Internal distribution code:
(A) [ ] Publication in OJ
(B) [ ] To Chairmen and Members
(C) [ ] To Chairmen
(D) [X] No distribution

Datasheet for the decision of 10 May 2012

Case Number: T 0929/09 - 3.5.02

Application Number: 01116124.7

Publication Number: 1176725

IPC: H03M 13/00, H03M 13/23, H03M 13/27, H03M 13/29

Language of the proceedings: EN

Title of invention:
Method of configuring transmission in mobile communication system

Applicant:
LG Electronics, Inc.

Opponent:
-

Headword:
-

Relevant legal provisions:
EPC Art. 54, 56

Relevant legal provisions (EPC 1973):
-

Keyword:
"Novelty and inventive step - yes (after amendment)"

Decisions cited:
-

Catchword:
-

Europäisches Patentamt | European Patent Office | Office européen des brevets

Beschwerdekammern | Boards of Appeal | Chambres de recours

Case Number: T 0929/09 - 3.5.02

D E C I S I O N
of the Technical Board of Appeal 3.5.02
of 10 May 2012

Appellant: (Applicant)
LG Electronics, Inc.
20, Yoido-Dong
Youngdungpo-gu
Seoul (KR)

Representative:
Urner, Peter
TER MEET STEINMEISTER & PARTNER GbR
Patentanwälte
Mauerkircherstrasse 45
D-81679 München (DE)

Decision under appeal: **Decision of the Examining Division of the European Patent Office posted 5 December 2008 refusing European patent application No. 01116124.7 pursuant to Article 97(2) EPC.**

Composition of the Board:

Chairman: M. Rognoni
Members: M. Léouffre
R. Moufang

Summary of Facts and Submissions

I. The appellant (applicant) appealed against the decision of the examining division refusing European patent application no. 01 116 124.7.

II. In the contested decision, the examining division held, *inter alia*, that the subject-matter of claim 1 according to the main request was not new over the following document:

D1: 3GPP2 standard C.S0002-0, version 1.0, July 1999, "Physical Layer Standard for cdma2000 Spread Spectrum Systems" (XP-001150467).

The examining division furthermore considered that the auxiliary request suffered from a number of deficiencies and was therefore also not allowable.

As a "further remark", the examining division noted that the 3GPP standard allowed reconfiguring the rates of the transmission channel at each frame. In support of this statement, the following document was annexed to the decision:

D4: 3G TS 25.302 version 3.3.0 (2000-01), "3rd Generation Partnership Project; Technical Specification Group Radio Access Network; Services provided by the Physical Layer" (XP014031127).

In the examination proceedings the following prior art was also cited:

D2: EP-A2-0 999 648

D3: WO-A1-00/03486.

III. In response to a communication from the Board, the appellant filed with a letter dated 10 April 2012 three new sets of claims by way of a Main Request and Auxiliary Requests I and II, and an amended description.

IV. On 10 May 2012 oral proceedings were held before the Board.

V. The appellant requested that the decision under appeal be set aside and that a patent be granted in the following version:

– claims 1 to 17 of the Main Request as filed in the oral proceedings,

– description: pages 27 to 33 filed in the oral proceedings, pages 1 to 26 and 34 to 35 filed with the letter dated 10 April 2012,

– drawings: 1 to 7 as originally filed.

In the alternative, the appellant requested to grant a patent on the basis of claims 1 to 17 of the Auxiliary Request I or II, filed with letter dated 10 April 2012.

VI. Claim 1 according to the Main Request reads as follows:

"A method of processing data to be transmitted in a 3GPP2 mobile communication system, the method comprising:

- encoding (S52) an input bitstream having a length (I) using a turbo encoder at a coding rate to output a coded bitstream;
- performing (S53) puncturing when the coded bitstream is greater than an interleaver size (N) on the coded bitstream using a rate matching module to match a length (L) of the coded bitstream to an interleaver size (N); and
- performing (S54) interleaving on an output bitstream of the rate matching module by an interleaver having the channel interleaver size (N),

the method being characterized in that

- a rate of the input bitstream being variable,
- the coding rate (1/n) is selected among coding rates of 1/3, 1/4 and 1/5 such that "n" is selected as the smallest integer number greater than a ratio (N/I), and
- the puncturing is enabled for symbol groups having indices 2j and 2j +1 if (j*K) mod J < K, wherein 'J' equals [I/2], 'j' denotes indices of the symbol groups increasing from '0' to J-1, 'K' equals [(L-N)/2], and wherein each of the symbol groups comprises L/I coded bits, so that

no puncturing is made at systematic bits (information bits) from two constituent encoders of the turbo encoder,

a uniform amount of puncturing is made at parity bit output bitstreams from the two constituent encoders, and

puncturing patterns of parity output bitstreams from the constituent encoders are designed to be uniform."

Claims 2 to 9 are dependent on claim 1

Claim 10 reads as follows:

"A radio communication device for use in a 3GPP2 mobile communication system, the device comprising:
- a channel encoder (S52) adapted to encode an input bitstream at a coding rate to output a coded bitstream, wherein the channel encoder is a turbo encoder, and wherein a rate of input bitstream is variable,
- a rate matching module (S53) adapted to perform puncturing on the coded bitstream to match a length (L) of the coded bitstream to an interleaver size (N); and
- an interleaver (S54) adapted to perform interleaving on an output bitstream of the rate matching module with the channel interleaver size (N),
- the device being characterized in that
- the turbo encoder is adapted to select the coding rate among coding rates of 1/3, 1/4 and 1/5 such that "n" is selected as the smallest integer number greater than a ratio (N/I), and
- the rate matching module is adapted to enable puncturing for symbol groups having indices 2j and 2j +1 if (j*K) mod J < K, wherein 'J' equals [I/2], 'j' denotes indices of the symbol groups increasing from '0' to J-1, 'K' equals [(L-N)/2], and wherein each of the symbol groups comprises L/I coded bits, whereby no puncturing is made at systematic bits (information bits) from two constituent encoders of the turbo encoder,
a uniform amount of puncturing is made at parity bit output bitstreams from the two constituent encoders, and
puncturing patterns of parity output bitstreams from the constituent encoders are designed to be uniform."

Claims 11 to 17 are dependent on claim 10.

The Auxiliary Requests I and II are not relevant to this decision.

VII. The appellant argued essentially as follows:

The object underlying the present invention, as specified in claims 1 and 10 of the Main Request, was to provide a method and a corresponding radio communication device that could provide maximum performance in matching an output bitstream to a fixed channel interleaver, even if the rate of the input bitstream was variable with frames, whereby a uniform amount of puncturing was carried out on the parity bits of the output bitstream from the constituent encoders. In particular, the number of bits to be punctured was minimised by selecting a coding rate among coding rates of 1/3, 1/4 and 1/5 such that "n" was selected as the smallest integer number greater than the ratio between the size N of the interleaver and the length I of the input bitstream. Furthermore, uniform puncturing was achieved by dividing symbol groups of n coded bits into groups with even indices and with odd indices, by performing puncturing, according to a predetermined puncturing patterns, on pairs of symbol groups comprising an even symbol group and a neighbouring odd single group and by spacing the punctured symbol group pairs uniformly along the length of the coded bitstream L, as specified in the characterizing portion of the independent claims.

D1 showed on pages 2-73 puncturing patterns of puncturing an output of the turbo encoder having a

coding rate of 1/6 so as to increase the coding rate to 1/2, 1/3 or 1/4. In this example each group of symbols was punctured according to a predetermined pattern.

D2 disclosed the puncturing algorithm for deleting a certain number of symbols from an input symbol string. However, this document was completely silent about grouping symbols, selecting certain groups of symbols and performing a predetermined puncturing pattern.

The method specified in claim 1 differed from the one disclosed in D1, which was regarded as the closest prior art, by the combination of selecting a certain coding rate in view of an input bit rate bitstream rate which was variable with frames and performing puncturing only at selected symbol groups so as to provide a uniform amount of puncturing made at parity bits of output bitstreams from the constituent encoders.

This combination of selecting coding rate and performing puncturing only at selected symbol groups was neither disclosed nor suggested by any of the cited documents.
Hence, the subject-matter of claims 1 and 10 was both new and inventive with respect to the cited prior art.

Reasons for the Decision

1. The appeal is admissible.

2.1 Claim 1 according to the main request is directed to a *"method of processing data to be transmitted in a 3GPP2*

mobile communication system" which comprises the standard steps of encoding an input bitstream of length I, puncturing the coded bitstream to match its length L to an interleaver size N and interleaving the punctured bitstream, as recited in the preamble of the claim and illustrated in Figure 1 of the application.

2.2 The claimed method further comprises the following features specified in the characterising part:

a) a rate of the input bitstream is variable,

b) the coding rate (1/n) is selected among coding rates of 1/3, 1/4 and 1/5 such that "n" is selected as the smallest integer number greater than a ratio (N/I),

c) the puncturing is enabled for symbol groups having indices 2j and 2j +1

c1) if (j*K) mod J < K, wherein 'J' equals [I/2], 'j' denotes indices of the symbol groups increasing from '0' to J-1, 'K' equals [(L-N)/2], and wherein each of the symbol groups comprises L/I coded bits,

d) so that

d1) no puncturing is made at systematic bits (information bits) from two constituent encoders of the turbo encoder,

d2) a uniform amount of puncturing is made at parity bit output bitstreams from the two constituent encoders, and

d3) puncturing patterns of parity output bitstreams from the constituent encoders are designed to be uniform.

2.3 Throughout the description of the application, it is made clear that the present invention relates to the processing of a variable input bitstream, *i.e.* a bitstream with a variable number of input bits per frame (see *e.g.* paragraph [0011]). All the remaining features of the characterising portion of the claim are fully supported by the description of the "fourth embodiment" starting from paragraph [0064].

Claim 10, which relates to a "*radio communication device*", has been amended so that its features correspond essentially to the steps recited in claim 1. The characterising portion of claim 10 refers to the parameter "I" without having it defined as in claim 1 as the length of the input bitstream. This deficiency does not seriously affect the clarity of claim 10, since the meaning of I can easily be inferred from claim wording.
Consequential amendments have been to the description in order to make it compatible with claims 1 and 10 of the Main Request.

2.4 In summary, the Board finds that the application documents now on file do not go beyond the content of the application as originally filed and thus are in compliance with Article 123(2) EPC.

3.1 As pointed out by the appellant, the method of claim 1 is directed to the processing of an input bitstream of variable rate *i.e.* of variable length. This implies that the number of input bits in a frame is not fixed for a given Radio Configuration but can vary after a channel between the mobile station and a base station is formed.

A problem addressed in the present application relates to matching the length L of a coded bitstream of variable length I to a channel interleaver of a given size N.

3.2 As set out in the characterizing part of claim, the solution to the above problem provided by the claimed method consists essentially:

– selecting one of the coding rates 1/3, 1/4 and 1/5 so that the resulting number of bits L exceeds the interleaver size by as little as possible;

– performing puncturing on the L coded bits according to a set of rules which ensure that punctured bits are uniformly distributed along the length L of the coded bitstream and do not coincide with the information bits.

3.3 The first rule consists in defining a symbol group as a group of n bits (where 1/n is the rate of channel coding) and in assigning even indices 2j and odd indices 2j + 1 to the symbol groups. As the number of groups matches the number of information bits I, the index j varies from 0 to J=I/2. In other words, each

index j is associated with an "even" symbol group 2j and an "uneven" symbol group 2j + 1. When puncturing is performed on an even symbol group, it is also performed on the neighbouring odd group.

The next step consists in determining the distance between punctured pairs, which depends on the total number of bits to be punctured, *i. e.* L-N, and on the total number of pairs, *i.e.* J=I/2. The algorithm which identifies the index j of the pairs to be punctured along the total length L of the coded bitstream is defined in feature c1) (see item 2.2 of the decision).

The claim does not identify specific puncturing patterns. However, it specifies the result to be obtained. For the skilled person it would be immediately clear how to select puncturing patterns that satisfy the conditions set out in the claim.

4. In summary, the Board is satisfied that claim 1 defines all the essential steps of the method of the invention which, in combination, solve the defined problem, and that this combination of steps is fully supported by the description.

State of the art

5.1 D1 relates to the Physical Layer Standard for cdma2000 Spread Spectrum Systems. Figure 2.1.3.1.1.2-5 illustrates a transmission chain comprising a convolutional or a turbo encoder for encoding an input bitstream (channel bits), a rate matching module with a puncturing module and a block interleaver.

Thus, D1 discloses all the features specified in the preamble of claim 1.

D1 specifies different combinations of bits/frames and interleaver sizes combined with different rate matching schemes. However, it does not teach to vary the rate of input bitstream (Bits/rate) once the radio configuration has been established.

As to the puncturing, D1 also discloses some puncturing patterns to be applied sequentially to the coded bitstream but does not teach to divide the bitstream into pairs of symbol groups and to apply the puncturing patterns to the pairs of even and groups evenly spread along the length of the coded bitstream.

6.1 As "further remarks", the examining division pointed out in the contested decision that, according to the applicant's arguments, the contribution of the present application to the prior art had been to change rates in the transmission channel without having to perform a new setup of the radio configuration (RC) of the 3GPP2 standard. Referring to D4, the examining division noted that the 3GPP standard allowed reconfiguring the rates of the transmission channel at each frame.

6.2 The Board agrees with the examining division that the teaching of D4 anticipates feature a) referred to above. However, there is no suggestion in D4 of performing puncturing according to features c) and d) (see item 2.2 of the decision).

7.1 D2 relates to a rate matching method for producing an output string of m symbols from an input string of n

symbols. Figure 15 shows that is it known to perform the symbol deleting operation so as to provide the maximum interval between deleted symbols.

7.2 D2, however, does not define symbol groups as in the claim and does not teach to perform puncturing on pairs of neighbouring symbol groups.

8.1 In the absence of any disclosure of the steps recited in the charactering part of claim 1 it was not obvious to the skilled person to arrive at the claimed method. Hence, the subject-matter of claim 1 involves an inventive step within the meaning of Article 56 EPC.

8.2 Claims 2 to 9 relate to particular embodiments of the method according to claim 1. Thus, their subject-matter also involves an inventive step.

8.3 Claim 10 is directed to a device and comprises all the features required to perform the combination of steps recited in claim 1. Claims 11 to 17 are dependent on claim 10.

For the same reasons given above, the device claims satisfy the requirements of Article 56 EPC.

9. Summarizing, the Board finds that the appellant's Main Request satisfies the requirements of the EPC and that a patent can be granted on the basis thereof.

Under these circumstances, there is no need to consider the appellant's Auxiliary Requests I and II.

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 in the following version:

   – claims 1 to 17 of the Main Request as filed in the oral proceedings,

   – description: pages 27 to 33 filed in the oral proceedings, pages 1 to 26 and 34 to 35 filed with the letter dated 10 April 2012,

   – drawings: 1 to 7 as originally filed.

The Registrar: The Chairman:

U. Bultmann M. Rognoni