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Datasheet for the decision of 18 February 2021

Case Number: T 1652/14 - 3.4.01

Application Number: 08787486.3

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Title of invention:
ANTENNA CARRIER AND DEVICE

Applicant:
Sony Ericsson Mobile Communications AB

Headword:
Multi-band branched monopole antenna / Sony Ericsson

Relevant legal provisions:
EPC Art. 54, 56, 84
RPBA 2020 Art. 11, 13(2)

Keyword:
Claims - clarity - main request and auxiliary request 1 (no) - auxiliary request 2 (yes)
Novelty - main request and auxiliary request 1 (no) - auxiliary request 2 (yes)
Inventive step - auxiliary request 2 (yes)

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Case Number: T 1652/14 - 3.4.01

D E C I S I O N
of Technical Board of Appeal 3.4.01
of 18 February 2021

Appellant: (Applicant)	Sony Ericsson Mobile Communications AB Nya Vattentornet 221 88 Lund (SE)
Representative:	Kraus & Weisert Patentanwälte PartGmbB Thomas-Wimmer-Ring 15 80539 München (DE)
Decision under appeal:	**Decision of the Examining Division of the European Patent Office posted on 7 April 2014 refusing European patent application No. 08787486.3 pursuant to Article 97(2) EPC.**

Composition of the Board:

Chairman	P. Scriven
Members:	T. Petelski
	C. Almberg

Summary of Facts and Submissions

I. The applicant lodged an appeal against the Examining Division's decision to refuse the European patent application 08 787 486.

II. The Examining Division found a lack of novelty or inventive step in view of document D4. All in all, the decision cites the following documents:

D1: WO 2006/070233 A1

D2: US 2006/0139214 A1

D3: JP 2006 246070 A

D4: US 2007/0115177 A1

D5: EP 1 113 524 A2

D6: US 2004/0196187 A1

III. The appellant requests that the decision be set aside and a patent be granted on the basis of a set of claims according to a main request, filed for the first time with the statement of grounds of appeal, or according to one of a first, second or third auxiliary request, filed on 22 December 2020 in response to the Board's summons to oral proceedings and the communication annexed to it. In this communication, the Board set out its preliminary opinion that the claims failed for lack of clarity and for lack of novelty in view of D4.

IV. In response to the appellant's announcement that it would not attend the oral proceedings, scheduled for 29 January 2021, these were cancelled, and the Board informed about its intention to meet on that day in order to decide on the case.

V. Claim 1 of the main request reads:

A carrier (23) that extends in three mutually orthogonal directions, X, Y and Z, when in use and which comprises:

- a back surface (26) defining a first XY-plane, and

- a side surface (28) defining an XZ-plane,

- whereby the carrier (23) comprises an antenna pattern (10),

wherein said antenna pattern (10) antenna pattern [sic] constitutes part of a high gain multi-band branched monopole or semi-PIFA antenna and said antenna is ground free, and comprises:

- a wider branch (12) that is located on said back surface of the carrier (23), and

- a narrower branch (14) that comprises a first section that extends substantially along the Z-direction of said side surface (28) and a second section that extends substantially in the X-direction of said side surface (28),

whereby said narrower branch (14) is narrower than said wider branch (12), and

whereby the wider branch (12) and the narrower branch (14) extend from a common point (16).

VI. Claim 1 of the first auxiliary request is identical to claim 1 of the main request except for a deletion of the redundant "antenna pattern" and the addition of two reference signs related to the first and second sections.

VII. Claim 1 of the second auxiliary request is directed to an antenna, rather than to a carrier, and reads:

A high gain multi-band branched monopole antenna comprising a carrier (23) that extends in three mutually orthogonal directions, X, Y and Z, when in use and which comprises:

- a back surface (26) defining a first XY-plane, and

- a side surface (28) defining an XZ-plane,

whereby the carrier (23) comprises an antenna pattern (10),

wherein said antenna pattern (10) comprises:

- a wider branch (12) that is located on said back surface of the carrier (23), and

- a narrower branch (14) that comprises a first section (14a) that extends substantially along the Z-direction of said side surface (28) and a second section (14b) that extends substantially in the X-direction of said side surface (28),

whereby said narrower branch (14) is narrower than said wider branch (12), and

whereby the wider branch (12) and the narrower branch (14) extend from a common point (16),

wherein the antenna is ground free.

VIII. Claim 1 of of the third auxiliary request adds to claim 1 of the second auxiliary request, at the end, the feature

[... ground free], *and*
wherein the first section (14a) of the narrower branch (14) has a length of at least 4mm.

IX. The appellant's arguments, relevant to the present decision, can be summarized as follows.

(a) Claim 1 of all requests was clear, because:

(i) Claim 1 of the main and first auxiliary requests was directed to a carrier with an antenna pattern. The reference to an antenna, which was not claimed, and to a ground-free antenna limited the carrier in

so far as it needed to be suitable for use as part of such an antenna; and it could be established, for every antenna pattern, if it was suitable or not. The antenna pattern in D4, for example, was grounded and was, therefore, not suitable for constituting a part of a ground-free antenna.

(ii) Claim 1 of the second and third auxiliary requests explicitly defined the antenna, and, therefore, removed the cause for the Board's clarity objection.

(b) The subject-matters of claim 1 of all requests was novel because:

(i) The antennas of D1, D2, D3, D4, and D5 were all connected to ground and were, therefore, not ground-free. Accordingly, the respective antenna patterns were not suitable for constituting part of a ground-free antenna.

(ii) The antenna in D4, and one of the two coupled antennas in D5, were PIFA antennas, arranged over a ground plate. Hence, they were not monopole or semi-PIFA antennas, which would require a distant ground plate. Accordingly, the respective antenna patterns were not suitable for constituting part a ground-free monopole or semi-PIFA antenna.

(iii) The antennas in D1, D3, D4, and D5 did not comprise two branches and the respective

antenna patterns were not suitable for constituting part of a branched antenna. D1 showed only a single branch; D3 showed coupled dipole and monopole antennas with one branch each; D5 showed two coupled antennas (microstrip and PIFA) with one branch each; and D4 showed a stub 12 in Figure 8c, which was not a branch of an antenna suitable for emitting radio waves, but merely provided a capacitance to influence the resonant frequency.

(iv) D6 showed two branches but in a planar monopole antenna pattern that did not extend over the back and the side planes of the respective carrier.

(c) The subject-matters of claim 1 of all requests involved an inventive step because:

(i) The stub 12 of the antenna pattern in D4 was designed capacitively to couple to the sole branch 2 of the antenna pattern, but did not itself emit any radiation and was not, therefore, a branch. There was no hint that would lead the skilled person to provide a second branch that was positioned with respect to the first branch such that their capacitive coupling was reduced, their relative isolation was increased, and the directivity improved.

(ii) By using an antenna that was not placed over a ground plane and did not have a contact point to ground, a large bandwidth

was achieved in the low-frequency band even when occupying a small volume, in contrast to the PIFA in D4.

(iii) Generally, regarding the other documents, the combination of arranging two branches in orthogonal planes with a distant ground plate lead to a high directivity in the high-band, a large bandwidth in the low-band, and good isolation and tunability, all with a pattern that was simple to manufacture, and small in volume. This combination of advantages was not possible with the type of antenna used in any of D1 - D6.

Reasons for the Decision

The invention and its interpretation

1. The invention lies in the field of radio antennas for mobile devices like mobile phones. Such antennas often need to be able to send and receive signals in different frequency bands, like GSM-850 or GSM-900 at lower frequencies, and GSM-1800 (DCS), GSM-1900 (PCS), or UMTS at higher frequencies. Preferably, such antennas are small, simple, and cheap to manufacture, have a high front-to-back ratio (reduced emission towards the head of the user), and little coupling between the different bands.

2. Monopole antennas are often used in mobile devices, because their size of a quarter of a wavelength is only half that of a comparable dipole antenna. A particular kind of monopole antenna used in this context is the PIFA (planer inverted F antenna), which is easy to produce, has a good front-to-back ratio, and a good impedance matching. On the downside, PIFAs have narrow bandwidths in low-frequency bands. They are typically arranged in parallel to a ground plate, to which they are connected through a shorting pin. One measure to expand the bandwidth of PIFAs is to reduce the area by which the ground plate overlaps the antenna pattern. Such configurations are known as "semi-PIFA" antennas.

3. Hence, when the patent refers to a "semi-PIFA" as being "ground free", the term "ground free" cannot say more than what is inherent to this kind of antenna, namely that it is arranged at most partially over a ground plate. In particular, it cannot say that there is no ground connection, or else the antenna would no longer be a (semi-) PIFA. This interpretation is supported by the description, which states on page 3, line 15 that the antenna is ground-free and on page 4, line 35 - page 5, line 4, that the same antenna may be connected to ground (thereby making it a semi-PIFA).

4. Although a PIFA is a particular kind of monopole antenna, the term "monopole antenna" was (and still is) mostly used in the art, in distinction to PIFA, for an antenna that is positioned in a ground-free volume away from any ground plate and which does not have a direct connection to ground. In the context of a monopole antenna, the term "ground free" was, therefore, understood by the skilled person as emphasizing the difference from a PIFA, in so far as the antenna has no connection to ground and is not placed over a ground

plate. Such (ground-free) monopole antennas exhibit large bandwidths.

5. The present invention aims at providing an improved antenna that is either a monopole antenna or semi-PIFA, which combines all above qualities (large bandwidth, in particular in the low-frequency band; good front-to-back ratio; little coupling between the bands) whilst still being compact and simple to manufacture.

6. The application is not specific on the differences between the two types of antenna. Nevertheless, the Board is confident that the skilled person would have understood the differences, from her knowledge of the art as explained above.

Main request - Clarity

7. Claim 1 is directed to a carrier comprising a back surface, a side surface and an antenna pattern. The antenna pattern is defined, at least partly, in terms of the antenna in which the carrier will be employed. Certain elements of the antenna, as, for example, the ground elements, in this case in the form of "mass blocks" (as they are called in the application on page 9, lines 7 - 11), are not part of the carrier. Hence, the carrier is a stand-alone element that is ground-free, even if it comprises connectors for connection to an external ground.

8. It is, therefore, not clear to what extent the definitions “wherein said antenna pattern constitutes part of a high gain multi—band branched monopole or semi-PIFA antenna” and “said antenna is ground free” serve to restrict the claimed carrier. This problem

persists under the appellant's interpretation of the carrier as "being suitable for use" as part of the defined antenna. The Board fails to see how it could be possible to judge, for an arbitrary carrier and antenna pattern, if it is suitable for use in such an antenna or not. To give an example: is a pattern that happens to be arranged over a ground plate also suitable for use when separated from the ground plate? If this separation caused a deterioration in performance, would the pattern still be considered as suitable to be used as such?

9. As a result, claim 1 is not clear (Article 84 EPC).

Main request - Novelty

10. Figure 8c of D4 shows a carrier 15 with an antenna pattern 2, the pattern having a wider first branch K arranged on a horizontal back surface of the carrier and a narrower second branch 12 arranged on a side surface, with both branches extending from a common point, and with the second branch having a vertically extending section and a horizontally extending section. The question of whether the stub 12 is able to emit radiation is irrelevant for its designation as a "branch", which is a purely geometrical description without any implication for its function.

11. It can be seen, in the same figure, that the carrier with its antenna pattern has a connection Gq intended for a connection to ground. When not included in an antenna structure, the carrier is ground-free.

12. The type of antenna in which the carrier is used is not a characteristic of the carrier itself, and is

interpreted as not restrictive for the carrier. The antenna type is, therefore, of no relevance for the question of novelty.

13. As a result, the subject-matter of claim 1 is not new (Article 54 EPC).

14. The above argument notwithstanding, it is noted that, in this particular case, it is possible to assert that the carrier of D4 is suitable for use in a ground-free semi-PIFA antenna (see the interpretation of this term given under item 3.), by using its connector Gq for a connection to ground, using its connector Q for a connection to the feed, and by using a small ground plate that only partially overlaps the antenna. Hence, the subject-matter of claim 1 would also not be new if the reference to the antenna could have been interpreted as the appellant argued.

First auxiliary request

15. The first auxiliary request contains only formal amendments with no change to the substance of the claims. The amendments do not address the the problems of clarity and novelty that apply to the main request and, hence, there are no exceptional circumstances, in the meaning of Article 13(2) RPBA 2020, that would justify taking this request into account.

Second auxiliary request - General remarks

16. In contrast to the main request, claim 1 is no longer directed to a carrier comprising an antenna pattern that "constitutes part of a high gain multi-band branched monopole or semi-PIFA antenna", but to a "high gain multi-band branched monopole antenna" that comprises said carrier.

17. This amendment is a reaction to the problem with clarity - and the consequential claim interpretation and novelty argument - first set out by the Board in its communication sent in preparation of oral proceedings. These newly identified issues constitute exceptional circumstances, in the sense of Article 13(2) RPBA 2020, that justify the consideration of this request.

18. It is apparent, from the amendment, that the clarity issues no longer apply.

19. The application as filed was directed to "an improved antenna" (see page 2, line 14 of the description) and, for this purpose, provided a carrier with a particular antenna pattern. The technical effects of the pattern depended on the type of antenna in which it was put to use, because the ground plate, and the ground connection in particular, have a strong influence on the emission properties. In this case, the advantages of the invention, which consist of a wide bandwidth, high directivity, small coupling, and good isolation (page 3, lines 5 - 20 of the published application), are intricately linked to the pattern used in a "high gain multi-band branched monopole or semi-PIFA antenna".

20. For this reason, the attempt to define the invention by the carrier alone failed, despite the definition, in the claims, of the intended use.

21. In defining the whole antenna, the present claims define no more than the initially described invention, without deviating from the originally described idea. In its assessment of novelty and inventive step the Examining Division, in its decision under items 1.1 and 2 of the Reasons, explicitly considered the use of the carrier in an antenna and also assessed dependent claims 13 - 15, which were directed to a device like a mobile phone that comprises the carrier - and therefore, necessarily, the whole antenna.

22. For these reasons, the Board considers the documents on file suitable for a complete examination of patentability and sees no special reasons, in the sense of Article 11 RPBA 2020, that would prevent it from issuing a decision on that matter.

Second auxiliary request - Novelty

23. Document D1 discloses a semi-PIFA with a single branch folded in two orthogonal planes. D2 discloses a semi-PIFA with 3 branches, one of which is folded in two orthogonal planes. D3 discloses combined monopole and dipole antennas with a single branch each, the branch of the monopole antenna being folded in two orthogonal planes. D4 discloses a PIFA with two branches in orthogonal planes. D5 comprises a PIFA and a microstrip antenna coupled by a single feed. And D6 discloses a planar monopole antenna with two branches.

24. It follows that the subject-matter of claim 1 differs from D1, D2, D3, D4, and D5 in that the antenna is a ground-free monopole, from D1 further in that the antenna comprises two branches, and from D1, D2, D3, D5, and D6 in that each of the two branches is entirely arranged in a plane orthogonal to the other.

25. Hence, the subject-matter of claim 1 is new (Article 54 EPC).

Second auxiliary request - Inventive step

26. Document D6 is the only document on file that discloses a ground-free, multi-band, branched, monopole antenna. In contrast to the other documents, it has broadband properties in the low-band, similar to the invention, due to its ground-free structure.

27. The two branches of the antenna in D6 lie in the same plane, whereas claim 1 defines two branches in orthogonal planes.

28. The technical effect of that difference starting from D6 lies in a reduced capacitive coupling between the branches and a higher directivity in the emission pattern.

29. The objective problem was to reduce the coupling between the high-band und the low-band, or to improve the front-to-back ratio.

30. The skilled person, trying to solve either or both these problems, would have had no incentive to deviate from the geometry described in D6, because the primary goal of D6 is "to provide a planar monopole antenna"

for dual frequency operation.

31. Even if the skilled person would have considered changing the geometry to a non-planer arrangement, she would have been bound by the specific dimensions indicated in D6, which would not have allowed the narrow branch of width 1 mm to fit the carrier's side surface of width 0.8 mm. Further, even if she would have considered amending the widths to fit branch 524 of Figure 5 to the side surface, this would have changed it's emission properties, because the antenna would no longer be centered with respect to the large ground plate 58. This would further have discouraged the skilled person from such changes.

32. For these reasons, the skilled person would also not have considered a combination of D6 with an antenna pattern of any of D1 - D5. The antennas described in the latter documents are of a different type and have different emission properties, and could not have been simply combined with a monopole antenna.

33. On the other hand, taking one of D1 - D5 as a starting point, the skilled person would have refrained from removing the ground connection from any of the antennas described in those documents. Each of them intentionally choose an antenna with a ground connection. The fundamental resonant frequency is mainly determined by the LC-circuit formed by the capacitive coupling of the antenna pattern to the ground plate and by the inductive properties of the short-circuited stub. D1 - D5 use different means of increasing the bandwidth or of adding further resonances to this fundamental frequency. D1 uses a combination of folding a single antenna branch for inducing harmonic resonances and coupling the branch to

one or more parasitic elements that induce further resonances. D2 uses a plurality of branches with different resonant frequencies that can be folded in order to save space. D3 combines a single-branch monopole with a dipole antenna. D4 couples a dual-band PIFA with an unfed, similar antenna with different resonance frequencies. Finally, D5 combines a PIFA with different antennas using the same feed and a common ground plate.

34. All these particular ideas for adding bandwidth would have been pointless without the ground connection.

35. It follows that the subject-matter of claim 1 involves an inventive step (Article 56 EPC). As a consequence, the lower ranking third auxiliary request needs not be assessed.

Conclusion

36. It follows from the above that the main request is not allowable for lack of novelty and clarity; the first auxiliary request is not considered; and the second auxiliary request is allowable, although some adaptation of the description will be needed.

Order

For these reasons it is decided that:

The decision under appeal is set aside. The case is remitted to the Examining Division with the order to grant a patent with the claims as filed with letter of 22 December 2020 titled "Second Auxiliary Request", and with a description to be adapted thereto and based on the description as filed with the statement of grounds of appeal.

The Registrar: The Chairman:

D. Meyfarth P. Scriven

Decision electronically authenticated