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D E C I S I O N
of 31 May 1996

Case Number: T 0832/94 - 3.5.1

Application Number: 87307944.6

Publication Number: 0270209

IPC: H01Q 9/04

Language of the proceedings: EN

Title of invention:
Dual-band circularly polarised antenna with hemispherical coverage

Applicant:
NORTHERN TELECOM LIMITED

Opponent:
-

Headword:
-

Relevant legal provisions:
EPC Art. 56

Keyword:
"Inventive step (no) - obvious on the basis of general knowledge, confirmed by second piece of prior art"

Decisions cited:
-

Catchword:
-

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Case Number: T 0832/94 - 3.5.1

D E C I S I O N
of the Technical Board of Appeal 3.5.1
of 31 May 1996

Appellant: NORTHERN TELECOM LIMITED
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Decision under appeal: **Decision of the Examining Division of the European Patent Office posted 5 May 1994 refusing European patent application No. 87 307 944.6 pursuant to Article 97(1) EPC.**

Composition of the Board:

Chairman: P. K. J. van den Berg
Members: W. B. Oettinger
C. Holtz

Summary of Facts and Submissions

I. The appeal contests the examining division's decision to refuse the European patent application No. 87 307 944.6 filed on 9 September 1987.

II. The reason given for the refusal was that the subject-matter of Claim 1 filed on 30 July 1992 did not involve an inventive step, having regard to prior art document

D2: FR-A-2 552 938.

III. That claim reads as follows (with obvious clerical errors corrected):

A circularly polarised antenna characterised in that the antenna includes first and second multiple patch antenna structures dimensioned to operate at two distinct frequencies, each antenna structure consisting of a like plurality of patches (11a-11d, 14a-14d) of electrically conductive material, the patches (11a-11d) of the first structure being spaced from a ground plane (10) by dielectric material (12), the patches (14a-14d) of the second structure being spaced from the patches of the first structure by dielectric material (13), the patches of the second structure each overlying a corresponding patch of the first structure and each having a dimension $\lambda_m^{(2)}/4$ which is less than the dimension $\lambda_m^{(1)}/4$ of the corresponding patch of the first structure, with separate coaxial feed means (16a, 17a [meaning 16a-16d, 17a-17d]) for each of the patches, said feed means passing through the ground plane, the patches of both structures being disposed in the planes of the patches so that the corresponding radiating edges of the two patch structures form superimposed antenna structures, corresponding patches of the first and second structures

having corresponding edges shorted to ground via a common set of ["shortening" corrected to read:] shorting pins (15a-15d) or a common plated edge.

IV. In essence, the division argued that

- the claimed antenna differed from the one shown in Figure 13 of D2 only by (firstly) the shorting pins or plated edge being common to the first and second structures and by (secondly) the coaxial feeds being separate for the two sets of patches; and

- the first difference would only amount to an obvious equivalent and the second would be rendered obvious by an alternative antenna known from D2, as shown for instance in Figure 14.

V. The appeal against that decision, which was posted on 5 May 1994, was lodged on 4 July 1994. The respective fee was paid on the same day.

On 5 September 1994, the appellant filed a statement of grounds.

VI. In essence, his submissions can be summarised as follows:

D2 infers (page 4, lines 4 to 6) that the two short circuit lines should not be placed on the same side of the two coaxial cables as in the claimed invention.

D2 mistakenly implies (page 7, lines 18 to 20) that using the outside edges of the slabs for one of the radiation frequencies is technically as good as using the inside edges. In contrast, the claimed invention deliberately uses the inside edges for both radiating frequencies to achieve better hemispherical coverage.

D2 furthermore implies (page 10, lines 34 to 36) that its author considered utilising similar edges for both frequencies to be a problem for the arrangement having separate feeds.

The author of D2 did not recognise the advantage of the great frequency separation, implicit in the claimed invention, achievable with the somewhat greater separation of the radiating edges.

The appellant concludes that D2 would direct the reader away from the concept underlying the claimed invention and that, therefore, the latter would involve an inventive step.

Reasons for the Decision

1. The appeal (cf. V) is admissible.

2. The antenna shown in, and described with reference to, Figure 13 of D2 (one "sector" thereof being also shown in, and described with reference to, Figures 8, 9 and 10) was considered, in the decision under appeal, to be the piece of prior art coming nearest to the claimed invention.

2.1 In the paragraph bridging pages 3 and 4 of that decision, the examining division recited expressly, using the wording of Claim 1, what is known from that piece of prior art. The differences, distinguishing this prior art and the subject-matter of Claim 1, were indicated by underlined words: "**common**" (as opposed to the claimed **separate**) coaxial feed means and "**separate**" (as opposed to the claimed **common**) set of shorting pins (or equivalent plated edge).

The appellant does not seem to dispute that this analysis is correct, and the Board sees no reason for a different view.

2.2 It is noted in passing, that the statement in the decision under appeal, about what D2 discloses, and the subsequent statement about what the differences between the claimed and the known antenna are, were a clear indication of what the examining division considered **should** have been included in the preamble (pre-characterising part) and what in the characterising part, respectively, of Claim 1, had this claim been **correctly** partitioned in accordance with Rule 29(1)(a) and (b), respectively, EPC.

2.3 The Board has considered though, whether the antenna shown in, and described with reference to, Figure 14 of D2 (one "sector" thereof being also shown in, and described with reference to, Figures 11 and 12) could be regarded as coming "nearest", or equally near, to the claimed invention.

However, this alternative approach would clearly be less appropriate because, in the claimed antenna, the radiating edges of the two patch structures lie on the same side and the radiation characteristics of the claimed antenna will therefore clearly be similar to those of the prior art antenna having the same arrangement of radiating edges (Figure 13) and less similar to those of the prior art antenna having the opposite arrangement of radiating edges (Figure 14).

2.4 Nevertheless, the Figure 14 antenna of D2 is to be regarded as a second piece of prior art known to the person skilled in the art considering to improve the Figure 13 antenna in any possible respect.

3. According to the description (page 12, lines 6 to 16) of Figure 9, applicable also to the Figure 13 antenna, $k = \beta / (\alpha+\beta)$ and $k' = \delta / (\gamma+\delta)$ shall **both** be of the order 0.2 to 0.5, preferably about 1/3. With $\alpha+\beta$ and $\gamma+\delta$ being different (page 12, lines 18 to 28), this means that, if k and k' are equal, β and δ must necessarily be different. In a case where, in Figure 9, the left-hand ends of β and δ coincide, this means further that their right-hand ends must **not** coincide.

3.1 It is thus directly derivable from D2 that, in a case where the coaxial feed means (CA12, CB12) is common to both patches (P12, P11), the sets of shorting pins (CC12, CC11) **cannot** be common to both patches.

3.2 However, a common coaxial feed means for both patches is functionally possible only if, and because, in Figure 10, the lower (P11) of the two patches is excited by way of field coupling replacing a direct feed. In D2, this is presupposed to be well-known, Figures 6 and 7 showing examples of yet older prior art (page 6, lines 21 to 26) for such indirect excitation. It is thus clearly implicit in D2 that the fact that the sets of shorting pins (CC12, CC11) do not coincide is directly related to the fact that the lower patch (P11) is excited by way of field coupling rather than by a separate feed means.

3.3 It will, furthermore, be immediately apparent to the person skilled in the respective art and thus knowing about indirect and direct excitation of antenna elements, that it is well possible to return, from the indirect excitation of the lower patch (P11) by field coupling, to the more straightforward direct excitation by a separate coaxial feed means. The use of direct excitation by separate feed means or of indirect excitation by a common feed means and field coupling is

primarily a matter of whether the transmitter or receiver connected to the antenna will provide or evaluate the two signals of different frequencies in a common or in separate circuitries.

It is therefore considered to be obvious to the skilled person to replace the common coaxial feed means (CA12, CB12) of the Figure 13 (and Figures 8 to 10) antenna of D2, if the case arises, by separate coaxial feed means.

As developed above, this appears to be obvious even without regard to the Figure 14 antenna of D2; however, this latter piece of prior art can be regarded as additionally confirming the skilled person's knowledge about the, in principle, equivalence and thus interchangeability of direct and indirect excitation, or feeding.

3.4 As also developed above, this obvious replacement of the common coaxial feed means (CA12, CB12) by separate coaxial feed means has for its direct and apparent consequence that, in Figure 9, the left-hand ends of β and δ cannot, and will not therefore, coincide, but δ will be shifted with respect to β, for instance to the left.

This being so, the skilled constructor of a respective antenna will immediately "see" a possible advantage in shifting, in Figure 8 or 9, the lower patch (P11) to the left with respect to the upper (P12) by an amount which allows the right-hand ends of β and δ to coincide: This would apparently allow, at the manufacturing stage, to insert a common set of shorting pins (or an equivalent shorting means such as a plated edge) in one go instead of having to apply separate shorting means for the first and second patches.

3.5 At this point, it appears worth mentioning that common or separate shorting planes were disclosed, and still are mentioned (rendering the description inconsistent with Claim 1), in the application description (column 3, lines 2 and 8) as being equally utilisable, depending on the circumstances, and thus equivalent alternatives.

3.6 In the Board's view, the skilled constructor will not be deterred from considering to modify the Figure 13 antenna of D2 in the way set out before (cf. point 3.4) by the fact that, by such modification, the left hand edges, in Figure 9, of the patches will be separated by a greater distance, because he will not see any disadvantage in this greater separation.

At the most, he would be encouraged, by this fact, to consider or investigate to what extent the electrical characteristics (e.g. impedance or radiation characteristic) of the antenna would thereby be changed, so that he might consider whether it would be convenient to compensate for such changes by suitable measures.

3.7 In what was developed above, the Board has taken the appellant's submissions (cf. VI) into consideration.

In particular, it is agreed that, in D2, the "separate coaxial feed means" feature is disclosed only in conjunction with the feature of shorting the patches of the two antenna structures on opposite ends (the radiating edges being thus opposite edges). However, as said before, it would be obvious to the person skilled in the art, taking into account also his general knowledge, that nothing would speak against using separate coaxial feed means, if the case arises, in an antenna which is otherwise similar to that of Figure 13 of D2.

3.8 The submission that, contrary to the opinion of the author of D2, the claimed invention would find application in GPS where a greater than 25% frequency separation would occur, is also not convincing.

Primarily, the frequency (or wavelength) separation is only, in accordance with the application documents (including Claim 1) as well as in accordance with D2 (page 12), a function of the (electrical) lengths of the two patches; no reason is therefore seen why an antenna as in Figure 13 of D2, but with the upper patch, in Figure 9, being shifted to the right, should yield a greater frequency separation.

But, however this may be, any change in the electrical characteristics of the antenna so modified, for instance in its radiation characteristic, will be a matter for the skilled person to consider or investigate. In the application documents, no particular effect which would be unexpected to the extent of surprising the skilled reader was disclosed.

3.9 In summary, for these reasons, in the Board's view the conclusion of lack of inventive step as drawn in the decision under appeal was correct.

4. The Board has considered whether the particulars of the present case would have suggested that a communication be issued before a final decision on the appeal; but no reason was seen for such a communication. The reasons for refusal given above are essentially the same as were given by the first instance, although the emphasis has shifted slightly.

4.1 A possible amendment of Claim 1 to the effect of restricting its subject-matter, in particular in the sense of Claim 2 or/and Claim 3, would in the Board's view not render that claim allowable.

The feature added by Claim 2 is directly known, in the same context, from D2; and no argument was submitted against the examining division's finding, in its communication of 24 June 1992, probably based on the prior art document cited in respect of the original Claim 5 in the Search Report, that the feature added by Claim 3 would be an immediately apparent choice of one out of two equally possible, equivalent, alternatives.

4.2 In these circumstances, the Board considers that the decision under appeal should be confirmed without any intermediate action.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar: The Chairman:

M. Kiehl P. K. J. van den Berg