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Datasheet for the decision
of 26 February 2021

Case Number: T 1619/17 - 3.5.07

Application Number: 03700323.3

Publication Number: 1470646

IPC: H03M7/42

Language of the proceedings: EN

Title of invention:
Adaptive variable length coding

Applicant:
Nokia Technologies Oy

Headword:
Adaptive variable length coding/NOKIA TECHNOLOGIES OY

Relevant legal provisions:
EPC Art. 123(2)
RPBA 2020 Art. 13(1), 13(2)

Keyword:
Amendments - added subject-matter - main request and first to
third auxiliary requests (yes)
Amendment after summons - exceptional circumstances - fourth
auxiliary request (no)

Case Number: T 1619/17 - 3.5.07

D E C I S I O N
of Technical Board of Appeal 3.5.07
of 26 February 2021

Appellant: (Applicant)	Nokia Technologies Oy Karakaari 7 02610 Espoo (FI)
Representative:	Berggren Oy P.O. Box 16 Eteläinen Rautatiekatu 10A 00101 Helsinki (FI)
Decision under appeal:	**Decision of the Examining Division of the European Patent Office posted on 20 February 2017 refusing European patent application No. 03700323.3 pursuant to Article 97(2) EPC**

Composition of the Board:

Chair	R. de Man
Members:	P. San-Bento Furtado
	E. Mille

Summary of Facts and Submissions

I.   The appeal lies from the decision of the examining
        division to refuse European patent application
        No. 03700323.3, which was filed as international
        application PCT/FI03/00055 published as WO 03/063360.
        In the decision under appeal, the examining division
        decided that a main request and first, second and third
        auxiliary requests added subject-matter extending
        beyond the content of the application as filed and that
        the subject-matter of claim 1 of each of the three
        auxiliary requests was not inventive over the
        disclosure of document

        D4: JP H05 347710 A, 27 December 1993,

        and related documents

        A4: Abstract of JP H05 347710 A, and
        T4: Translation by the Japanese Patent Office of JP H05
             347710 A.

II.   With the statement of grounds of appeal, the appellant
        filed an amended main request and amended first to
        third auxiliary requests.

III.   In a communication accompanying a summons to oral
        proceedings, the board expressed its preliminary
        opinion that claims 1 and 3 of the main request were
        unclear and added subject-matter extending beyond the
        content of the application as filed and that claim 1 of
        the main request was not novel over document D4 and
        lacked inventive step over the prior art acknowledged
        in the background section of the application. The board
        found that the same objections applied to the first

auxiliary request, that the second auxiliary request
did not fulfil the requirements of Articles 56, 84 and
123(2) EPC, and that the third auxiliary request did
not fulfil the requirements of Articles 56 and 84 EPC.

IV.   In response to the board's preliminary opinion, the
       appellant requested that the oral proceedings be held
       by videoconference.

V.   Oral proceedings were held by videoconference as
       scheduled, during which the appellant filed a fourth
       auxiliary request. At the end of the oral proceedings,
       the Chair announced the board's decision.

VI.   The appellant's final requests were that the contested
       decision be set aside and that a patent be granted on
       the basis of the main request or one of the first to
       fourth auxiliary requests.

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

       "A method of encoding a set of quantised transform
       coefficient values comprising a certain first number of
       zero valued quantised transform coefficients and a
       certain second number of non-zero valued quantised
       transform coefficients, wherein the method comprises:
          forming a set of symbol pairs to be variable-length
       encoded from said set of quantised transform
       coefficient values, said symbol pairs comprising a
       first value indicative of the value of the non-zero-
       valued quantised transform coefficient and a second
       value indicative of a number of zero-valued quantised
       transform coefficients preceding or following the non-
       zero-valued quantised transform coefficient, and
          variable-length encoding each said set of symbol
       pairs by using a set of variable-length codewords and a
       mapping between the first value and the second value

and a variable length codeword in the set of variable-length codewords;

    using the first number or the second number as a parameter; and

    providing an indication of the parameter in an encoded bitstream;

    characterised in that said mapping comprises using the parameter for:

    using a fixed set of variable length codewords as a variable length coding table, and changing the mapping between possible values of the pairs of the first value and the second value, which may arise in the set of quantised transform coefficient values for an image block, and variable-length codewords in the fixed set of variable-length codewords in dependence upon the parameter."

VIII.   Claim 1 of the first auxiliary request differs from that of the main request in that the text "a certain first number of" and "a certain second number of" was deleted and the text "using the first number or the second number as a parameter" was replaced with "using the number of non-zero valued quantised transform coefficients as a parameter".

IX.   Claim 1 of the second auxiliary request differs from that of the first auxiliary request in that the text at the end of the claim starting from "using the number of non-zero valued quantised transform coefficients" was replaced with

    "and

    providing an indication of the number of non-zero valued quantised transform coefficients in an encoded bitstream;

    characterised in that said mapping comprises using both the number of non-zero valued quantised transform

coefficients and a type of frame or image block to
which the quantised transform coefficients relate for:
    using a fixed set of variable length codewords as a
variable length coding table, and changing the mapping
between possible values of the pairs of the first value
and the second value, which may arise in the set of
quantised transform coefficient values for an image
block, and variable-length codewords in the fixed set
of variable-length codewords in dependence upon both
the number of non-zero valued quantised transform
coefficients and a type of frame or image block to
which the quantised transform coefficients relate."

X.   Claim 1 of the third auxiliary request reads as
        follows:

"A method of encoding a set of quantised transform
coefficient values comprising zero valued quantised
transform coefficients and non-zero valued quantised
transform coefficients, wherein the method comprises:
    forming a set of run-level pairs to be variable-
length encoded from said set of quantised transform
coefficient values, wherein said level value indicates
the value of the non-zero-valued quantised transform
coefficient and the run value indicates a number of
zero-valued quantised transform coefficients preceding
or following the non-zero-valued quantised transform
coefficient, and
    variable-length encoding each said set of run-level
pairs by using a set of variable-length codewords and a
mapping between each run and level and a variable
length codeword in the set of variable-length
codewords; and
    providing an indication of the number of non-zero
valued quantised transform coefficients in an encoded
bitstream;

characterised in that said mapping comprises using
both the number of non-zero valued quantised transform
coefficients and a type of frame or image block to
which the quantised transform coefficients relate for:
    using a fixed variable length codeword table, and
changing the mapping between possible values of the
run-level pairs, which may arise in the set of
quantised transform coefficient values for an image
block, and variable-length codewords in the fixed
variable-length codeword table in dependence upon both
the number of non-zero valued quantised transform
coefficients and a type of frame or image block to
which the quantised transform coefficients relate."

XI.   Claim 1 of the fourth auxiliary request differs from
       that of the third auxiliary request in that

-    "obtained from pixel values of an image block" has
     been added before ", wherein the method
     comprises";
-    "mapping between each run and level" has been
     replaced with "mapping between each run and level
     pair"; and
-    the text at the end of the claim following
     "characterised in that" has been replaced with
       "said mapping comprises using both the number of
     non-zero valued quantised transform coefficients
     and a type of the image block to which the
     quantised transform coefficients relate for:
       using a fixed set of variable length codewords,
     and changing only the mapping between possible
     values of the run-level pairs and variable-length
     codewords in the fixed set of variable-length
     codewords in dependence upon both the run value and
     the type of the image block to which the quantised
     transform coefficients relate."

XII.   The appellant's arguments, where relevant to this
         decision, are addressed in detail below.

Reasons for the Decision

Application

1.   The application concerns adaptive variable-length
         encoding of a set of quantised transform coefficient
         values, for instance for video compression.

1.1   Video coding systems reduce spatial redundancy using a
         technique known as "block-based transform coding",
         whereby a mathematical transformation is applied to the
         pixels of an image on a macroblock-by-macroblock basis.
         Transform coding translates the image data from a
         representation comprising pixel values to a form
         comprising a set of Discrete Cosine Transform (DCT)
         coefficient values (page 4, lines 17 to 27, of the
         international publication). In a video encoder, the DCT
         coefficients for each block are quantised (page 8,
         lines 16 to 27; Figure 1, transformation block 104 and
         quantiser 106) to form a sequence ("set" in the claims)
         of quantised coefficient values (page 8, line 29, to
         page 9, line 10; Figure 4).

1.2   The video encoder represents each non-zero quantised
         coefficient value in the sequence by two values:
         "level", which is the value of the quantised
         coefficient, and "run", which is the number of
         consecutive zero-valued coefficients preceding the
         coefficient in question (page 9, lines 12 to 19). For
         example, as described on page 20, line 27, to page 22,
         line 1, the sequence "0, 1, 2, 0, 0, 0, -1, 0, 0, 0, 0,
         0, 0, 0, 0, 0" corresponds to the (run, level) pairs
         "(1, 1), (0, 2), (3, -1), EOB" (where the end-of-block

symbol EOB indicates that there are no more non-zero values). The run and level values are further compressed using variable length coding (VLC). A variable number of bits is assigned to each (run, level) pair such that symbols which are more likely to occur are represented by VLC codewords having fewer bits. Look-up tables are used to define the mapping between each possible symbol and its corresponding variable length code (page 9, line 21 to page 10, line 14; page 22, lines 4 to 14).

1.3   In the method described in the application, VLC coding of the (run, level) pairs is performed by selecting one of a set of VLC coding (look-up) tables (or "assignment tables") stored in the encoder, where each coding table defines a set of variable-length codewords and a mapping between the codewords and the possible (run, level) pairs. A coding table is selected on the basis of either the number of non-zero-valued coefficients or the number of zero-valued coefficients in the array of quantised transform coefficients for the image block being coded (page 28, lines 11 to 25; page 34, line 22, to page 35, line 3).

Main request

2.   *Added subject-matter – claim 1*

2.1   Both in the decision under appeal and in the board's communication, the feature "using a fixed set of variable length codewords <u>as</u> a variable length coding table" (emphasis added) of the characterising part of claim 1 was considered to infringe Article 123(2) EPC.

2.2   In line with the appellant's arguments discussed in the decision under appeal (point 1.1) and in the board's preliminary opinion (points 8.2 and 9.1, last

paragraph), at the oral proceedings the appellant
reiterated that the feature "using a fixed set of
variable length codewords as a variable length coding
table, and changing the mapping [...]" meant that a
single list of VLC codewords, such as the list
contained in the rightmost column of Table 1 on page 21
of the international publication, was used as the VLC
table and that the mapping from (run, level) pairs to
VLC codewords was changed in dependence on a parameter
by selecting a mapping from (run, level) pairs to the
VLC indices of the VLC codewords (second rightmost
column of Table 1). Hence, the different mappings
between (run, level) pairs and VLC codewords were
implemented by storing the list of VLC codewords only
once and by storing one list of VLC indices for each
mapping. This solution for implementing the mappings
reduced memory consumption.

2.3   The appellant argued that the feature "using a fixed
        set of variable length codewords as a variable length
        coding table" was disclosed in several passages of the
        application as published. It was clear from page 26,
        lines 13 to 16, and page 27, line 28, to page 28,
        line 2, that the mapping described in the application
        was a kind of assignment or relationship between the
        input values and the output values. Although assignment
        tables were mentioned in the application, for example
        on page 28, lines 11 to 18, there were other
        possibilities for implementing different mappings.
        Table 1 on page 21 showed an example of a look-up table
        including a mapping. The mapping could be done by using
        the VLC indices as specified in claim 1. The "fixed set
        of variable length codewords" of claim 1 was the fixed
        VLC table corresponding to the rightmost column of
        Table 1. This was disclosed on page 20, lines 16 to 25,
        and page 37, lines 11 to 14. It was clear from page 37,

lines 11 to 14, that the fixed set of VLC codewords was used as a VLC table, and that only the mapping changed between image blocks.

2.4   The board is however of the opinion that it cannot be directly and unambiguously derived from the passages cited by the appellant that a "fixed set of variable length codewords" is used as a VLC table, nor that the fixed set of codewords and the mappings are used as specified by claim 1. The appellant argued (see point 2.2 above) that these features were to be interpreted as meaning that the VLC tables were implemented by storing a single list of VLC codewords and a plurality of lists of VLC indices, one for each mapping.

The passage on page 26 discloses that a relationship is established between the codewords and the mappings between the (run, level) pairs, the passage on page 27 discloses that the codeword is selected from a set of codewords, and page 28, lines 11 to 18, describes "assignment tables" which define assignments of pairs of values to codewords. But none of these passages defines the set of codewords as the VLC table or assignment table itself. The board could not find any passage describing the rightmost column of Table 1 as a VLC table.

Page 20, lines 16 to 25, refers to a "fixed look-up table" but does not explain how it is implemented. The "fixed set of VLC codewords" is mentioned on page 37, lines 11 to 14, which discloses that "a fixed set of VLC codewords is used and only the mapping [...] changes ...". However, that passage only refers to the fixed set of VLC codewords and mapping at an abstract level; it does not describe a concrete implementation of the set of VLC codewords and the mapping. From that

passage it cannot be directly and unambiguously derived
that the mapping is done by using the fixed set of VLC
codewords as a VLC table, let alone that the fixed set
of VLC codewords is stored only once.

2.5   Therefore, claim 1 does not fulfil the requirements of
        Article 123(2) EPC as it adds subject-matter extending
        beyond the content of the application as filed.

First and second auxiliary requests

3.   Claim 1 of each of the first and second auxiliary
        requests also includes the feature of claim 1 of the
        main request objected to above. Therefore, for the same
        reasons as given for the main request, the first and
        second auxiliary requests do not fulfil the
        requirements of Article 123(2) EPC.

Third auxiliary request

4.   *Added subject-matter - claim 1*

5.   The characterising part of claim 1 of the third
        auxiliary request includes the following feature:
        (a) "using a fixed variable length codeword table, and
            changing the mapping between possible values of the
            run-level pairs, which may arise in the set of
            quantised transform coefficient values for an image
            block, and variable-length codewords in the fixed
            variable-length codeword table in dependence upon
            both the number of non-zero valued quantised
            transform coefficients and a type of frame or image
            block to which the quantised transform coefficients
            relate".

5.1   In its communication under Article 15(1) RPBA 2020, the
       board expressed its preliminary opinion that, since the
       feature "using a fixed set of variable length codewords
       as a variable length coding table" of the higher
       ranking requests was no longer specified in claim 1 of
       the third auxiliary request, the objection against that
       feature had been overcome.

       However, at the oral proceedings the appellant was
       heard on the question of whether feature (a) added
       subject-matter for reasons similar to those given for
       the main request, given that it still specified the use
       of a (single) fixed VLC codeword table.

5.2   The appellant's arguments as regards compliance of
       feature (a) with Article 123(2) EPC were essentially
       the same as those given for claim 1 of the main
       request. According to the appellant, claim 1 of the
       third auxiliary request should also be interpreted as
       specifying that a single occurrence of the codewords is
       stored, the lists of indices being used for the
       mappings. The appellant cited page 35, lines 16 to 20,
       and the tables on page 36 as further basis for the
       feature. In the statement of grounds of appeal, the
       appellant argued that changing the wording "a fixed set
       of variable length codewords as a variable length
       coding table" to "a fixed variable length codeword
       table" did not bring anything new to the claims.

5.3   The description on page 35, lines 13 to 30, discloses
       that the variation of the statistical properties of the
       (run, level) pairs with respect to the number of non-
       zero-valued coefficients may be obtained empirically.
       The tables on page 36 illustrate probability
       distributions of (run, level) pairs. According to
       page 35, lines 16 to 18, the VLC codewords and the
       mappings between the codewords can be designed and

stored as one or more look-up tables in the encoder. In the board's opinion, this means that if there is one single mapping, only one look-up table is stored. It does not directly and unambiguously disclose that the list of VLC codewords is stored once as the VLC table separately from the mappings and that each mapping is implemented as a list of indices. Therefore, these passages do not disclose feature (a).

5.4   The board concludes that claim 1 of the third auxiliary request does not fulfil the requirements of Article 123(2) EPC.

Fourth auxiliary request

6.   *Admission of the request into the proceedings*

6.1   The fourth auxiliary request was filed during the oral proceedings and hence in a late phase of the already advanced stage of the appeal proceedings after notification of a summons to oral proceedings as referred to in Article 13(2) RPBA 2020.

The appellant argued that the late submission of this auxiliary request was justified and that the request should be admitted because the objection of added subject-matter against the third auxiliary request had been raised for the first time at the oral proceedings. These were exceptional circumstances justifying admittance of the request. With regard to the question of whether this request addressed the outstanding objections, the appellant maintained its argument that, compared with the prior art, the claimed method had the technical effect of reducing memory requirements by storing only one occurrence of the fixed list of VLC codewords as the VLC table.

6.2   The board agrees that the objection of added subject-
        matter against the third auxiliary request was raised
        for the first time in the oral proceedings. However,
        the characterising part of claim 1 of the fourth
        auxiliary request still refers to "using a fixed set of
        variable length codewords, and changing only the
        mapping ..." and the appellant maintained its position
        that the claimed invention achieved the technical
        effect of reduced memory consumption due to the use of
        a single VLC codeword table. Since the appellant's case
        for the allowability of the fourth auxiliary request is
        still based on an alleged effect for which, in the
        board's opinion, there is no basis in the application
        as filed, the fourth auxiliary request is *prima facie*
        not allowable.

6.3   Furthermore, the amendments introduced with claim 1 of
        the fourth auxiliary request also try to address
        objections that had been raised before the oral
        proceedings. For example, the insertion of the text
        "obtained from pixel values of an image block" and of
        the word "pair" after "mapping between each run and
        level" concern clarity objections raised in the board's
        communication. The appellant could have tried to
        overcome these objections with amendments filed in
        advance of the oral proceedings and chose not to do so
        then.

6.4   Therefore, the board does not recognise the presence of
        any exceptional circumstances which would justify
        admitting the request at such a late stage. In view of
        this, in accordance with Article 13(1) and 13(2) RPBA
        2020, the board does not admit the fourth auxiliary
        request into the appeal proceedings.

Conclusion

7.   Since the main request and first to third auxiliary
         requests are not allowable, and the fourth auxiliary
         request is not admitted into the proceedings, the
         appeal is to be dismissed.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar: The Chair:

S. Lichtenvort   R. de Man

Decision electronically authenticated