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**Datasheet for the decision
of 2 December 2016**

Case Number: T 2177/13 - 3.5.05

Application Number: 08782007.2

Publication Number: 2235864

IPC: H04L1/00

Language of the proceedings: EN

Title of invention:
Decoding scheme using multiple hypotheses about transmitted
messages

Applicant:
QUALCOMM Incorporated

Headword:
Decoding hypotheses/QUALCOMM

Relevant legal provisions:
EPC Art. 56, 111(1)
EPC R. 103(1)(a)
RPBA Art. 15(3)

Keyword:
Oral proceedings - non-attendance of the appellant
Inventive step - (no): obvious implementation details
Remittal to the first instance for further prosecution - (no)
Reimbursement of appeal fee - (no)

Decisions cited:
G 0010/93, T 2249/13

Beschwerdekammern

Boards of Appeal

Chambres de recours

European Patent Office
D-80298 MUNICH
GERMANY
Tel. +49 (0) 89 2399-0
Fax +49 (0) 89 2399-4465

Case Number: **T 2177/13 - 3.5.05**

D E C I S I O N
of Technical Board of Appeal 3.5.05
of 2 December 2016

Appellant:
(Applicant)

QUALCOMM Incorporated
Attn: International IP Administration
5775 Morehouse Drive
San Diego, California 92121-1714 (US)

Representative:

Carstens, Dirk Wilhelm
Wagner & Geyer
Gewürzmühlstraße 5
80538 München (DE)

Decision under appeal:

Decision of the Examining Division of the
European Patent Office posted on 27 March 2013
refusing European patent application
No. 08782007.2 pursuant to Article 97(2) EPC.

Composition of the Board:

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

Summary of Facts and Submissions

I.   The appeal is against the decision of the examining
        division to refuse the present European patent
        application for lack of novelty (Article 54 EPC) with
        regard to independent claims 1 and 9 over the
        disclosure of

        D5:   US-A-2003/0097625,

        and for lack of inventive step (Article 56 EPC) in
        respect of independent claims 1, 9 and 15, having
        regard to the disclosure of

        D1:   EP-A-1 463 207.

II.   With the statement setting out the grounds of appeal,
        the appellant re-filed the claims underlying the
        appealed decision as a main request, and amended claims
        as a first auxiliary request. It requested that the
        decision of the examining division be set aside and
        that a patent be granted on the basis of the main
        request or the first auxiliary request. In addition,
        oral proceedings were requested as an auxiliary
        measure.

III.   In a communication under Rule 100(2) EPC, the board
        gave its preliminary opinion on the appeal. In
        particular, it introduced the following prior-art
        document into the appeal proceedings under
        Article 114(1) EPC:

        D6:   WO-A-03/003586.

        It raised objections under Articles 54 and 56 EPC in

view of D6.

IV.   By a letter of reply dated 31 May 2016, the appellant
        submitted further amended claims according to second to
        fourth auxiliary requests, together with
        counter-arguments on the objections raised in the
        board's communication under Rule 100(2) EPC, and
        requested that

            - the decision under appeal be set aside;
            - a patent be granted on the basis of the claims of
              the main request or one of the first to fourth
              auxiliary requests, or
            - if the board still considered document D6 to
              anticipate the claimed subject-matter, the case
              be remitted to the department of first instance
              with the order to examine the now claimed
              subject-matter with respect to that document;
            - the appeal fee be reimbursed "inasmuch as it
              appears that the appeal regarding the decision
              and the art-based objections therein was
              well-founded".

V.   In an annex to the summons to oral proceedings pursuant
        to Article 15(1) RPBA, the board indicated that it
        maintained its objections under Articles 54 and/or 56
        EPC, mainly having regard to D6, and that it was not
        minded to remit the case for further prosecution under
        Article 111(1) EPC. Furthermore, the appellant was also
        informed that the requested reimbursement did not seem
        to be equitable by reason of a substantial procedural
        violation under Rule 103(1)(a) EPC.

VI.   With a letter of reply dated 2 November 2016, the
        appellant submitted counter-arguments in support of
        novelty and inventive step in response to the

objections raised in the board's communication under
Article 15(1) RPBA, and requested that

- the decision under appeal be set aside;
- the case be remitted to the department of first
  instance "either in order to assess the
  application in light of the newly cited
  document D6 or with the order to grant a
  European patent based on the pending claims".

VII.   One day before the scheduled oral proceedings, the
       appellant informed the board that it would not be
       attending them.

VIII. Oral proceedings were held on 2 December 2016 in the
       absence of the appellant. The board established from
       the file that the appellant's final requests were that

- the decision under appeal be set aside;
- the case be remitted to the examining division
  either for further prosecution or with the order
  to grant a patent on the basis of the main
  request or first auxiliary request submitted with
  the statement setting out the grounds of appeal,
  or on the basis of the claims of the second to
  fourth auxiliary requests submitted with the
  letter dated 31 May 2016;
- the appeal fee be reimbursed "inasmuch as it
  appears that the appeal regarding the decision
  and the art-based objections therein was
  well-founded".

After due deliberation on the basis of those final
requests and the written submissions, the board's
decision was announced at the end of the oral

proceedings.

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

"A method for decoding encoded data bits of a
wireless communication transmission, comprising:
    generating (2202) multiple hypotheses, each
hypothesis specifying a set of bit values of the
encoded data bits that are known or predicted based on
a-priori information regarding the transmission or a
related transmission;
    evaluating (2204) the multiple hypotheses by
performing decoding (2208) for the encoded data bits,
wherein the decoding involves eliminating (2206) sets
of decoded bits that are inconsistent with the bit
values specified by the hypotheses; and
    selecting (2218), as output, decoded bits
corresponding to one of the hypotheses."

Claim 1 of the **first auxiliary request** reads as follows
(amendments to claim 1 of the main request underlined
by the board):

"A method for decoding encoded data bits of a
wireless communication transmission, comprising:
    generating (2202) multiple hypotheses, each
hypothesis specifying a set of bit values of the
encoded data bits that are known or predicted based on
a-priori information regarding the transmission or a
related transmission, wherein each hypothesis has a
different set of bit values based on message
information received from a medium access control, MAC,
processor (1120);
    evaluating (2204) the multiple hypotheses by
performing decoding (2208) for the encoded data bits,
wherein the decoding involves eliminating (2206) sets

of decoded bits that are inconsistent with the bit
values specified by the hypotheses; and
    selecting (2218), as output, decoded bits
corresponding to one of the hypotheses."

Claim 1 of the **second auxiliary request** reads as
follows (amendments to claim 1 of the main request
underlined by the board):

    "A method for decoding encoded data bits of a
wireless communication transmission, comprising:
    generating (2202) multiple hypotheses, each
hypothesis specifying a set of bit values of the
encoded data bits that are known or predicted based on
a-priori information regarding the transmission or a
related transmission;
    evaluating (2204) the multiple hypotheses by
performing decoding (2208) for the encoded data bits,
wherein the decoding involves eliminating (2206) sets
of decoded bits that are inconsistent with the bit
values specified by the hypotheses, wherein eliminating
sets of decoded bits that are inconsistent with the bit
values specified by the hypotheses comprises
removing (2206), from a set of possible decoding paths,
decoding paths that correspond to decoded data bits
that are inconsistent with the bit values specified by
the hypothesis[sic]; and
    selecting (2218), as output, decoded bits
corresponding to one of the hypotheses."

Claim 1 of the **third auxiliary request** reads as follows
(amendments to claim 1 of the main request underlined
by the board):

    "A method for decoding encoded data bits of a
wireless communication transmission, comprising:

generating (2202) multiple hypotheses <u>in an</u>[sic]
<u>hypothesis engine (1110)</u>, each hypothesis specifying a
set of bit values of the encoded data bits that are
known or predicted based on a-priori information
regarding the transmission or a related transmission<u>,
wherein said hypothesis engine (1110) uses predicted
bit values to generate multiple hypothesis by assuming
different combinations of bit values</u>;
     evaluating (2204) the multiple hypotheses by
performing decoding (2208) for the encoded data bits,
wherein the decoding involves eliminating (2206) sets
of decoded bits that are inconsistent with the bit
values specified by the hypotheses; and
     selecting (2218), as output, decoded bits
corresponding to one of the hypotheses."

Claim 1 of the **fourth auxiliary request** reads as
follows (amendments to claim 1 of the main request
underlined by the board):

     "A method for decoding encoded data bits of a
wireless communication transmission, comprising:
     generating (2202) multiple hypotheses <u>at a</u>
<u>hypothesis engine (1110)</u>, each hypothesis specifying a
set of bit values of the encoded data bits that are
known or predicted based on a-priori information
regarding the transmission or a related transmission<u>,
wherein each hypothesis has a different set of bit
values based on message type information received at
the hypothesis engine (1110) from a medium access
control, MAC, processor (1120)</u>;
     evaluating (2204) the multiple hypotheses by
performing decoding (2208) for the encoded data bits,
wherein the decoding involves eliminating (2206) sets
of decoded bits that are inconsistent with the bit
values specified by the hypotheses; and

selecting (2218), as output, decoded bits corresponding to one of the hypotheses."

Reasons for the Decision

1.   *Non-attendance of the appellant at oral proceedings*

1.1   The appellant decided not to attend the scheduled oral proceedings before the board (cf. point VII above). Pursuant to Article 15(3) RPBA, the board is not "obliged to delay any step in the proceedings, including its decision, by reason only of the absence at the oral proceedings of any party duly summoned who may then be treated as relying only on its written case."

1.2   In the present case, the appellant submitted comments in support of the patentability of the claim requests on file in response to the objections raised in the board's communication under Article 15(1) RPBA (cf. point VI above). The board considered those comments but maintained its objections under Article 56 EPC (cf. points 2.1 and 3.1 below). So, in the exercise of its discretion under Article 15(3) RPBA, the board took a decision at the end of the oral proceedings, in the absence of the duly summoned appellant.

2.   MAIN REQUEST

        Claim 1 of the main request is identical to claim 1 underlying the appealed decision.

2.1   *Novelty and inventive step (Articles 54 and 56 EPC)*

2.1.1   The board first notes that it understands the term "bit value of the encoded data bit" as used in present

claim 1 to refer to "any *physical* or *logical* value associated with a received data bit".

2.1.2   As regards the closest prior art for the subject-matter claimed, the board considers prior-art document **D6,** introduced by the board, to be a more suitable starting point for assessing novelty and inventive step than documents D1 and D5, cited in the decision under appeal (cf. point I above). Document **D1** relates to Viterbi-decoding of encoded data based on predetermined synchronisation bits and bit locations but is silent about generating and processing multiple hypotheses based on those synchronisation bits. Document **D5** is concerned with data decoding relying on cyclic redundancy checks (CRCs) using multiple sampling methods to sample the received bits in parallel, prior to decoding and selecting the "best" signal from the sampled ones, and is likewise silent as to generating and processing multiple hypotheses based on different a-priori sample or CRC information.

2.1.3   The board holds that **D6** discloses the following limiting features of present claim 1:

A method for decoding encoded data bits ("received bits v_k" with bit positions "k") of a wireless communication transmission (see e.g. paragraph [0032]), comprising the steps of:
(a) generating multiple hypotheses ("hypotheses h"), each hypothesis specifying a set of bit values of the encoded data bits ("sequence S_h of scaling factors s_k") that are predicted based on a-priori information (e.g. "amplitude A_k"; "variance σ_k^2" of the received bits; see paragraph [0052], first sentence) regarding the transmission (see e.g. paragraph [0055]: *"... a number of hypotheses are*

formed for a given code segment ... to be decoded.
Each hypothesis h corresponds to a hypothesized
sequence S_h of scaling factors ...", in conjunction
with paragraph [0009]: "... The scale information
may include the variance and amplitude of the
samples ..." and Fig. 6, step 612);

(b) evaluating the multiple hypotheses by performing
    decoding for the encoded data bits (see e.g.
    paragraph [0057]: "... the code segment is Turbo
    decoded in accordance with the selected
    hypothesis ... to provide a candidate sequence of
    decoded bits ..." in conjunction with Fig. 6,
    steps 614 to 618);

(c) selecting, as output, decoded bits corresponding to
    one of the hypotheses (see e.g. paragraph [0013]:
    "... The quality of the decoded results for all
    hypotheses are compared, and the decoded bits for
    the hypothesis that provides the 'best' decoded
    result ... are provided as the Turbo decoder output
    for the code segment", in conjunction with
    paragraph [0058] and Fig. 6, steps 620 to 626).

2.1.4   As to feature (a), the appellant persistently argued
        that the "hypotheses" used in document D6 related to
        scaling factors, i.e. to attributes of a soft bit,
        rather than to a "bit value of an encoded data bit"
        such as "0" or "1" as defined in present claim 1 (cf.
        appellant's letter dated 31 May 2016, page 5). Thus,
        according to claim 1, the transmitted information
        itself was hypothesised and not the manner in which the
        information was represented (cf. appellant's letter
        dated 2 November 2016, pages 2 to 4).

        The board is not persuaded by this argument. Firstly,
        the term "bit value" is not necessarily limited to the
        logical values of a data bit like "0" and "1" (cf.

point 2.1.1 above). Secondly, even if the notion "bit value" specified only logical values, it is apparent to the board that D6 in fact indicates that each hypothesis h corresponds to "a particular set of one or more values for a set of one or more parameters used for decoding the code segment" (see paragraph [0012], second sentence) and that "scale information may relate to the variance and amplitude of the bits to be decoded, and may be needed to accurately evaluate a particular function for the MAP decoding" (see paragraph [0011], third sentence). From this the skilled reader may immediately infer that by means of the scale information the actual *logical* bit values ("1" or "0") of the encoded data bits could readily be determined, depending on the scaling of the corresponding data bits. Hence, contrary to the appellant's assertions, those hypotheses of D6 indeed specify - via the scaling information - "a set of bit values of the encoded data bits" according to feature (a) of present claim 1. Thirdly, given that the scale information in D6 may even *include* the variance σ_k^2 and amplitude A_k of the received bits (see page 2, penultimate sentence) and that each received bit v_k can be calculated directly from σ_k and A_k (see page 7, equation Eq(2) in paragraph [0032]), the skilled reader of D6 would readily appreciate that the hypotheses h relating to the scale information s_k indeed imply the hypothesised *logical* values of the encoded data bits.

2.1.5   However, the appellant was able to persuade the board that D6 fails to disclose directly and unambiguously that the decoding according to feature (b) is indeed performed by eliminating the sets of decoded bits which are inconsistent with those specified by the respective hypotheses.

2.1.6   Hence, the subject-matter of claim 1 differs from the
        disclosure of D6 in that

        (b') the decoding involves eliminating sets of decoded
             bits that are inconsistent with the bit values
             specified by the hypotheses.

        Accordingly, D6 does not take away the novelty of the
        subject-matter claimed (Article 54 EPC).

2.1.7   As regards the issue of inventive step, the skilled
        reader would in particular notice from the teaching of
        D6 that, by successive decoding of encoded data bits on
        the basis of the accordingly selected hypotheses,
        "candidate sequences of decoded bits" are established
        for the purpose of subsequently finding the "best
        hypothesis" (see e.g. paragraphs [0057] to [0059], in
        conjunction with Fig. 6, steps 614 to 622). The board
        holds that the skilled person in the field of channel
        coding, in order to solve the objective problem of "how
        to actually implement the selection of the candidate
        sequences in the decoding system of D6", would be well
        aware that sequences of decoded bits which do not match
        - for whatever reason - with bit values specified by
        the respective hypotheses, i.e. "non-candidate
        sequences", cannot be taken into account and therefore
        have compellingly to be eliminated somehow in the
        underlying decoding process. Consequently, in the
        absence of more specific measures regarding the
        consistency check and data elimination algorithm,
        distinguishing feature (b') constitutes a
        straightforward implementation detail for the skilled
        person and cannot confer inventive step on present
        claim 1.

2.2   In view of the above, the main request is not allowable
        under Article 56 EPC.

3.   AUXILIARY REQUESTS

        Claim 1 of the first to fourth auxiliary requests
        further specify that (emphasis added by the board)

        (d) each hypothesis has a different set of bit values
            based on message information received from a MAC
            processor (first auxiliary request);
        (e) decoding paths that correspond to decoded data bits
            that are inconsistent with the bit values specified
            by the hypothesis are removed from a set of
            possible decoding paths (second auxiliary request);
        (f) the multiple hypotheses are generated in a
            hypothesis engine which uses predicted bit values
            by assuming different combinations of bit values
            (third auxiliary request);
        (g) the multiple hypotheses are generated at a
            hypothesis engine and that the hypotheses are based
            on message type information received at the
            hypothesis engine from a MAC processor (fourth
            auxiliary request).

3.1   *Inventive step (Article 56 EPC)*

3.1.1   As to feature (d), D6 teaches that the set of
        hypothesised bit values relying on the a-priori scale
        information is based on the known or estimated *physical*
        bit parameters, namely the amplitude A_k of a received
        bit in position k and the associated standard deviation
        σ_k or variance σ_k^2 (see e.g. paragraphs [0011] and
        [0051] to [0054]). Further, that information may
        evidently be delivered as "extrinsic information" that
        is indicative of adjustments in the confidence in the

detected bit values based on earlier decoding processes
in the system of D6 (see e.g. paragraphs [0007], [0009]
and [0083], in conjunction with Fig. 8). In view of the
fact that the processing for deriving such extrinsic
information has to be performed at the medium access
layer (MAC) in the underlying system (see in particular
Fig. 8), the board finds that feature (d) is (at least)
implicitly disclosed by D6.

3.1.2   Concerning feature (e), the board considers that the
         skilled person, confronted with the objective problem
         of "how to implement the selection of hypothesised
         candidate sequences in typical channel decoders", would
         be aware from his general knowledge that the proposed
         trellis-based (see e.g. "trellis states" in
         paragraph [0046] of D6) turbo decoding of convolutional
         codes according to D6 can equally be applied to the
         Viterbi decoding scheme (see e.g. paragraph [0092]).
         In a typical Viterbi decoder, disregarding trellis
         states and their corresponding decoding paths which are
         found to be inconsistent with the predetermined bits at
         the respective bit positions is known e.g. from **D1** (see
         e.g. abstract; paragraph [0024], in conjunction with
         Figs. 4A and 4B and claim 1). Hence, given that the
         scaling factors do indeed correspond to bit values of
         the encoded data bits as claimed (cf. point 2.1.4
         above) and contrary to the appellant's view,
         feature (e) cannot contribute to inventive step either.

3.1.3   Moreover, as to feature (f), the added use of a
         "hypothesis engine" refers simply to a certain
         labelling of the unit which is supposed to process the
         respective hypotheses, while using predicted bit values
         and assuming different combinations of those bit values
         corresponds directly to different sequences of scaling
         factors in the language of D6, contrary to the

appellant's contention. Thus, feature (f) likewise cannot warrant an inventive step.

3.1.4   Lastly, as to feature (g), the board accepts that the indication of a message *type* as possible a-priori information is not derivable from D6 by any explicit statement or unambiguous implication. As to the question of obviousness, the board finds that it relates to the partial problem of "how to *generate* realistic hypotheses in the decoding system of D6" rather than "how to actually implement the *selection* of candidate sequences in the decoding system of D6" based on such hypotheses, underlying distinguishing feature (b') of claim 1 (see point 2.1.7 above). However, contrary to the appellant's opinion, D6 also teaches that estimated a-priori information such as A_k and σ_k^2, which relate to *different* hypothesised sequences S, are in fact based e.g. on the "bit rate" used for the received bits (see e.g. paragraph [0054]). It is in turn commonly known that the bit rate used for the transmission of data messages may typically depend on the type of messages to be transmitted (such as *control* or *data* messages). Hence, the board holds that the skilled person would take up this hint to arrive at a solution according to feature (g), without exercising inventive skills. Thus, distinguishing features (b') and (g) represent a mere juxtaposition of obvious implementation measures.

3.2   Consequently, the first to fourth auxiliary requests are likewise not allowable under Article 56 EPC.

4.   *Request for remittal for further prosecution*

4.1   The appellant requested that the case be remitted to the examining division for further prosecution in the

light of newly introduced document D6 (cf. appellant's
letter dated 31 May 2016, page 2, last paragraph).

4.2   The board, however, in the exercise of its discretion
        under Article 111(1) EPC, decides not to remit the case
        in view of the following observations:

        -   document D6, originating from the present
            appellant, was introduced by the board in reaction
            to fresh arguments and new claims according to the
            first auxiliary request submitted with the
            statement setting out the grounds of appeal (see
            also G 10/93, OJ EPO 1995, 172, Reasons 3, stating
            that, in *ex parte* proceedings, the Boards of Appeal
            are restricted neither to examination of the
            grounds for the contested decision nor to the facts
            and evidence on which the decision was based);
        -   the board, comprising technically qualified
            members, is in a position to judge the technical
            content of the claims and to deal with the merits
            of the present claim requests without remitting the
            case (see e.g. T 2249/13, Reasons 32).

5.   *Request for reimbursement of the appeal fee*

5.1   The appellant further requested that the appeal fee be
        reimbursed on the grounds that the appeal regarding the
        decision and its objections was well-founded (cf.
        appellant's letter dated 31 May 2016, page 2, last
        paragraph).

5.2   According to Rule 103(1)(a) EPC, the appeal fee is
        reimbursed only if the board deems the appeal to be
        allowable, and reimbursement to be equitable by reason
        of a substantial procedural violation. However, the
        present appeal is not allowable (see points 2 and 3

above). Nor can the board see that the first-instance proceedings were tainted with any procedural violation, let alone a *substantial* one. Consequently, this request must be refused as well.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar: The Chair:

K. Götz-Wein   A. Ritzka

Decision electronically authenticated