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Datasheet for the decision of 14 December 2016

Case Number: T 2240/10 - 3.5.05

Application Number: 06821115.0

Publication Number: 1929688

IPC: H04L1/00

Language of the proceedings: EN

Title of invention:
Apparatus and method for error correction in mobile wireless applications incorporating correction bypass

Applicant:
NXP B.V.

Headword:
Adaptive error correction/NXP

Relevant legal provisions:
EPC Art. 56

Keyword:
Inventive step - (yes, after amendment)

Decisions cited:

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Case Number: T 2240/10 - 3.5.05

D E C I S I O N
of Technical Board of Appeal 3.5.05
of 14 December 2016

Appellant: (Applicant)	NXP B.V. High Tech Campus 60 5656 AG Eindhoven (NL)
Representative:	Grünecker Patent- und Rechtsanwälte PartG mbB Leopoldstraße 4 80802 München (DE)
Decision under appeal:	**Decision of the Examining Division of the European Patent Office posted on 15 June 2010 refusing European patent application No. 06821115.0 pursuant to Article 97(2) EPC.**

Composition of the Board:

Chair	A. Ritzka
Members:	K. Bengi-Akyuerek
	D. Prietzel-Funk

Summary of Facts and Submissions

I. The appeal is against the decision of the examining division to refuse the present European patent application for lack of inventive step (Article 56 EPC) with respect to the claims of a main request and two auxiliary requests, having regard to the disclosure of

D2: E. de Diego Balaguer et al.: "Performance Evaluation of Power Saving Strategies for DVB-H Services using adaptive MPE-FEC Decoding", Proceedings of IEEE Conference Personal, Indoor and Mobile Radio Communications, pp. 2221-2226, September 2005,

and for lack of essential features (Article 84 EPC) in respect of the first auxiliary request.

By way of an *obiter dictum* under the heading "Additional comments", the decision under appeal also stated that two dependent claims of the claim requests on file lacked clarity (Article 84 EPC).

II. With the statement setting out the grounds of appeal, the appellant filed amended sets of claims according to a main request and three auxiliary requests. It requested that the decision of the examining division be set aside and that a patent be granted on the basis of the main request or one of the auxiliary requests. In addition, oral proceedings were requested as an auxiliary measure.

III. In an annex to the summons to oral proceedings scheduled for 13 December 2016 pursuant to Article 15(1) RPBA, the board expressed its preliminary opinion on the appeal. In particular, it raised

objections under Article 84 EPC on the grounds that the independent claims of all claim requests on file lacked the essential features of the invention. It also indicated, in relation to novelty and inventive step, that the present invention appeared to include subject-matter not disclosed or rendered obvious by prior-art document D2 relied upon in the decision under appeal.

IV. By a letter of reply dated 5 December 2016, the appellant submitted an amended set of claims as its new main request, replacing the former claim requests on file, and requested that

- the decision under appeal be set aside;
- a patent be granted on the basis of the newly filed claims and the description and drawings underlying the decision under appeal.

Additionally, it maintained its request for oral proceedings as an auxiliary measure.

V. The board then cancelled the scheduled oral proceedings.

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

"A device supporting error correction, comprising: a receiver (120) configured to receive data over a communication link; a decapsulator (122) coupled to the receiver and configured to create datagrams; a decoder (124) coupled to the decapsulator and configured to store the datagrams in a table and to create codewords, the decoder storing the datagrams in table columns to create codewords in table rows; and a user interface (126) coupled to the decoder and

configured to render images corresponding with the datagrams on the user interface; wherein the decapsulator (122) is configured to:

generate erasure attributes which describe the error likelihood of each symbol in the codeword derived from the associated datagrams; and

the decoder (124) is configured to:

store the erasure attributes in an erasure table:[sic]

determining for each codeword whether decoding is required for a given codeword;

if the erasure table identifies the given codeword as correct, the given codeword is left in the datagram table as correct;

if the erasure table identifies the given codeword as having too many errors to be corrected, the codeword is not corrected and is identified in the datagram table as uncorrectable,

otherwise, the given codeword is corrected and stored in the datagram table as corrected."

Further independent **claim 5** is directed to a corresponding method.

Reasons for the Decision

1. NEW MAIN REQUEST

Claim 1 of the present main request comprises the following limiting features (as labelled by the board):

A device supporting error correction, comprising:
(a) a receiver configured to receive data over a communication link;
(b) a decapsulator coupled to the receiver and configured to
    (b1) create datagrams;
    (b2) generate erasure attributes which describe the error likelihood of each symbol in the codeword derived from the associated datagrams;
(c) a decoder coupled to the decapsulator and configured to
    (c1) store the datagrams in a table in table columns to create codewords in table rows;
    (c2) store the erasure attributes in an erasure table;
    (c3) determine for each codeword whether decoding is required for the given codeword;
    (c4) if the erasure table identifies the given codeword as correct, the given codeword is left in the datagram table as correct;
    (c5) if the erasure table identifies the given codeword as having too many errors to be corrected, the given codeword is not corrected and is identified in the datagram table as uncorrectable;
    (c6) otherwise, the given codeword is corrected and stored in the datagram table as corrected;
(d) a user interface coupled to the decoder and configured to render images corresponding with the datagrams on the user interface.

Features (b2) and (c3) to (c6) were added to claim 1 of the main request underlying the appealed decision in response to the objection as to lack of essential

features, raised under Article 84 EPC in the board's communication pursuant to Article 15(1) RPBA. Those new features are in particular based on the teaching of page 8, lines 14-28; page 10, line 29 to page 11, line 13 and claims 3 and 4, in conjunction with Figure 6 of the application as originally filed. Hence, the above amendments comply with Article 123(2) EPC.

1.1 Article 52(1) EPC: novelty and inventive step

In the board's judgment, the present independent claims 1 and 5 now meet the requirements of Articles 54 and 56 EPC, for the reasons set out below.

1.1.1 The present invention concerns an adaptive forward error correction scheme for IP (Internet Protocol) datagrams applied by a Reed-Solomon (RS) decoder such as a standardised MPE-FEC (Multi-Protocol Encapsulation with Forward Error Correction) decoder, specifically adapted for mobile and portable TV receivers. To this end, the received IP datagrams are stored column by column in a datagram table such as an MPE-FEC table comprising 191 columns for the MPE part (corresponding to the actual IP datagrams) and 64 columns for the FEC part (corresponding to the calculated RS codewords used for error correction). According to the application, the problem to be solved by the independent claims is to improve error correction in mobile wireless applications while reducing memory, computational and power-consumption requirements (see e.g. page 1, lines 4-6 of the application as filed). This is primarily based on the insight that it might not be necessary to correct each and every codeword received (see e.g. page 11, lines 14-15 of the original application).

1.1.2 Document **D2**, upon which the appealed decision solely relied, relates to power-saving schemes for wireless DVB-H (Digital Video Broadcasting-Handhelds) systems using adaptive MPE-FEC decoding, and thus naturally discloses features (a) and (d) of claim 1.

As to features (b1) and (b2), D2 teaches the generation of IP datagrams along with erasure (error) information. The erasure information is supposed to indicate the reliability, i.e. the error probability, of the individual symbols (marked as "reliable" or "unreliable" symbols), based on CRC calculations, for the actual Reed-Solomon decoding process (see page 2223, left-hand column, lines 3-20).

As to features (c1) and (c2), the MPE-FEC decoder of D2 stores the received and decapsulated IP datagrams column by column in a datagram table ("MPE-FEC frame"), made up of an "application data table" (MPE part) comprising 191 columns and an "RS data table" (FEC part with parity bits) including 64 "RS columns" (see e.g. Figs. 1 and 3). Based on the underlying DVB-H standard, the data associated with the application data table is delivered to the DVB receiver by data packets called "MPE sections", while the data associated with the RS data table is conveyed by data packets called "MPE-FEC sections" (see page 2222, left-hand column, last paragraph). Moreover, erasure information is included *within* (i.e. spread over) the datagram table, i.e. the MPE-FEC frame, rather than within a dedicated *erasure table* according to feature (c2). Consequently, the system of D2 relies solely on one table, namely the "MPE-FEC frame", and not on two tables, i.e. the datagram table *and* a separate erasure table, as required by claim 1.

As to features (c3) to (c6), based on the erasure information ("reliable"; "unreliable") included in the MPE-FEC frame, the RS decoder of D2 is able to correct up to 64 symbols per codeword within the MPE-FEC frame (see page 2223, left-hand column, lines 20-27). If there are more than 64 "unreliable" symbols in a row, the RS decoder will not be able to correct them and will just output those symbols *without* error correction (see page 2223, left-hand column, lines 20-33). It also proposes to omit (i.e. selectively bypass) some RS codewords depending on the number of erasures in the MPE-FEC frame to reduce the receiver's power consumption (see page 2223, left-hand column, last paragraph to right-hand column, first paragraph). However, D2 does not use a specific erasure table to determine the need for decoding, which independently and exclusively establishes whether a stored codeword is (i) already correct, (ii) to be corrected or (iii) uncorrectable (according to features (c3) to (c6) of claim 1).

1.1.3 Thus, the board holds that D2 fails to disclose features (c3) to (c6) of present claim 1. Consequently, the subject-matter of claim 1 is novel over D2 (Article 54 EPC).

1.1.4 As to the issue of inventive step, the board is satisfied that distinguishing features (c3) to (c6), now going beyond only "selectively bypassing codewords" as claimed in claim 1 underlying the appealed decision, causally contribute to the overall technical effect that Reed-Solomon decoding may, based on the information derivable from the erasure table, indeed be selectively bypassed e.g. in the case of "correct" or "uncorrectable" codewords, to shorten processing time and avoid unnecessary memory access (cf. page 11,

lines 15-17 and Fig. 6 of the present application as filed). The objective technical problem to be solved by claim 1 may therefore be formulated as "how to further reduce the power consumption of the DVB-H receiver in D2".

1.1.5 Concerning the above objective problem, D2 expressly proposes reducing power consumption by either "omitting RS columns in reception processing" or "Carrying out the half RS decoding in post-processing" (see page 2223, left-hand column, section III, second sentence). Furthermore, as specially mentioned in the impugned decision, D2 comprises the following passage (see page 2223, left-hand column, last paragraph to right-hand column, first paragraph):

> *"... if all the application data table sections have been received correctly the receiver does not need to receive any MPE-FEC sections and can be switched off. If the application data table has any error, then all the MPE-FEC sections are received to accomplish the error correction ..., receiving only the necessary RS columns and switching off the receiver without receiving the remaining RS columns would result in a power consumption improvement. The number of columns that may be omitted will depend on the number of errors/erasures in the MPE-FEC and the error correction capability of the decoder."*

From this teaching the board understands that only if the DVB-H receiver detects, e.g. by way of a cyclic redundancy check (CRC), that at least one IP datagram (application codeword) stored in the application data table is erroneous, do all the data packets carrying the RS codewords, i.e. the "MPE-FEC sections" (see

point 1.1.2 above), relating to the corresponding RS data table, have to be *received* by the DVB receiver. Otherwise, if the received IP datagrams corresponding to an application data table are found to be correct, the associated RS codewords and columns are deemed to be obsolete and are therefore *not received* at all by the receiver (due to switch-off).

This concept, however, contrasts entirely with that underlying present claim 1. According to the wording of claim 1, all the transmitted data (i.e. including both the MPE and MPE-FEC sections) are continuously received by the receiver (see features (a), (b1) and (b2) of claim 1). By virtue of features (c1) to (c6), determining whether a certain codeword derived from the stored datagrams is "correct", "corrected" or "uncorrectable" depends exclusively on the evaluation of the erasure table and its corresponding attributes. Moreover, those erasure attributes are persistently stored in the erasure table *after* receiving the transmitted data and *after* creating the codewords based on the datagrams in the datagram table (see in particular features (b2) and (c2) of claim 1).

In view of the completely different concept used for reducing the power consumption of a DVB receiver in D2, the board holds that the skilled person, when confronted with the above objective problem, would rather elaborate on the optimal number of RS columns to be omitted and/or on improving the error correction capabilities of the underlying decoder and, consequently, come up with an entirely distinct solution from that claimed.

1.1.6 Hence, the subject-matter of claim 1 credibly provides a synergistic inventive effect going beyond the sum of

the individual effects of its distinguishing features. This applies *mutatis mutandis* to the corresponding independent claim 5.

1.1.7 Given that the decision under appeal did not discuss any other prior-art document for the assessment of inventive step and the board considers D2 to be indeed the closest prior-art document on file, the board sees no reason to arrive at a different conclusion based on the other documents on file.

1.1.8 In view of the above, the subject-matter of the present independent claims is held to be new and inventive over D2, within the meaning of Articles 54 and 56 EPC.

1.2 As regards the objection under Article 84 EPC raised in the *obiter dictum* of the appealed decision with respect to the features of present dependent claims 3 and 7 (cf. point I above), namely that the probability of an erroneous symbol being 1 was unclear since in real systems one could "never be certain that a symbol is erroneous", the board considers that the *definition* of such a probability value as a parameter in certain scenarios is not unclear but at most unrealistic.

1.3 In conclusion, the board decides that a patent is to be granted on the basis of claims 1 to 7 according to the new main request.

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 claims 1 to 7 submitted with the letter of 5 December 2016, with the description and the drawings to be adapted accordingly.

The Registrar: The Chair:

K. Götz-Wein A. Ritzka

Decision electronically authenticated