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**Datasheet for the decision  
of 17 February 2016**

**Case Number:** T 2466/11 - 3.5.05

**Application Number:** 04797825.9

**Publication Number:** 1695499

**IPC:** H04L25/02, H04L27/26

**Language of the proceedings:** EN

**Title of invention:**

CHANNEL ESTIMATION BY ADAPTIVE INTERPOLATION

**Applicant:**

Optis Wireless Technology, LLC

**Headword:**

Channel estimation by interpolation of pilot symbols/OPTIS  
WIRELESS

**Relevant legal provisions:**

EPC Art. 56  
EPC R. 103

**Keyword:**

Inventive step - (yes)  
Reimbursement of appeal fee - (no)

**Decisions cited:**

**Catchword:**



**Beschwerdekammern**  
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**Chambres de recours**

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Case Number: T 2466/11 - 3.5.05

**D E C I S I O N**  
**of Technical Board of Appeal 3.5.05**  
**of 17 February 2016**

**Appellant:** Optis Wireless Technology, LLC  
(Applicant) P.O. Box 250649  
Plano, TX 75025 (US)

**Representative:** Grünecker Patent- und Rechtsanwälte  
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Leopoldstraße 4  
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**Decision under appeal:** **Decision of the Examining Division of the  
European Patent Office posted on 1 August 2011  
refusing European patent application No.  
04797825.9 pursuant to Article 97(2) EPC.**

**Composition of the Board:**

**Chair** A. Ritzka  
**Members:** P. Cretaine  
F. Blumer

## Summary of Facts and Submissions

I. This appeal is against the decision of the examining division dispatched on 1 August 2011 refusing European patent application No. 04 797 825.9 on the grounds of added subject-matter (Article 123(2) EPC), lack of unity (Article 82 EPC), and lack of inventive step (Article 56 EPC) having regard to the disclosure of

**D1:** US 6 542 562.

II. Notice of appeal was received on 30 September 2011. The appeal fee was paid on the same day. A statement setting out the grounds of appeal was received on 21 November 2011. The appellant requested that the decision of the examining division be set aside and that a patent be granted on the basis of claims 1 to 14 submitted with the letter of 31 May 2011 on which the decision was based. The appellant also requested that the appeal fee be reimbursed for reasons of substantial procedural violations. In addition, oral proceedings were requested as an auxiliary measure.

III. A summons to oral proceedings was issued on 13 November 2015. In an annex to this summons pursuant to Article 15(1) RPBA the board gave its preliminary opinion on the appeal. In particular, the board indicated that, in its view, the requirements of Article 123(2) EPC were fulfilled but that independent claims 1 and 8 did not meet the requirements of Article 56 EPC, having regard to the disclosure of D1. The board further indicated that the issue of non-unity a posteriori should not be dealt with as long as the objection under Article 56 EPC was outstanding. The board also expressed the opinion that no procedural violation had occurred during substantive examination and that, as a consequence, a

reimbursement of the appeal fee under Rule 103(1)(a) EPC would be unlikely.

- IV. With a letter of reply dated 15 January 2016, the appellant submitted claims of auxiliary requests I, II and III and provided arguments in respect of these requests and of the previously filed main request.
- V. Oral proceedings were held on 17 February 2016. The appellant's final requests were that the decision under appeal be set aside and that a patent be granted on the basis of the main request as filed with letter dated 31 May 2011, or, subsidiarily, on the basis of any of auxiliary requests 1 to 3 as filed with letter dated 15 January 2016. The appellant further requested that the appeal fee be reimbursed.
- VI. At the end of the oral proceedings, the decision of the board was announced.
- VII. Claim 1 of the main request reads as follows:

"A method of adaptive interpolation filtering a signal in a receiver to estimate a channel using pilot symbols, comprising:

determining (120, 130, 140, 150) at least one correlation function parameter of the channel, wherein the at least one correlation function parameter is a Doppler frequency shift; characterized by determining (122, 134, 142, 152) an asymmetric first filter configuration, for which more old pilot symbols than future pilot symbols are used to perform the channel estimation, based on the correlation function parameter; and

performing (124, 136, 144, 158) interpolation filtering in time on the signal using the determined first filter configuration; wherein the method repeats to update the first filter configuration."

The main request comprises a further independent claim (claim 8) directed to a corresponding apparatus.

Considering the outcome of the decision, the details of the auxiliary requests do not need to be addressed.

### **Reasons for the Decision**

1. The appeal is admissible.
2. Main request - Article 123(2) EPC

It was stated in the impugned decision that the scope of the feature in claim 1 reciting that more old pilot symbols than future pilot symbols were used to perform the channel estimation encompassed the determination of the number of causal coefficients, i.e. coefficients based on old pilot symbols, in relation to the number of non-causal coefficients, i.e. coefficients based on future pilot symbols. Since the description failed to disclose how to determine the number of causal coefficients in relation to the number of non-causal coefficients, claim 1 did not meet the requirements of Article 123(2) EPC.

The board, however, agrees with the appellant that this objection was based on a feature, namely the determination of the number of causal coefficients in relation to the number of non-causal coefficients as a

function of the Doppler frequency, which is not present in claim 1.

The exact wording of the feature present in claim 1 is "for which more old pilot symbols than future pilot symbols are used to perform the channel estimation" and this is disclosed in the application as originally filed, see [0073] of the published application.

The board therefore judges that the requirements of Article 123(2) EPC are met in that respect.

3. Main request - Article 56 EPC

3.1 It was common ground during the oral proceedings that D1 is the closest prior art on file and discloses the following features of claim 1:

A method of adaptive interpolation filtering a signal in a receiver to estimate a channel using pilot symbols, comprising:

- determining at least one correlation function parameter of the channel, wherein the at least one correlation function parameter is a Doppler frequency shift,
- determining a filter configuration based on the correlation function parameter, and
- performing interpolation filtering in time on the signal using the determined first filter configuration,
- wherein the method repeats to update the first filter configuration.

3.2 However, D1 is silent on any relation between the numbers of old and future pilot symbols used. In that respect, the relation " $m \geq n_B$ " and the sentence "the parameter  $n_B$  is the number of slots that are buffered"

in D1, cited in the decision under appeal, do not unambiguously disclose that  $n_B$  represents the number of future pilot symbols. As pointed out by the appellant, the relevant passages in D1 (see column 3, lines 2 to 8 and equation (5)) explain that in a first step a primary channel estimate for each slot is obtained, based on received pilot symbols, and that in order to acquire a refined channel estimate for each symbol  $j$  in slot  $k-n_B$ ,  $m$  consecutive primary channel estimates, and not pilot symbols, are used, where  $m \geq n_B$ . Therefore,  $m$  represents the number of primary channel estimates and not the overall number of pilot symbols. It is furthermore unclear what is meant by the sentence that "the parameter  $n_B$  is the number of slots that are buffered" since D1 does not explain for what purpose the slots, and not the primary channel estimates, are to be buffered, and how this is related to the channel estimation for each symbol in a slot. It may well be that all slots have to be buffered in order to perform the filter calculations. The appellant further plausibly argued that the filter in D1 does not interpolate pilot symbols as such but primary channel estimates, the pilot symbols being used as shown in formula (5) to acquire the primary channel estimates.

Thus, in the board's view, the skilled person is not given any hint by D1 to consider that  $n_B$  represents the number of future pilot symbols and that the buffering requirements are determined solely by the number of future pilot symbols.

- 3.3 The subject-matter of claim 1 therefore differs from the disclosure of D1 in that the interpolation filter is designed as asymmetric, in the sense that more old pilot symbols than future pilot symbols are used.



A technical effect of using an asymmetric filter based on more old than future pilot symbols is that the buffering requirements for received pilot symbols are reduced in comparison to using a symmetric filter having the same number of coefficients, i.e. having the same complexity. However, a drawback of using an asymmetric filter is that, for a given complexity, the performance is reduced.

Based on these technical effects, the objective technical problem can be defined as how to adjust the resources needed by the interpolation filter depending on the channel conditions, as stated in paragraphs [0013] and [0014] of the application.

The skilled person, starting from D1, would consider adapting the resources by adjusting the complexity of the filter to the channel conditions, i.e. by increasing or decreasing the overall number of pilot symbols used. Keeping in mind that the best performance is achieved by using the same number of old and future pilot symbols, the skilled person would stick to a symmetric configuration of the filter. The skilled person would not obtain any hint either from D1 that a reduction in the number of future pilot symbols, while maintaining the overall number pilot symbols to achieve the same complexity, would definitely reduce the buffering requirements, for the reasons mentioned in section 3.2 above.

For these reasons the board judges that the skilled person would not arrive at the subject-matter of claim 1 without the exercise of inventive skill. Thus claim 1 meets the requirements of Article 56 EPC, having regard to the prior art on file.

Independent claim 8 contains substantially the same features as claim 1, but expressed in terms of a claim for an apparatus. Therefore claim 8 also meets the requirements of Article 56 EPC.

4. Since the appellant's main request is allowable, there is no need for the board to consider the auxiliary requests.
5. Reimbursement of the appeal fee

The appellant has requested that the appeal fee be refunded in view of apparent substantial procedural violations.

According to Rule 103(1)(a), EPC the appeal fee is to be reimbursed in full where the board of appeal deems an appeal to be allowable, if such reimbursement is equitable by reason of a substantial procedural violation.

In the present case, the alleged procedural violations are the following:

- the objection under Article 123(2) EPC in the decision under appeal was based on a feature that was not present in claim 1,
- the objections under Articles 123(2), 56 and 82 EPC were not the same as the objections which were raised under the same respective EPC articles in the summons to oral proceedings, so that the appellant's right to be heard under Article 113(1) EPC was violated.

As to the first point, i.e. the substantiation of the Article 123 EPC objection, the board notes that the examining division correctly identified the feature which was added to the previous version of claim 1,

namely that more old pilot symbols than future pilot symbols are used to perform the channel estimation. In the board's judgment however, any misinterpretation of the technical meaning of this feature which there might have been on the part of the examining division does not represent a procedural violation, according to the case law of the boards of appeal.

As to the second point, the board first notes that the appellant, by amending the claims and not attending the oral proceedings, is taken to have decided to rely only on its written submissions. Further, the objection under Article 56 EPC was based on the same passages of D1 which were used in the objection raised in the summons to oral proceedings. Moreover, the Article 82 EPC objection in the decision was almost identical to the objection raised in the summons. In that respect it is to be noted that, due to the deletion of dependent claims 5 and 21 filed with letter of 26 October 2007, invention 2 identified in the summons to oral proceedings was no longer present in the set of claims on which the decision was based, i.e. the claims of the present main request. The inventions identified in the decision under appeal as inventions 1, 2 and 3 corresponded in fact to the inventions identified as inventions 1, 3 and 4, respectively, in the summons to oral proceedings. For these reasons the board judges that the requirements of Article 113(1) EPC have been fully met.

Therefore, the board decides that no procedural violation occurred during the first instance proceedings and that the appeal fee is not to be refunded.

## 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 1 to 14 as filed with letter dated 31 May 2011;
  - description pages:
    - 1 to 3 and 6 to 20 as originally filed;
    - 4, 4a, 5 as filed with letter dated 31 May 2011;
  - drawing sheets 1/16 to 16/16 as originally filed.
3. The request for reimbursement of the appeal fee is refused.

The Registrar:

The Chair:



L. Malécot-Grob

A. Ritzka

Decision electronically authenticated