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Datasheet for the decision
of 19 January 2017

Case Number:	T 0679/14 - 3.5.07
Application Number:	99962985.0
Publication Number:	1147614
IPC:	H03M13/27
Language of the proceedings:	EN

Title of invention:
Turbo code interleaver using linear congruential sequences

Applicant:
Qualcomm Incorporated

Headword:
Turbo code interleaver/QUALCOMM

Relevant legal provisions:
EPC Art. 56
EPC R. 42(1)(b), 103(1)(a), 111(2)

Keyword:
Appeal decision - binding effect (yes)
Inventive step (yes)
Substantial procedural violation - reimbursement of appeal fee (yes)

Decisions cited:

T 0153/93, T 1123/04, T 0017/07, T 2321/08, T 1123/09,
T 0105/11, T 0449/15

Catchword:

Beschwerdekammern

Boards of Appeal

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Case Number: T 0679/14 - 3.5.07

D E C I S I O N
of Technical Board of Appeal 3.5.07
of 19 January 2017

Appellant: (Applicant)	Qualcomm Incorporated 5775 Morehouse Drive San Diego, CA 92121-1714 (US)
Representative:	Wagner & Geyer Partnerschaft Patent- und Rechtsanwälte Gewürzmühlstrasse 5 80538 München (DE)
Decision under appeal:	**Decision of the Examining Division of the European Patent Office posted on 3 September 2013 refusing European patent application No. 99962985.0 pursuant to Article 97(2) EPC.**

Composition of the Board:

Chairman	R. Moufang
Members:	P. San-Bento Furtado
	M. Rognoni

Summary of Facts and Submissions

I.   The appeal lies from the decision of the Examining
        Division to refuse European patent application
        No. 99962985.0, which was filed as international
        application PCT/US99/28580 and published as
        WO 00/35103, because the application did not meet the
        requirements of Article 56 EPC.

II.   The Examining Division found that the subject-matter of
        the independent claims of a main request was not
        inventive over the following prior-art document:
        D2:   Clark, G.C., Bibb Cain, J.: "8.3. Interleaver
              Structures for Coded Systems", Error Correction
              Coding for Digital Communications, pages 345 to
              352, Plenum Press, New York, 1981.

        The same objections as raised for the main request were
        considered to apply with regard to claims 1, 9, 19 and
        27 of a first auxiliary request, claims 1, 12 and 22 of
        a second auxiliary request, claims 1, 5, 8 and 10 of a
        third auxiliary request and claim 1 of a fifth
        auxiliary request. A fourth and a sixth auxiliary
        requests were not admitted under Rule 137(3) EPC.

III.   This is the second appeal relating to the above
        mentioned application. In the first appeal proceedings
        resulting in decision T 17/07 of 20 December 2010 the
        competent board had come to the conclusion that the
        claims then on file, submitted with the letter faxed on
        24 November 2010, fulfilled the requirements of
        Articles 84 and 123(2) EPC, and decided to remit the
        case to the Examining Division for further prosecution
        because novelty and inventive step of that request had
        not been assessed by the first instance.

IV.   In the examination proceedings after the first appeal,
        a first summons to oral proceedings to take place on
        18 January 2012 was sent on 17 October 2011. After that
        a new date for oral proceedings was fixed eight times.
        On three of those occasions, the oral proceedings were
        postponed in reaction to requests by the applicant on
        grounds related respectively to non-observance of the
        two-month notice for the summons, family vacation of
        the attorney and illness (see letters of 13 January
        2012, 12 July 2012 and 14 March 2013). On two occasions
        they were cancelled by the Examining Division, with the
        statements "oral proceedings cannot take place" and
        "the first member has to attend another meeting"
        respectively (see brief communications of 23 March 2012
        and 11 January 2013). For the other three
        postponements, no reason is apparent from the file.

V.   In the statement of grounds of appeal, the appellant
        requested that the contested decision be set aside and
        that a patent be granted on the basis of the main
        request filed with letter of 24 November 2010,
        corresponding to that on which the first appeal
        decision T 17/07 was based, or, alternatively, the
        first auxiliary request filed with letter of
        16 December 2011, both requests resubmitted with the
        grounds of appeal.

VI.   The appellant was invited to oral proceedings. In a
        subsequent communication sent in advance of the oral
        proceedings, the Board also referred to document D1,
        which had been cited by the Examining Division in its
        communication of 19 August 2002:
        D1:   Dolinar, S., Divsalar, D.: "Weight Distributions
               for Turbo Codes Using Random and Nonrandom
               Permutations", TDA Progress Report 42-122,
               15 August 1995.

The Board drew attention to apparent deficiencies, to be discussed at the oral proceedings, of the examination proceedings before the first instance and of the reasoning of the contested decision.

The Board stated that, taking into account the long duration of the proceedings thus far, the fact that this was the second appeal in the present case, and that the Board had to assume that a proper search had been carried out, it was not inclined to remit the case to the department of first instance for further prosecution regardless of whether the deficiencies were found to amount to procedural violations.

The Board made a preliminary assessment of inventive step of the subject-matter of the independent claims of the main request, taking document D2 as the starting point. It also summarised the disclosure of document D1, which it considered also relevant for the assessment of inventive step. With regard to the auxiliary request, the additional feature seemed to be well known and would hence not change the result of the assessment of inventive step compared with that of the main request.

VII.   With a letter of reply the appellant filed a second auxiliary request.

VIII.   Oral proceedings were held on 19 January 2017. During the oral proceedings the appellant filed a new set of claims as sole request, replacing all previous requests, and a complete set of pages of the description, and requested reimbursement of the appeal fee. At the end of the oral proceedings, the chairman pronounced the Board's decision.

IX.   The appellant's final requests were that
        -   the contested decision be set aside;
        -   the case be remitted to the department of first
            instance with the order to grant a patent on the
            basis of claims 1 to 38 and description pages 1 to
            3, 3a, 4, 4a and 5 to 21 as filed during the oral
            proceedings on 19 January 2017, and of the drawings
            of Figures 1 to 3 as published;
        -   the appeal fee be reimbursed.

X.   Claim 1 of the sole request reads as follows:

        "An interleaver (16) for a turbo coder (10),
        comprising:
           means for writing data elements sequentially by rows
        to a matrix of bit storage locations, the matrix
        comprising a first plurality of rows and a second
        plurality of columns;
           means for permuting the rows of the matrix;
           means for pseudo-randomly rearranging the data
        elements in each row in the matrix of bit storage
        locations in accordance with a linear congruential
        sequence recursion, wherein the linear congruential
        sequences associated with two distinct rows are
        different; and
           means for reading the data elements sequentially by
        columns from the matrix of bit storage locations."

        Independent claim 10 reads as follows:

        "A turbo coder (10), comprising:
           a first coder (12) configured to receive a plurality
        of input bits in succession and generate a first
        plurality of output symbols therefrom;
           an interleaver (16), comprising:

means for writing the plurality of input bits
sequentially by rows to a matrix of bit storage
locations, the matrix comprising a first plurality of
rows and a second plurality of columns;
        means for permuting the rows of the matrix;
        means for pseudo-randomly rearranging the bits in
each row in the matrix of bit storage locations in
accordance with a linear congruential sequence
recursion, where in [sic] the linear congruential
sequences associated with two distinct rows are
different; and
        means for reading the bits sequentially by
columns from the matrix of bits storage locations to
provide a plurality of interleaved bits; and
    a second coder (14) configured to receive the
plurality of interleaved bits in succession from the
interleaver (16) and generate a second plurality of
output symbols therefrom."

Independent claim 21 recites "A method of interleaving
data elements for a turbo coder (10)" comprising the
four steps defined in claim 1 with respect to the means
of the interleaver.

Independent claim 30 recites "A method of turbo coding"
comprising the steps defined in claim 10 with reference
to the components of the turbo coder.

Claims 2 to 9, 11 to 20, 22 to 29 and 31 to 38 are
dependent claims.

XI.   Insofar as relevant for the present decision, the
        appellant's arguments were as follows:

        The present invention provided for an interleaver, in
        particular a code interleaver of a turbo coder, with

better performance and reduced implementation
complexity compared to other existing known turbo code
interleavers.

The interleaver was essentially a block, or row-column,
interleaver with **both** row-interleaving and intra-row
elements permutation, the latter being done in linear
congruent form. A turbo code could be improved by using
such an interleaver "inasmuch as it was possible to
avoid or at least minimise bad mappings of error
events".

The Examining Division appeared not to have taken into
account the advantageous aspects of the invention, in
particular better performance of the interleaver and
reduced implementation complexity. Document D2 only
related to a single sequence of integers and did not
contemplate any addressing supporting a mathematical
construct of rows and columns. Such a construct of a
two-dimensional interleaver employed by a parallel
turbo coder generally outperformed a parallel turbo
coder having a one-dimensional interleaver (such as the
one described in D2) in terms of coding gain.

The Examining Division appeared to be of the opinion
that rows and columns were merely "metaphorical" but
not real. However, whether physical or mathematical,
the indexing of rows and columns was indeed real and
significant in the present invention, and could not be
mischaracterised as, or reduced to, a metaphor for the
sake of expediency.

Document D2 did not actually disclose or point to a
two-dimensional interleaver in which rows were permuted
and data elements in each row of the matrix were then
pseudo-randomly rearranged in the matrix of bit storage

locations using linear congruential sequences, wherein the linear congruential sequences associated with two distinct rows were different.

There was no teaching in the prior art to pick something from one embodiment and combine it with another embodiment.

Even taking into account the disclosure of document D2 and the concept of two-dimensional interleavers, there was no hint for the skilled person to use linear congruential sequences for element permutations in individual rows, wherein the linear congruential sequences associated with two distinct rows were different. Moreover, in D2 there was no hint that these rows were permuted. Even if the skilled person combined the different embodiments of document D2, it would not be obvious to arrive at the claimed solution. The skilled person would not additionally permute rows.

The first embodiment of document D1 mentioned in the Board's communication already proposed a solution to improve interleaving based on column permutations in addition to row permutations. The skilled person would therefore not search for another solution to the problem. There was no hint in the prior art to modify the interleaver of D1 by replacing those column permutations with different linear congruential sequences in distinct rows.

The appellant was dissatisfied with the way the case had been handled in the first-instance proceedings. The repeated adjournment of oral proceedings had been prejudicial to it. The reasoning of the Examining Division was unclear. The appellant was not in favour

of remittal to the department of first instance for
assessment of inventive step.

Reasons for the Decision

1.   The appeal complies with the provisions referred to in
        Rule 101 EPC and is therefore admissible.

Appeal – procedural aspects

2.   Decision T 17/07 of the first appeal in the present
        case established that the claims then on file satisfied
        the requirements of Articles 84 and 123(2) EPC.

        The claims now on file differ from those on which that
        first appeal decision was based in that "for a turbo
        coder (10)" has been added to the text of independent
        claims 1 and 21. Since that amendment does not
        prejudice clarity and finds direct and unambiguous
        support in the application as originally filed (see
        e.g. the title or the brief description of Figure 2 on
        page 4, lines 33 and 34, of the present application),
        it does not affect the conclusion of the first appeal
        decision with regard to clarity and added subject-
        matter.

        The finding of that first appeal decision being *res
        judicata* (see decision T 153/93 of 21 February 1994,
        reasons 2 and 3, Case Law of the Boards of Appeal,
        8th edition 2016, IV.E.7.7 and 7.7.4, and T 449/15 of
        25 February 2016, reasons 2), the Board confirms that
        the claims satisfy the requirements of Articles 84 and
        123(2) EPC.

3.   At the oral proceedings the appellant expressed its
        dissatisfaction with the way the case had been handled
        in the first-instance proceedings and said that it
        found the reasoning of the Examining Division unclear.
        Nevertheless, it was not in favour of remittal to the
        department of first instance for assessment of
        inventive step and accordingly requested further
        prosecution by the Board.

4.   This is the second appeal in the present application,
        which entered the European phase in June 2001. In the
        Board's view, the long duration of the proceedings thus
        far and the fact that this is the second appeal
        constitute special reasons under Article 11 RPBA for
        not remitting the case in reaction to fundamental
        deficiencies in the first-instance proceedings. The
        Board therefore considers that, irrespective of its
        conclusions on the deficiencies found, it should
        further examine the claims with regard to inventive
        step.

Inventive step

5.   Each of independent claims 1, 10, 21 and 30 recites the
        concrete application of the claimed invention for turbo
        coders. According to established case law, processes
        for encoding/decoding are to be regarded as technical
        processes, even if they are based essentially on
        mathematical processes (see also Case Law of the Boards
        of Appeal, 8th edition 2016, I.A.2.2.2). Interleaving
        is used to create a more uniform distribution of errors
        and improve the performance of the encoding and
        decoding process. It therefore improves the performance
        of a process viewed as technical. As a consequence, and
        although the interleaving method is based on

mathematical operations, the Board recognises the
technicality of the claimed invention.

6.   Claim 1 recites an interleaver comprising means for
        writing data elements in storage locations, rearranging
        data elements and reading data from the storage
        locations. According to decision T 17/07, the claim
        "covers both means that physically write the permuted
        rows and rearranged data elements in the matrix and
        means that generate indexes which can be used for
        permuting the rows and rearranging the data elements in
        each row" (see reasons 3.1).

        The fact that according to decision T 17/07 the claim
        covers two implementations of the interleaving method
        does not imply that the matrix features should be
        considered merely conceptual and ignored in the
        assessment of inventive step, as seems to have been
        done in the appealed decision at least with regard to
        some matrix features (see also point 14.6 below).

        In each of the interpretations of T 17/07, the claimed
        interleaver has the effect that data retrieved from the
        storage locations is rearranged in relation to the data
        that was previously stored in those storage locations.
        The same applies to the corresponding subject-matter of
        the other independent claims.

        In addition, since the claimed interleaver writes the
        data elements by rows but reads the data elements by
        columns rather than by rows, in addition to the other
        features of the claim, the matrix features cannot be
        simply mapped to features of an interleaver permuting
        data elements only within each individual subsequence
        of the received sequence of data elements, each
        subsequence corresponding to a row or a column. Insofar

as the matrix features play a role in the interleaving performed and its associated properties, they should not be ignored in the assessment of inventive step.

7.   Prior-art document D2 discloses interleaving techniques for coding systems (see e.g. page 345, first two text paragraphs, Figure 8-9). Even though it does not mention turbo coders, the Board considers that the skilled person would also take its teaching into account in the general context of interleavers for turbo coders. It is therefore an appropriate starting point for the assessment of inventive step in the present case.

7.1   Document D2 explains on page 345, second text paragraph, that two principal classes of interleavers are periodic and pseudorandom. Starting on page 346, in section 8.3.1 document D2 describes periodic interleavers, in particular two types: block interleavers and convolutional interleavers. Block interleavers are said to accept blocks and perform identical permutations over each block of symbols (page 346, first text paragraph). As an example of a typical block interleaver, document D2 discloses the "(B, N) block interleaver" in subsection 8.3.1.1, which takes the coded symbols and writes them by columns into a matrix of N rows and B columns, the permutation consisting of "reading these symbols out of the matrix by rows prior to transmission" (see page 346, second text paragraph). This appears to correspond to the means for writing data elements sequentially by rows to a matrix and reading sequentially by columns of the claim (interchanging writing by columns and reading by rows with writing by rows and reading by columns does not result in a different technical teaching).

7.2   The interleaver of claim 1 differs from the (B,N) block
        interleaver of document D2 in that it is an interleaver
        for a turbo coder and includes means for respectively
        ("rows" in the claim corresponding to "columns" in D2)
        (a) permuting the rows of the matrix;
        (b) pseudo-randomly rearranging the data elements in
            each row in the matrix of bit storage locations in
            accordance with a linear congruential sequence
            (LCS) recursion, wherein the LCSs associated with
            two distinct rows are different.

7.3   With regard to the problem solved by the claimed
        invention, in the grounds of appeal the appellant
        reiterated some of the arguments presented in the
        first-instance proceedings, namely that the claimed
        invention provided good error rate performance and
        simplicity of implementation (see also page 3, lines 19
        to 37 of the description). At the oral proceedings the
        appellant added that the implementation of the
        receiving side in the system of the invention was
        simpler because it required only the parameters used in
        the interleaver.

        The Board is not convinced that the distinguishing
        features result in reduced complexity of the
        implementation with regard to the (B,N) block
        interleaver of document D2, especially since claim 1
        does not give any implementation details.

        The contested decision did not provide any comments on
        the error rate performance. As explained in
        document D2, the (B,N) block interleaver lacks
        robustness if there is substantial variation in the
        characteristics of the burst noise process (page 346,
        penultimate paragraph).

The Board therefore recognises that the distinguishing
features improve randomness and may potentially improve
the error rate performance of the interleaver for some
burst error patterns.

7.4   In the Board's view, the skilled person facing the
above problem of improving the error rate performance
would search for other permutation and interleaving
techniques. However, none of the available prior-art
documents discloses both features (a) and (b) used in
the same context as in the present invention.

7.4.1   Document D2 discloses pseudorandom interleavers in
section 8.3.2, starting on page 349. According to that
disclosure, a pseudorandom interleaver is a block
interleaver which takes a block of L channel symbols
and reorders, or permutes, them in a pseudorandom
fashion. Document D2 explains that if the same
permutation is used on each interleaver block, certain
interference patterns will exist that can seriously
degrade the performance. It then teaches changing the
permutation frequently to avoid that problem, e.g. by
storing a fixed number of permutations, say M, in a ROM
and randomly selecting a permutation from this group
for each interleaved block. An example of such an
interleaver is described in the paragraph bridging
pages 349 and 350 with reference to Figure 8-11 of
page 350. On page 350, document D2 discusses the
question of selecting the permutations to be used and
refers to the use of LCSs for the permutation (see
page 350, Equation (8-2), and preceding paragraph). The
equation expressing the pseudorandom sequence in
document D2, Equation (8-2), actually corresponds to
the equation of claim 3 of the present application,
which further defines the LCS of claim 1. These
features of a pseudoramdom interleaver with a new

permutation for each succeeding interleaved block correspond to those of distinguishing feature (b).

At the oral proceedings the appellant argued that the pseudorandom interleavers disclosed in section 8.3.2 of document D2 did not use a matrix; interleaving was performed only on one column. The Board agrees but notes that the matrix features are already disclosed for the (B,N) block interleaver of section 8.3.1.1. The question is therefore whether the skilled person would enhance that (B,N) block interleaver by adding the pseudorandom interleaving of section 8.3.2 corresponding to feature (b) above and thereby arrive at the claimed solution. With respect to that question, the Board agrees with the appellant that none of the documents hints at using LCS permutations in individual rows of a (B,N) block interleaver, and that the combination of the two separate embodiments of D2 would still not include feature (a). The Board is therefore persuaded that it would not be obvious for the skilled person to arrive at the claimed invention when starting from document D2.

8.   Document D1 discloses in the context of turbo coding block interleavers defined by a matrix (see page 61, section B.1), in which columns are reordered. It teaches that a block interleaver can be improved by permuting rows in addition to its columns (page 61, last four lines). That embodiment therefore does not include feature (b) either.

On page 62, document D1 discloses permutations based on circular shifting similar to those of feature (b). However, those features are disclosed with regard to a separate embodiment (see page 62, section B.2). At the oral proceedings, the appellant argued that in the

light of the disclosure of the solution including both row and column permutations for the first embodiment of document D1 (page 61, section B.1), the skilled person would have no incentive to remove from that embodiment the column permutations and replace them with the circular shifting of the second embodiment applied at each row. The Board agrees with the appellant, noting that the idea of performing different permutations in distinct rows is clearly different from that of permuting columns across all rows of the matrix. None of the available prior-art documents discloses how to combine the circular shifting with a block interleaver like that disclosed in section B.1 of document D1.

9.   The Board is therefore satisfied that the cited prior-art documents, either individually or in combination, do not render obvious the subject-matter of claim 1, the same applying for corresponding independent claims 10, 21 and 30. The application therefore fulfils the requirements of Articles 52(1) and 56 EPC.

Remittal

10.   From the above the Board concludes that the claims comply with Articles 84, 123(2), 52(1) and 56 EPC. The description has been adapted to the present claims. No other deficiencies can be identified with regard to the application documents on file. The Board therefore decides to set aside the decision under appeal and to remit the case to the department of first instance with the order to grant a patent on the basis of the sole request on file.

Reimbursement of the appeal fee

11.   The appellant's request for reimbursement of the appeal
         fee can be granted only if such reimbursement is
         equitable by reason of a substantial procedural
         violation (Rule 103(1)(a) EPC).

12.   The deficiencies apparent in the first-instance
         proceedings in the present case, which were discussed
         in the Board's communication and at the oral
         proceedings, concern, on the one hand, the multiple
         postponements of oral proceedings by the Examining
         Division and, on the other hand, the written decision.

13.   *Postponements of oral proceedings by the Division*

13.1   It is contrary to the principles of procedural
         efficiency and legal certainty to repeatedly adjourn
         oral proceedings. According to the Guidelines for
         Examination in the EPO, E-II, 7 and the case law cited
         there, a request for postponement of oral proceedings
         is allowable only if the party concerned can advance
         serious reasons which justify the fixing of a new date.
         Regarding postponements at the instigation of the
         Division, the Guidelines, E-II, 7.1, state that in
         exceptional cases the Division might have to postpone
         oral proceedings for reasons similar to those mentioned
         for the parties but only if a suitable replacement
         cannot be found.

13.2   The Board finds, in line with the Guidelines, that it
         is unacceptable to repeatedly postpone oral proceedings
         without serious reasons, especially if it is done
         several times in the same examination proceedings after
         long delays have already occurred. Fixing a new date
         for oral proceedings almost inevitably causes

unnecessary work and additional costs, also for the
attorney and/or applicant, for example due to re-
planning, cancelling a booked business trip, making new
travel arrangements, or repeated preparation of the
case. Furthermore, the negative consequences of
repeated delays are not limited to the applicant
because legal certainty is necessary to protect the
interests not only of the applicant but also those of
the general public or third parties.

13.3   In the present case, the application entered the
European phase in June 2001. The eight postponements of
oral proceedings (see section IV above) caused an extra
delay of almost one and a half years after more than
ten years of examination (including the first appeal).
Two postponements were at the instigation of the
Examining Division and not based on serious reasons.
The same can be assumed to apply to the other three
postponements for which no request by the applicant and
no other ground for postponement can be found in the
file. In the opinion of the Board, the first member's
attendance at a meeting does not in principle qualify
as a serious reason. Repeated fixing of new dates for
oral proceedings could have been avoided by replacing
one or more members of the Examining Division, as
indicated in the Guidelines.

The Board finds that in the present case, although the
individual delays caused by the postponements were
short, the Examining Division acted against the
interests of procedural efficiency, at the same time
ignoring clear rules given in the Guidelines to avoid
such delays.

At the oral proceedings before the Board, the appellant
explained that during the first-instance proceedings

the applicant had expressed its disagreement with the
repeated rescheduling of oral proceedings, and that the
postponements had caused additional overheads and
expenses. It is however not apparent from the file to
which extent the applicant made such submissions and
firmly objected to the postponements during the first-
instance proceedings.

13.4   Taking the above into account, the Board concludes that
        the postponement of oral proceedings on those five
        occasions at the instigation of the Examining Division
        without serious reasons, as far as apparent from the
        file, constitute a procedural deficiency in the
        circumstances of the present case. The Board
        nevertheless refrains from deciding whether it amounts
        to a substantial procedural violation making the
        reimbursement of the appeal fee equitable within the
        meaning of Rule 103(1)(a) EPC.

14.   *Written decision*

14.1   According to Rule 111(2) EPC, decisions of the EPO open
        to appeal must be reasoned. The case law of the Boards
        of Appeal establishes criteria for substantiating those
        decisions (see e.g. Case Law of the Boards of Appeal,
        8th edition 2016, III.K.4.2.1), for instance:
            "The reasoning given in a decision open to appeal
            has to enable the appellants and the board of
            appeal to examine whether the decision was
            justified or not. A decision therefore should
            discuss the facts, evidence and arguments which are
            essential to the decision in detail. It has to
            contain the logical chain of reasoning which led to
            the relevant conclusion".

The reasoning and grounds should "be comprehensible to
those conducting a later judicial review". According to
decision T 1123/04 of 25 August 2006, "it should not be
necessary for a board of appeal to have to reconstruct
or even speculate as to the possible reasons for a
negative decision in the first instance proceedings." A
decision should be complete and self-contained (see
reasons 3.3).

14.2   Even though the decision under appeal does not properly
        identify at least some of the claims on which the
        decision was based, after an analysis of its grounds it
        can be concluded that the reasoning applies to the
        requests on which the decision should have been based,
        namely the main request considered in decision T 17/07,
        and the first to sixth auxiliary requests filed with
        letter dated 16 December 2011.

14.3   In the decision under appeal the Examining Division did
        not explicitly mention what it considered to be the
        starting point for its inventive-step argumentation.
        Since it compared the invention with the disclosure of
        Figure 8-11 and Equation (8-2) of document D2, the
        Board concludes that it considered document D2 to be
        the closest prior art. However, the contested decision
        referred only to Figure 8-11 and Equation (8-2) of
        document D2, without clearly explaining how they
        corresponded to claimed features or their relevance for
        the assessment of inventive step.

        In particular, the Examining Division stated that
        "figure 8-11 of D2 implements a linear recursive
        sequence interleaving rule; see equation 8-2 of D2".
        However, Figure 8-11 and Equation (8-2) cannot be
        understood without a closer reading of text passages of
        the document. Furthermore, there is no reference in

Figure 8-11 to Equation (8-2) or vice versa. It cannot be concluded from their content alone that they are disclosed in combination in document D2. In order to be understandable, the decision should therefore have explained how the Examining Division interpreted the cited figure and equation and should have cited text passages of document D2 supporting its interpretation.

14.4   A passage of section 2 of the decision relating to the assessment of inventive step of claim 1 of the main request reads as follows:

"Construing claim 1 of the main request as described above, i.e. following T17/07, the question is how the subject-matter of claim 1 differs from the interleaving method of D2, figure 8-11. Claim 1 allows that the frame length L is the same as in D2, which means that according to claim 1 this frame length is divided into plural segments, with then a LCS interleaving being applied to each segment. It is not clear what the effect of this difference should be on the interleaving properties such as interleaving distance. As claim 1 does not specify the number of segments, this number can be high, e.g. 16 segments for L=32, which means two symbols per segment. Obviously, in this case the interleaving is very small, as the symbols are then only permuted inside their own segment."

In this passage the Examining Division refers to "this difference" without clearly saying what the difference to the prior art is. The Board speculates that the difference is that "this frame length is divided into plural segments, with then a LCS interleaving being applied to each segment", but the claim mentions neither frames nor segments. It is not clear either

what "frame length L" is with respect to the claimed
interleaver. It seems from page 5, last paragraph, that
the Examining Division considered the difference to
reside in LCS interleaving being applied to segments
instead of to the whole frame (whatever the frame and
segments mean in the context of the claim), and it
could be that segments were considered to correspond to
rows. In any case, the reasoning for claim 1 of the
main request does not further clarify those points and
does not discuss the features related to permutations
of rows, writing by rows and reading by columns.

14.5   In the opinion of the Board, the reasoning with respect
        to the auxiliary requests, including non-admission of
        the fourth and sixth auxiliary requests under
        Rule 137(3) EPC, is also incomplete and unclear. With
        regard to the fourth auxiliary request, the reasoning
        given in the contested decision was that the
        independent claims no longer defined that the
        interleaving was done according to linear recursive
        sequences. For the sixth auxiliary request it was
        essentially explained that claim 1 was related to
        details of Figure 2, but that the generalisation to an
        interleaver controller as opposed to an interleaver was
        not admitted under Rule 137(3) EPC. Without further
        reasons, these are not valid arguments for not
        admitting those claim sets into the proceedings under
        Rule 137(3) EPC.

14.6   In the grounds of appeal the appellant complained that
        the decision mischaracterised the features describing
        the indexing of rows and columns and reduced them to a
        metaphor for the sake of expediency.

        In the Examining Division's communication accompanying
        the summons to oral proceedings the notion of rows and

columns had been seen as being "only metaphorical". In the decision under appeal, the Examining Division no longer referred to these features as "metaphorical" but stated, with regard to the fifth auxiliary request and in section 9 (see page 7), that the language of the claim, in particular the description of interleaving in terms of a matrix having rows and columns with permutations being done inside the matrix, was merely a conceptual description, not a reference to real technical (i.e. structural or electronic) features of the interleaver.

It is not clear whether the Examining Division's view that the "matrix features" were merely conceptual also applied to the main request and first to third auxiliary requests.

Since some of the matrix features e.g. columns, writing by rows and reading by columns, have not been discussed in the assessment of inventive step, the Examining Division seems to have considered that those features lacked technical character and therefore did not have to be taken into account. On the other hand, assuming, as explained under point 14.4 above, that the Examining Division mapped rows of the claimed interleaver to segments in document D2, at least one of the matrix features was not ignored in the assessment of inventive step. Similarly, for the first auxiliary request the Examining Division referred to "the row permutations to increase data shuffling". It is then unclear why some but not all "merely conceptual" matrix features should be ignored.

14.7   With regard to the inventive-step reasoning for the first auxiliary request, the Examining Division first briefly referred to the interpretation of the feature

"bit reversal rule" of claim 1. It afterwards stated
the following:

> "Also in this case it is not clear what the
> technical effect should be compared to D2, in which
> one LCS permutation is applied to the whole input
> data frame. It is understood that according to the
> application this row permutation is to increase the
> data shuffling compared to not having this row
> permutation. However, the LCS interleaving of D2
> was not acknowledged in the application as filed,
> so that it is not clear what the technical effect
> of the interleaver of claim 1 - interpreted
> according to T 17/07 - compared to that of D2
> should be" (see paragraph bridging pages 5 and 6 of
> the contested decision).

The Examining Division then concluded that a technical
inventive concept could therefore not be recognised,
contrary to Article 56 EPC.

Stating that it is not clear what the technical effect
is because document D2 was not acknowledged in the
application as filed seems to imply that in order to
have the technical effect of its invention recognised
over the closest prior art the applicant would have to
acknowledge the closest prior art in the original
application. This contradicts the case law regarding
acknowledgement of prior art in patent applications as
originally filed. In particular, according to decision
T 2321/08 of 11 May 2009 (followed by T 1123/09 of
17 December 2009, which was cited in the communication
accompanying the summons to oral proceedings),
"Rule 27(1)(b) EPC 1973 does not put a stringent
obligation on the applicant to cite documents
reflecting prior art known to him already at the time
of filing the application" (see reasons 7.3) and the

applicant may amend the application to acknowledge
prior art during examination (reasons 8). Logically,
the applicant is not obliged to acknowledge prior art
unknown to it either. Similarly, as explained in
decision T 105/11 of 10 March 2016, "Rule 42(1)(c) EPC
merely requires the invention to be presented in such
terms that the technical problem and its solution can
be understood" (see reasons 4.9 and 4.10).

Furthermore, from the reasoning above it is not clear
whether the Examining Division conceded that the "data
shuffling" was considered to be increased and why. If
it accepted increased "data shuffling", it is unclear
why it could not recognise any associated technical
problem in the context of interleaving.

In the Board's view, it is the duty of the Examining
Division to identify the objective technical problem
and technical effect of the distinguishing features
with regard to the closest prior art or, alternatively,
to clearly explain why the distinguishing features do
not solve a technical problem, e.g. because they do not
have a technical effect. The above reasoning does not
fulfil either of those prerequisites.

14.8   In the grounds of appeal, the appellant argued that the
        Examining Division appeared not to have taken into
        account the advantageous aspects of the invention, in
        particular reduced implementation complexity and better
        performance of the interleaver. The Board finds that
        the decision under appeal discusses the first alleged
        advantage of implementation simplicity but agrees with
        the appellant that it does not address the second
        advantage mentioned by the appellant.

Indeed, the Board could not find in the contested decision a discussion of the applicant's argument that the claimed interleaver resulted in a good error rate performance. This argument was invoked in the applicant's letter of 11 May 2012 (page 2, first three lines), was repeated in the oral proceedings (see minutes, page 2, paragraph 8), and seems to correspond to the "coding gain" advantage mentioned on page 3, lines 19 to 33 of the application. Furthermore, good error rate performance could be considered to be related to the increased "data shuffling" mentioned but not further discussed in the appealed decision. That argument of the applicant was therefore relevant for the decision and should have been addressed.

14.9   For the reasons given above, the Board shares the appellant's view that the reasoning of the contested decision is unclear.

The decision under appeal does not deal with all the features of claim 1 of the main request and of the other refused claims (see e.g. points 14.4 and 14.6 above), does not provide a logical sequence of arguments that justify its tenor (see points 14.3 to 14.7), fails to address an essential argument of the applicant (see 14.8 above) and does not discuss in detail some of the facts, evidence and arguments which are essential to the decision (e.g. other relevant passages of document D2, see point 14.3 above).

Consequently, the appealed decision is insufficiently reasoned and does not meet the requirements of Rule 111(2) EPC, which constitutes a substantial procedural violation. As the appeal is deemed to be allowable and reimbursement of the appeal fee is equitable by reason of a substantial procedural

violation, the request for reimbursement of the appeal
fee is to be granted in accordance with Rule 103(1)(a)
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 on the basis of the
   following documents:
   - claims 1 to 38 as filed during the oral proceedings
     of 19 January 2017;
   - description pages 1-3, 3a, 4, 4a, 5-21 as filed
     during the oral proceedings of 19 January 2017;
   - drawings of Figures 1 to 3 as published.

3. The appeal fee is to be reimbursed.

The Registrar: The Chairman:

N. Maslin   R. Moufang

Decision electronically authenticated