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**Datasheet for the decision
of 7 March 2014**

Case Number: T 0736/13 - 3.5.05

Application Number: 00310939.4

Publication Number: 1111863

IPC: H04L25/03, H04L27/34

Language of the proceedings: EN

Title of invention:

Method and apparatus for shortening the critical path of reduced complexity sequence estimation techniques

Applicant:

Alcatel-Lucent USA Inc.

Headword:

Channel equalisation/ALCATEL-LUCENT

Relevant legal provisions:

EPC Art. 84, 111(1), 123(2)

RPBA Art. 13(1)

Keyword:

Clarity - (yes, after amendment)

Added subject-matter - main request (yes)

Admission of first auxiliary request - (no)

Remittal to the first instance for further prosecution - (yes)

Decisions cited:

T 0824/06

Catchword:



**Beschwerdekammern
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Chambres de recours**

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Case Number: T 0736/13 - 3.5.05

D E C I S I O N
of Technical Board of Appeal 3.5.05
of 7 March 2014

Appellant: Alcatel-Lucent USA Inc.
(Applicant) 600-700 Mountain Avenue
Murray Hill, NJ 07974 (US)

Representative: 2SPL Patentanwälte
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Decision under appeal: **Decision of the Examining Division of the
European Patent Office posted on 24 October 2012
refusing European patent application
No. 00310939.4 pursuant to Article 97(2) EPC.**

Composition of the Board:

Chair: A. Ritzka
Members: K. Bengi-Akyuerek
F. Blumer

Summary of Facts and Submissions

- I. The appeal is against the decision of the examining division, posted on 24 October 2012, to refuse European patent application No. 00310939.4 on the ground of lack of clarity (Article 84 EPC) of the set of claims filed on 16 March 2007 as the sole ground for refusal, essentially due to the use of the phrase "speculative sequences of one or more channel symbols" in independent claims 1 and 30.

In an *obiter dictum* under the heading "Further remark not forming part of the decision", the decision under appeal further stated that the claims on file also lacked support by the description within the meaning of Articles 84 and 123(2) EPC.

- II. Notice of appeal was received on 14 December 2012. The appeal fee was paid on the same day. With the statement setting out the grounds of appeal, received on 4 March 2013, the appellant submitted US patent document US-B-6 999 521 together with the corresponding "USPTO Notice of Allowance" related to the US examination procedure in support of novelty and inventive step of the underlying subject-matter and a preliminary list of patent documents retrieved by a simple database search as evidence of the clarity of the term "speculative sequences". The appellant requested "to withdraw the refusal" of the application and "to grant a patent with a scope of protection described by the set of amended claims as filed on 16 March 2007". No oral proceedings were requested.
- III. With a communication pursuant to Rule 100(2) EPC dated 15 October 2013, the board gave its preliminary opinion on the appeal. In particular, the objections raised in

the appealed decision under Articles 84 and 123(2) EPC arising from the expression "speculative sequences of one or more channel symbols" comprised in the independent claims on file were maintained by the board.

IV. By letter of reply dated 29 November 2013, the appellant filed a new set of claims (claims 1 to 30) in which the phrase "speculative sequences of one or more channel symbols" objected to was replaced by the clause "possible states of a trellis defined by a code and/or a dispersive channel". It requested that the decision under appeal be set aside and that the case be remitted to the first-instance department with the order to grant a patent based on the amended claims.

V. A summons to oral proceedings scheduled for 7 March 2014 was issued on 9 December 2013. In an annex to this summons, the board expressed its preliminary opinion on the appeal pursuant to Article 15(1) RPBA. In particular, it stated that the option encompassed by "or" within the new phrase "possible states of a trellis defined by a code and/or a dispersive channel" gave rise to an unallowable extension of the original content under Article 123(2) EPC, since there was apparently no embodiment and/or equation throughout the whole application dealing with the case that the trellis could indeed be defined by the channel state alone. However, the appellant was also informed that replacing the phrase "for speculative sequences of one or more channel symbols" with "for possible states of a trellis defined by a code **and** a dispersive channel" in the present independent claims would overcome the objections raised and that the case could be remitted to the department of first instance for further prosecution under Article 111(1) EPC if those

objections were overcome.

- VI. By letter of reply received on 3 January 2014, the appellant filed a new set of claims (claims 1 to 30) and submitted counter-arguments in support of compliance of the phrase in question with Article 123(2) EPC. It requested that the decision under appeal be set aside and that the case be remitted to the department of first instance for further prosecution under Article 111(1) EPC.
- VII. With a communication dated 27 January 2014, the appellant was informed that the scheduled oral proceedings would take place on 7 March 2014 as announced.
- VIII. By letter of reply received on 6 February 2014, the appellant filed a new set of claims (claims 1 to 30) as an auxiliary request in which the word "or" was removed from the phrase objected to under Article 123(2) EPC. It requested that the decision under appeal be set aside and that the case be remitted to the first-instance department for further prosecution under Article 111(1) EPC based on the claims filed with the letter of 3 January 2014 as a main request or, alternatively, based on the claims of the auxiliary request.
- IX. Oral proceedings were held as scheduled on 7 March 2014, during which the appellant filed a new first auxiliary request and a new second auxiliary request in response to objections raised by the board under Article 123(2) EPC during the oral proceedings. The appellant's final request was that the decision under appeal be set aside and that the case be remitted to the examining division for further prosecution on

the basis of the main request as filed with the letter received on 3 January 2014, or, subsidiarily, based on the first auxiliary request ("Replacement Claims" 1-30) or on the second auxiliary request (claims 1-30), both auxiliary requests as filed during the oral proceedings before the board.

At the end of the oral proceedings, the decision of the board was announced.

X. Claim 1 of the **main request** reads as follows:

"A method for processing a received signal, said method characterized by the steps of:
precomputing branch metrics using said received signal for possible states of a trellis defined by a code and/or a dispersive channel;
storing said precomputed branch metrics in at least one pipeline register (460);
selecting one of said precomputed branch metrics from one of said at least one pipeline register based on at least one survivor symbol from a corresponding state;
computing path metrics using said selected precomputed branch metrics; and
selecting a path having a best path metric for a given state."

Claim 1 of the **first auxiliary request** reads as follows:

"A method for processing a signal received from a dispersive channel having a channel memory, said method characterized by the steps of:
precomputing branch metrics using said signal for possible states of a trellis defined by the channel

memory;

storing said precomputed branch metrics in at least one pipeline register (460);

selecting one of said precomputed branch metrics from one of said at least one pipeline register based on at least one survivor symbol from a corresponding state;

computing path metrics using said selected precomputed branch metrics; and

selecting a path having a best path metric for a given state."

Claim 1 of the **second auxiliary request** differs from claim 1 of the main request in that the phrase "for possible states of a trellis defined by a code and/or a dispersive channel" has been replaced by the expression "for possible states of a trellis defined by a code and a dispersive channel", i.e. in that the "or" option has been removed.

The further independent claim 30 of the pending requests is directed to a corresponding "signal processor".

Reasons for the Decision

1. The appeal is admissible.
2. MAIN REQUEST

Independent claims 1 and 30 of this request differ from the independent claims underlying the appealed decision in that they now specify that

- A) the branch metrics are precomputed using the received signal for possible states of a trellis

defined by a code and/or a dispersive channel
(emphasis added).

The amendment related to feature A) was made in response to the objections raised by the board under Articles 84 and 123(2) EPC (cf. board's communication under Rule 100(2) EPC of 15 October 2013, sections 2.1 and 2.2), and the appellant provided paragraphs [0013] and [0015] of the published application as a basis for that amendment.

2.1 Article 123(2) EPC

In the board's judgment, independent claims 1 and 30 of this request do not comply with Article 123(2) EPC, for the following reasons:

2.1.1 The wording of feature A) suggests that a trellis may be defined in three ways: (i) by a code and a dispersive channel ("and" option), (ii) by a code alone (first "or" option), and (iii) by a dispersive channel alone (second "or" option).

As regards the definition of any trellis, the only teaching the application as filed provides in this respect is that a trellis (i.e. "super trellis") is "defined by the combined code and channel state" (cf. page 8, lines 8-9 of the application as filed corresponding to paragraph [0015] of the application as published). From this the skilled reader understands that the trellis in question is defined by the trellis code and the (dispersive) channel (see also appellant's letter of reply dated 29 November 2013, page 2, second sentence), in accordance with option (i) above. However, nowhere in the entire application is there any basis for a different definition of a trellis.

Consequently, the use of a trellis which is defined solely by a code or by a dispersive channel according to options (ii) and (iii) is not directly and unambiguously derivable from the original disclosure of the present application.

2.1.2 As to option (ii), at the oral proceedings the appellant agreed with the board that feature A) also encompassed option (ii) due to the symmetry of the "or" phrase (i.e. the first "or" option) and that this option was indeed not originally disclosed.

2.1.3 As to option (iii), however, the appellant argued in the written procedure and during the oral proceedings that it was based on page 7, lines 5-7 and page 3, lines 12-15 of the application as filed taken in combination with the skilled person's common general knowledge. According to the appellant, the skilled person in the field of channel coding and equalisation would have no difficulty in adapting the teachings of the original disclosure to trellis-based equalisation of uncoded signals, since the skilled person would simply apply the equations of the present application by setting the parameter S related to the number of code states according to equation (2) on page 8 of the original application to one (i.e. $S = 1$).

The board cannot follow this line of argument. As to the cited disclosure, the passage of page 7, lines 5-7 reads

"... While the present invention is illustrated herein using decoding and equalization of trellis coded signals, the present invention also applies to the equalization of uncoded signals, as would be apparent to a person of ordinary skill in the

art ...",

whilst the disclosure of page 3, lines 12-15 provides

"... Precomputing the branch metrics for all possible symbol combinations in the channel memory in accordance with the present invention makes it possible to remove the branch metrics unit (BMU) and decision-feedback unit (DFU) from the feedback loop ...".

In this regard, the board holds that neither from the fact that the present invention is supposed to be also applicable to the equalisation of uncoded signals nor from the indication that performing pre-computation of the branch metrics for the symbols in the channel memory enables the removal of certain units from the decision-feedback loop the skilled reader could indeed deduce that a trellis is defined by the channel (states) alone. This is all the more so when considering that the notion of a "trellis" typically makes sense only in the event of using trellis-based coding. As to the equations of the application as filed, which are all related to the case of trellis-coded modulation with a trellis defined by code and channel states, the board notes that the parameter indicating the code states μ_n (cf. page 8, equation (2) of the application as filed) would have to be adapted in the event of uncoded signals. It is also apparent to the board that the value of this parameter provided in equation (2) has an impact on a multitude of subsequent equations of the present invention, in particular equations (4) to (6) and (9) to (11).

The appellant argued during the oral proceedings that the skilled person would set μ_n to ones or simply

remove it from the equations. Additionally considering that setting μ_n to zeros would also be a viable adaptation, the board finds that adaptation of the original teaching to a trellis made up of uncoded signals is not unequivocally derivable from the application as filed. Nor is it unambiguously clear to the skilled reader whether all the steps according to claims 1 and 30 are still to be performed in case of uncoded signals. In this context, the board also notes that, for an amendment to be allowable, Article 123(2) EPC requires its direct and unambiguous disclosure. A reasonable plausibility is insufficient in this respect (see e.g. T 824/06, point 3.5).

2.1.4 In view of the above, claims 1 and 30 of this request contain subject-matter which extends beyond the content of the application as filed.

2.2 In conclusion, this request is not allowable under Article 123(2) EPC.

3. FIRST AUXILIARY REQUEST

Independent claims 1 and 30 of this request differ from claims 1 and 30 of the main request in that they specify that

- B) the signal is received from a dispersive channel having a channel memory;
- C) the trellis is defined by the channel memory.

Those amendments were allegedly made in response to the objections raised by the board under Article 123(2) EPC.

3.1 *Admission into the appeal proceedings*

The board decided not to admit the first auxiliary request into the appeal proceedings, for the following reasons:

- 3.1.1 This request was submitted during the oral proceedings before the board, i.e. at a relatively late stage of the procedure. The appellant argued that the request was filed late since the board indicated for the first time at the oral proceedings that feature A) also encompassed the case that a trellis may be defined by a code alone (see option (ii) above) and that this option was neither originally disclosed nor intended according to the present invention (cf. point 2.1.2 above). Furthermore, the appellant submitted that the amendments related to the independent claims were based on original claim 1 and paragraph [0007] of the application as published combined with the skilled person's common general knowledge about trellis codes.

This argument does not convince the board. The board rather considers that neither claim 1 as originally filed nor paragraph [0007] as published, which corresponds to page 3, lines 6 to 18 as originally filed and discussed in point 2.1.3 above, refers to a trellis. Therefore those passages cannot provide a basis for "a **trellis** defined by a channel memory" (emphasis added by the board). The further paragraph [0015] of the published application (corresponding to page 8, lines 3-13 as originally filed) only provides a basis for a trellis defined by a code and a channel state.

- 3.1.2 Moreover, the board holds that the amendments related to features B) and C) cover option (iii), i.e. the case that the trellis is defined by the channel states alone and thus excluding coding states. The opinion of the

board that option (iii) does not comply with Article 123(2) EPC was communicated to the appellant both in the written procedure (cf. board's communication under Article 15(1) RPBA of 9 December 2013, section 2.2) and during the oral proceedings before the board with respect to the main request. Nevertheless, this request was filed before the board. Furthermore, claim 1 is not clearly allowable for the very reasons as set out in points 2.1.3 and 3.1.1 above.

3.2 In view of the foregoing, the board decided to exercise its discretionary power to not admit the request into the appeal proceedings under Article 13(1) RPBA.

4. SECOND AUXILIARY REQUEST

Independent claims 1 and 30 of this request differ from claims 1 and 30 of the main request in that the word "or" between "a code" and "a dispersive channel" in feature A) has been deleted, and they correspond to the independent claims of the auxiliary request filed with the appellant's letter of reply dated 6 February 2014 (cf. point VIII above). In particular, the claim set of the second auxiliary request differs from the set of claims underlying the appealed decision in that claims 1 and 30 as amended now specify that

D) the branch metrics are precomputed using the received signal for possible states of a trellis defined by a code and a dispersive channel (emphasis added),

in that dependent claims 2, 4, and 13 further define

E) the symbol " \tilde{u} " and the metric selection operation, and in that dependent claims 2, 4, 19, 22, and 23 have been amended to rectify various clerical errors.

The amendment related to feature D) was made in response to the objection raised by the board under Article 123(2) EPC (cf. board's communication under Article 15(1) RPBA, section 2.2) and is based on page 8, lines 7-9 of the original application. Amendment E) was made in response to the objection raised by the board under Article 84 EPC (cf. board's communication under Article 15(1) RPBA, section 2.4; see also the appealed decision, section 2.6) and is supported by page 11, lines 22-24 and page 12, lines 9-15 of the application as filed.

The board is thus satisfied that the above amendments comply with Article 123(2) EPC.

4.1 Article 84 EPC

4.1.1 The examining division (rightly) held that the phrase "speculative sequences of one or more channel symbols" of former claims 1 and 30 was unclear and not supported by the description (cf. appealed decision, sections 2.1 and 2.2).

The board finds that - by way of the replacement of that phrase by the wording according to feature D) - the above objection is considered to be overcome.

4.1.2 The examining division further held that the step of "selecting one of said precomputed branch metrics" in former claims 1 and 30 was also unclear, since it did not define how the "survivor symbol from a corresponding state" was selected (cf. appealed decision, section 2.3).

However, the board takes the view that the skilled reader in the field of channel equalisation would

understand from the above step that the precomputed and stored branch metrics are supposed to be selected based on *any* survivor symbol determined from the corresponding state in the context of any channel equalisation scheme - regardless of how the survivor symbol is actually selected. Therefore, the board is satisfied that the feature objected to is clearly defined.

- 4.1.3 Also, the examining division found that the dependent claims contained symbols which were not properly defined (cf. appealed decision, section 2.6). As a result of amendment E), the board considers that the corresponding objections no longer apply.
- 4.1.4 In conclusion, the board judges that the claims of this request are now clear within the meaning of Article 84 EPC.
- 4.2 Since the sole ground for refusal is thus considered to be overcome by way of the second auxiliary request, the decision under appeal is to be set aside.
- 5. *Remittal to the department of first instance*
- 5.1 In view of the amendments made to the claims in the course of the appeal proceedings, the sole ground for refusal (i.e. lack of clarity under Article 84 EPC) given in the appealed decision no longer applies with regard to the second auxiliary request.
- 5.2 In the decision under appeal, the issues of novelty and inventive step were not decided upon, nor was an assessment of novelty and inventive step discussed in any form therein with respect to the cited prior-art documents. The board therefore concludes that, in the

present circumstances, it is not appropriate to take a definitive decision on novelty and inventive step for the first time in the second-instance proceedings.

- 5.3 For these reasons, the board has decided to exercise its discretion to remit the case to the department of first instance for further prosecution under Article 111(1) EPC, on the basis of claims 1 to 30 filed as second auxiliary request during the oral proceedings before the board.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.
2. The case is remitted to the examining division for further prosecution on the basis of the second auxiliary request (claims 1 to 30) as filed during the oral proceedings before the board.

The Registrar:

The Chair:



K. Götz

A. Ritzka

Decision electronically authenticated