3GPP TSG-RAN WG4 Meeting # 102-e R4-2207083

Electronic Meeting, February 21 – March 3, 2022

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| *CR-Form-v12.1* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
|  | | | | | | | | |
|  | **36.133** | **CR** | **7137** | **rev** | **-** | **Current version:** | **17.4.0** |  |
|  | | | | | | | | |
| *For* [***HELP***](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* | | | | | | | | |
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| ***Proposed change affects:*** | UICC apps |  | ME | **X** | Radio Access Network |  | Core Network |  |

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| ***Title:*** | Big CR of RRM requirements for Rel-17 NB-IoT and eMTC | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | Huawei, HiSilicon | | | | | | | | | |
| ***Source to TSG:*** | R4 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | NB\_IOTenh4\_LTE\_eMTC6-Core | | | | |  | ***Date:*** | | | 2022-03-07 |
|  |  | | | |  | |  | | |  |
| ***Category:*** | **B** |  | | | | | ***Release:*** | | | Rel-17 |
|  | *Use one of the following categories:* ***F*** *(correction)* ***A*** *(mirror corresponding to a change in an earlier release)* ***B*** *(addition of feature),* ***C*** *(functional modification of feature)* ***D*** *(editorial modification)*  Detailed explanations of the above categories can be found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | | | | | | | | *Use one of the following releases: Rel-8 (Release 8) Rel-9 (Release 9) Rel-10 (Release 10) Rel-11 (Release 11) … Rel-15 (Release 15) Rel-16 (Release 16) Rel-17 (Release 17) Rel-18 (Release 18)* | |
|  |  | | | | | | | | | |
| ***Reason for change:*** | | Big CR to capture the RRM requirement of Rel-17 NB-IoT and eMTC | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | Big CR to capture endorsed draft CR of RRM requirements of Rel-17 NB-IoT and eMTC:  **RAN4#101-bis-e**  R4-2202717 Draft CR on including channel quality table for 16 QAM for Rel-17 NB-IoT  **RAN4#102-e**  R4-2207035 Draft CR on intra-frequency measurement requirements for Rel-17 NB-IoT  R4-2207036 Draft CR on Connected mode inter-frequency neighbour cell measurement before RLF for Rel-17 NB-IoT  R4-2207037 draft CR: Introduction of channel quality report for NB-IoT supporting 16QAM | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | The corresponding requirements are missing. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | 8.14.x1 (new), 8.14.x2 (new) and 9.1.22.x1 (new) | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | |  | **X** | Other core specifications | | | | TS/TR ... CR ... | | |
| ***affected:*** | |  | **x** | Test specifications | | | | TS/TR ... CR ... | | |
| ***(show related CRs)*** | |  | **X** | O&M Specifications | | | | TS/TR ... CR ... | | |
|  | |  | | | | | | | | |
| ***Other comments:*** | |  | | | | | | | | |
|  | |  | | | | | | | | |
| ***This CR's revision history:*** | |  | | | | | | | | |

### <Start of Change 1 (R4-2207037)>

### 8.14.x1 Connected mode channel quality report for UE Category NB2 supporting 16QAM

The requirements in this clause shall apply for UE Category NB2 supporting 16QAM for unicast NPDSCH as defined in TS 36.331 [2] when triggered by the MAC-CE command as specified in TS 36.321 [17].

The DL channel quality provides the serving eNB with the following information with the parameters specified in Table 8.14.x1-1:

- The reported candidateRep should correspond to the minimum number of NPDCCH repetitions that achieves a hypothetical NPDCCH block error rate no larger than 1%, and correspond to the NPDSCH transport block size that achieves a NPDSCH block error rate no larger than 10%.

- If the candidateRep entry corresponds to NPDCCH repetitions level X and NPDSCH transport block size Y, then no other candidate with NPDCCH repetitions level ≤ X and NPDSCH transport block size ≥ Y should satisfy the block error rate conditions for both NPDCCH and NPDSCH.

- If there is no candidateRep entry to satisfy the condition, UE should report ‘noMeasurement’.

The report mapping is defined in Table 9.1.22.17-1.

Table 8.14.x1-1: NPDCCH transmission parameters for downlink quality reporting

|  |  |
| --- | --- |
| Parameters | Values |
| DCI format | Format N1 |
| Number of information bits (excluding CRC) | 23bits |
| System bandwidth | 200kHz |
| Aggregation level | 2 |
| DRX | OFF |

The reported candidateRep value shall be derived from the channel quality measured from the time [UE finishes the decoding of Downlink Channel Quality report MAC CE] to [the end of NPDCCH period which carries the uplink grant of channel quality report for measurement of DL channel quality of the configured carrier].

### <End of Change 1>

### <Start of Change 2 (R4-2207035)>

### 8.14.x2 NB-IoT neighbour cell measurements

#### 8.14.x2.1 Introduction

This clause contains requirements for the neighbour cell measurements performed by the UE category NB1 in RRC\_CONNECTED state. The requirements in this clause are applicable when:

* the UE is in normal coverage or in enhanced coverage on the serving cell and
* the target cell fulfils the criteria for normal coverage.

#### 8.14.x2.2 Requirements

The UE supporting *connectedModeMeasurements-r17* [31] shall measure neighbour cells when the criterion for triggering the neighbour cell measurements defined in [1] is fulfilled and the UE is not in relaxed monitoring mode as defined in [1]. The UE may trigger the neighbour cell measurements before or during radio link failure depending on the fulfilment of the criterion.

The measurement quantities are defined in [4], the measurement model is defined in [22].

The requirements for intra-frequency neighbour cell measurement when the target carrier is same as serving carrier is defined in clause 8.14.x2.3.

The requirements for inter-frequency neighbour cell measurement when the target carrier is different from serving carrier is defined in clause 8.14.x2.4.

#### 8.14.x2.3 Intra-frequency neighbour cell measurements

The UE shall be able to identify a new detectable intra-frequency cell within Tidentify\_intra ­­­when the criteria for intra-frequency measurements is fulfilled [1]. An intra frequency cell is considered to be detectable according to NRSRP, NRSRP Ês/Iot, NSCH\_RP and NSCH Ês/Iot defined in Annex B.x.y for a corresponding Band.

Tidentify\_intra = Tdetect\_intra + Tmeasure \_intra

When DRX is not used, Tdetect\_intra is 1400 ms, and Tmeasure \_intra is 800 ms and 1600 ms for NRS-based measurement and NSSS-based measurement respectively.

When DRX is used, Tdetect\_intra and Tmeasure \_intra are defined in table 8.14.x2.3-1 and 8.14.x2.3-2.

Table 8.14.x2.3-1: Requirement for intra-frequency detection

|  |  |
| --- | --- |
| DRX cycle length (s) | Tdetect\_intra (s) (DRX cycles) |
| 0.256<DRX-cycle≤10.24 | (6)Note 1 |
| Note1: Time depends upon the DRX cycle in use | |

Table 8.14.x2.3-2: Requirement for intra-frequency measurement

|  |  |
| --- | --- |
| DRX cycle length (s) | Tmeasure\_intra (s) (DRX cycles) |
| 0.256<DRX-cycle≤10.24 | (5)Note 1 |
| Note1: Time depends upon the DRX cycle in use | |

When UE is monitoring multiple carriers, Tidentify\_intra = Tdetect + Tmeasure, where Tdetect = Tdetect \_intra+Nfreq\* Tdetect\_inter and Tmeasure = Tmeasure \_intra+Nfreq\* Tmeasure\_inter. Nfreq is number of inter-frequency carriers to be measured according to the measurement capability, and Tdetect\_inter  and Tmeasure\_inter are defined in clause 8.14.x2.4

### <End of Change 2>

### <Start of Change 3 (R4-2207036)>

#### 8.14.x2.4 Inter-frequency neighbour cell measurements

The UE shall be able to identify a new detectable inter-frequency cell within Tidentify\_inter\_NB1-NC ­­­when the criteria for inter-frequency measurement is fulfilled [1]. An inter frequency cell is considered to be detectable according to NRSRP, NRSRP Ês/Iot, NSCH\_RP and NSCH Ês/Iot defined in Annex B.x.y for a corresponding Band.

Tidentify \_inter\_NB1-NC = Tdetect\_inter NB1-NC + Tmeasure \_inter NB1-NC

Where

ms

* N = 70,
* Ta,i is the interval between available measurement samples in measurement occasions (MOdetect\_inter\_NB1-NC) for inter-frequency detection. The UE shall restart the cell detection when the following condition is not met:

200 ≤ Ta,i ≤ 5000 ms

* The UE is not required to monitor NPSS/NSSS more frequent than once per 40ms.
* MOdetect\_inter\_NB1-NC are time occasions containing at least subframes #0, #4, or #9 containing NPSS/NSSS and fulfil the following conditions:
  + Resources on which the UE is not scheduled for data transmission or reception,
  + Resources on which the UE is not required to do NPDCCH monitoring,
  + Resources occurring during the DRX inactive period
  + Length of MOdetect\_inter\_NB1-NC  is at least 200 ms.

Tmeasure\_inter\_NB1-NC is the physical layer measurement period of NRSRP on the detected inter-frequency cell as defined below:

ms

* M = 60 for NRS-based RRM measurement and M = 40 for NSSS based RRM measurement,
* Tb,i is the interval between available measurement samples in measurement occasions (MOmeasure\_inter\_NB1-NC) for inter-frequency measurement. The UE shall restart the measurement when following conditions is not met:

50 ≤ Tb,i ≤ 5000 ms for RRM measurement

* The UE is not required to monitor NRS more frequent than once per 20ms for NRS-based measurement and NSSS more frequent than 40 ms for NSSS-based measurement.
* MOmeasure\_inter\_NB1-NC are time occasion containing at least NRS or NSSS that fulfil the following conditions:
  + Resources on which the UE is not scheduled for data transmission or reception,
  + Resources on which the UE is not required to do NPDCCH monitoring,
  + Resources occurring during the DRX inactive period,
  + Length of MOmeasure\_inter\_NB1-NC  is at least 50 ms.

When UE is monitoring multiple carriers, Tidentify\_inter\_NB1-NC = Tdetect\_NB1-NC + Tmeasure\_NB1-NC, where Tdetect\_NB1-NC = Tdetect \_intra\_NB1-NC +Nfreq\* Tdetect\_inter\_NB1-NC and Tmeasure\_NB1-NC = Tmeasure \_intra\_NB1-NC +Nfreq\* Tmeasure\_inter\_NB1-NC. Nfreq is number of inter-frequency carriers to be measured according to the measurement capability, and Tdetect\_intra\_NB1-NC and Tmeasure\_intra\_NB1-NC are defined in clause 8.14.x2.3

### <End of Change 3>

### <Start of Change 4 (R4-2202717 and R4-2207037)>

#### 9.1.22.x1 Channel quality reporting for UE Category NB2 with 16-QAM

Table 9.1.22.x1-1: Downlink channel quality measurement report mapping when the reception of unicast NPDSCH modulated with 16-QAM is configured

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Reported value | NPDCCH repetition level | NPDSCH transport block  error probability not exceeding 0.1 | | | |
| Modulation | Code rate x 1024 | Repetition | Efficiency |
| noMeasurement | No measurement reporting | Out of range | | | |
| candidateRep-A | 1 | QPSK | 221 | 1 | 0.4316 |
| candidateRep-B | 2 | QPSK | 140 | 1 | 0.2737 |
| candidateRep-C | 4 | QPSK | 81 | 1 | 0.1579 |
| candidateRep-D | 8 | QPSK | 81 | 2 | 0.0789 |
| candidateRep-E | 16 | QPSK | 81 | 4 | 0.0395 |
| candidateRep-F | 32 | QPSK | 81 | 8 | 0.0198 |
| candidateRep-G | 1 | QPSK | 336.8 | 1 | 0.6579 |
| candidateRep-H | 1 | QPSK | 453.6 | 1 | 0.8860 |
| candidateRep-I | 1 | QPSK | 579.4 | 1 | 1.1316 |
| candidateRep-J | 1 | QPSK | 759 | 1 | 1.4825 |
| candidateRep-K | 1 | 16QAM | 487.3 | 1 | 1.9035 |
| candidateRep-L | 1 | 16QAM | 541.2 | 1 | 2.1140 |
| candidateRep-M | 1 | 16QAM | 658 | 1 | 2.5702 |
| candidateRep-N | 1 | 16QAM | 783.7 | 1 | 3.0614 |
| candidateRep-O | 1 | 16QAM | 837.6 | 1 | 3.2719 |

### <End of Change 4>