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Datasheet for the decision of 3 July 2012

Case Number: T 1809/08 - 3.5.05

Application Number: 00300356.3

Publication Number: 1024622

IPC: H04L 1/00

Language of the proceedings: EN

Title of invention:
Method and system for selecting a coding/modulation scheme

Applicant:
ALCATEL LUCENT

Headword:
Selection of optimal coding scheme/ALCATEL LUCENT

Relevant legal provisions:
EPC Art. 56, 84, 123(2)

Keyword:
"Clarity of claims - Yes (after amendments)"
"Added subject-matter - No"
"Inventive step - Yes (after amendments)"

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Case Number: T 1809/08 - 3.5.05

D E C I S I O N
of the Technical Board of Appeal 3.5.05
of 3 July 2012

Appellant: (Applicant)
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Decision under appeal:
Decision of the Examining Division of the European Patent Office posted 22 February 2008 refusing European patent application No. 00300356.3 pursuant to Article 97(2) EPC.

Composition of the Board:

Chair: A. Ritzka
Members: P. Cretaine
D. Prietzel-Funk

Summary of Facts and Submissions

I. This appeal is against the decision of the examining division to refuse European patent application No. 00 300 356.3, published as EP 1 024 622. The decision was announced in oral proceedings held on 7 November 2007 and written reasons were dispatched on 22 February 2008.

II. The application was refused because the independent claims according to a main request did not meet the requirements of Article 123(2) EPC and because of lack of inventive step (Articles 52(1) and 56 EPC) of the independent claims according to the first and the second auxiliary requests, having regard to the disclosure of

D1: US 5 533 004.

III. The notice of appeal was received on 3 April 2008 and the appeal fee was paid on the same day. In the statement setting out the grounds of appeal, submitted with letter dated 26 June 2008, the appellant (applicant) requested as sole request, that the appealed decision be set aside and that a patent be granted based on claims 1 to 6 as filed with the statement setting out the grounds of appeal.

IV. A summons to oral proceedings to be held on 3 July 2012 was issued on 13 March 2012. In an annex accompanying the summons the board expressed the preliminary opinion that the claims of the sole request met the requirements of Article 123(2) EPC but not those of Article 84 EPC. The board also expressed its view that,

even if the clarity objection were overcome, the subject-matter of the claims would not involve an inventive step, having regard to the disclosure of D1.

V. With a letter of reply dated 31 May 2012, the appellant filed claims 1 to 9 to replace the sole request on file, together with arguments in support of the allowability of this request. The appellant also informed the board that it would be attending the scheduled oral proceedings.

VI. By letter dated 13 June 2012, the board was informed of a change of representative of the appellant. The appellant also filed claims 1 to 7 according to a first auxiliary request.

VII. At the oral proceedings held as scheduled on 3 July 2012, the appellant filed a new main and sole request. All previous requests were withdrawn.

VIII. The appellant has requested that the decision under appeal be set aside and that a patent be granted on the basis of the main and sole request submitted during the oral proceedings.

IX. Claim 1 of the main request reads as follows:

"A method for selecting one of k coding schemes in a transmitter, each scheme providing a different amount of error protection, the method CHARACTERIZED BY the steps of:
(a) measuring a channel quality metric (CQM)
(step 210);

(b) initially selecting a first coding scheme from one of the k coding schemes as a function of the measured CQM to achieve a highest throughput at the measured CQM (step 215);
(c) calculating a number of data blocks, B, required to transmit a given amount of data, D, using the selected coding scheme (step 220);
(d) determining which of the other k coding schemes may transmit the given amount of data, D, using the same number of, B, data blocks; and
(e) selecting a second coding scheme, from among the selected and determined schemes, based on the amount of error protection in the scheme, where each scheme provides a different amount of error protection including using a different number of parity bits per data block to transmit the number of data D in the same number of B data blocks to achieve the highest throughput at the measured CQM (step 225)."

The request includes a further independent claim seeking protection for a corresponding transmitter (claim 5).

X. At the end of the oral proceedings the chair announced the board's decision.

Reasons for the Decision

1. The appeal is admissible.

2. *Admissibility of request filed in oral proceedings*

Although the new main request was filed late, during the oral proceedings, the board exercised its discretion to admit it into the proceedings since it had been submitted in order to overcome particular concerns of the board and was overall convergent with the claims submitted before.

3. *Article 123(2) EPC*

The decision under appeal stated that the feature of having each coding scheme using a different number of parity bits per data blocks introduced subject-matter which extended beyond the content of the application as filed.

The board notes however that the application as originally filed mentions in several passages that the different coding schemes generate parity bits which are added to the payload bits (see paragraphs [0002], [0003], [0007] and claim 5 of the published application). It is also common knowledge, as mentioned in the description (see paragraph [0002] of the published application), that coding schemes using a different number of parity bits provide a different amount of error protection. Therefore, the board judges that selection of one coding scheme among several coding schemes using a different number of parity bits,

as claimed in claims 1 and 5, is supported by the application documents as originally filed.

The requirements of Article 123(2) EPC in that respect are thus met.

4. *Clarity of claims - Article 84 EPC*

The board is satisfied that the unclear wording "highest throughput to carrier-interference ratio" has been replaced in independent claims 1 (features (a) and (e)) and 5 by the wording "highest throughput at the measured CQM". The amendment is based on the description (see column 3, lines 51 to 58 and column 4, lines 3 to 7 and 10 to 11 of the published application) which indicates that a coding scheme is initially selected to achieve the highest throughput at the measured carrier-to-interference ratio (i.e. at a measured channel quality metric CQM) and that a second coding scheme achieving the same throughput is subsequently selected, according to a further criterion.

5. *Inventive step - Article 56 EPC*

5.1 Prior art

D1 discloses a method for selecting a modulation technique associated with a coding technique (see Figure 4), based on the channel quality measurement or alternatively on the quantity of data to be transmitted. The coding associated with a modulation technique is an error detection coding, e.g. a FEC (see column 2, lines 39-40, and column 7, lines 29-30) or a CRC (see column 4, lines 19-20), both schemes involving the use

of parity bits. The modulation used may be QPSK, 16QAM, 64QAM or 256QAM. A block of payload data has 168 bits. The coding rate R is the ratio of payload bits/(error coding bits + payload bits) and is always less than 1. A lower rate R thus indicates a strong error protection, provided for instance by a lot of parity bits in the block. In that respect, the schemes denoted in Figure 4 "Format number 0" and "Format number 1" have the same number of parity bits per block of data. The resulting encoded block comprises 168/R bits. The encoded block is then modulated to produce symbols. The number of bits grouped into one symbol is K when the constellation size is 2^K (see figure 4). The symbol block formed from the encoded block thus comprises 168/KR symbols. After KR symbol blocks have been formed, i.e. 168 symbols, the data is transmitted as a unit or slot of a TDMA (see column 4, lines 60-67 and Figure 6). This corresponds therefore to 168K encoded bits, i.e. to 168KR payload data bits. The effective data rate, i.e. the number of payload bits per transmitted symbol, is KR (see figure 4). The system of D1 selects an initial modulation technique based on a channel quality measure (see column 6, lines 14-16), e.g. RSSI, BER, etc. The update of the selection for subsequent transmission is then based on subsequent measurements of the channel quality (see column 6, lines 16-18). Alternatively, the initial and subsequent selections may be based on the quantity of data to be transmitted. A lower rate modulation is used if the time required to send the data, i.e. the number of slots or units, is the same as the time required for a transmission using a higher rate modulation technique. An example is given where payload data shorter than 8 blocks is transmitted using

a 64QAM modulation instead of a 256QAM modulation, using the same number of slots (see column 6, lines 32-39). In that specific example, choosing a 64QAM modulation, which has a lower K than a 256QAM modulation, implies choosing a lower R (0.5 instead of 0.75), thus using more parity bits.

5.2 The method disclosed in D1 presents several important differences compared with the subject-matter of claim 1. These differences are the following:

- the method according to claim 1 is for selecting a coding scheme, while the method of D1 is for selecting a modulation scheme, associated with a coding scheme. This implies in particular that symbol blocks as defined in D1 (see Figure 6) have different lengths in time depending on the modulation scheme used, whereas the method according to claim 1 defines fixed length blocks.

- the method according to claim 1 provides, after an initial selection step of a coding scheme based on a channel quality metric, further steps achieving the selection of a second coding scheme which provides a different number of parity bits (advantageously a higher number) and ensures the same data throughput as the initially selected scheme, i.e. which is able to transmit the same amount of data in the same number of blocks. It is implicit from claim 1 that the second selected coding scheme is applied to the data bits to be transmitted, instead of the initially selected coding scheme. In D1, in contrast, the initially and subsequently selected modulation schemes are applied to different successive transmission intervals (see

column 6, lines 10 to 12). Moreover, the successive selections of the modulation schemes are all based on the same criterion, which is either the channel quality or, alternatively, the quantity of data to be transmitted. Furthermore, in case of using the quantity of data to be transmitted as the selection criterion for the modulation scheme, the aim of choosing a lower rate modulation, if possible, is to increase the reliability of the data transmission by transmitting fewer data bits per symbol and not to increase the number of parity bits in a block. This is illustrated by the fact that selecting a lower rate modulation does not always lead to a higher number of parity bits transmitted (see in Figure 4, the modulation schemes 16QAM and QPSK having the same code rate 1/2).

5.3 The technical effects of these differences are that the claimed method enables selection of a coding scheme to take advantage of any spare bandwidth in a physical layer block (e.g. a time slot) for adding parity bits, thereby increasing error protection and, as a consequence, allowing error correction.

The objective technical problem may thus be seen as how to improve the level of error protection while at the same time keeping the highest possible data throughput.

The appellant has plausibly argued that, due to the numerous differences between the technical teaching of D1 and the subject-matter of the invention (see section 4.2 above), the argumentation that the skilled person would modify the method disclosed in D1 to design a method according to claim 1 is based on hindsight. In particular the skilled person would get no hint to

depart from the basic technical teaching of D1 which is to use combined modulation/coding schemes, with the modulation scheme being selected first, a predetermined coding scheme being associated with the then selected modulation scheme. Moreover, D1 contemplates taking advantage of any spare bandwidth for decreasing the modulation rate, i.e. for improving the reliability of transmission (e.g. protection against noise), which is a different approach from the claimed invention which takes advantage of any spare bandwidth for increasing the error protection, and thus implicitly the error correction.

The board therefore judges that the subject-matter of claim 1 involves an inventive step (Article 56 EPC) having regard to the prior-art document on file (D1).

Independent claim 5 contains the same features as claim 1 but expressed in terms of a claim for a transmitter. Therefore claim 5 also meets the requirements of Article 56 EPC.

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 based on the set of claims 1 - 9, submitted in oral proceedings before the board, and a description to be adapted thereto.

The Registrar: The Chair:

K. Götz A. Ritzka