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(54) **Title:** A WAVEGUIDE INTERFACE ARRANGEMENT

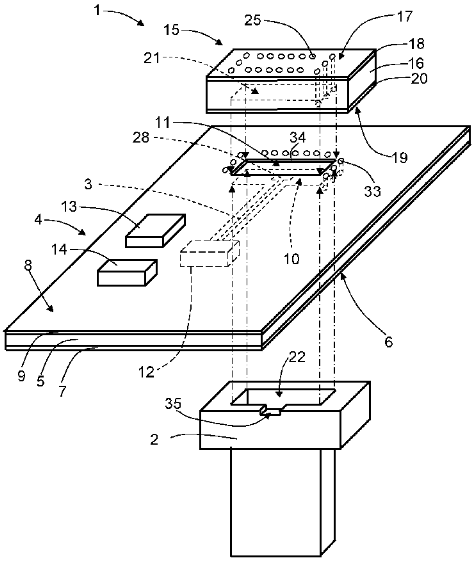

FIG. 1

(57) **Abstract:** The present disclosure relates to a waveguide interface arrangement (1, 1') for electrically connecting a waveguide device (2) to a microwave conductor (3) that runs in a metallization (7, 9) on one main side (6, 8) of a printed circuit board (4), PCB, comprising a PCB dielectric layer (5), a first PCB main side (6) with a first PCB metallization (7) and a first PCB aperture (10) in the first PCB metallization (7), and a second PCB main side (8) with a second PCB metallization (9) and a second PCB aperture (11) in the second PCB metallization (9). The first PCB aperture (10) corresponds to a waveguide aperture (22) and a backshort (15, 15') is attached to the second PCB main side (8), comprising a backshort dielectric layer (16), a first backshort main side (17, 23) with a first backshort metallization (18, 24), and a second backshort main side (19, 19') with a second backshort metallization (20, 20') and a backshort aperture (21, 21') in the second backshort metallization (20, 20'). -The backshort metallizations (18, 24; 20, 20') are electrically connected to each other. -The first backshort metallization (18, 24) covers a main part of the first backshort main side (17, 23). -The second backshort metallization (20, 20') is electrically connected to the second PCB metallization (9). -The backshort aperture (21, 21') is adapted to face the second PCB aperture (11).

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TITLE

A waveguide interface arrangement

TECHNICAL FIELD

The present disclosure relates to wireless communication systems, and in particular to a waveguide interface arrangement adapted for electrically connecting a waveguide interface to a microwave conductor.

BACKGROUND

In many fields of wireless communication, such as microwave communication, as well as for applications associated with radars and other sensors using microwave technology, waveguides are used for transporting wireless signals, due to the low losses incurred in a waveguide.

In many applications, microwave radios are using waveguides as interface to antennas. Therefore, it is common to use a microstrip to waveguide transition in the design. This transition is normally designed around a printed circuit board (PCB) where there is a waveguide port one side of the PCB and a so called backshort on the other side, where the backshort is used for reflecting the wave back through the waveguide port. Traditionally a backshort is a mechanical part, made in metal, which is pushed against the PCB with springs, screws or similar devices. There could also be electrical gaskets in the interfaces to minimize potential leakages. For some applications conductive glue and soldering can be used.

There are certain obstacles with the existing solutions, for example leakage, cost and thermal mismatch.

Leakage drives the tolerances and complexity of the interfaces, and relatively high manufacturing costs are due to tolerance requirements and complexity. Thermal mismatch occur, and in particular if the backshort is glued or soldered to the PCB. The PCB material is made of combination of plastic and glass fiber and the backshort is made in metal. This will of course cause a thermal mismatch that is difficult to handle in products that are exposed to large temperature variations such as outdoor products.

There is thus a need for an improved waveguide transition arrangement adapted for electrically connecting a waveguide interface to a microwave conductor, where the above drawbacks are minimized.

SUMMARY

It is an object of the present disclosure to provide an improved waveguide transition arrangement adapted for electrically connecting a waveguide interface to a microwave conductor

Said object is obtained by means of a waveguide interface arrangement arranged for electrically connecting a waveguide device to a microwave conductor, where the microwave conductor runs in a metallization on one main side of a printed circuit board (PCB). The PCB comprises a PCB dielectric layer, a first PCB main side with a first PCB metallization and a first PCB aperture in the first PCB metallization. The PCB further comprises a second PCB main side with a second PCB metallization and a second PCB aperture in the second PCB metallization. At least one electronic component is mounted to a PCB metallization and the first PCB main side is adapted for attachment of a waveguide device, where the first PCB aperture is adapted to correspond to a waveguide aperture. The waveguide interface arrangement further comprises a backshort that is attached to the second PCB main side. The backshort comprises a backshort dielectric layer, a first backshort main side with a first backshort metallization, and a second backshort main side with a second backshort metallization and a backshort aperture in the second backshort metallization. The backshort metallizations are electrically connected to each other, and the first backshort metallization covers a main part of the first backshort main side. The second backshort metallization is electrically connected to the second PCB metallization, and the backshort aperture is adapted to face the second PCB aperture.

This provides a low cost and high performance solution for a waveguide interface arrangement that minimizes reliability problems. A potential leakage path that normally is very hard to cope with can be avoided. Thereto, the production process will be simplified since the backshort can be mounted in a standard SMD process without screws and springs. Overall, the cost for the backshort will be reduced significantly.

According to some aspects, the dielectric layers are made in the same dielectric material.

Using the same material in the dielectric layers minimizes reliability problems, in particular problems due to thermal mismatch between materials.

According to some aspects, the main sides run mutually parallel to each other.

This provides a compact and inexpensive design, allowing standard PCB materials to be used.

According to some aspects, the backshort dielectric layer is homogenous and the backshort main sides are arranged opposite each other.

Such a backshort can easily be implemented in a PCB production process and therefore be very inexpensive. Furthermore, the size of the backshort will be relatively small since the physical dimensions will shrink with the dielectric constant of the dielectric material used for the backshort.

According to some aspects, the backshort dielectric layer comprises an air-filled cavity that communicates with the backshort aperture. The cavity is defined by the first backshort main side and cavity walls extending between the first backshort main side and the backshort aperture.

Having an air-filled cavity provides minimal dielectric losses.

According to some aspects, the backshort metallizations are electrically connected to each other by means of at least partly metalized cavity walls extending between the first backshort main side and the backshort aperture.

According to some aspects, the backshort metallizations are electrically connected to each other by means of via connections.

This means that both via fences or metalized surfaces can be used for creating electrical walls.

According to some aspects, the microwave conductor is either formed in the first PCB metallization or in the second PCB metallization. In the latter case, the microwave conductor is adapted to enter the backshort via an opening in the second backshort metallization.

The waveguide interface arrangement is thus independent on which side the microwave conductor runs.

According to some aspects, the microwave conductor comprises a radiating element at its end.

This enables tuning of the waveguide interface arrangement.

According to some aspects, the PCB metallizations are electrically connected by means of via connections that circumvent the PCB apertures. Alternatively, the PCB metallizations are electrically connected by means of at least one metalized wall that connects the PCB apertures.

This means that both via fences or metalized surfaces can be used for creating electrical walls.

According to some aspects, the second backshort metallization is electrically connected to the second PCB metallization by means of soldering.

In this way, the backshort is attached to the PCB in a both mechanically rigid and electrically reliable manner.

This object is also obtained by means of backshorts and methods that are associated with the above advantages.

BRIEF DESCRIPTION OF THE DRAWINGS

The present disclosure will now be described more in detail with reference to the appended drawings, where:

Figure 1 shows a schematic perspective exploded view of a first example of a waveguide interface arrangement together with a waveguide device;

Figure 2 shows a schematic perspective view of the first example of a waveguide interface arrangement together with a waveguide device;

Figure 3 shows a schematic side view of Figure 2;

Figure 4 corresponds to Figure 3 and illustrates as second example;

Figure 5 shows a schematic perspective view of a backshort according to the second example;

Figure 6 shows a schematic end side view of the backshort according to the second example; and

Figure 7 shows a flowchart for methods according to the present disclosure.

DETAILED DESCRIPTION

Aspects of the present disclosure will now be described more fully hereinafter with reference to the accompanying drawings. The different devices, systems and methods disclosed herein can, however, be realized in many different forms and should not be construed as being limited to the aspects set forth herein. Like numbers in the drawings refer to like elements throughout.

The terminology used herein is for describing aspects of the disclosure only and is not intended to limit the invention. As used herein, the singular forms "a", "an" and "the" are intended to include the plural forms as well, unless the context clearly indicates otherwise.

According to a first example, with reference to Figure 1, showing a schematic perspective exploded view, Figure 2, showing a schematic perspective view, and Figure 3, showing a schematic side view, there is a waveguide interface arrangement 1 arranged for electrically connecting a waveguide device 2 to a microwave conductor 3. A printed circuit board 4 (PCB) comprises a PCB dielectric layer 5, a first PCB main side 6 with a first PCB metallization 7 and a first PCB aperture 10 in the first PCB metallization 7, and a second PCB main side 8 with a second PCB metallization 9 and a second PCB aperture 11 in the second PCB metallization 9. The PCB metallizations 7, 9 are provided on opposite sides of the PCB dielectric layer 5.

In this example, the microwave conductor 3 runs in the first PCB metallization 7, and is in the form of a microstrip conductor, where the second PCB metallization 9 forms a ground plane for the microstrip conductor 3. In this case, the microwave conductor 3 runs through an opening 35 in the waveguide device 2. According to some aspects, the microwave conductor 3 comprises a radiating element 28 at its end, where the radiating element 28 for example can be in the form of a rectangular or circular patch element. The radiating element 28 is adapted to enhance the properties of the electrical connection between the waveguide device 2 and the microwave conductor 3, and can be used as a tuning element.

The microwave conductor 3 is connected to another component, for example at least one electronic component 12 that is mounted to the first PCB metallization 7, where such a component for example can be a connector, a filter or an amplifier. Generally, at least one electronic component 12, 13, 14 is mounted to a PCB metallization 7, 9.

The first PCB main side 6 is adapted for attachment of a waveguide device 2, where the first PCB aperture 10 is adapted to correspond to a waveguide aperture 22, as indicated in Figure 1. According to some aspects, the PCB metallizations 8, 9 are electrically connected by means of via connections 33 that circumvent the PCB apertures 10, 11. For reasons of clarity, the via connections are only shown schematically, and only a few via connections are shown completely by means of hidden contour markings. It is to be understood that a sufficient amount of sufficiently spaced via connections completely circumvent the PCB apertures 10, 11 and electrically connect the PCB metallizations 8, 9 to each other.

Alternatively, according to some aspect, the PCB metallizations 8, 9 are electrically connected by means of at least one metalized wall 34 that connects the PCB apertures 10, 11, the wall being comprised in the PCB dielectric layer 5.

The waveguide interface arrangement 1 further comprises a backshort 15 that is attached to the second PCB main side 8, where the backshort 15 comprises a backshort dielectric layer 16. The backshort 15 further comprises a first backshort main side 17 with a first backshort metallization 18, a second backshort main side 19 with a second backshort metallization 20 and a backshort aperture 21 in the second backshort metallization 20. The backshort metallizations 18, 20 are provided on opposite sides of the backshort dielectric layer 16.

The backshort metallizations 18, 20 are electrically connected to each other, according to some aspects by means of via connections 25, here the via connections 25 circumvent the backshort aperture 21. For reasons of clarity, the via connections are only shown schematically, and only a few via connections are shown completely by means of hidden contour markings. It is to be understood that a sufficient amount of sufficiently spaced via connections circumvent the backshort aperture 21 and electrically connect the backshort metallizations 18, 20 to each other.

The first backshort metallization 18 covers a main part of the first backshort main side 17, where, according to some aspects, the first backshort main side 17 and the second backshort main side 19 run mutually parallel opposite each other and form outer main sides of the backshort 15, where the backshort dielectric layer 16 is homogenous. According to some further aspects, all main sides 6, 8, 17, 19 run mutually parallel to each other. The second backshort metallization 20 is electrically connected to the second PCB metallization 9, and the backshort aperture 21 is adapted to face the second PCB aperture 11.

According to some aspects, the dielectric layers 5, 16 are made in the same dielectric material which means that the PCB 4 and the backshort 15 will have the same thermal expansion and retraction properties. This enables soldering or electrical conducting glue to be used as the interface between the backshort 15, 15' and the PCB 4.

According to some aspects, the second backshort metallization 20 is electrically connected to the second PCB metallization 9 by means of soldering. In this way, the backshort 15 is securely attached to the PCB 4, and the metallizations 9, 20 will be electrically connected to each other in a reliable manner. For example, mounting the backshort 15 to the PCB 4 can be performed in an ordinary pick-and-place process where other components 12, 13, 14 are mounted to the PCB 4 a well.

Alternatively, electrically conducting glue and/or mechanical attachment means such as screws can be used for attaching the backshort 15 to the PCB 4 in such a way that the metallizations 9, 20 will be electrically connected to each other.

A second example will now be described with reference to Figure 4, showing a schematic side view of a waveguide interface arrangement 1' with a waveguide device 2, Figure 5 showing a perspective side view of a backshort 5' and Figure 6 showing a schematic side view of the backshort 5'. The PCB 4 is of the same kind as in the first example, except that the microwave conductor 3 runs in the second PCB metallization 9; the main difference between the examples lies in how the backshort is formed.

The backshort 15' is attached to the second PCB main side 8, and comprises a backshort dielectric layer 16'. The backshort 15' further comprises a first backshort main side 23 with a first backshort metallization 24, a second backshort main side 19' with a second backshort metallization 20' and a backshort aperture 21' in the second backshort metallization 20'. The backshort dielectric layer 16' comprises an air-filled cavity 26 that communicates with the backshort aperture 21', and where the cavity 26 is defined by the first backshort main side 23 and cavity walls 29, 30, 31, 32 extending between the first backshort main side 23 and the backshort aperture 21'. The first backshort main side 23 is here extending within air-filled cavity 26, parallel to the second backshort main side 19', and has a smaller extent than the second backshort main side 19'.

According to some aspects, the backshort metallizations 24, 20' are electrically connected to each other by means of at least partly metalized cavity walls 29, 30, 31, 32 extending between the first backshort main side 23 and the backshort aperture 21'. In this way, a coherent metallization can be formed by the backshort metallizations 24, 20' and the metalized cavity walls 29, 30, 31, 32.

Alternatively, the backshort metallizations 24, 20' are electrically connected to each other by means of via connections in same way as for the backshort of the first example. As illustrated in Figure 4, the microwave conductor 3 is formed in the second PCB metallization 9 and is adapted to enter the backshort 15' via an opening 27 in the second backshort metallization 20'.

According to some aspects, the second backshort metallization 20' is electrically connected to the second PCB metallization 9 by means of soldering.

Generally the present disclosure relates to a waveguide interface arrangement 1, 1' arranged for electrically connecting a waveguide device 2 to a microwave conductor 3, where the microwave conductor 3 runs in a metallization 7, 9 on one main side 6, 8 of a printed circuit board 4 (PCB). The PCB comprises comprising a PCB dielectric layer 5, a first PCB main side 6 with a first PCB metallization 7 and a first PCB aperture 10 in the first PCB metallization 7, and a second PCB main side 8 with a second PCB metallization 9 and a second PCB aperture 11 in the second PCB metallization 9. At least one electronic component 12, 13, 14 is mounted to a PCB metallization 7, 9, and the first PCB main side 6 is adapted for attachment of a waveguide device 2, the first PCB aperture 10 being adapted to correspond to a waveguide aperture 22. The waveguide interface arrangement 1, 1' comprises a backshort 15, 15' that is attached to the second PCB main side 8, where the backshort 15, 15' comprises a backshort dielectric layer 16, a first backshort main side 17, 23 with a first backshort metallization 18, 24, and a second backshort main side 19, 19' with a second backshort metallization 20, 20' and a backshort aperture 21, 21' in the second backshort metallization 20, 20'. The backshort metallizations 18, 24; 20, 20' are electrically connected to each other, and the first backshort metallization 18, 24 covers a main part of the first backshort main side 17, 23. Furthermore, the second backshort metallization 20, 20' is electrically connected to the second PCB metallization 9, and the backshort aperture 21, 21' is adapted to face the second PCB aperture 11.

Generally the present disclosure relates to a backshort 15, 15' adapted to be attached to a printed circuit board 4 (PCB) at a main side 8 of the PCB 4 opposite a main side 6 of the PCB 4 where a waveguide device 2 is adapted to be mounted. The backshort 15, 15' comprises a backshort dielectric layer 16, 16', a first backshort main side 17, 23 with a first backshort metallization 18, 24 and a second backshort main side 19, 19' with a second backshort metallization 20, 20' and a backshort aperture 21, 21' in the second backshort metallization 20, 20'. The backshort metallizations 18, 24; 20, 20' are electrically connected to each other and the first backshort metallization 18, 24 covers a main part of the first backshort main side 17, 23.

According to some aspects, tuning of the waveguide interface arrangement 1, 1' can be performed by means of the tuning element 28 and/or by choosing a certain thickness of the backshort dielectric layer 16 16'. According to some aspects, the tuning of the waveguide interface arrangement 1, 1' can also, alone or in combination with any one of the above, be performed by choosing a certain distance that the microwave conductor 3 extends between the backshort 15, 15' and the PCB 4.

With reference to Figure 7, the present disclosure relates to a method for configuring a waveguide interface arrangement 1, 1' waveguide interface arrangement 1, 1' used for electrically connecting a waveguide device 2 to a microwave conductor 3 in a printed circuit board 4 (PCB) having a PCB dielectric layer 5 with first PCB main side 6 and a second PCB main side 8. The first PCB main side 6 is used for attachment of a waveguide device 2, where the method comprises providing S100 a first PCB metallization 7 at the first PCB main side 6 and a first PCB aperture 10 in the first PCB metallization 7, where the first PCB aperture 10 is adapted to correspond to a waveguide aperture 22 and providing S200 a second PCB metallization 9 at the second PCB main side 8 and a second PCB aperture 11 in the second PCB metallization 9. The method further comprises mounting S300 at least one electronic component 12, 13, 14 to a PCB metallization 7, 9, providing S400 a backshort 15, 15’ having a backshort dielectric layer 16 with a first backshort main side 17, 23 and a second backshort main side 19, 19’ and providing S500 a first backshort metallization 18, 24 at the first backshort main side 17, 23. The method further comprises providing S600 a second backshort metallization 20, 20’ at the second backshort main side 19, 19’ and a backshort aperture 21, 21’ in the second backshort metallization 20, 20’, where the backshort metallizations 18, 24; 20, 20’ are electrically connected to each other, and the first backshort metallization 18, 24 covers a main part of the first backshort main side 17, 23. The method further comprises attaching S700 the backshort 15, 15’ to the second PCB main side 8 such that the second backshort metallization 20, 20’ is electrically connected to the second PCB metallization 9, and such that the backshort aperture 21, 21’ is adapted to face the second PCB aperture 11.

According to some aspects, attaching S700 the backshort 15, 15’ to the second PCB main side 8 is performed using a pick-and-place process.

According to some aspects, the dielectric layers 5, 16 are made in the same dielectric material.

According to some aspects, the main sides 6, 8, 17, 23, 19 run mutually parallel to each other.

According to some aspects, the backshort dielectric layer 16 is homogenous and the backshort main sides 17, 19 are arranged opposite each other.

According to some aspects, the backshort dielectric layer 16’ comprises an air-filled cavity 26 that communicates with the backshort aperture 21’, and where the cavity 26 is defined by the first backshort main side 23 and cavity walls 29, 30, 31, 32 extending between the first backshort main side 23 and the backshort aperture 21’.

According to some aspects, the backshort metallizations 24, 20 are electrically connected to each other by using at least partly metalized cavity walls 29, 30, 31, 32 extending between the first backshort main side 23 and the backshort aperture 21’.

According to some aspects, the backshort metallizations 18, 24; 20 are electrically connected to each other by using via connections 25.

According to some aspects, the microwave conductor 3 is formed in the first PCB metallization 7.

According to some aspects, the microwave conductor 3 is formed in the second PCB metallization 9 and enters the backshort 15’ via an opening 27 in the second backshort metallization 20’.

According to some aspects, the microwave conductor 3 has a radiating element 28 at its end.

According to some aspects, the PCB metallizations 8, 9 are electrically connected by using via connections 33 that circumvent the PCB apertures 10, 11.

According to some aspects, the PCB metallizations 8, 9 are electrically connected by using at least one metalized wall 34 that connects the PCB apertures 10, 11.

According to some aspects, the second backshort metallization 20, 20’ is electrically connected to the second PCB metallization 9 by using soldering.

The present disclosure is not limited to the examples described above, but may vary freely within the scope of the appended claims. For example, for all examples, the microwave conductor 3 can run in any PCB metallization 7, 9 and either pass an opening 27 in the second backshort metallization 20’ or an opening 35 in the waveguide device 2. The metallization may be in the form of copper foils which are attached to the dielectric layer 5, 16, 16’ in a conventional manner and etched away where applicable. Screen printing and other means of applying metalized structures are of course also conceivable.

The dielectric layers 5, 16, 16’ are preferably made in the same dielectric material, but could be made by different dielectric layers, for example due to minimizing losses. In any case, the dielectric materials of the dielectric layers 5, 16, 16’ should preferably have at least similar thermal properties regarding expansion and retraction. This enables soldering or electrical conducting glue to be used as the interface between the backshort 15, 15’ and the PCB 4.

Two examples have been presented where the backshort either is formed in a homogenous backshort dielectric layer 16 such that a cavity is defined in the dielectric layer 16 by means of delimiting via connections 25 and the first backshort metallization 18, or by an air-filled part in the backshort dielectric layer 16’.

In the former case, according to the first example, there is a via fence between the backshort metallizations 18, 20, and such a backshort 15 can easily be implemented in a PCB production process and therefore be very inexpensive. Another advantage will be that the size of the backshort 15 will be relatively small since the physical dimensions will shrink with the dielectric constant of the dielectric material used for the backshort 15.

In the latter case, according to the second example, the air-filled part is electrically delimited by via connections and the first backshort metallization 24, or by metalized cavity walls 29, 30, 31, 32 and the first backshort metallization 24. According to some aspects, the cavity could be completely or partly filled with another dielectric material, allowing the cavity to be designed with desired dielectric and loss properties.

By means of the present disclosure there is provided a low cost high performance solution for a waveguide interface arrangement that minimizes reliability problems. One advantage is that a potential leakage path that normally is very hard to cope with can be avoided. Thereto, the production process will be simplified since the backshort can be mounted in a standard SMD process without screws and springs. Overall, the cost for the backshort will be reduced significantly.

CLAIMS

1. A waveguide interface arrangement (1, 1') arranged for electrically connecting a waveguide device (2) to a microwave conductor (3), where the microwave conductor (3) runs in a metallization (7, 9) on one main side (6, 8) of a printed circuit board (4), PCB, comprising a PCB dielectric layer (5), a first PCB main side (6) with a first PCB metallization (7) and a first PCB aperture (10) in the first PCB metallization (7), and a second PCB main side (8) with a second PCB metallization (9) and a second PCB aperture (11) in the second PCB metallization (9), where at least one electronic component (12, 13, 14) is mounted to a PCB metallization (7, 9), where the first PCB main side (6) is adapted for attachment of a waveguide device (2), the first PCB aperture (10) being adapted to correspond to a waveguide aperture (22), and where the waveguide interface arrangement (1, 1') comprises a backshort (15, 15') that is attached to the second PCB main side (8), wherein the backshort (15, 15') comprises a backshort dielectric layer (16), a first backshort main side (17, 23) with a first backshort metallization (18, 24), and a second backshort main side (19, 19') with a second backshort metallization (20, 20') and a backshort aperture (21, 21') in the second backshort metallization (20, 20'), where:

- the backshort metallizations (18, 24; 20, 20') are electrically connected to each other,
- the first backshort metallization (18, 24) covers a main part of the first backshort main side (17, 23),
- the second backshort metallization (20, 20') is electrically connected to the second PCB metallization (9), and where
- the backshort aperture (21, 21') is adapted to face the second PCB aperture (11).

2. The waveguide interface arrangement (1, 1') according to claim 1, wherein the dielectric layers (5, 16) are made in the same dielectric material.

3. The waveguide interface arrangement (1) according to any one of the claims 1 or 2, wherein the main sides (6, 8, 17, 23, 19) run mutually parallel to each other.

4. The waveguide interface arrangement (1) according to any one of the previous claims, wherein the backshort dielectric layer (16) is homogenous and the backshort main sides (17, 19) are arranged opposite each other.

5. The waveguide interface arrangement (1') according to any one of the claims 1-3, wherein the backshort dielectric layer (16') comprises an air-filled cavity (26) that communicates with the backshort aperture (21'), and where the cavity (26) is defined by the first backshort main side (23) and cavity walls (29, 30, 31, 32) extending between the first backshort main side (23) and the backshort aperture (21').

6. The waveguide interface arrangement (1) according to claim 5, wherein the backshort metallizations (24, 20) are electrically connected to each other by means of at least partly metalized cavity walls (29, 30, 31, 32) extending between the first backshort main side (23) and the backshort aperture (21’).

7. The waveguide interface arrangement (1) according to any one of the claims 1-5, wherein the backshort metallizations (18, 24; 20) are electrically connected to each other by means of via connections (25).

8. The waveguide interface arrangement (1) according to any one of the previous claims, wherein the microwave conductor (3) is formed in the first PCB metallization (7).

9. The waveguide interface arrangement (1’) according to any one of the claims 1-7, wherein the microwave conductor (3) is formed in the second PCB metallization (9) and is adapted to enter the backshort (15’) via an opening (27) in the second backshort metallization (20’).

10. The waveguide interface arrangement (1) according to any one of the previous claims, wherein the microwave conductor (3) comprises a radiating element (28) at its end.

11. The waveguide interface arrangement (1) according to any one of the previous claims, wherein the PCB metallizations (8, 9) are electrically connected by means of via connections (33) that circumvent the PCB apertures (10, 11).

12. The waveguide interface arrangement (1) according to any one of the claims 1-10, wherein the PCB metallizations (8, 9) are electrically connected by means of at least one metalized wall (34) that connects the PCB apertures (10, 11).

13. The waveguide interface arrangement (1) according to any one of the previous claims, wherein the second backshort metallization (20, 20’) is electrically connected to the second PCB metallization (9) by means of soldering.

14. A backshort (15, 15’) adapted to be attached to a printed circuit board (4), PCB, at a main side (8) of the PCB (4) opposite a main side (6) of the PCB (4) where a waveguide device (2) is adapted to be mounted, wherein the backshort (15, 15’) comprises a backshort dielectric layer (16, 16’), a first backshort main side (17, 23) with a first backshort metallization (18, 24) and a second backshort main side (19, 19’) with a second backshort metallization (20, 20’) and a backshort aperture (21, 21’) in the second backshort metallization (20, 20’), where the backshort

metallizations (18, 24; 20, 20’) are electrically connected to each other and where the first backshort metallization (18, 24) covers a main part of the first backshort main side (17, 23).

15. The backshort (15, 15’) according to claim 14, wherein the dielectric layers (5, 16) are made in the same dielectric material.

16. The backshort (15, 15’) according to any one of the claims 14 or 15, wherein the backshort main sides (17, 23, 19) run mutually parallel to each other.

17. The backshort (15) according to any one of the claims 14-16, wherein the backshort dielectric layer (16) is homogenous and the backshort main sides (17, 19) are arranged opposite each other.

18. The backshort (15’) according to any one of the claims 14-16, wherein the backshort dielectric layer (16’) comprises an air-filled cavity (26) that communicates with the backshort aperture (21’), and where the cavity (26) is defined by the first backshort main side (23) and cavity walls (29, 30, 31, 32) extending between the first backshort main side (23) and the backshort aperture (21’).

19. The backshort (15’) according to claim 18, wherein the backshort metallizations (24, 20) are electrically connected to each other by means of at least partly metalized cavity walls (29, 30, 31, 32) extending between the first backshort main side (23) and the backshort aperture (21’).

20. The backshort (15, 15’) according to any one of the claims 14-18, wherein the backshort metallizations (18, 24; 20) are electrically connected to each other by means of via connections (25).

21. A method for configuring a waveguide interface arrangement (1, 1’) waveguide interface arrangement (1, 1’) used for electrically connecting a waveguide device (2) to a microwave conductor (3) in a printed circuit board (4), PCB, having a PCB dielectric layer (5) with first PCB main side (6) and a second PCB main side (8), where the first PCB main side (6) is used for attachment of a waveguide device (2), where the method comprises:

providing (S100) a first PCB metallization (7) at the first PCB main side (6) and a first PCB aperture (10) in the first PCB metallization (7), where the first PCB aperture (10) is adapted to correspond to a waveguide aperture (22);

providing (S200) a second PCB metallization (9) at the second PCB main side (8) and a second PCB aperture (11) in the second PCB metallization (9);

mounting (S300) at least one electronic component (12, 13, 14) to a PCB metallization (7, 9);

providing (S400) a backshort (15, 15') having a backshort dielectric layer (16) with a first backshort main side (17, 23) and a second backshort main side (19, 19');

providing (S500) a first backshort metallization (18, 24) at the first backshort main side (17, 23); and

providing (S600) a second backshort metallization (20, 20') at the second backshort main side (19, 19') and a backshort aperture (21, 21') in the second backshort metallization (20, 20');

where the backshort metallizations (18, 24; 20, 20') are electrically connected to each other, and the first backshort metallization (18, 24) covers a main part of the first backshort main side (17, 23), where the method further comprises

attaching (S700) the backshort (15, 15') to the second PCB main side (8) such that the second backshort metallization (20, 20') is electrically connected to the second PCB metallization (9), and such that the backshort aperture (21, 21') is adapted to face the second PCB aperture (11).

22. The method according to claim 21, wherein attaching (S700) the backshort (15, 15') to the second PCB main side (8) is performed using a pick-and-place process.

23. The method according to one of the claims 21 or 22, wherein the dielectric layers (5, 16) are made in the same dielectric material.

24. The method according to any one of the claims 21-23, wherein the main sides (6, 8, 17, 23, 19) run mutually parallel to each other.

25. The method according to any one of the claims 21-24, wherein the backshort dielectric layer (16) is homogenous and the backshort main sides (17, 19) are arranged opposite each other.

26. The method according to any one of the claims 21-24, wherein the backshort dielectric layer (16') comprises an air-filled cavity (26) that communicates with the backshort aperture (21'), and where the cavity (26) is defined by the first backshort main side (23) and cavity walls (29, 30, 31, 32) extending between the first backshort main side (23) and the backshort aperture (21').

27. The method according to claim 26, wherein the backshort metallizations (24, 20) are electrically connected to each other by using at least partly metalized cavity walls (29, 30, 31, 32) extending between the first backshort main side (23) and the backshort aperture (21').

28. The method according to any one of the claims 21-26, wherein the backshort metallizations (18, 24; 20) are electrically connected to each other by using via connections (25).

29. The method according to any one of the claims 21-28, wherein the microwave conductor (3) is formed in the first PCB metallization (7).

30. The method according to any one of the claim 21-28, wherein the microwave conductor (3) is formed in the second PCB metallization (9) and enters the backshort (15') via an opening (27) in the second backshort metallization (20').

31. The method according to any one of the claim 21-30, wherein the microwave conductor (3) has a radiating element (28) at its end.

32. The method according to any one of the claims 21-31, wherein the PCB metallizations (8, 9) are electrically connected by using via connections (33) that circumvent the PCB apertures (10, 11).

33. The method according to any one of the claims 21-31, wherein the PCB metallizations (8, 9) are electrically connected by using at least one metalized wall (34) that connects the PCB apertures (10, 11).

34. The method according to any one of the claims 21-33, wherein the second backshort metallization (20, 20') is electrically connected to the second PCB metallization (9) by using soldering.

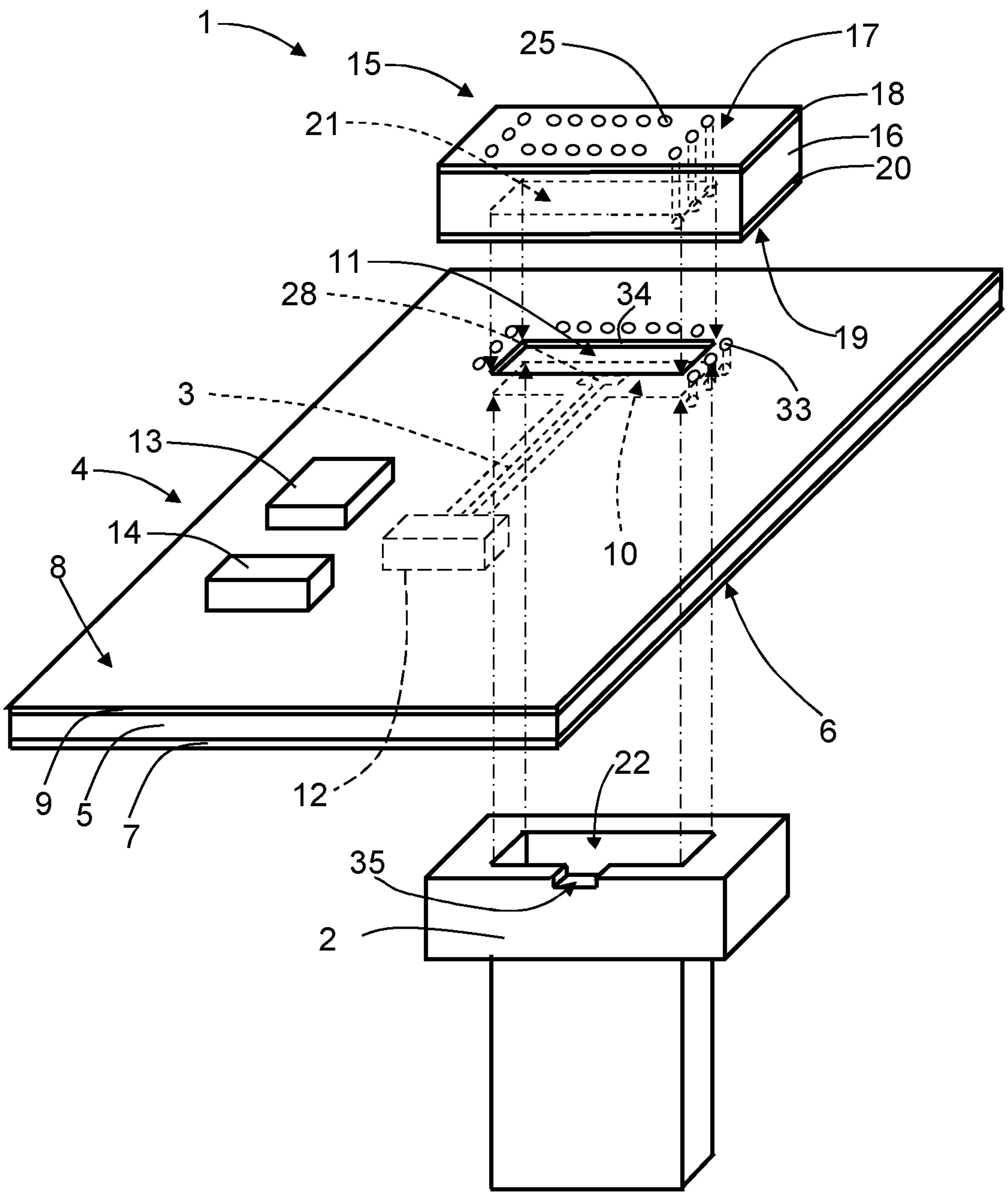

FIG. 1

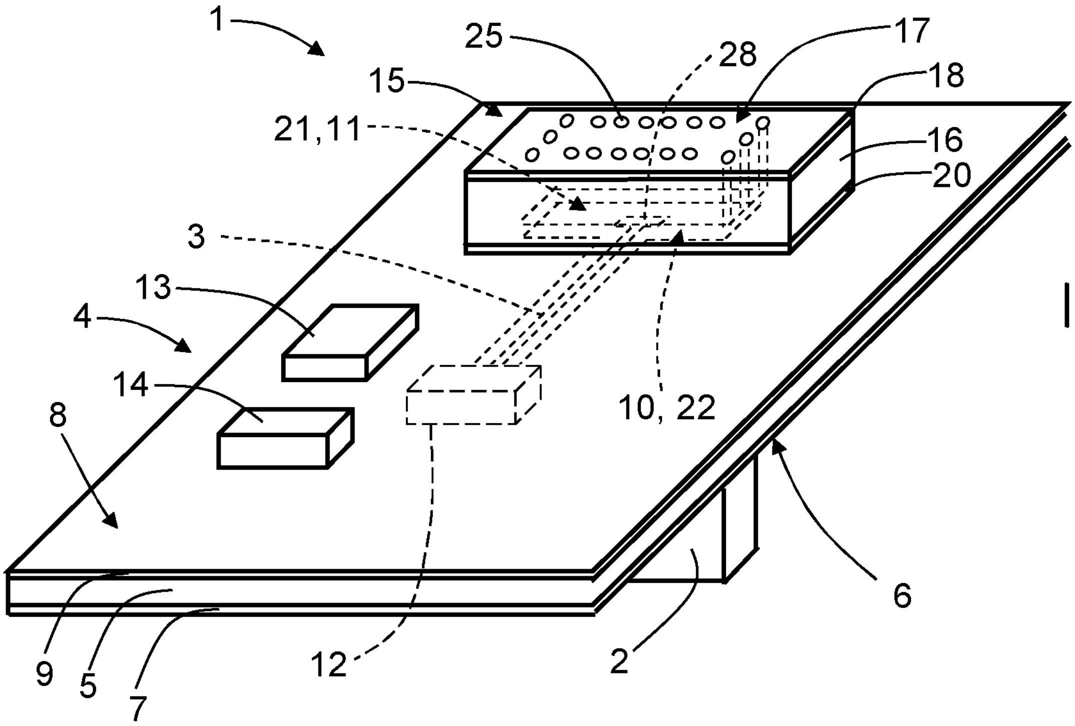

FIG. 2

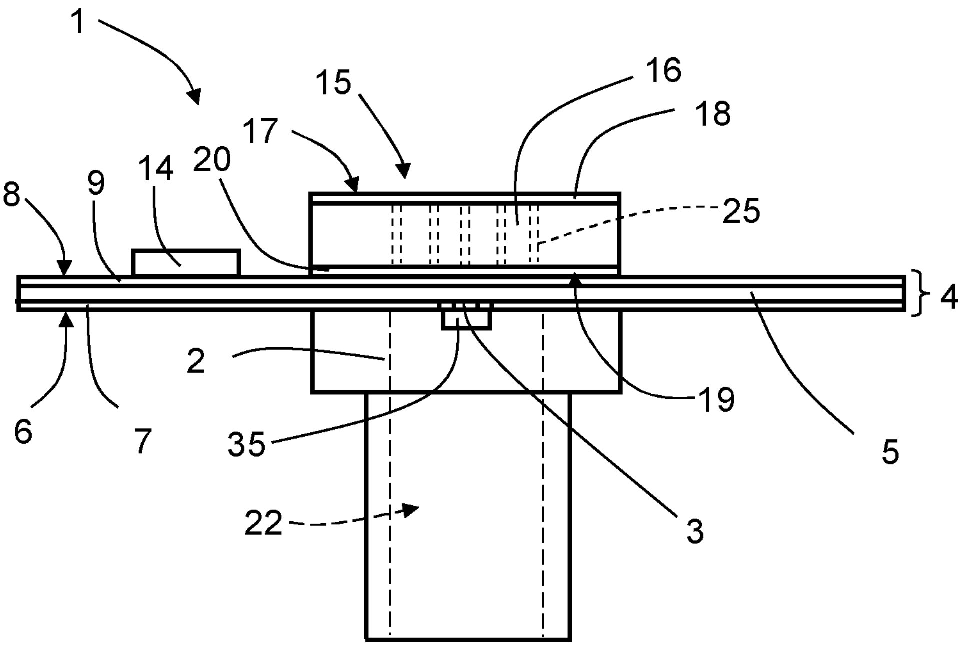
1
15
16
17
18
20
14
9
8
25
4
2
19
6
7
35
5
22
3

FIG. 3

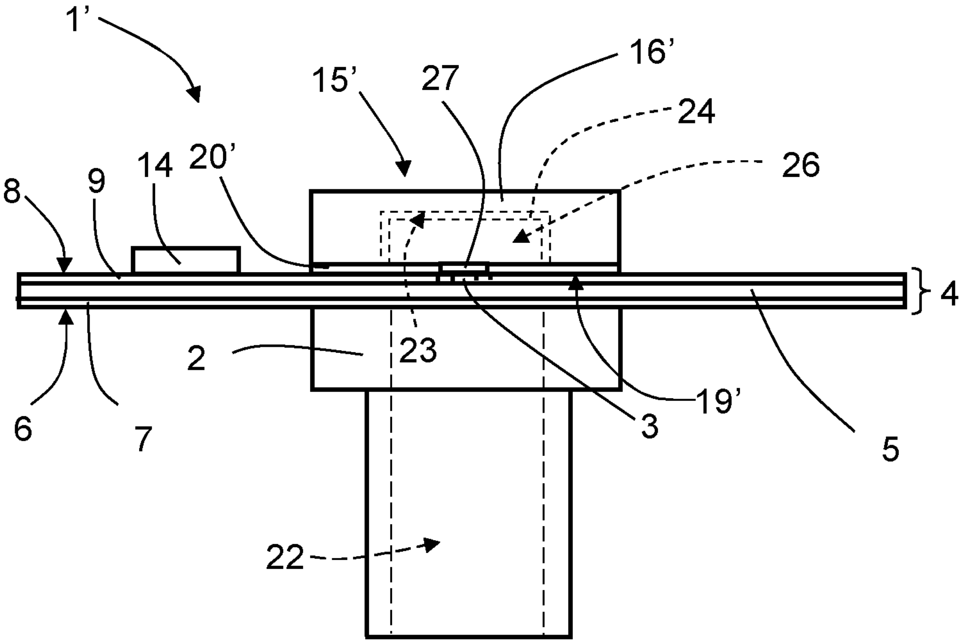
1'
15'
27
16'
24
26
20'
14
9
8
4
2
23
19'
6
7
3
5
22

FIG. 4

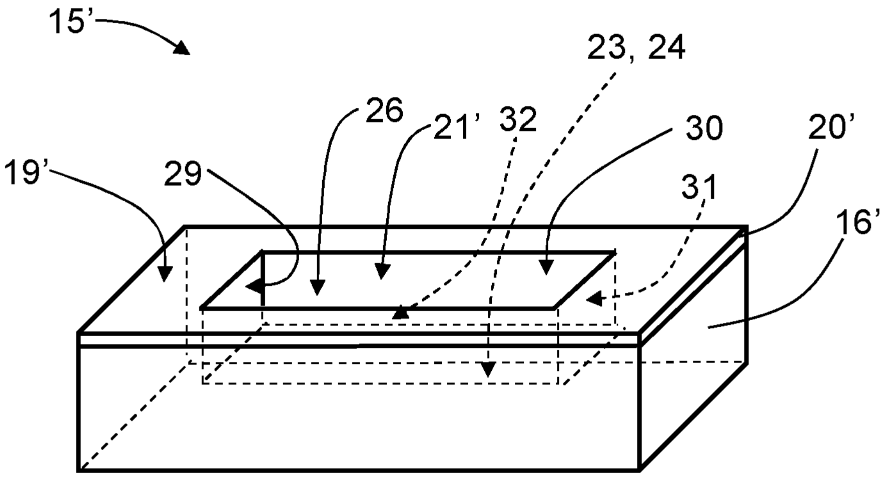

FIG. 5

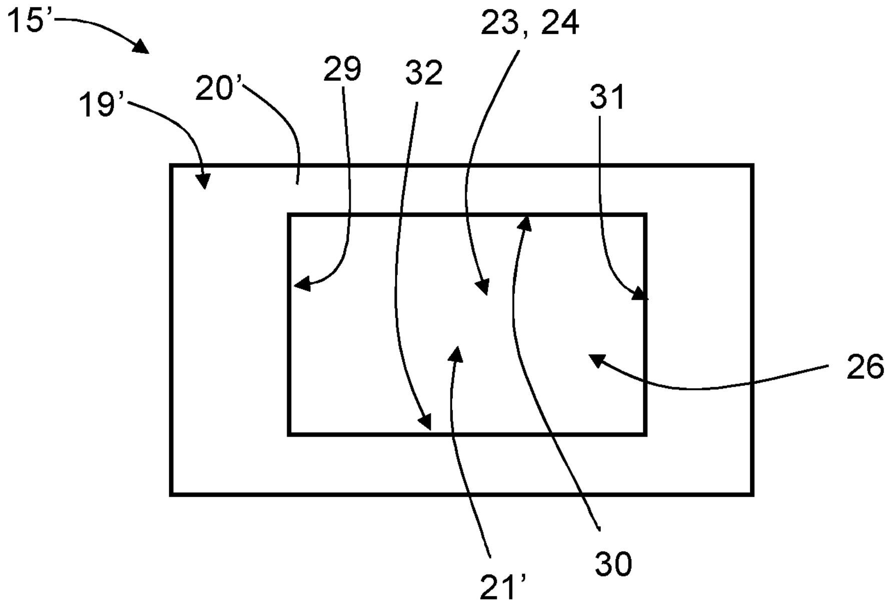

FIG. 6

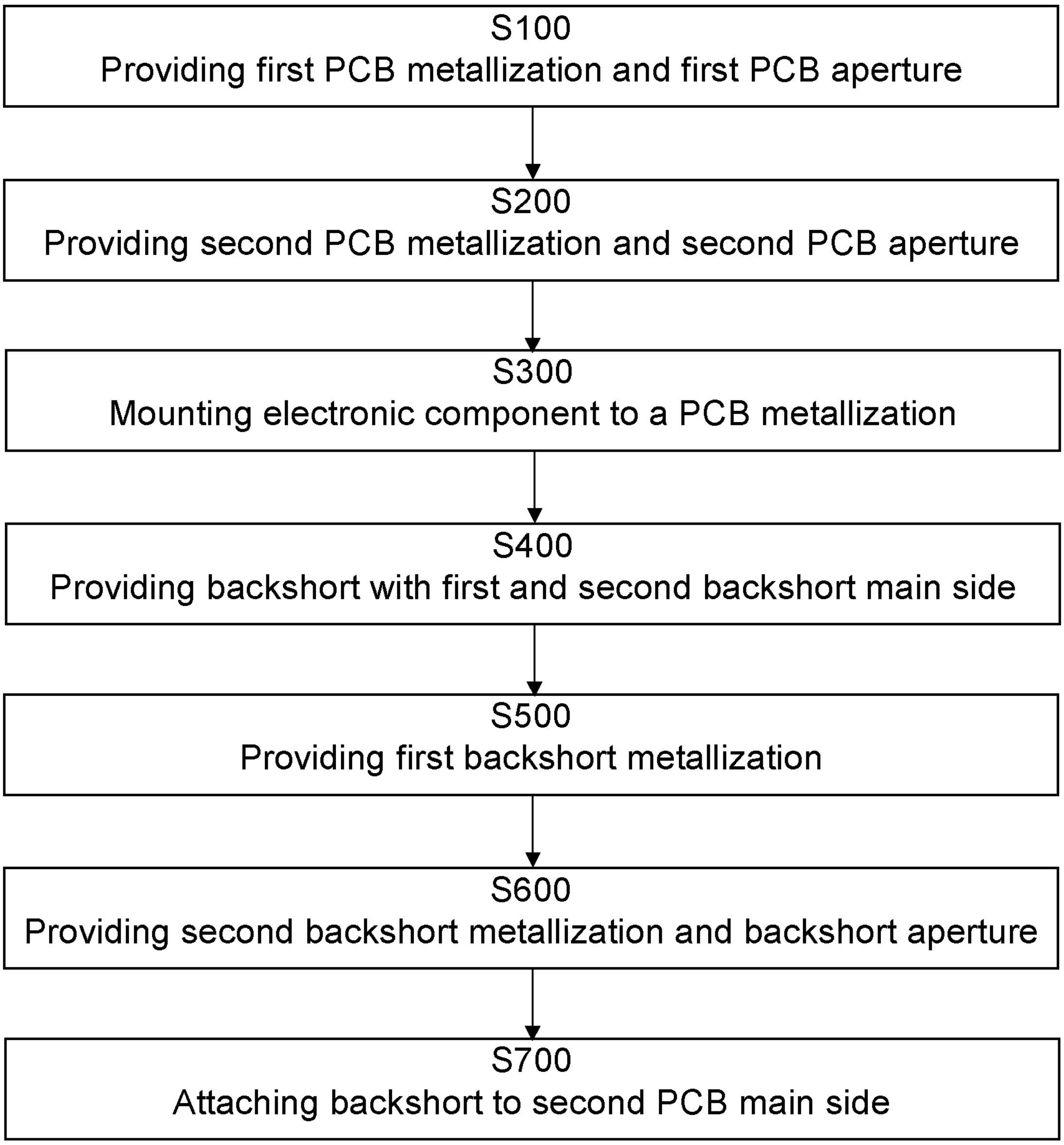
S100
Providing first PCB metallization and first PCB aperture
S200
Providing second PCB metallization and second PCB aperture
S300
Mounting electronic component to a PCB metallization
S400
Providing backshort with first and second backshort main side
S500
Providing first backshort metallization
S600
Providing second backshort metallization and backshort aperture
S700
Attaching backshort to second PCB main side

FIG. 7

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE2020/050640

A. CLASSIFICATION OF SUBJECT MATTER

IPC: see extra sheet

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC: H01P, H05K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE, DK, FI, NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, PAJ, WPI data, COMPENDEX, INSPEC, IBM-TDB, IPRally

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2019199212 A1 (SAAB AB), 17 October 2019 (2019-10-17); page 7, line 24 - page 12, line 27; page 15, line 23 - line 24; figures 1a-2b	14-20
A		1-13, 21-34
	--	
A	K. Sakakibara et al. 'Broadband and Planar Microstrip-to-Waveguide Transitions in Millimeter-Wave Band', in: 2008 International Conference on Microwave and Millimeter Wave Technology, 21-24 April 2008, Nanjing, China, ISBN 978-1-4244-1879-4, DOI 10.1109/ICMMT.2008.4540667; whole document	1-34
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☒ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:

- "A" document defining the general state of the art which is not considered to be of particular relevance
- "D" document cited by the applicant in the international application
- "E" earlier application or patent but published on or after the international filing date
- "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed
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- "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
- "&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
29-03-2021	29-03-2021

Name and mailing address of the ISA/SE	Authorized officer
Patent- och registreringsverket Box 5055 S-102 42 STOCKHOLM Facsimile No. + 46 8 666 02 86	Jenny Wallner Telephone No. + 46 8 782 28 00

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 20070182505 A1 (FUJITA AKIHISA ET AL), 9 August 2007 (2007-08-09); abstract; figure 1; all claims --	1-34
A	US 20190207286 A1 (MOALLEM MEYSAM), 4 July 2019 (2019-07-04); paragraphs [0004]-[0005], [0018]-[0022]; figure 1A --	1-34
A	US 20150054593 A1 (WANG CHUNG JUI), 26 February 2015 (2015-02-26); paragraphs [0004]-[0007], [0041]; figures 1-4 --	1-34
A	US 20120256707 A1 (LEIBA YIGAL ET AL), 11 October 2012 (2012-10-11); abstract; all figures -- --------	1-34

Continuation of: second sheet

International Patent Classification (IPC)

H01P 5/107 (2006.01)
H01P 3/12 (2006.01)
H05K 1/14 (2006.01)

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				JP	4568235 B2	27/10/2010
				JP	2007214777 A	23/08/2007
				US	7750755 B2	06/07/2010
US	20190207286	A1	04/07/2019	US	10403954 B2	03/09/2019
				US	20190393581 A1	26/12/2019
US	20150054593	A1	26/02/2015	US	9054404 B2	09/06/2015
US	20120256707	A1	11/10/2012	US	9270005 B2	23/02/2016