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Datasheet for the decision of 12 May 2010

Case Number: T 0400/07 - 3.5.05

Application Number: 03100035.9

Publication Number: 1313252

IPC: H04L 1/18

Language of the proceedings: EN

Title of invention:
Incremental redundancy radio link protocol

Applicant:
AT&T Corp.

Opponent:
-

Headword:
Quantised soft-decision information/AT&T

Relevant legal provisions:
-

Relevant legal provisions (EPC 1973):
EPC Art. 54, 56, 84, 106, 107, 108

Keyword:
"Inventive step - no"

Decisions cited:
J 0010/07

Catchword:
-

Case Number: T 0400/07 - 3.5.05

D E C I S I O N
of the Technical Board of Appeal 3.5.05
of 12 May 2010

Appellant:	AT&T Corp. 32 Avenue of the Americas New York, NY 10013-2412 (US)
Representative:	Asquith, Julian Peter Marks & Clerk LLP 4220 Nash Court Oxford Business Park South Oxford Oxfordshire OX4 2RU (GB)
Decision under appeal:	**Decision of the Examining Division of the European Patent Office posted 9 October 2006 refusing European patent application No. 03100035.9 pursuant to Article 97(1) EPC 1973.**

Composition of the Board:

Chairman: D. H. Rees
Members: A. Ritzka
G. Weiss

Summary of Facts and Submissions

I. This appeal is against the decision of the examining division dispatched 9 October 2006, refusing European Patent Application No. 03 100 035.9 for the reasons that the subject-matter of claim 1 did not involve an inventive step having regard to the disclosure of

D1: WO 96/26583 A

and that the amendments of claim 8 did not comply with the provisions of Article 123(2) EPC.

II. The notice of appeal was received on 30 October 2006. The appeal fee was paid on 1 November 2006. The statement setting out the grounds of appeal was received on 16 February 2007. The appellant implicitly requested that the decision under appeal be set aside and a patent granted based on

Claims	
1 to 8	as filed with letter of 16 February 2007;
Description, pages	
2, 4 to 28	as originally filed;
1, 3	as filed with letter of 27 August 2004;
3A	as filed with letter of 16 February 2007;
Drawings Sheets	
1/8 to 8/8	as originally filed.

III. With letter dated 27 January 2010 the appellant provided, in response to a query from the board, a copy of the grounds of appeal with corrected references to the application documents.

IV. The board issued a summons to oral proceedings scheduled for 12 May 2010. In a communication accompanying the summons the board took the preliminary view that claims 1 and 8 were considered to be unclear and did further not appear to involve an inventive step having regard to the disclosure of D1 and

D2: K.R. Narayanan et al, "Physical layer for packet data over IS-136", Vehicular Technology Conference, 1997, IEEE, 4 May 1997, ISBN: 0-7803-3659-3, pages 1029 to 1033.

V. With its letter of 12 April 2010 the appellant filed an amended set of claims 1 to 8 and requested that a patent be granted on the basis of these claims. Moreover, the appellant commented on the objections presented in the board's communication.

VI. On 11 May 2010 the appellant's representative announced by phone and fax that his client would not attend the oral proceedings.

VII. Oral proceedings took place as scheduled on 12 May 2010. Nobody attended on behalf of the appellant. After deliberation on the basis of the statement setting out the grounds of appeal and the submissions and requests received on 12 April 2010 the board announced its decision.

VIII. Claim 1 reads as follows:

"A receiver (310), characterized by:

a quantizer (904) that quantizes soft-decision information of subblocks received from a layer 1 protocol into a q level representation, to reduce storage requirements in a receive table that stores the quantized soft-decision information, the soft-decision information comprising at least in part a frame check sequence computed over a data block;

a decoder (906) that decodes at least the q level representation of the soft decision information to yield a concatenated block of data comprising error detection bits of the frame check sequence and the data block;

a frame check sequence decoder (908) that computes the frame check sequence of the data block and indicates whether the data block passed the frame check; and

a deblocking module (910) that de-concatenates the data block and the frame check sequence."

Independent claim 8 is directed to a method of receiving transmitted data corresponding to claim 1.

Reasons for the Decision

1. *Admissibility*

The appeal complies with the provisions of Articles 106 to 108 EPC 1973, which are applicable according to J 0010/07, point 1 (see Facts and Submissions point II above). Therefore it is admissible.

2. *Non-attendance of oral proceedings*

Nobody attended the hearing on behalf of the appellant.

Article 15(3) RPBA stipulates that the board shall not be 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.

Thus, the board was in a position to take a decision at the end of the hearing.

3. *Clarity*

In claims 1 and 8 filed with letter of 12 April 2010 the references to the vague terms "modified version of IS-136 layer" and "uncoded soft-decision information" were cancelled, overcoming the objections under Article 84 EPC 1973 raised in the board's communication.

4. *Novelty and inventive step*

D2 discloses an evaluation of several Forward Error Correction (FEC), interleaving and Automatic Repeat Request (ARQ) schemes of transmitting packet data over IS-136. The evaluation is based on the IS-136 physical layer design modified only as to FEC, interleaving and ARQ protocols. The data is provided with a CRC checksum and encoded using a convolutional encoder. At the receiver, the received signal is demodulated using a differentially coherent detector, deinterleaved and decoded using a soft-decision decoder. The decoded packet is checked for errors using the CRC check. If the CRC check-sum is zero, the packet is accepted, otherwise a packet error is declared and a retransmission requested. The frame error rate is considered as a performance criterion. See sections "1. Introduction" and "2. System Model".

According to the Type III ARQ, which is an incremental redundancy ARQ scheme, a data packet is encoded and punctured at the transmitter. When the packet is received and deemed erroneous, the receiver stores all the branch metrics and requests retransmission. The transmitter now transmits the bits that were punctured during the first transmission. The first and second transmissions are decoded using a soft-decision Viterbi decoder, implying that at least the bits transmitted in the first transmission are stored during retransmission. See sections "4.3 ARQ with Code Combining (Type III ARQ)" and "6. Results and Discussion".

The evaluation comes to the result that the performance of Type III ARQ (ARQ with code combining) is uniformly better than the other schemes. However, the storage requirement is greater for Type III ARQ. See sections "4.3 ARQ with Code Combining (Type III ARQ)" and "6. Results and Discussion".

D2 thus discloses a receiver that is operable under the IS-136 standard. This implies that the receiver comprises a decoder which decodes received soft-decision information comprising at least in part a frame check sequence computed over a data block to yield a concatenated block of data comprising error detection bits of the frame check sequence and the data block and a frame check sequence decoder that computes a frame check sequence of the data block and indicates whether the data block passed the frame check. As a communication system according to the IS-136 is intended to transmit packet data, i.e. a user is primarily interested in getting the mere data, it is evident that the data block and the frame check sequence are eventually separated, implying that the receiver comprises a deblocking module that de-concatenates the data block and the frame check sequence.

The subject-matter of claim 1 is considered to differ from D2 in the quantizer that "quantises soft-decision information of subblocks received from a layer 1 protocol into a q level representation, to reduce storage requirements in a receive table that stores the quantised soft-decision information", on which the further decoding is based. Thus, the subject-matter of claim 1 is novel, (Article 54(1),(2) EPC 1973).

D1 discloses a receiver comprising means for decoding a received signal in accordance with the Viterbi algorithm, said means calculating estimates of the merit of the decisions made in addition to decoding the received symbols. The Viterbi algorithm is solved generating a hard bit decision and information on the merit of the decision, i.e. a soft decision. Both of them are stored, increasing the memory capacity required for each point in the trellis diagram. Since the capacity of the memory storing the soft decisions is dependent on the word length of the value representing the soft decisions, the originally obtained soft decisions are converted into float value format prior to being stored. For example 16-bit soft decisions can be compressed first into twelve bits and then into a float value comprising eight bits. See page 1, lines 10 to 14; page 3, lines 25 to 30; page 8, lines 3 to 7; page 8, line 30 to page 9, line 3. D1 discloses that the additionally needed memory capacity for storing soft decisions can be reduced by converting the soft decisions into a format requiring less memory capacity.

Starting from D2, which is considered to be the most relevant prior art document, converting the soft-decision information of subblocks received from a layer 1 protocol into a q level representation, to reduce storage requirements in a receive table that stores the quantised soft-decision information, has the technical effect of reducing the memory capacity needed for storing data on which the further decoding is based. This is therefore considered to be the problem underlying the claimed subject matter.

D1 lies in the technical field of soft-decision decoding in mobile communications. As the application lies in the same field, the skilled person, looking for a solution of the problem of enhanced memory capacity need due to the storage of soft-decision information, would consult D1.

D1 teaches to solve this problem for soft-decision information in a Viterbi decoder by converting the soft-decision information into floating point format, which is less memory capacity consuming, see page 8, line 30 to page 9, line 3. According to the generally known layer model the decoder is allocated to layer 2.

It is common general knowledge that soft-decision information is stored in a Trellis diagram during the execution of a Viterbi algorithm and that it is retrieved for evaluation of the merit of the decision during later steps of the decoding algorithm, i.e. soft-decision information constitutes data on which the further decoding is based.

The skilled person would understand that the problem of enhanced memory capacity need due to storing data on which the further decoding is based, is identical for soft-decision information stored during the execution of the Viterbi algorithm according to D1 and for transmitted bits and branch metrics stored during retransmission according to D2 and that its solution disclosed in D1 may be used in both contexts.

The board therefore judges that the skilled person would apply the concept of D1 to the receiver disclosed in D2.

In the well established concept of communication layers, by definition, layer 1 assures the transmission of physical signals and converts received signals into a series of bits, whether they be in a hard- or in a soft-decision format, to be delivered to layer 2. Layer 2 decodes the series of bits, using e.g. a soft-decision decoding scheme based on soft-decision information, which may equally be provided by layer 1 and computed in preceding iterations of the specific decoding algorithm in layer 2. The skilled person would understand that the problem of enhanced memory capacity need due to the storage of soft-decision information arises, whether it is generated in layer 1 or layer 2 and regardless of the format, e.g. a receive table, in which it is stored.

The skilled person would further understand that the need for memory capacity due to storing soft-decision information can effectively be reduced in converting the soft-decision information into a format consuming less memory capacity. Further, compressing 16-bit soft decisions into a float value comprising eight bits (see D1, page 8, line 35 to page 9, line 3), implies a quantization into a 256, i.e. q level representation.

It would thus be obvious to amend the receiver disclosed in D2 such that it includes a quantizer that quantises soft-decision information of subblocks received from a layer 1 protocol into a q level representation, to reduce storage requirements in a receive table that stores the quantised soft-decision information.

Turning to the appellant's argument that in D1 soft-decision information from the Viterbi detector 23 were compressed whereas according to claim 1 soft-decision information of subblocks received from a layer 1 protocol was quantised, the board notes that in D1, firstly, the detector 23 provides initial bit decisions, which may be allocated to layer 1, and secondly the compressed soft-decision information is used as input to the Viterbi channel decoder 25 (see Figure 2 and page 6, line 24 to page 7, line 9). Even if detector 23 was not considered to be allocated to layer 1, the compressed soft-decision is still applied to the Viterbi channel decoder, i.e. used in the Viterbi algorithm. As set out above, the skilled person would understand that the problem of saving memory capacity equally arises for signals after layer 1 processing and during Viterbi processing, which is often allocated to layer 2.

The board notes that the concept of layers is a model facilitating the functional grouping of the various functions in communication systems by use of protocols. However, the allocation of a particular function to a specific layer is a matter of definition in a specific standard and thus somewhat arbitrary. The technical interaction of a particular functional device with preceding or following functional devices is independent of the layer to which it is allocated. The allocation to a specific layer has an effect on the specification of the corresponding protocol only. However, it does not have an immediate technical effect.

As to the appellant's argument that the skilled person would not modify the receiver disclosed in D2 since D2 did not discuss a Viterbi algorithm, the board observes that D2 mentions the use of a Viterbi decoder several times e.g. in the context of the various ARQ schemes, (see sections 4.1, 4.2, 4.3) and indeed suggests the use of a Viterbi decoder in the context of Type III ARQ, (see page 1031, column 2, lines 20 to 22).

As to the appellant's argument that D2 taught away from the receiver of claim 1 since section 4.1 stated that this technique imposed only small storage requirements on the receiver, the board notes that D2 states in section 6 explicitly that "the performance of Type III ARQ is uniformly better than the other two schemes and is significantly better than the ARQ scheme with majority voting [disclosed in section 4.1], especially at low C/I. However, the storage requirement is greater for Type III ARQ.", (see page 1032, right column, 2nd paragraph). Thus, D2 teaches that the most recommendable ARQ scheme suffers from an enhanced storage requirement.

Therefore, the appellant's arguments do not convince the board.

Thus, the subject-matter of claim 1 does not involve an inventive step, (Article 56 EPC 1973).

Similar arguments apply to claim 8.

Order

For these reasons, it is decided that:

The appeal is dismissed.

Registrar: Chairman:

A. Vottner D.H. Rees