Internal distribution code:

(A) [-] Publication in OJ
(B) [-] To Chairmen and Members
(C) [-] To Chairmen
(D) [X] No distribution

Datasheet for the decision of 9 October 2018

Case Number: T 1981/15 - 3.4.03

Application Number: 08720878.1

Publication Number: 2124253

IPC: H01L21/60, H01L23/02, H01L23/12, H01P1/00, H01P5/02, H01L23/66

Language of the proceedings: EN

Title of invention:
HIGH FREQUENCY PACKAGE

Applicant:
Mitsubishi Electric Corporation

Headword:

Relevant legal provisions:
EPC Art. 52(1), 56, 84, 123(2), 153(2), 153(4)
EPC R. 49(10)
RPBA Art. 15(1)

Keyword:
Inventive step - (yes)
Claims - clarity (yes)
Amendments - added subject-matter (no)
Languages of the EPO - translation into official language of the EPO

Decisions cited:

Catchword:

Europäisches Patentamt
European Patent Office
Office européen des brevets

Beschwerdekammern

Boards of Appeal

Chambres de recours

Boards of Appeal of the
European Patent Office
Richard-Reitzner-Allee 8
85540 Haar
GERMANY
Tel. +49 (0)89 2399-0
Fax +49 (0)89 2399-4465

Case Number: T 1981/15 - 3.4.03

D E C I S I O N
of Technical Board of Appeal 3.4.03
of 9 October 2018

Appellant: (Applicant)	Mitsubishi Electric Corporation 7-3, Marunouchi 2-chome Chiyoda-ku Tokyo 100-8310 (JP)
Representative:	Zech, Stefan Markus Meissner Bolte Patentanwälte Rechtsanwälte Partnerschaft mbB Postfach 86 06 24 81633 München (DE)
Decision under appeal:	**Decision of the Examining Division of the European Patent Office posted on 27 May 2015 refusing European patent application No. 08720878.1 pursuant to Article 97(2) EPC.**

Composition of the Board:

Chairman	G. Eliasson
Members:	S. Ward
	W. Van der Eijk

Summary of Facts and Submissions

I. The appeal is against the decision of the Examining Division refusing European patent application No. 08 720 878 on the grounds that the claimed subject-matter did not involve an inventive step within the meaning of Article 56 EPC.

II. At the end of the oral proceedings held before the Board the appellant requested that the decision under appeal be set aside and that a patent be granted on the basis of the following documents:

Claims: claims 1 and 2 of the main request, originally filed as second auxiliary request on 10 September 2018;
Description: pages 1 to 12 as filed on 10 September 2018;
Drawings: sheets 1/5 to 5/5 as filed with entry into the regional phase before the EPO.

Failing that, the appellant requested that the decision under appeal be set aside and that a patent be granted on the basis of the third auxiliary request filed on 10 September 2018.

III. The following documents are referred to:

D1: EP 1 729 340 A1
D2: JP 2005 101856 A

IV. Claim 1 of the main request (filed as the second auxiliary request on 10 September 2018) reads as follows:

"A radio-frequency package comprising:

a radio-frequency device (2);
a multilayer dielectric substrate (20) having a surface layer on which the radio-frequency device (2) is mounted; and
an electromagnetic shield member (3, 4) that covers a portion of the surface layer of the multilayer dielectric substrate (20) and the radio-frequency device (2), wherein the multilayer dielectric substrate (20) includes an internal conductor pad for bias/control signal (5) arranged on the surface layer of the multilayer dielectric substrate (20) inside the electromagnetic shield member (3, 4) and wire-connected to the radio-frequency device (2),
a first signal via-hole (24) connected to the internal conductor pad (5) and arranged inside the electromagnetic shield member (3, 4),
an external conductor pad for bias/control signal (21) arranged outside the electromagnetic shield member (3, 4),
a second signal via-hole (22) connected to the external conductor pad (21) and arranged outside the electromagnetic shield member (3, 4), and
an inner-layer signal line (23) that connects between the first signal via-hole (24) and the second signal via-hole (22), and
characterized in that
the internal conductor pad (5) includes a leading-end open line (50) having a length of a quarter of a wavelength of a radio-frequency signal used in the radio-frequency device (2)."

V. The findings of the Examining Division, insofar as they are relevant to the present decision, may be briefly summarised as follows:

The subject-matter of claim 1 differed from D1 in that the leading-end open line [referred to as a "slot line" in the claims then on file] was included in the internal conductor pad. D1 disclosed a slot line on an internal-layer signal line 60, and this already solved the problem of preventing the leakage of high frequency components to the outside. The subject matter of claim 1 was therefore a mere design alternative for the location of the slot line, which was not inventive in view of Document D1 and the knowledge of the skilled person.

VI. With the summons to oral proceedings, the Board sent the appellant a communication under Article 15(1) RPBA indicating that the questions of inventive step and compliance with the requirements of Article 123(2) EPC would be discussed.

Reasons for the Decision

1. The appeal is admissible.

2. *Article 84 and Rule 49(10) EPC*

2.1 Claim 1 defines that the internal conductor pad includes a "leading-end open line 50". This term, which was present in the translation of the international application into English pursuant to Article 153(4) EPC, was objected to during the examination procedure under Article 84 and Rule 49(10) EPC for being "not generally accepted in the art" (see e.g. communication of 24 July 2014, point 1.1). As a result, this feature was amended to "slot line" in the version of the claims

as refused. Since the term "leading-end open line 50" has been re-instated into claim 1 of the present main request, it is necessary for the Board to consider the objections previously raised against it.

2.2 The last sentence of Rule 49(10) EPC reads as follows:

"Only the technical terms, formulae, signs and symbols generally accepted in the field in question shall be used."

The intention, in the opinion of the Board, is to prohibit the use of terminology (and formulae, signs and symbols) which would be misleading or unfamiliar to the person skilled in the art.

2.3 In the present case, the term in question appears in claim 1 as follows:

"the internal conductor pad (5) includes a leading-end open line (50) having a length of a quarter of a wavelength of a radio-frequency signal used in the radio-frequency device (2)."

Hence, it is defined that the internal conductor pad includes the line 50, which is therefore in electrical contact with the remainder of the pad. The line has a length of a quarter of a wavelength, and the skilled person would be aware that such lines are often terminated with a short circuit or an open circuit. In the present case the end is defined to be open ("leading-end *open* line"), and the open termination must clearly be the distal end of the line, i.e. the end removed from the electrical connection with the pad. The Board sees nothing in this that could be considered unclear or misleading.

While the term "leading", taken in isolation, might appear imprecise, the skilled person would, as set out above, understand from the claim that the open end is the distal end, remote from the pad. Labelling this end as the "leading" end does not add any new technical information, but neither can it be seen as misleading or detracting from the clarity of the claim.

2.4 Hence, within the context of the subject-matter of claim 1, the Board finds that element 50 is described in a manner which is clear and comprehensible, using terms which would be understood by a person skilled in the technical field. The requirements of Article 84 and Rule 49(10) EPC are therefore met.

3. *Article 123(2) EPC*

3.1 For the purposes of applying Article 123(2) EPC, the application as filed is the PCT application JP 2008/053292 (Article 153(2) EPC), which was published as WO 2008/111391 A1. While the translation provided pursuant to Article 153(4) EPC is normally assumed to be accurate, this matter may be investigated in cases where doubts arise.

3.2 In the present case, the Japanese term for the element 50 was originally translated into English as "leading-end open line 50". The Board noted in its communication pursuant to Article 15(1) RPBA that, in response to objections from the Examining Division, the applicant (now the appellant) had offered other possible English translations, such as "slot line" (which appeared in the claims as refused). As a consequence, it was not certain how the Japanese term should best be rendered

into English. The Board suggested that a certified translation would assist in judging this matter.

3.3 The appellant subsequently provided such a certified translation, in which the term was translated as "distal-end-open line 50". The element 83 in D1 which, in the original international application, comprises the same Japanese characters, was similarly translated as "distal-end-open line 83".

3.4 Since the Board judges that, within the context of the present invention, the terms "leading-end open line" and "distal-end-open line" would convey exactly the same technical information to the skilled person (see point 2.3, above), the Board is satisfied that the translation provided pursuant to Article 153(4) EPC can be considered accurate, and that the appearance of the term "leading-end open line" in the claims of the main request does not add subject-matter which extends beyond the content of the application as filed.

3.5 Claims 1 and 2 of the present main request differ from those in the translation provided pursuant to Article 153(4) EPC only in the deletion of "substantially" in the phase "a length of substantially a quarter of the wavelength". The Examining Division had no objection to this amendment and neither does the Board.

The main request therefore meets the requirements of Article 123(2) EPC.

4. *Inventive Step*

4.1 The appellant does not dispute that document D1 discloses all of the features of claim 1 (including a quarter wavelength "leading-end open line", which is

referred to as a "slot line" in D1) with the exception of the claimed *location* of the leading-end open line. In claim 1, the leading-end open line is included as part of the internal conductor pad, whereas in D1 the slot line 83 is provided on an internal layer signal line 60 (see e.g. Fig. 6, claim 8).

4.2 The appellant argued that the distinguishing feature of claim 1 solved two problems:

(a) to provide a *further* reduction in the leakage of high frequency components to the outside of the high frequency package; and

(b) to provide a device which is simpler and cheaper to manufacture.

4.3 Concerning problem (a), it is explained in the description of the present application (e.g. paragraphs [0007]-[0009] and [0023]) that a spurious emission in the cavity may couple to the wire 6 and propagate along a path consisting of the internal conductor pad 5, the inner-layer signal line 23, the two signal via-holes 22, 24, and the external conductor pad 21, from which it "radiates to the outside".

4.4 The Examining Division pointed out that D1 already recognised the problem of such radiative leakage and disclosed a solution in the form of a "slot line 83" in the conductive path, which would reflect spurious emissions coupled to the wire and thereby suppress "leakage of a high-frequency component to the outside via the external terminals 51" (D1, paragraph [0050]).

The Examining Division further argued that the skilled person would understand that this effect would be

achieved irrespective of the position of the quarter wavelength element along the conductive path between the internal conductor pad 5 and the external conductor pad 21. Hence, shifting it from the inner-layer signal line (as in D1) to the internal conductor pad 5 (as in claim 1) represented an obvious and non-inventive design alternative.

4.5 The appellant did not challenge this analysis *per se*, but argued that there were in fact *two* sources of leakage: the first type of leakage as described above, and a second type of leakage "caused by a radiation through the space of the inner layer".

This second type of leakage arose as follows: In the arrangement of D1, the high frequency signal resulting from a spurious wave coupling to the wire would propagate some distance before encountering the slot line, from which it would be reflected. While propagating along the conductive path towards (and back from) the slot line, the high frequency signal would give rise to radiative leakage, which would propagate through the multilayer dielectric substrate 23 and exit the device.

The appellant contended that the present invention had the technical effect of suppressing this second source of leakage, as well as the first, thus providing a further reduction in spurious emissions compared with D1.

4.6 Although this second type of leakage is not explicitly mentioned in the application, the Board finds it plausible that it would occur; in high frequency circuits, it is well-known that leakage and spurious electromagnetic effects can arise in many ways (some of

which are discussed in paragraph [0020] of the description). Moreover, the Board does not object to the technical problem being considered to extend to the suppression of the second type of leakage also (hence, to *further* reduce leakage of high frequency components to the outside); this would clearly be consistent with the general aim of the invention to reduce or eliminate (any) radiative leakage from the interior of the package to the outside.

4.7 The question then arises whether it is plausible that the distinguishing feature actually solves the posed problem.

In the statement of grounds of appeal the appellant provided graphs of computer simulations of leakage levels in a radio frequency package under the following conditions: the package comprised no leading-end open line (referred to as an "open stub" in the statement of grounds); an open stub is provided in an inner layer (as in D1); an open stub is located according to the present invention. In oral proceedings the appellant stated that the operating frequency was about 34 GHz, which is consistent with the markings on the graphs.

4.8 The Board's summary of the arguments of the appellant in this regard is as follows:

The first simulation (labelled "(1)") shows that with no open stub, the level of the first type of leakage (via the signal line) is very high, whereas the second type of leakage ("through the space of an inner layer") is almost negligible (less than -30 dB).

The second simulation (labelled "(3)") shows that with an open stub provided in an inner layer, the level of

the first type of leakage is much reduced (down to about -19 dB), which is consistent with the teaching of D1. The second type of leakage, while still relatively small (about -17 dB, corresponding to a power ratio of about 0.02) is nevertheless considerably greater than in the case where no stub is provided. This can plausibly be explained by noting that the signal is reflected from the stub back to the circuit (with at least part of the energy being presumably reflected back and forth multiple times), resulting in increased radiative loss into the dielectric substrate.

The third simulation (labelled "(2)") shows that with an open stub provided as in claim 1, the level of the first type of leakage is again very low (about -20 dB) compared with the first simulation, but here the level of the second type of leakage has returned to negligible levels (about -36 dB).

4.9 The Board sees no reason to question these simulations or the conclusions drawn from them by the appellant, and is therefore satisfied that the distinguishing feature of claim 1 of the main request would provide a positive technical effect which would not be obtained using the arrangement of the closest prior art.

4.10 The Board finds no hint in D1 which would incite the skilled person to solve the posed problem in the claimed manner.

4.11 In the contested decision the Examining Division concluded that the skilled person would be led to the distinguishing feature on the basis of common general knowledge. In reaching this conclusion, the Examining Division explicitly rejected the applicant's suggestion that the distinguishing feature had the technical

effect of providing a further suppression of the unwanted signal, and considered the problem to be solved to be merely "selecting an alternative arrangement as to where to locate the slot line within the same electrical path" (Reasons, point 9.3, emphasis in the original). For the reasons set out above, the Board accepts the contention of the appellant that the distinguishing feature solves the problem of providing a further suppression of unwanted leakage, and sees no reason to believe that such a solution would be evident from the common general knowledge of the person skilled in the art.

4.12 In the written procedure the Examining Division also argued a lack of inventive step on the basis of D1 in combination with document D2, which discloses a high frequency transmission board with a transmission line 2 and two quarter wavelength conductive portions 3 formed on the surface of a ceramic substrate.

Again, the problem was seen as merely selecting where to locate the leading-end open line, and the claimed solution was considered obvious, since D2 disclosed that quarter wavelength conductive portions could be arranged on the surface of a dielectric substrate.

Clearly this argument is no longer pertinent once it is accepted that the problem is in fact to provide a further reduction in the leakage of high frequency components to the outside of a high frequency package, since the teaching of D2 is entirely unconnected with this issue.

4.13 For the reasons given above, and on the basis of the first technical problem proposed by the appellant (see point 4.2, above), the Board concludes that the

subject-matter of claim 1 of the main request involves an inventive step within the meaning of Articles 52(1) and 56 EPC. It is therefore unnecessary for the Board to consider the second proposed problem.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The case is remitted to the department of first instance with the order to grant a patent on the basis of the following documents:

   Claims: claims 1 and 2 of the main request, originally filed as second auxiliary request on 10 September 2018;
   Description: pages 1 to 12 as filed on 10 September 2018;
   Drawings: sheets 1/5 to 5/5 as filed with entry into the regional phase before the EPO.

The Registrar: The Chairman:

S. Sánchez Chiquero G. Eliasson

Decision electronically authenticated