14 in any suitable way, and any further desired final fabrication steps are carried out. For example, indicia may be printed onto the SIM card 10.

While the present embodiment is described in relation to a rotatable third mould member 38 and reciprocally movable first and third mould members 30, 38, it will be understood that other arrangements for facilitating necessary relative movement between the mould members is envisaged. For example, the first and second mould members 30, 34 may be disposed adjacent each other with the first and second mould parts 32, 36 facing in the same direction, and the third mould member 38 disposed adjacent the first and second mould members 30, 34, with the third mould part 39 facing an opposite direction to the first and second mould parts 32, 36 and the third mould part 39 movable such that the third mould part 39 is selectively alignable with the first or second mould part 32, 36.

While the present embodiment is described in relation to fabrication of a 1ff type SIM card that has a de-pluggable 2ff type SIM card integrally formed with the 1ff type SIM card, and a 3ff type re-pluggable SIM card engageable with and disengageable from the 2ff type SIM card, it will be understood that other variations are possible.

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For example, a 1ff type SIM card may be fabricated with only a re-pluggable 2ff or 3ff type SIM card engageable with and disengageable from the 1ff type SIM card.

Alternatively, each of the 2ff and 3ff type SIM cards may be re-pluggable such that the 3ff type card is re-pluggable with a 2ff type SIM card and the 2ff type SIM

card is re-pluggable with the 1ff type SIM card. With this arrangement, an additional mould part and additional fabrication steps would be required such that the 2ff type SIM card is moulded directly onto the 3ff type SIM card
5 and the 1ff type SIM card is subsequently moulded directly onto the 2ff type SIM card.

As a further alternative, a SIM card may be produced that has a 4ff type SIM card re-pluggable in a 3ff type SIM
10 card, and a 3ff type SIM card re-pluggable in a 2ff or 1ff type SIM card.

It will be appreciated that the present SIM card fabrication method enables a versatile re-pluggable SIM
15 card to be made as part of the moulding process by moulding a second SIM card directly onto a first SIM card.

It will also be appreciated that while the above embodiments are described in relation to fabrication of a
20 SIM card using a rotatable mould, other fabrication arrangements within the scope of the present invention are envisaged. For example, a first SIM card may be moulded separately, inserted into a mould and a second SIM card moulded directly on the first SIM card.

25 In the claims which follow and in the preceding description of the invention, except where the context requires otherwise due to express language or necessary implication, the word "comprise" or "include" or
30 variations such as "comprises", "comprising", "include" or "including" is used in an inclusive sense, i.e. to specify the presence of the stated features but not to preclude the presence or addition of further features in various embodiments of the invention.

35 Modifications and variations as would be apparent to a skilled addressee are deemed to be within the scope of the

present invention.

CLAIMS:

1. A method of fabricating a SIM card, the method comprising:

5 moulding a first SIM card portion;

 moulding a second SIM card portion on the first SIM card portion;

 the first SIM card portion being shaped such that when the second SIM card portion is moulded around the first SIM card portion, the first SIM card portion is engageable with and disengageable from the second SIM card portion.

2. A method as claimed in claim 1, comprising:

15 providing a first mould part, a second mould part and a third mould part;

 disposing the first mould part and the third mould part adjacent each other so as to define a first mould for moulding a first SIM card portion;

20 moulding the first SIM card portion using the first mould;

 disposing the second mould part and the third mould part adjacent each other so as to define a second mould for moulding a second SIM card portion, the second mould containing the first moulded SIM card portion; and

 moulding the second SIM card portion using the second mould and the first SIM card portion contained in the second mould such that the second SIM card portion is moulded around the first SIM card portion;

30 the first mould being configured such that when the first SIM card portion is moulded and the second SIM card portion subsequently moulded around the first SIM card portion, the first SIM card portion is engageable with and disengageable from the second SIM card portion.

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3. A method as claimed in claim 2, wherein the first mould is configured such that the first SIM card portion

includes an engagement portion arranged such that when the second SIM card portion is moulded around the first SIM card portion, the first SIM card portion engages with the second SIM card portion and is disengageable from the second SIM card portion by application of manual force.

4. A method as claimed in claim 3, wherein the engagement portion comprises at least one trough or at least one ridge.

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5. A method as claimed in any one of claims 2 to 4, wherein the step of moulding the first SIM card portion includes the step of injecting a first mouldable material into the first mould, and the step of moulding the second SIM card portion includes the step of injecting a second mouldable material into the second mould, the first mouldable material not adhering to the second mouldable material.

6. A method as claimed in claim 5, wherein one of the first and second mouldable materials is an ABS material and the other of the first and second mouldable materials is a non-ABS material.

7. A method as claimed in claim 6, wherein the non-ABS material comprises polycarbonate material.

8. A method as claimed in any one of claims 5 to 7, wherein at least one of the first or second mouldable materials includes an adhesion prevention additive material.

9. A method as claimed in any one of claims 2 to 8, comprising the step of coating the first SIM card portion with an adhesion prevention material.

10. A method as claimed in any one of claims 2 to 9,

comprising the step of adding a lubricant material to or coating a lubricant material on the first and/or second mouldable materials.

5 11. A method as claimed in any one of claims 2 to 10, wherein the step of disposing the first mould part and the third mould part adjacent each other comprises moving the first mould part into contact with the third mould part.

10 12. A method as claimed in any one of claims 2 to 11, comprising rotating the third mould part such that the third mould part aligns with the second mould part after the step of moulding the first SIM card portion.

15 13. A method as claimed in any one of claims 2 to 12, wherein the step of disposing the second mould part and the third mould part adjacent each other comprises moving the second mould part into contact with the third mould part after the step of rotating the third mould part.

20 14. A method as claimed in any one of claims 2 to 13, wherein the second SIM card portion is incorporated into a third SIM card portion larger than the second SIM card portion.

25 15. A method as claimed in claim 14, wherein the second SIM card portion is disconnectable from the third SIM card portion.

30 16. A method as claimed in any one of claims 12 to 15, wherein the first SIM card portion is a 3ff type SIM card, the second SIM card portion is a 2ff type SIM card, and the third SIM card portion is a 1ff type SIM card.

35 17. A method as claimed in any one of claims 2 to 16, comprising:
moulding a third SIM card portion on the second SIM

card portion;

the second SIM card portion being shaped such that
when the third SIM card portion is moulded around the
second SIM card portion, the second SIM card portion is
5 engageable with and disengageable from the third SIM card
portion.

18. A method as claimed in any one of claims 2 to 17,
comprising the step of disposing SIM circuitry on the
10 first SIM card portion.

19. A method as claimed in any one of claims 2 to 18,
comprises the step of disposing indicia on the SIM card.

15 20. A SIM card fabricated according to the method as
claimed in any one of the preceding claims.

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