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Datasheet for the decision of 30 January 2012

Case Number: T 0443/11 - 3.5.02

Application Number: 03019290.0

Publication Number: 1367726

IPC: H03M 13/00, H03M 13/29, H03M 13/27

Language of the proceedings: EN

Title of invention:
Turbo interleaving apparatus and method

Applicant:
SAMSUNG ELECTRONICS CO., LTD.

Opponent:
-

Headword:
-

Relevant legal provisions:
EPC Art. 76(1), 83, 84, 123(2)
EPC R. 42(1)(e), 48(1)(c)

Keyword:
"Added subject-matter (no)"
"Sufficiency of disclosure (yes)"
"Clarity (yes)"

Decisions cited:
T 1123/09

Catchword:
See point 3.4 of the reasons.

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Beschwerdekammern | Boards of Appeal | Chambres de recours

Case Number: T 0443/11 **-** 3.5.02

D E C I S I O N
of the Technical Board of Appeal 3.5.02
of 30 January 2012

Appellant: (Applicant)
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Decision under appeal:
Decision of the Examining Division of the European Patent Office posted 24 September 2010 refusing European application No. 03019290.0 pursuant to Article 97(2) EPC.

Composition of the Board:

Chairman: M. Ruggiu
Members: R. Lord
P. Mühlens

Summary of Facts and Submissions

I. This is an appeal of the applicant against the decision of the examining division to refuse European patent application No. 03 019 290.0, which is a divisional application of the European application No. 00 927 908.4, which was in turn based on the international application PCT/KR00/00504, published as WO 00/70771.

II. The reason given for the refusal was that the application did not meet the requirements of Article 83 and Rule 42(1)(e) EPC.

III. The following document of the state of the art has been cited during the procedure before the first instance:

D1: 3GPP Technical Specification Group for Radio Access Network (RAN WG1) technical specification TS 25.212 V1.0.0 (April 1999).

IV. In a communication dated 15 September 2011, accompanying a summons to oral proceedings, the board informed the appellant ***inter alia*** of its preliminary opinion that it agreed with the argumentation in his grounds of appeal concerning Article 83 and Rule 42(1)(e) EPC and that it considered that the objections raised by the examining division in sections 3 to 6 of the annex to summons to oral proceedings dated 23 April 2010 were not valid. In a letter dated 11 January 2012 the appellant requested the grant of a patent in the following version:

Description

Pages 1 to 5, 7, 9 to 15 and 17 to 27 as originally filed,
Page 6a filed with letter of 26 July 2004,
Pages 6b and 16 filed with letter of 26 June 2006,
Pages 6 and 8 filed with letter of 11 January 2012.

Claim

No. 1 filed with the letter of 11 January 2012.

Drawings

Sheets 1/11 to 11/11 as originally filed.

V. The single claim reads as follows:

"A turbo encoder comprising:
a first encoder (111) for encoding a frame of K input information bits to generate first coded symbols;
an interleaver for
sequentially writing the K input information bits into an R x C rectangular matrix row by row starting in the first column of the first row,
selecting a primitive root g0 corresponding to a prime number p,
generating a base sequence C(i) for intra-row permutation as
$C(i) = [g0 \times C(i-1)] \bmod p$, $i = 1, 2, \ldots, (p-2)$ and $C(0) = 1$,
determining a minimum prime integer set $\{q_j\}$ for $j = 0, 1, 2, \ldots, R-1$ such that
g.c.d $\{q_j, p-1\} = 1$ and $q_j > 6$, $q_j > q_{(j-1)}$ for each $j = 1, 2, \ldots, R-1$,
where g.c.d is a greatest common divider and
$q_0 = 1$,

determining $\{p_j\}$ from $\{q_j\}$ using

$p_{P(j)} = q_j$, j = 0, 1, ... , R-1

where P(j) indicates a predetermined inter-row permutation pattern,

permuting positions of the information bits in a jth row in accordance with

$C_j(i) = C([ixp_j] \bmod (p-1))$,

where j = 0, 1, 2, ... , (R-1), i = 0, 1, 2, ... , (p-2), $C_j(p-1) = 0$, and $C_j(p) = p$;

performing inter-row permutations according to the predetermined inter-row permutation pattern P(j), and

reading out the information bits from the permuted R x C rectangular matrix column by column starting in the first row of the first column; and

a second encoder (113) for encoding the interleaved information bits to generate second coded symbols,

wherein the R x C rectangular matrix has R rows and C columns, K specifies the number of the input information bits in the frame and K = R x C, C=p+1 and K>R>1;

characterized in that

the prime number p is the minimum prime number satisfying $0 \leq (p+1)-K/R$; and

the interleaver is arranged to implement, between the permuting of the positions of the information bits and the performing inter-row permutations, one of the following:

exchanging $C_{R-1}(p)$ with $C_{R-1}(0)$,

exchanging $C_{R-1}(p)$ with $C_{R-1}(p-1)$,

exchanging $C_j(p)$ with $C_j(0)$ for every j, wherein j = 0, 1, 2, ... R-1,

exchanging $C_j(p)$ with $C_j(p-1)$ for every j, wherein j = 0, 1, 2, ... R-1,

exchanging $C_j(p)$ with $C_j(k)$ for every j, wherein j = 0, 1, 2, ... R-1 and wherein k indicates a specific exchanging position searched for a given interleaving rule, or
exchanging $C_{R-1}(p)$ with $C_{R-1}(k)$, wherein k indicates a specific exchanging position searched for a given interleaving rule."

VI. The appellant essentially argued as follows:

It was not disputed that the skilled person would be able to implement an encoder according to D1. The claimed encoder differed from that of D1 only by the two features of the characterising portion of the claim, neither of which would present any difficulty in implementation.

The interleaver and deinterleaver of figures 2 and 3 were disclosed only as known general structures for these elements, so that the question as to whether the claims were consistent with this disclosure was not relevant for the assessment of sufficiency of disclosure.

The decision T 1123/09 was not relevant to the present case, because it concerned a claim wording which specified that the permutation and the collection of permutated bits were separate operations. This was not the case in the present claims.

Reasons for the Decision

1. The appeal is admissible.

2. *Amendments (Articles 76(1) and 123(2) EPC)*

2.1 The pre-characterising portion of the claim is based on claims 1 and 2 of the original parent application (WO00/70771), which disclosure was repeated as Embodiments 1 and 2 on page 28 of the present divisional application as originally filed. The first feature of the characterising portion is derived from page 16, line 15 of the parent application and the corresponding passage in the description of the present application. The six alternative "exchanging" steps were disclosed in the parent application at page 18, lines 19 to 28 and in the corresponding passage of the present application.

2.2 In the summons to oral proceedings dated 23 April 2010 the examining division argued that the application contravened the requirement of Article 123(2) EPC because the claims defined the condition that the prime number p is selected to satisfy $0 \leq (p+1)-K/R$, whereas the application disclosed that the invention was based on the method of D1, in which the corresponding condition was $0 < (p+1)-K/R$ (i.e. the "less than" requirement in D1 had been replaced by "less than or equal to"). However, as the examining division acknowledged, the condition as now claimed was disclosed in the original application, in particular in paragraph [0048] (of the published application). Since the remainder of the application is entirely consistent with this version of the condition, the board considers

that the skilled person would understand that the application makes use of this modified condition, not that of D1. The introduction of this definition into the claim therefore does not result in the addition of subject-matter beyond the content of the application as filed.

2.3 The description of the application has been amended to be consistent with the claims.

2.4 Thus, the amendments to the application do not contravene Article 76(1) or 123(2) EPC.

3. *Sufficiency of disclosure (Article 83 and Rule 42(1)(e) EPC)*

3.1 The objection in the decision under appeal concerning sufficiency of disclosure is based on the argumentation in decision T 1123/09 (17 December 2009) relating to claim interpretation. The board considers that this argumentation is not applicable to the present case, because of differences in the wording of the claims. Specifically, claim 1 as addressed in T 1123/09 defines that the "inter-column permutation" step is performed by the interleavers, whereas the step of "collecting the permutated bits" is performed by a different component, namely the modulator, thus clearly indicating that these two steps are separate operations which are not combined. In contrast, the present claim defines that both of the corresponding steps (permutation and reading out) are performed by the interleaver, so that the option of these two steps being combined in one operation is not excluded. Thus the claim covers the embodiments described in the

application with reference to figures 9 and 10, in which the inter-row permutation is combined with the reading out step by reading out using interleaved addresses.

3.2 In the light of this interpretation of the claim, the board sees no inconsistency between the claim and the teaching of the application in paragraphs [0025] and [0026] relating to figures 2 and 3, which concerns an interleaver and a deinterleaver in which the write or read operation is combined with a permutation operation by using interleaved write or read addresses.

3.3 Thus, considering the application as a whole, the board concludes that, as indicated in paragraph [0024], the teaching relating to figures 2 and 3 should be understood as explaining techniques for carrying out the permutation operations in combination with the write or read steps which can be used in the claimed invention, thus providing teaching in this respect which meets the general requirement of Article 83 EPC. Considering the embodiments described in detail in the application, in particular with reference to figures 9 and 10, the board concludes that these are consistent with the claim, since the claim covers the performing of the inter-row permutation and reading out in a combined operation. Thus, the application describes in detail at least one way of carrying out the invention, as required by Rule 42(1)(e) EPC.

3.4 The board notes also in this context that during the course of the proceedings the examining division has argued (see in particular section 6 of the summons to oral proceedings dated 23 April 2010) that claim 1 has

to be taken literally. The board disagrees with this statement, since it is established case law of the boards of appeal that claims should be interpreted in the manner that they would be understood by a person skilled in the art. In the present context the board considers that the skilled person would understand the definition of the interleaver in the present claim as specifying that the interleaver should operate so as to arrive at the result which would be produced by applying the defined mathematical operations, without requiring that it actually explicitly carries out each of these operations as a distinct process step. Such an interpretation is consistent with the conventional manner in which mathematical operations are implemented in electronic devices, according to which a device is implemented in such a manner as to produce the result of the required mathematical operation by whatever method is appropriate for the particular hardware and/or software used, without placing any other restrictions on the actual operations carried out. Thus, a literal interpretation of the present claim in this respect is not appropriate.

4. *Clarity and irrelevant matter (Article 84 and Rule 48(1)(c) EPC)*

4.1 In the summons to oral proceedings dated 23 April 2010 the examining division raised objections under Article 84 and Rule 48(1)(c) EPC. The board considers, for the following reasons, that the present claim meets those requirements.

4.2 The division argued that the then valid claims lacked an essential feature, thus not clearly defining the invention, because they did not exclude the case that the selected primitive root g0 is 1. The board considers that the absence of an explicit exclusion of this value does not result in a loss of clarity, since it would be evident to the skilled person that this value of the primitive root was excluded, because if g0=1, then all of the C(i) would be equal to 1, so that C(i) would not be a permutation sequence. Since the claim requires C(i) to be a permutation sequence, the case that g0=1 is implicitly excluded, so that there is no lack of clarity in the claim.

4.3 The division also argued that the application contained irrelevant matter, contrary to the requirement of Rule 48(1)(e) EPC. The reasons given for this objection were that the claims were restricted to the case where K=RxC, whereas paragraphs [0048] to [0050] covered other cases, and that paragraphs [0053] and [0054] taught that the invention differed from D1 only in "step B-5)", i.e. the "exchanging" step of the present claim, thus implying that the invention also covered cases in which K was not equal to RxC. The board does not find this argumentation convincing, for two reasons. Firstly, the board considers that from the discussion of the prior art interleaver in paragraph [0049] it would be clear to the skilled person that, although the encoding technique as a whole might be applied to cases in which K is not equal to RxC, the invention is restricted to the case in which it does, since it is only in that case (i.e. that in which C=p+1) that the problem addressed by the invention arises. Thus, the description of the other cases can be understood as

being useful for the understanding of the technical background to the invention. In particular, the board understands that the purpose of the defined step of generating the permutation sequences using the primitive root of a prime number derived from the frame size K is to cope with the fact that this parameter varies in a manner which cannot be predicted in advance. Hence, a discussion of how to proceed with different values of K seems to the board to be appropriate. Secondly, the board does not understand paragraphs [0053] and [0054] as teaching that the invention differs from D1 only in the step B-5), but rather that it discloses merely that it is the introduction of this step which provides the solution to the problem. The board is therefore not able to identify any matter in the application which could be considered to be irrelevant within the meaning of Rule 48(1)(e) EPC.

5. *Novelty and inventive step (Articles 54 and 56 EPC)*

The board sees no reason to deviate from the position of the examining division and the appellant that D1 represents the most relevant prior art. The claimed encoder differs from that of D1 by the two features of the characterising portion of the claim. Of these, the latter (i.e. the "exchanging" step) addresses a technical problem (as discussed in the application with reference to figures 4 to 8) which is not identified in the available prior art, and does so in a manner which is also not suggested anywhere in the available prior art. Thus, the subject-matter of the claim is considered to be new and to involve an inventive step.

6. *Formal requirements of the EPC*

With the appellant's current request, the earlier multiple independent claims have been replaced by a single independent claim drafted in the two-part form as required by Rule 43(1) EPC, and the description has been adapted accordingly. The remaining formal requirements of the EPC had already been addressed by amendments to the description filed during the procedure before the examining division.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The case is remitted to the first instance with the order to grant a patent in the following version:

Description

Pages 1 to 5, 7, 9 to 15 and 17 to 27 as originally filed,
Page 6a filed with letter of 26 July 2004,
Pages 6b and 16 filed with letter of 26 June 2006,
Pages 6 and 8 filed with letter of 11 January 2012.

Claim

No. 1 filed with the letter of 11 January 2012.

Drawings

Sheets 1/11 to 11/11 as originally filed.

The Registrar: The Chairman:

C. Moser M. Ruggiu