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Datasheet for the decision of 11 July 2022

Case Number: T 0603/20 - 3.5.05

Application Number: 14879036.3

Publication Number: 3086500

IPC: H04L1/18, H04L1/00, H04L1/16, H04W52/04

Language of the proceedings: EN

Title of invention:
HYBRID AUTOMATIC REPEAT REQUEST METHOD AND RELATED APPARATUS

Applicant:
Huawei Technologies Co., Ltd.

Headword:
HARQ/HUAWEI

Relevant legal provisions:
EPC Art. 54
RPBA 2020 Art. 12(2), 12(4)

Keyword:
Novelty - main request and second auxiliary request (no)
Amendment to case - first and third auxiliary requests - admitted (no)

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Case Number: T 0603/20 - 3.5.05

D E C I S I O N
of Technical Board of Appeal 3.5.05
of 11 July 2022

Appellant: (Applicant)	Huawei Technologies Co., Ltd. Huawei Administration Building Bantian Longgang District Shenzhen, Guangdong 518129 (CN)
Representative:	Gill Jennings & Every LLP The Broadgate Tower 20 Primrose Street London EC2A 2ES (GB)
Decision under appeal:	**Decision of the Examining Division of the European Patent Office posted on 10 October 2019 refusing European patent application No. 14879036.3 pursuant to Article 97(2) EPC.**

Composition of the Board:

Chairwoman	A. Ritzka
Members:	C. Barel-Faucheux
	E. Mille

Summary of Facts and Submissions

I. The appellant (applicant) filed an appeal against the decision of the examining division to refuse European patent application No. 14879036.3. The decision was made during oral proceedings held in the absence of the appellant, which had been duly summoned. The decision is based on a sole request submitted with a letter dated 13 August 2019 in reaction to a communication accompanying the summons to oral proceedings.

II. The decision cited, *inter alia*, the following documents:

D2: EP 2 141 851 A2, 6 January 2010
D7: EP 1 229 682 A2, 7 August 2002
D8: US 6 301 249 B1, 9 October 2001

III. The examining division decided that the subject-matter of independent claims 1, 4, 7 and 10 of the sole request did not meet the requirements of Article 123(2) EPC and was not novel in view of documents D2, D7 or D8 (Article 54 EPC). It also held that the subject-matter of dependent claims 2, 3, 5, 6, 8, 9 and 11 was either not novel or not inventive.

IV. With its statement of grounds of appeal, the appellant filed a main request and a first auxiliary request. The main request corresponds to the main request considered in the decision under appeal. The appellant requested that the decision under appeal be set aside and that a patent be granted on the basis of either the main request or the first auxiliary request.

V. In its communication accompanying the summons to oral proceedings, the board informed the appellant, *inter alia*, that it was not convinced by the objections under Article 123(2) EPC raised by the examining division against the main request but that it did consider claim 1 of the main request to be unclear contrary to the requirements of Article 84 EPC.

The board stated that the subject-matter of claim 1 of the main request did not appear to be novel over the disclosure of document D7.

Moreover, the board was inclined not to admit the auxiliary request.

VI. With a letter dated 10 June 2022, filed in preparation for the oral proceedings, the appellant filed a second and a third auxiliary request and submitted further arguments in favour of the admissibility of the first auxiliary request and the allowability of all the requests.

VII. Oral proceedings were held on 11 July 2022. At the end of the oral proceedings, the Chair announced the board's decision.

VIII. The appellant's final requests were that the decision under appeal be set aside and that a patent be granted on the basis of the set of claims of the main request considered in the decision under appeal or, alternatively, on the basis of the first auxiliary request filed with the statement of grounds of appeal, or on the basis of the second or third auxiliary requests filed with the letter dated 10 June 2022.

IX. Claim 1 of the main request reads as follows:

"A hybrid automatic repeat request method, comprising:

receiving (110) a packet sent by a transmit end;

checking (120) N data sub-blocks comprised in the packet, and generating feedback information corresponding to the packet according to a check result, wherein the feedback information comprises N check characters corresponding to the N data sub-blocks, and the check character is an acknowledgment character ACK or a negative acknowledgment character NACK, wherein N is an integer greater than or equal to 2; and

returning (130) the feedback information to the transmit end;

characterized in that the method further comprises:

when the returned feedback information comprises a negative acknowledgment character NACK, receiving only a re-transmitted data sub-block corresponding to the negative acknowledgment character NACK; and

when the returned feedback information comprises no negative acknowledgement character NACK, receiving a next packet sent by the transmit end."

X. Claim 1 of the first auxiliary request corresponds to claim 1 of the main request but with the deletion of the full stop at the end, after "receiving a next packet sent by the transmit end", and with the addition of

";

wherein the checking N data sub-blocks comprised in the packet, and generating feedback information according to a check result comprises:

decoding the N data sub-blocks comprised in the packet;

determining whether decoding of each data sub-block is correct; and
if correct, generating an acknowledgment character ACK corresponding to a data sub-block that is determined as correct; or
if incorrect, generating a negative acknowledgment character NACK corresponding to a data sub-block that is determined as incorrect;
wherein the determining whether decoding of each data sub-block is correct comprises:
calculating a log likelihood ratio of each bit in each data sub-block; and
determining whether log likelihood ratios of all bits in a data sub-block are greater than a
preset threshold; and if yes, determining that decoding of the data sub-block is correct; otherwise,
determining that decoding of the data sub-block is incorrect;
wherein the log likelihood ratio is a log likelihood ratio LLR of each bit in several data sub-blocks, which is expressed as either LLR(x) = log(P(x=0¦r)/P(x=1¦r)) or LLR(x) = log(P(x=1¦r)/P(x=0¦r)), wherein r is a received code word, x is a received bit, P(x = 0|r) represents a possibility that x = 0 on the condition of the received code word r, and P(x = 1|r) represents a possibility that x = 1 on the condition of the received code word r."

XI. Claim 1 of the second auxiliary request corresponds to claim 1 of the main request, although the text
"when the returned feedback information comprises a negative acknowledgment character NACK, receiving only a re-transmitted data sub-block corresponding to the negative acknowledgment character NACK"
has been replaced by

"when the returned feedback information comprises one or more negative acknowledgment characters NACKs, receiving only one or more re-transmitted data sub-blocks corresponding to the one or more negative acknowledgment characters NACKs".

XII. Claim 1 of the third auxiliary request corresponds to claim 1 of the first auxiliary request but with the replacement of "when the returned feedback information comprises a negative acknowledgment character NACK, receiving only a re-transmitted data sub-block corresponding to the negative acknowledgment character NACK" by "when the returned feedback information comprises one or more negative acknowledgment characters NACKs, receiving only one or more re-transmitted data sub-blocks corresponding to the one or more negative acknowledgment characters NACKs" and with the replacement of "if incorrect, generating a negative acknowledgment character NACK corresponding to a data sub-block that is determined as incorrect" by "if incorrect, generating one or more negative acknowledgment characters NACKs corresponding to one or more data sub-blocks that are determined as incorrect".

XIII. The appellant's arguments, where relevant to the decision, are discussed in detail below.

Reasons for the Decision

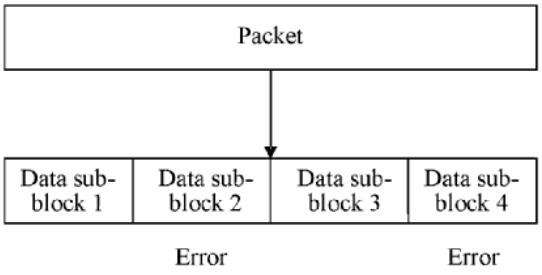
The application

1. The application relates to a hybrid automatic repeat request (HARQ) method. In an existing HARQ technology,

after a transmit end sends a packet to a receive end, the receive end decodes the received packet; if the decoding is incorrect, a negative acknowledgement character (NACK) corresponding to the packet is fed back to the transmit end; or if the decoding is correct, an acknowledgement character (ACK) corresponding to the packet is fed back to the transmit end. After receiving a NACK, the transmit end re-transmits one complete packet to the receive end. In another existing HARQ technology, after receiving a NACK, a transmit end may sequentially attempt to re-send a preset volume of data of a packet until a receive end returns an acknowledgement character. Both technologies would cause an increased transmission delay and result in a waste of resources (see paragraphs [0001] to [0004] of the application as originally filed).

2. The application proposes using feedback information that includes N check characters corresponding to N data sub-blocks of a packet and returning the feedback information to a transmit end (see Figures 1 and 2 reproduced below). The transmit end then selects, according to the NACK, a data sub-block for re-transmission (see paragraphs [0017], [0047], [0068] and [0074]).

FIG. 1



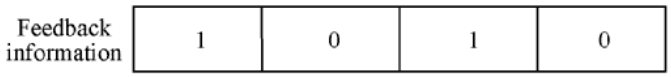


FIG. 2

Main request - interpretation of claim 1

3. In its communication accompanying the summons to oral proceedings, the board argued that it was not clear, in the step of "receiving only a re-transmitted data sub-block corresponding to the negative acknowledgement character NACK", whether:
a) the only data sub-block received was a re-transmitted data sub-block (corresponding to alternative 2 of point 4.1 of the decision), or
b) whether, among a plurality of data sub-blocks received, only one data sub-block was a re-transmitted one and corresponded to the NACK (almost corresponding to alternative 1 of point 4.1 of the decision).

3.1 The board notes that claim 1 appears to be an attempt to cover the first embodiment of paragraph [0030].
The appellant did not contest this interpretation (see its letter of reply to the board's communication,

clarity section on page 2: "the re-transmitted data sub-block is not re-transmitted among other data sub-blocks").
Therefore, for the assessment of novelty, the board has interpreted claim 1 as covering this first embodiment, with the interpretation of the step of "receiving only a re-transmitted data sub-block corresponding to the negative acknowledgement character NACK" corresponding to alternative a) in the section 3 above.

Main request - Lack of novelty over document D7

4. The examining division stated that document D7 disclosed, in paragraph [0099] and Figure 9, all of the features of claim 1 (see the decision under appeal, point 4.2.6).

4.1 Document D7 discloses a data transmitting/receiving method in an HARQ data communication system. To transmit a physical layer information stream having a plurality of sub-blocks, each sub-block having an error correction code, a quality of service (QoS), and a priority if the sub-blocks have a different QoS, the encoded physical layer information stream is divided into a plurality of slots. The slot data are sequentially transmitted to a receiver at predetermined time intervals. If an HARQ message for the initial slot data is received from the receiver, indicating that at least one of the sub-blocks in the initial slot data has a reception error, slot data with a sub-block having errors, repeated within the number of the sub-blocks, is re-transmitted. The failed sub-block should be transmitted at least twice, and the slot data includes only the failed sub-block (see paragraphs [0009] and [0010]).

4.2 One packet to be transmitted is defined as a physical layer packet (PLP). One PLP may include a plurality of sub-packets called transport units (TUs) and each TU is variable in length (paragraph [0059]). A re-transmission unit and an initial transmission TU can be the same or different in size (paragraphs [0040] and [0041]). An example where four TUs are transmitted in one packet is given (paragraph [0060]). A multi-response signal includes a message indicating successful reception (ACK) or failed reception (NACK) for each TU (paragraph [0084]). If only TU0 has failed, the transmitter simply retransmits TU0. In constructing a PLP, four TUs are needed as in the initial transmission. Therefore, the transmitter repeats TU0 in the places of TU1, TU2 and TU3 (paragraph [0093]).

4.3 The receiver transmits, to the transmitter, ACK signals for the "CRC-good" TUs and NACK signals for the "CRC-bad" TUs as the multi-response signal bit. If the receiver transmits a multi-response signal "1100", this represents that TU0 and TU1 are CRC-good and TU2 and TU3 are CRC-bad. The CRC-bad TUs are repeated in the second slot and encoded with a first code C_0. When TU3 is again CRC-bad, only TU3 can be repeated in the four positions for the third slot and encoded with code C_0. After the third transmission, when the same TU3 is CRC-bad, only TU3 is encoded with the next code C1 for re-transmission (paragraph [0099] and Figure 9).

4.4 If there is no transmission request, the next packet is transmitted (see flow chart of Figure 7 as well as paragraph [0089]).

4.5 Therefore, in a case where a sole TU as a sub-block is CRC-bad, only the corresponding re-transmitted data

sub-block corresponding to a NACK is received, possibly a plurality of times.

5. In its letter filed in preparation for the oral proceedings and during the oral proceedings, the appellant argued, referring to Figure 8 of D7, that the structure of the data transmitted and received in D7 was different from that defined in the method of claim 1. In particular, in a TLP 400 having four TUs, the four TUs were transmitted across three coding blocks. In a situation where one or more TUs were incorrectly received, the flowchart shown in Figure 7 indicated that the process ultimately returned to step 310, and from there to step 312 in which the code was changed. The incorrectly transmitted TUs were then re-coded across the coding blocks and re-transmitted.

Consequently, in D7 there was no step of receiving re-transmitted data sub-blocks since the coding blocks sent were different from those of the original transmission.

5.1 The board refers to Figures 7 to 9 of D7. A multi-response signal includes a message indicating successful reception (ACK) or failed reception (NACK) for each TU (paragraph [0084]). If the multi-response signal shows a re-transmission request in step 302, the transmitter checks whether the transmission failure has occurred on a "Physical Layer Packet-basis" (or "PLP-basis") in step 310. The "PLP-basis" transmission refers to transmission of all three slot data 410, 420 and 430 separated from the PLP 400 (TU0, TU1, TU2, TU3) (paragraph [0090]). Thus, the code is changed (Figure 7, step 312) only if there has been a PLP-basis transmission failure (Figure 7, answer to step 310 is "yes"). Paragraph [0092] states that the re-

transmission can be considered in two ways: when one PLP is fully transmitted, the next available code is taken and the PLP is re-transmitted with the code; and when the PLP is not completely transmitted, for example, when only the first PLP data 410 or only the first and second PLP data 410 and 420 are transmitted, the transmitted PLP data is re-transmitted with the original code in the following slot. If only TU0 has failed, the transmitter simply re-transmits TU0. In constructing a PLP, four TUs are needed, as in the initial transmission. Therefore, the transmitter repeats TU0 in the places of TU1, TU2 and TU3 (paragraph [0093]). If the multi-response signal is "1000" and TU1 has the highest priority, only TU1 can occur twice, as indicated by reference numeral 410-c (see paragraph [0099] and Figure 9 reproduced below).

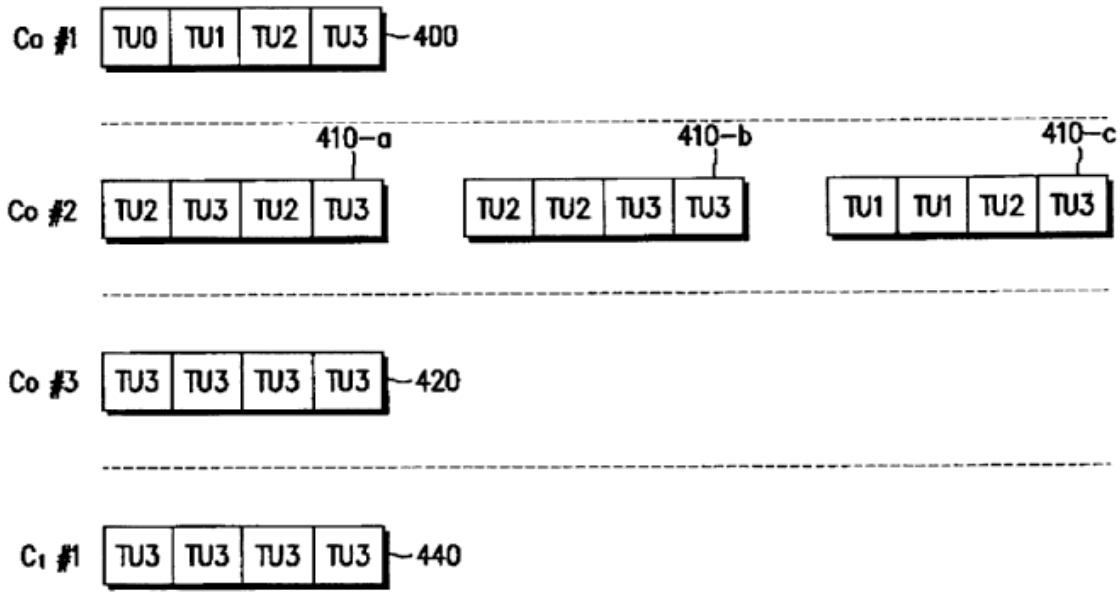


FIG. 9

6. Therefore, contrary to the appellant's arguments, in D7 there is a step of receiving re-transmitted data sub-blocks, with the coding blocks sent being the same as

those of the original transmission. Therefore, D7 does disclose a step of receiving re-transmitted data sub-blocks.

7. During the oral proceedings, the appellant referred to the interleaving at the transmitter referred to in paragraph [0083] and illustrated in Figure 8 by the white blocks at the transmitter. It argued that in document D7, a next packet was received also when the returned feedback information comprised a negative acknowledgement character NACK.

7.1 The board considers a "packet" in claim 1 to correspond to a "packet for a particular user" (see paragraph [0082]: "If a PLP directed to a particular user includes four different data TU0, TU1, TU2 and TU3 as indicated by reference numeral 400"). The other packets are packets/data for other users (see paragraph [0084]: "the transmitter transmits the PLP for the particular user at time t0, and then data for other users"). This is similar to considering the de-interleaved packets/ data at the receiver. Furthermore, claim 1 also encompasses a method in which the received packets are de-interleaved packets.

8. Document D7 thus discloses all of the features of claim 1. Therefore, the subject-matter of claim 1 of the main request lacks novelty over the disclosure of document D7 (Article 54 EPC).

Second auxiliary request - Admissibility

9. The board stated in its communication that it was not clear which steps were performed in case the returned feedback information comprised a plurality of NACKs. In particular, it was not clear which re-transmitted data

sub-block corresponding to which NACK was received (see the board's communication, point 21).

10. Since clarity was a new objection raised by the board, and since the second auxiliary request corresponds to the main request but with amendments made to overcome, at least partly, the clarity objection, the board has decided to admit the second auxiliary request into the proceedings (Article 13(2) RPBA 2020).

Second auxiliary request - Lack of novelty over document D7

11. Claim 1 of the second auxiliary request corresponds to claim 1 of the main request, although the text
"when the returned feedback information comprises a negative acknowledgment character NACK, receiving only a re-transmitted data sub-block corresponding to the negative acknowledgment character NACK"
has been replaced by
"when the returned feedback information comprises one or more negative acknowledgment characters NACKs, receiving only one or more re-transmitted data sub-blocks corresponding to the one or more negative acknowledgment characters NACKs" (see section XI. above).

12. In document D7, if the receiver transmits a multi-response signal "1100", this indicates that TU0 and TU1 are CRC-good and TU2 and TU3 are CRC-bad. The CRC-bad TUs are repeated in the next slot Co #2 and encoded with the code C0 (see paragraph [0099] and Figure 9 reproduced above).

13. Therefore, the subject-matter of claim 1 of the second auxiliary request lacks novelty over the disclosure of document D7 (Article 54 EPC).

First and third auxiliary requests - Not admissible

14. Claim 1 of the first auxiliary request is a combination of claims 1, 2 and 3 of the main request, with the addition of the definition of a log likelihood ratio (LLR) taken from paragraphs [0037] and [0038] of the description as originally filed.

15. Claim 1 of the first auxiliary request constitutes an amendment of the appellant's appeal case which may be admitted only at the discretion of the board (Articles 12(2) and (4) RPBA 2020).

16. According to Article 12(4) RPBA 2020, the appellant must clearly identify each amendment and provide reasons for submitting it in the appeal proceedings. The appellant must also provide reasons as to why the amendment overcomes the objections raised.

16.1 This requirement has not been complied with. First of all, the appellant did not refute the arguments of the examining division based on the examining division's interpretation of claim 1. Moreover, it did also not amend the claims in order to exclude other possible interpretations.

16.2 As to the suitability of the amendment for addressing the issues which led to the decision under appeal, the appellant argued that the added features of claim 1 of the auxiliary request provided the technical effect that the calculation of the LLRs was simple and easy to implement. Therefore, according to the appellant, an appropriate objective technical problem was to provide an HARQ that was easier to implement. Since none of the cited prior art disclosed the features related to the

calculation of the LLRs, the skilled person would not have been able to arrive at the method of claim 1 of the first auxiliary request. Therefore, claim 1 of the first auxiliary request is inventive.

16.3 The board notes that adding a step of calculating LLRs evidently cannot simplify an existing method without this step. It is also not clear compared to which entity, the hybrid ARQ provided is "easier" to implement. Furthermore, the fact that no prior art would disclose features like LLRs calculations (which are nevertheless well known for Soft-Input Soft-Output (SISO) decoders) does not prevent the skilled person from using such well-known LLRs.

16.4 In the proceedings before the department of first instance, the appellant chose not to attend the oral proceedings. The appellant then filed the first auxiliary request with its statement of grounds of appeal.

16.5 During the oral proceedings, the appellant argued that it had decided not to attend the oral proceedings before the examining division since the examining division had already taken as a basis an incorrect interpretation of claim 1.

16.6 With regard to the particular circumstances of the present case, the board is of the view that the first auxiliary request could and should have been presented earlier, for example in reply to the communication accompanying the summons to oral proceedings before the examining division or, at the latest, during the oral proceedings before the examining division, at which, however, the appellant chose not to be represented.

16.7 In the particular circumstances of the present case, the board sees no reason why the appellant could only have filed the first auxiliary request in reaction to the contested decision.

16.8 Moreover, the introduction of features taken from the description into the claim necessitates a remittal to the examining division for a new search to be performed and this is contrary to the need for procedural economy.

17. Thus, the board has decided not to admit the first auxiliary request into the proceedings.

18. The third auxiliary request corresponds to the first auxiliary request but with the same amendments as the second auxiliary request. For the same reasons as those set out with respect to the first auxiliary request, the board has decided not to admit the third auxiliary request.

Conclusion

19. Since none of the admitted requests is allowable, the appeal is to be dismissed.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar: The Chairwoman:

K. Götz-Wein A. Ritzka

Decision electronically authenticated