3GPP TSG-RAN WG1 Meeting #110-bis-e R1-22xxxxx

e-Meeting, October 10th – 19th, 2022

Agenda Item: 8.9

Source: Moderator (Ericsson)

Title: Moderator Summary [110bis-e-R17-NB-IoT-eMTC-01]

Document for: Discussion and Decision

# 1 Introduction

In [1], a discussion paper “On the no repetition number acquisition via DCI for 16-QAM in NB-IoT” was submitted accompanied with its corresponding DRAFT CR [2].

This Moderator Summary “[110bis-e-R17-NB-IoT-eMTC-01]” aims at collecting views on [1] and [2] as per the instructions below:

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| [110bis-e-R17-NB-IoT-eMTC-01] Email discussion to clarify on the no acquisition of the repetition number via DCI for 16-QAM transmissions in NB-IoT by Oct 14 – Gerardo (Ericsson)   * Check on October 12 whether there is consensus for specification change |

In the following sections a background according to [1] and [2] is provided, and afterwards there is a section to collect companies’ views.

# 2 Background: On the no repetition number acquisition via DCI for 16-QAM in NB-IoT

## 2.1 16-QAM for NB-IoT in DL

In [1] it was mentioned:

* In TS 36.213 clause 16.4.1, the following statement can be found: “, where the value of  is determined by the repetition number field in the corresponding DCI (see Clause 16.4.1.3) ”.
* The cited statement from TS 36.213 clause 16.4.1 does not hold for NPDSCH with 16-QAM, because when *npdsch-16QAM-Config-r17* is configured and NPDSCH is (re)transmitted with 16QAM, the value of  is not determined by the repetition number field in the corresponding DCI.

Based on the above, the clarification on the repetition number acquisition for NPUSCH with 16-QAM is proposed to be as follows [1]:

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| ------------------------------------------------------- Text Start ------------------------------------------------------------  16.4.1 UE procedure for receiving the narrowband physical downlink shared channel  A UE shall upon detection on a given serving cell of a NPDCCH with DCI format N1, N2 ending in subframe *n* intended for the UE, decode, starting in  *- n+5* DL subframe for FDD,  *- n+5* subframefor TDD,  the corresponding NPDSCH transmission in *N* consecutive NB-IoT DL subframe(s) *ni* with *i = 0, 1, …, N-1* according to the NPDCCH information, where  - subframe *n* is the last subframe in which the NPDCCH is transmitted and is determined from the starting subframe of NPDCCH transmission and the DCI subframe repetition number field in the corresponding DCI;  - subframe(s) *ni* with *i=0,1,…,N-1* are *N* consecutive NB-IoT DL subframe(s) excluding subframes used for SI messages or scheduling gap (if any) or processing gap (if any) where, *n0<n1<…,nN-1* ,  - , where the value of  is determined by the repetition number field in the corresponding DCI, except when *npdsch-16QAM-Config-r17* is configured and NPDSCH is (re)transmitted with 16QAM (see Clause 16.4.1.3), the value of is determined by the resource assignment field in the corresponding DCI (see Clause 16.4.1.3), and the value of is determined by the Number of scheduled TB for Unicast field or Number of scheduled TB for SC-MTCH field, if present, in the corresponding DCI,  otherwise,  ------------------------------------------------------- Text Ends ------------------------------------------------------------ |

Moreover, the “Consequences if not approved” state that: “TS 36.213 clause 16.4.1 will keep stating that in all cases  is obtained via DCI, which does not hold for DL (re)transmissions with 16-QAM in NB-IoT”.

## 2.2 16-QAM for NB-IoT in UL

In [1] it was mentioned:

* In TS 36.213 clause 16.5.1, the following statement can be found: “, where the value of is determined by the repetition number field in the corresponding DCI (see Clause 16.5.1.1),”.
* The cited statement from TS 36.213 clause 16.5.1 does not hold for NPUSCH with 16-QAM, because when *npusch-16QAM-Config-r17* is configured and NPUSCH is (re)transmitted with 16QAM, the value of  is not determined by the repetition number field in the corresponding DCI.

Based on the above, the clarification on the repetition number acquisition for NPUSCH with 16-QAM is proposed to be as follows [1]:

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| ------------------------------------------------------- Text Start ------------------------------------------------------------  16.5.1 UE procedure for transmitting format 1 narrowband physical uplink shared channel  NPUSCH format 1 transmission can be scheduled by a NPDCCH with DCI format N0, or the transmission can correspond to using preconfigured uplink resource configured by higher layers. Transmission using preconfigured uplink resource is initiated by higher layers as specified in [14] , while retransmission of transport blocks transmitted using preconfigured uplink resource are scheduled by a NPDCCH with DCI format N0.  A UE shall upon detection on a given serving cell of a NPDCCH with DCI format N0 ending in NB-IoT DL subframe *n* scheduling NPUSCH intended for the UE, perform, at the end of  *- n+k0**+K*offset DL subframe for FDD,  *- k0* NB-IoT UL subframes following the end of *n+*8 subframefor TDD,  a corresponding NPUSCH transmission using NPUSCH format 1 in *N* consecutive NB-IoT UL slots *ni* with *i = 0, 1, …, N-1* according to the NPDCCH information where  - subframe *n* is the last subframe in which the NPDCCH is transmitted and is determined from the starting subframe of NPDCCH transmission and the DCI subframe repetition number field in the corresponding DCI; and  - , where the value of  is determined by the repetition number field in the corresponding DCI, except when *npusch-16QAM-Config-r17* is configured and NPUSCH is (re)transmitted with 16QAM (see Clause 16.5.1.1), the value of is determined by the resource assignment field in the corresponding DCI (see Clause 16.5.1.1), the value of  is the number of NB-IoT UL slots of the resource unit (defined in clause 10.1.2.3 of [3]) corresponding to the  allocated number of subcarriers (as determined in Clause 16.5.1.1) in the corresponding DCI, and the value of is determined by the Number of scheduled TB for Unicast field, if present, in the corresponding DCI,  otherwise  ------------------------------------------------------- Text Ends ------------------------------------------------------------ |

Moreover, the “Consequences if not approved” state that: “TS 36.213 clause 16.5.1 will keep stating that in all cases  is obtained via DCI, which does not hold for UL (re)transmissions with 16-QAM in NB-IoT”.

# 3 Companies views: On the no repetition number acquisition via DCI for 16-QAM in NB-IoT

The Moderator kindly requests companies to provide their views on the issue about “the no repetition number acquisition via DCI for 16-QAM in NB-IoT”.

**Question 1: Are you ok with the text proposals in section 2.1 and 2.2 of this Feature Lead Summary? which aim to clarify that *N*rep is not determined by the repetition number field in the corresponding DCI when 16-QAM is configured and NPUSCH/NPDSCH is (re)transmitted with 16-QAM.**

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| **Company** | **Yes/No** | **Comments** |
| Lenovo |  | We agree to have clarification for N\_Rep for 16QAM. Although we have clear definition of N\_Rep in Clause 16.4.1.3 and Clause 16.5.1.1, we don’t think the CR is the best way.  How about the folloiwing udpate:  , where the value of  is determined by the repetition number field in the corresponding DCI, or =1 for PDSCH with 16QAM (see Clause 16.4.1.3) 16.4.1.3 Resource allocation The resource allocation information in DCI format N1, N2 (paging) for NPDSCH indicates to a scheduled UE  - a number of subframes () determined by the resource assignment field () in the corresponding DCI according to Table 16.4.1.3-1.  - a repetition number () determined by the repetition number field () in the corresponding DCI according to Table 16.4.1.3-2. For NPDSCH with 16QAM, . |
| Qualcomm | No | We do not think this change is needed, since Clause 16.4.1.3 and 16.5.1.1 already clarify the behavior for 16-QAM. We do not think that an implementer reading the current version of the specification would arrive to a wrong implementation. In general, repeating the same specification text in multiple places is a bad idea.  If there is a majority of companies that think that this clarification is needed, we would suggest to actually just point to Clauses 16.4.1.3 and 16.5.1.1 directly, e.g.:  , where the value of  is determined as specified in ~~by the repetition number field in the corresponding DCI (see~~ Clause 16.4.1.3~~)~~  Our preference would be to not change the specifications. |
| Huawei, HiSilicon | No | We don’t think this is an essential change. With the following, the spec has been clear without any ambiguity.  (36.212)  - Repetition number – 3 bits as defined in clause 16.5.1.1 of [3]. If 16QAM is indicated, it functions as Modulation and coding scheme for 16QAM as defined in 16.5.1.2 of [3].  (36.213)  - a repetition number () determined by the repetition number field () in the corresponding DCI according to Table 16.4.1.3-2. For NPDSCH with 16QAM, .   * a repetition number () determined by the repetition number field according to Table 16.5.1.1-3. For a NPUSCH transmission using preconfigured uplink resource, the UE shall use the repetition number configured by higher layers. For NPUSCH with 16QAM, . |
| Ericsson | See comment | The statement under discussion says:  “ is determined by the repetition number field in the corresponding DCI ”  The above statement does not hold true for 16-QAM, hence is not correct as it is now.  A clarification is needed to make the statement valid for 16-QAM, hence the proposed TPs in this document, or Lenovo’s suggestion, or a simpler clarification based on a hybrid between QC’s and HW’s should be adopted.  The simpler hybrid solution can be:  DL:  - , where the value of  is determined as specified in Clause 16.4.1.3, and Clause 6.4.3.2 of [4]),  UL:  - , where the value of  is determined as specified in Clause 16.5.1.1, and Clause 6.4.3.1 of [4]), |
| ZTE, Sanechips |  | Take DL as an example,  In clause 16.4.1, we have indicated that ‘see clause 16.4.1.3’  - , where the value of  is determined by the repetition number field in the corresponding DCI (see Clause 16.4.1.3), the value of is determined by the resource assignment field in the corresponding DCI (see Clause 16.4.1.3), and the value of is determined by the Number of scheduled TB for Unicast field or Number of scheduled TB for SC-MTCH field, if present, in the corresponding DCI,  otherwise,  And in clause 16.4.1.3, we have indicated that  - a repetition number () determined by the repetition number field () in the corresponding DCI according to Table 16.4.1.3-2. For NPDSCH with 16QAM, .  If the sentence ‘For NPDSCH with 16QAM, ’ is not valid, then the two places highlighted with red need to be corrected. If the sentence is valid, then no correction is needed. We can not say this sentence is only valid in clause 16.4.1.3 and not valid in clause 16.4.1, since it is explicitly indicated that it is referred to clause 16.4.1.3 in clause 16.4.1.  So, if there is no implementation problem, we slightly prefer to keep the current description. And adding a note such as  ‘For NPDSCH with 16QAM, ’ in clause 16.4.1.3 will cover the case that repetition number () is determined by the repetition number field () in the corresponding DCI in clause 16.4.1 and 16.4.1.3. |
| Ericsson |  | To ZTE:  In your DL example, the statements in clause 16.4.1.3 can be kept as they are, since they will be in line with the clarification in 16.4.1:  - , where the value of  is determined as specified in Clause 16.4.1.3, and Clause 6.4.3.2 of [4]),  The point is that the statement saying “ is determined by the repetition number field in the corresponding DCI” holds true till Rel-16, but the statement does not hold true anymore from Rel-17 since the acquisition of  for 16-QAM is done in a different manner. Hence, to make statement correct is better to remove the part that does not hold any more in an “ universal manner” and instead refer to the relevant clauses: “, where the value of  is determined as specified in Clause 16.4.1.3, and Clause 6.4.3.2 of [4])” |
| ZTE, Sanechips |  | Thanks Ericsson for the follow-up, I understand your motivation and agree that the statement of “ is determined by the repetition number field in the corresponding DCI” is maybe not so perfect.  My point is, if correction is needed, then both the following two statements needs to be corrected, since the two statements mentions it is determined by repetition field in DCI:  The first statement:  - , where the value of  is determined by the repetition number field in the corresponding DCI (see Clause 16.4.1.3), the value of is determined by the resource assignment field in the corresponding DCI (see Clause 16.4.1.3), and the value of is determined by the Number of scheduled TB for Unicast field or Number of scheduled TB for SC-MTCH field, if present, in the corresponding DCI,  otherwise,  The second statement  - a repetition number () determined by the repetition number field () in the corresponding DCI according to Table 16.4.1.3-2. For NPDSCH with 16QAM, .  If we think the interpretation of ‘For NPDSCH with 16QAM, .’ is valid for the second statement and no need to correct the second statement, then the first statement correction is also not needed, since the first statement mentions that it is referred to the second statement.  The UL case is similar. |
| Nokia, NSB |  | We have no strong view, but we tend to agree that the change is not needed as the specification is clear enough and there should be no ambiguity in implementation.  However, if a clarification is needed then I think Qualcomm’s suggestion is a good one. |
| Ericsson |  | Thanks. About the following comment: “*I understand your motivation and agree that the statement of “ is determined by the repetition number field in the corresponding DCI” is maybe not so perfect.*”. It is not that “*is maybe not so perfect*” but rather that the statement saying “ is determined by the repetition number field in the corresponding DCI” holds true till Rel-16 but does not hold true anymore from Rel-17.  To address your comment about that the statements in 16.4.1 and 16.4.1.3 both would need to be corrected “*since the two statements mentions it is determined by repetition field in DCI*”, we can do it as follows (preserving the wording in clause 16.4.13 and 16.5.1.1, just changing the location of the text):  DL:  16.4.1  - , where the value of  is determined as specified in Clause 16.4.1.3),  16.4.1.3  - For NPDSCH with 16QAM, . Otherwise, a repetition number () is determined by the repetition number field () in the corresponding DCI according to Table 16.4.1.3-2.  UL:  16.5.1  - , where the value of  is determined as specified in Clause 16.5.1.1),  16.5.1.1   * For NPUSCH with 16QAM, . Otherwise, a repetition number () is determined by the repetition number field according to Table 16.5.1.1-3. For a NPUSCH transmission using preconfigured uplink resource, the UE shall use the repetition number configured by higher layers. |

# References

1. [R1-2210073](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110b-e/Docs/R1-2210073.zip), “On the no repetition number acquisition via DCI for 16-QAM in NB-IoT,” Ericsson, RAN1 #110-bis-e, October 10th – 19th, 2022.
2. [R1-2210073](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110b-e/Docs/R1-2210072.zip), “DRAFT CR Clarification on the no acquisition of the repetition number via DCI for 16-QAM transmissions in NB-IoT,” Ericsson, RAN1 #110-bis-e, October 10th – 19th, 2022.