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D E C I S I O N
of 17 February 1994

Case Number: T 0863/93 - 3.5.1

Application Number: 88303040.5

Publication Number: 0286366

IPC: H04B 7/08

Language of the proceedings: EN

Title of invention:
Space diversity receiving system

Applicant:
Pioneer Electronic Corporation

Opponent:
-

Headword:
-

Relevant legal norms:
EPC Art. 52(1), 56

Keyword:
"Inventive step (yes)"

Decisions cited:
-

Catchword:
-

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Beschwerdekammern | Boards of Appeal | Chambres de recours

Case Number: T 0863/93 - 3.5.1

D E C I S I O N
of the Technical Board of Appeal 3.5.1
of 17 February 1994

Appellant: Pioneer Electronic Corporation
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Tokyo 153 (JP)

Representative: Brunner, Michael John et al.
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Decision under appeal: **Decision of the Examining Division of the European Patent Office dated 19 April 1993 refusing European patent application No. 88 303 040.5 pursuant to Article 97(1) EPC.**

Composition of the Board:

Chairman: P.K.J. van den Berg
Members: A.S. Clelland
E.M.C. Holtz

Summary of Facts and Submissions

I. The Appellant contests the decision of the Examining Division dated 19 April 1993 refusing European patent application No. 88 303 040.5.

II. The reason given for the refusal was that the subject-matter of Claim 1 lacked an inventive step having regard to the prior art known from the following documents:

D1: US-A-4 525 869

D2: IEEE Transactions on Vehicular Technology, Vol. VT-22, No. 4, November 1973, pages 185 to 191.

III. On 3 June 1993 the Appellant filed a notice of appeal and subsequently paid the appeal fee. Cancellation of the decision as a whole was requested. A statement setting out the grounds of appeal was subsequently filed on 2 August 1993, in which the Appellant further requested reimbursement of the appeal fee and, if the appeal Board intended to refuse the application, oral proceedings.

IV. The application consists of the following documents:

Claims: 1 to 4 as received on 8 March 1993;

Description: pages 1 to 6 and 8 to 15 as originally filed;
pages 7, 7a as received on 8 March 1993;

Drawings: sheets 1/3 to 3/3 as received on 27 April 1988.

V. Claim 1 reads as follows:

"A space diversity receiving system in which, of a plurality of antennas (1,2), one higher in received electric field strength is selected, and the output thereof is applied to an FM receiver, characterized by

level detecting means (7a) for detecting a received electric field strength of a selected antenna from among the plurality of antennas;

AC component separating means (11) separating an AC component from an output of the level detection means;

trigger signal generating means (13,14) for producing a trigger signal when a level of the AC component exceeds a reference value; and

antenna selecting means (53,54) for comparing antenna electric field strength and selecting an antenna presently higher in received electric field strength in response to the trigger signal."

VI. The Appellant's arguments in support of patentability can be summarised as follows:

The decision of the Examining Division is based on a faulty understanding of the disclosure of document D1. The decision presupposes that D1 operates by selecting the antenna which is highest in received electric field strength; however, D1 does not make a comparison between antennas. The judging circuit receives only a single signal from one of the antennas and compares the received signal with what amounts to an integrated version of the same signal in order to provide a reference. Thus, D1 nowhere effects a comparison of the signals from respective antennas.

Reasons for the Decision

1. The present invention is concerned with space diversity receiving systems of the kind in which two or more antennas are provided for a single receiver, some form of switching being effected between the antennas in order to maintain a signal level adequate for good reception.

The invention is designed to overcome problems with two known existing diversity receiving systems, shown in Figures 1 and 3 respectively of the application. In the Figure 1 system an instantaneous signal strength value is compared with an averaged value from the same antenna in order to determine when the instantaneous value is well below the average value and cause antenna switching when this condition occurs, on the assumptions that such a condition is indicative of poor reception and that the other antenna will provide better reception. This known receiver is said to have the disadvantage that at low signal strengths, giving rise to a low average output, the instantaneous value will not fall sufficiently below the average value to operate the switching (column 3, lines 43 to 52 of the published application). Moreover, the assumption that the other antenna has a higher field strength may be incorrect. In the second prior art system, shown in Figure 3, a sample-and-hold arrangement is provided to enable direct comparison of the signal strengths of the antennas so as to choose the strongest; regular switching is however effected with a predetermined period for comparison purposes. This arrangement is said to have the disadvantage of generating switching noise in certain circumstances (column 3, lines 53 to 58 of the published application).

The described embodiment of the application in effect combines these two prior art arrangements by providing direct comparison of signal strengths by means of a sample-and-hold arrangement not dissimilar to that disclosed in Figure 3, such a comparison however only being made when a triggering circuit operates in response either to abrupt changes in signal strength indicative of multi-path reception or to random noise indicative of low signal levels (paragraph bridging columns 5 and 6 of the published application).

2. The Examining Division's decision is based on the premise that the most relevant prior art document is D1. This document discloses a space diversity receiving system having two antennas, the output of one of which is applied to an FM receiver. As can be seen from Figures 2 and 3 of D1 and the associated text at column 2, line 46 to column 3, line 10, a level detecting means 8 detects a received electric field strength of a selected antenna of the two antennas. The Figure 3a embodiment of the level detector provides a varying DC component proportional to signal strength, which is passed to a "judging circuit" 10 in which the level of the varying DC component is compared with a reference value in the form of a time-averaged received signal, as in the prior art acknowledged at Figure 1 of the application. When the signal falls well below the average value a trigger signal is generated by a pulse generator 11 and passed to antenna selecting means 2,12 for switching to the other antenna. In a second embodiment of level detector shown in Figure 3b a signal proportional to signal strength fluctuations, e.g. multi-path reception, is derived.

3. The Examining Division considers the D1 arrangement to differ from that claimed in Claim 1 of the application in the following respects:

(a) In D1 comparison is effected with a DC signal component, albeit a varying DC component, whereas an AC component is used in the invention;

(b) D1 does not produce a trigger signal when a level of the AC component exceeds a reference value.

4. The Board is unable to see any difference of substance between the "AC component separating means" of Claim 1 and the "detector circuit" of Figure 3b of D1; in both cases a signal is obtained representing fluctuations in received signal strength. On the other hand, it is not clear from the description of D1 just how the output of the Figure 3b circuit is processed, since the "judging circuit" 10 seems more appropriate to the Figure 3a embodiment. The "judging circuit" does not produce a trigger signal in response to a reference level being exceeded, but rather in response to sudden downward changes in signal strength to a level substantially below an averaged level, as illustrated in Figure 6 of D1.

5. Be that as it may, in the Board's view there is a further and more fundamental distinction between the claimed arrangement and that of D1, namely that D1 does not effect a comparison of antenna electric field strengths in order to select the antenna having the higher field strengths; rather, the known arrangement switches between antennas when the instantaneous signal is substantially lower than the average signal in like manner to the prior art acknowledged in Figure 1 of the application. It is stated at column 4, lines 34 to 38 of D1 that when signal strength is satisfactory no further switching takes place. Thus, even if the other antenna has a higher signal strength the receiver will not switch antennas until the signal from the first antenna is unsatisfactory.

6. It therefore appears that the impugned decision does not accurately reflect the disclosure of D1 in that it consistently assumes that the antenna which is highest in received electric field strength is selected; as can be seen from the above analysis this is not the case, switching being effected in D1 in response to a momentarily unsatisfactory signal. If after switching the received signal is satisfactory, no further switching will take place, even if this signal is subsequently lower in strength than the alternatively available signal.

The skilled person, faced with the problems known from the acknowledged prior art and given the disclosure of D1, would not in the Board's view arrive at the claimed arrangement without the exercise of invention.

7. The Board has also considered whether the skilled person, faced with the problems known from the acknowledged prior art and aware of the disclosure of D2, would be led in the direction of the claimed invention. D2 also discloses a space diversity receiving system, see Figure 1 on page 186. In this system however AC component separating means 1,2 separates an AC component from an output of the if amplifier; this is a signal proportional to the envelope of the received signal which is filtered to remove noise and the DC component, so that the comparison is apparently effected between a negative voltage and a varying signal of zero average amplitude, see "sketch A" in Figure 1 of D2. If the level is below the level of reference 4, the comparator 3 gives an output, see sketch B, which causes switching pulses to be provided by the multivibrator 5. The response time is sufficiently fast such that if the immediately switched antenna is satisfactory, further switching is inhibited until the signal level again falls below the reference. Thus, as in D1, there is no

direct comparison of the signal strengths from the two antennas. The skilled person would not therefore be led by D2 to provide this feature.

8. Nor would any combination of D1 or D2 with any other document cited in the application or in the European Search Report, or with either of the acknowledged prior art systems, cause the skilled person to arrive at the claimed arrangement without the exercise of invention. The most plausible combination would appear to be that of the two acknowledged prior art arrangements themselves, in which an instantaneous signal level lower than the average level (Figure 1) causes a pulse to be generated and thus a comparison between the antenna signal strengths to be made (Figure 3). Even if it were obvious for the skilled person to provide such a combination, the feature of AC component separating means is not disclosed by these two prior art arrangements and would not appear to form part of the common general knowledge in the art such that the skilled person would, as a matter of course, consider its application to the combined arrangement.

9. The Board accordingly concludes that the subject-matter of Claim 1 is novel and inventive.

10. In the Statement of Grounds the Appellant requests a full refund of the appeal fee on the ground that the examiner misunderstood the operation of the device of D1 when deciding to refuse the application.

In accordance with Rule 67 EPC the reimbursement of appeal fees shall be ordered where the appeal is allowable and reimbursement is equitable by reason of a substantial procedural violation. It is the established jurisprudence of the Boards of Appeal that in order to fall within Rule 67 EPC a **procedural** violation as

opposed to an error of judgment must have occurred (see for example T 19/87 OJ EPO 1988, 286). In the present case it is clear that no procedural error has occurred; the issue raised by the Appellant, the disclosure of D1, is a matter of judgment which does not justify the reimbursement of the appeal fee.

Order

For these reasons, it is decided that:

1. The decision under appeal is set aside.

2. The case is remitted to the first instance with the order to grant a patent on the basis of the documents set forth in paragraph IV above.

The Registrar: The Chairman:

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