**3GPP TSG RAN meeting #95e RP-22xxxx**

**Electronic Meeting, March 17-23, 2022**

## Status Report to TSG

**Agenda item:** 10.4.1

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **WI / SI Name** | Additional enhancements for NB-IoT and LTE-MTC | | | | |
| included in this status report | Study Item:  No | Core part:  Yes | Performance part:  Yes | | Testing part:  No |
| **Acronym** | NB\_IOTenh4\_LTE\_eMTC6 | | | | |
| **Unique ID** | 860044 | | | | |
| **TSG Tdoc of latest approved WI/SI description (if any)** | RP-211340 | | | | |
| **Target Completion Date**  **(indicate if changed)** | Study Item: | Core part: 03/2022 | Performance part: 09/2022 | Testing part: | |
| **Overall Completion level** | Study Item: | Core part:  100% | Performance Part: 30% | Testing part: | |

Note: Overall completion level percentage numbers should use one of the colors below:

* xx%: Normal progress, no RAN plenary action needed
* xx%: Progress behind schedule, may need RAN plenary intervention. If so, SR should clearly define requested action
* xx%: Progress critically behind, RAN plenary shall intervene. SR should define requested action

**Source:**

|  |  |  |
| --- | --- | --- |
| **Leading WG** | | RAN WG 1 |
| **Rapporteur** | **Name** | Yubo YANG  Emre YAVUZ |
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## 1 Work plan related evaluation

|  |  |
| --- | --- |
| **Do you want to modify the time budget for this WI/SI compared to what was endorsed at the last RAN meeting?** | No |

*If you answered No: Then please remove the Excel file from the zip file of this status report.*

*If you answered Yes: Then please fill out the attached Excel template to request a modification of the time budgets for your WI /SI. The Excel table has to be filled out for all affected RAN WGs and up to the target date of the WI/SI. The basis are the endorsed time budgets of the last RAN meeting. Please highlight all changes of the values.  
 One time unit (TU) corresponds to ~ 2 hours in the meeting.  
 If this status report covers a WI with Core and Performance part, then please have one line for each in the attached Excel table.  
 Note: If no Excel table is attached, then this means no time budget change.*

**Additional explanations/motivations for the time budget changes in the attached Excel table:**

## 2. Detailed progress in RAN WGs since last TSG meeting (for all involved WGs)

NOTE: Agreements and Open issues impacted cross-TSG aspects shall be explicitly highlighted

## 2.1 RAN1

#### 2.1.1 Agreements

In RAN1#108-e meeting, 26 contributions [1-26] were submitted, and the following agreements were achieved:

For NB-IoT 16-QAM:

Agreement

* When 16QAM is configured, the new CQI table is used.

Note: There’s no consensus in RAN1 on the use of legacy CQI table when 16-QAM is configured

* Send LS to RAN2 with this agreement

Agreement

[Draft] LS on use of CQI table for NB-IoT DL 16QAM, R1-2202879, is endorsed in principle.

Agreement

Final LS on use of CQI table for NB-IoT DL 16QAM, R1-2202880, is endorsed in principle.

Note:

In the table for channel quality reporting for 16-QAM in DL, the “Code rate x 1024” entry for “candidateRep-B” has been updated from “280” to “140”.

Agreement

The term ∆*TF*,*ci* can also be applied to NPUSCH with QPSK, when 16-QAM is configured.

Agreement

The following TPs captured in R1-2202881 are endorsed.

* TP for Section 6.3.2, TS36.212
* TP for Section 16.2.2, TS36.213
* TP for Section 16.4.1.5, TS36.213
* TP for Section 16.5.1.2, TS36.213
* TP for Section 16.2.1.1.1, TS36.213

For eMTC 14-HARQ processes:

Agreement

The TP to section 5.4.3 of TS36.211 is endorsed.

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| --- |
| **~~~~~~~~~~~~~~~~~~~~~~~~~~~~~ Start of text proposal to TS36.211~~~~~~~~~~~~~~~~~~~~~~~~~~~**  ***-----------------------------< Start of the 1stChange >------------------------------***  5.4.3         Mapping to physical resources                                                  < Unchanged parts are omitted >  For BL/CE UEs, PUCCH is transmitted with  repetitions.  -    The BL/CE UE is not expected to transmit with  when *~~CE-PDSCH-14HARQ-Config~~ce-PDSCH-14HARQ-Config* is configured.                                                    < Unchanged parts are omitted >  **~~~~~~~~~~~~~~~~~~~~~~~~~~~~ End of text proposal to TS36.211 ~~~~~~~~~~~~~~~~~~~~~~~~~~~~** |

Agreement

The TP to section 7.1.11 of TS36.213 is endorsed.

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| **~~~~~~~~~~~~~~~~~~~~~~~~~~~ Start of text proposal to 36.213 ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~**  ***-----------------------------< Start of the 1stChange >------------------------------***  7.1.11       PDSCH subframe assignment for BL/CE UE  A BL/CE UE shall upon detection of a MPDCCH with DCI format 6-1A/6-1B/6-2 intended for the UE,  decode the corresponding PDSCH in subframe(s) *n+ki* with *i = 0, 1, …, NTBN-1* according to the MPDCCH, where                                                                  < Unchanged parts are omitted >  -    otherwise,  -    subframe(s) *ni*= *n+ki*with *i=0,1,…, NTBN-1* are *NTBN* consecutive BL/CE DL subframe(s), where , and subframe *n+x* is the *j*th BL/CE DL subframe after subframe *n*, and*j* is given by the value of the PDSCH scheduling delay option as defined in [4] if the UE is configured with CEModeA and 'PDSCH scheduling delay and HARQ-ACK delay for 14 HARQ' field is present in the corresponding DCI, *j*=2 otherwise.                                                                  < Unchanged parts are omitted >  **~~~~~~~~~~~~~~~~~~~~~~~~~~~~End of text proposal to 36.213 ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~** |

Conclusion

* In Rel-17 for the 14 HARQ process feature, the use of the “Repetition Number” field was intended to address adverse radio condition where at most 1 HARQ process along with PDSCH repetitions are suitable to be used.
  + Other scenarios making use of PDSCH repetitions (e.g., combining the use of repetitions/no-repetitions) are not precluded subject to be compliant to the “PDSCH scheduling delays” and “HARQ-ACK delays” introduced in Rel-17.

#### 2.1.2 Remaining Open issues

None.

## 2.2 RAN2

#### 2.2.1 Agreements

**RAN2#116bis-e**

Contributions [27] – [60] were submitted to RAN2#116bis-e meeting.

**NB-IoT neighbour cell measurements and corresponding measurement triggering before RLF**

RAN2 discussed NB-IoT neighbour cell measurements and corresponding measurement triggering before RLF and made the following agreements:

|  |
| --- |
| RAN2#116bis-e agreements:   * Confirm that early RLF for NB-IoT is not supported in Release 17. * Value for TSearchDeltaP is [15s, 30s, 45s, 60s] * Neighbour cell monitoring in RRC\_CONNECTED has no impact on neighbour cell monitoring in RRC\_IDLE state * If upon transition to RRC\_CONNECTED state, UE is not in relaxed neighbour cell monitoring state in RRC\_IDLE, then timer TsearchDeltaP restarted with the RRC\_CONNECTED state timer value. * If upon transition to RRC\_CONNECTED state, UE is in relaxed neighbour cell monitoring state in RRC\_IDLE, then timer TsearchDeltaP is not started. * In RRC\_CONNECTED state, when UE stops fulfilling the criteria ((SrxlevRef – Srxlev) < SSearchDeltaP) then timer TsearchDeltaP is started with the RRC\_CONNECTED timer value (FFS update variable names offline). * Set the RRC\_CONNECTED state reference level to the last serving cell measurement, Srxlev, obtained before entering RRC\_CONNECTED state. * No indication from UE to NW that indicates UE needs to perform inter-frequency measurements * No dedicated signalling to enable/disable neighbour cell measurement for a UE in RRC\_CONNECTED. * FFS whether support for connected mode measurements for RLF is indicated with or without FDD/TDD differentiation. * Support for connected mode measurements for RLF is indicated without EPC/5GC differentiation. |

RAN2 has agreed on an email discussion after the meeting to collect the open issues:

* [Post116bis-e][309][NBIOT/eMTC R17] RLF measurements open issues (Qualcomm)

**Scope**: Capture open issues on NB-IoT neighbor cell measurements and corresponding measurement triggering before RLF

**Intended outcome**: Open issues list in R2-2201794

**NB-IoT carrier selection based on the coverage level and associated carrier specific configuration**

RAN2 discussed NB-IoT carrier selection based on the coverage level and associated carrier specific configuration and made the following agreements.

|  |
| --- |
| RAN2#116bis-e agreements:   * UE can be enabled/disabled coverage-based paging carrier selection via dedicated signalling. Presence or absence of the coverage information can be implicit enable/disable indication. * In SIB, the value range for Rmax (npdcch-NumRepetitionPaging) in R17 paging carrier (list) configuration can be ENUMERATED {r1, r2, r4, r8, r16, r32, r64, r128}. * In SIB, coverage specific nB is supported, e.g., a common nB value is configured for the R17 paging carrier(s) with same Rmax (npdcch-NumRepetitionPaging). * Coverage-specific default DRX cycle is not supported. * Working assumption: In SIB, coverage specific ue-SpecificDRX-CycleMin is supported, e.g., a common ue-SpecificDRX-CycleMin value is configured for the R17 paging carrier(s) with same Rmax (npdcch-NumRepetitionPaging). * (FFS check whether there are any issues with the UE specific minimum DRX cycle per coverage level, can confirm WA if no issues.) * Paging weight can still be used in coverage-based paging carrier selection. * In SIB, both non-mixed operation mode and mixed operation mode can be supported in R17 paging carrier list configuration. They can be configured separately (as legacy). * The extension in SIB22-NB can be used for providing R17 paging carrier list configuration. * No “offset” (headroom) would be introduced for the configured NRSRP threshold. * A configurable cell specific timer period can be applied when UE compares its serving cell NRSRP with the NRSRP threshold. FFS how to signal and value range. * It’s specified that UE does not switch paging carrier if it has stayed less than [xx] seconds on the carrier or within a PTW. FFS value of [xx] seconds * Coverage based paging carrier selection is enabled implicitly, i.e., when relevant parameters are provided to the UE during release. * The Rel-17 paging carriers can also be used as the DL carriers for random access. * No need to introduce a subgroup of paging carriers for the more easily changed CE level. * In SIB, at most 2 coverage levels can be configured in R17 paging carrier list, each coverage level has one NRSRP threshold * Rmax may be configured per carrier or per carrier group (coverage level). * A paging carrier group index, e.g., the index to one of the two lists which correspond to the 2 coverage levels in SIB, is provided to the UE in dedicated signalling (when UE is released to idle). * UE measured NRSRP can be reported to network for assisting the network to provide suitable coverage level related information. FFS how. * FFS whether to introduce a new paging carrier list, e.g., DL-ConfigCommon-NB-r17, or just to extend PCCH-ConfigList-NB. * Support for coverage based paging carrier selection is indicated without FDD/TDD differentiation. * Support for coverage based paging carrier selection is indicated without EPC/5GC differentiation. |

RAN2 has agreed on an email discussion after the meeting to collect the open issues:

* [Post116bis-e][310][NBIOT/eMTC R17] Carrier Selection open issues (ZTE)

**Scope**: Capture open issues on NB-IoT carrier selection based on the coverage level, and associated carrier specific configuration

**Intended outcome**: Open issues list in R2-2201795

**NB-IoT: 16-QAM for unicast in UL and DL**

RAN2 discussed 16-QAM for unicast in UL and DL and made the following agreements.

|  |
| --- |
| RAN2#116bis-e agreements:   * For 16-QAM for unicast NPDSCH and 16-QAM for unicast NPUSCH, wait for RAN1 to conclude on the scope of the capability before discussion FDD/TDD differentiation. * Support for 16-QAM for unicast NPDSCH & 16-QAM for unicast NPUSCH are indicated without EPC/5GC differentiation. |

**eMTC: 14-HARQ processes in DL, for HD-FDD Cat M1 UEs**

RAN2 discussed 14-HARQ processes in DL, for HD-FDD Cat M1 UEs and made the following agreements.

|  |
| --- |
| RAN2#116bis-e agreements:   * Introduce a new UE capability ce-14HARQProcesses-r17, conditional to support of ce-ModeA-r13. Signalling of the capability implies support of HARQ-ACK delay solution with Alt-1. * Introduce a new UE capability ce-14HARQProcesses-Alt2-r17, conditional to support of ce-14HARQProcesses-r17, for additional support of HARQ-ACK delay solution with Alt-2e. * Support for 14 HARQ processes for PDSCH is indicated without EPC/5GC differentiation. |

**eMTC: maximum DL TBS of 1736 bits**

RAN2 discussed maximum DL TBS of 1736 bits and made the following agreements.

|  |
| --- |
| RAN2#116bis-e agreements:   * Support for maximum DL TBS of 1736 bits is indicated without EPC/5GC differentiation. |

RAN2 has agreed on an email discussion after the meeting to collect the open issues on objectives led by other WGs:

* [Post116bis-e][312][NBIOT/eMTC R17] Other open issues (Ericsson)

**Scope**: Capture open issues on WI objectives led by other WGs

**Intended outcome**: Open issues list in R2-2201797

**RAN2#117bis-e**

Contributions [61] – [80] were submitted to RAN2#117-e meeting.

**NB-IoT neighbour cell measurements and corresponding measurement triggering before RLF**

RAN2 discussed NB-IoT neighbour cell measurements and corresponding measurement triggering before RLF and made the following agreements:

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| --- |
| RAN2#117-e agreements:   * The 2 capabilities for connected mode intra-frequency and inter-frequency measurement are per UE without FDD/TDD differentiation. |

**NB-IoT carrier selection based on the coverage level and associated carrier specific configuration**

RAN2 discussed NB-IoT carrier selection based on the coverage level and associated carrier specific configuration and made the following agreements.

|  |
| --- |
| RAN2#117-e agreements:   * RAN2 introduces a new ue-SpecificDRX-CycleMin parameter which is configured per coverage level. * Same rules, e.g., to wait a certain period of time or avoid paging carrier switching in PTW would be applied no matter UE selects legacy paging carrier or coverage-based paging carrier. * RAN2 use the way of extending PCCH-Config-NB to provide the R17 paging carrier list configuration in SIB. * It’s RAN2 assumption that the assigned information to UE in dedicated signaling also need to be delivered to core network and sent back to eNB in next paging. * UEPagingCoverageInformation RRC container is used to deliver the assigned information to UE in dedicated signalling to core network and sent back to eNB. A response LS to RAN3 would be sent as early as possible. * Only one timer is specified to reduce paging carrier switching, regardless of whether UE is in PTW and regardless of the currently selected carrier. * The timer is started after UE selects/switches between coverage based/non-coverage based carrier. When the timer is running, UE does not switch its current paging carrier. When timer expires, UE is allowed to switch its paging carrier based on its coverage status with respect to what was configured by the network. * The timer is configured in SIB with a cell-specific value. * The unit of the timer is second, from 2.56s up to 40.96s (maximum 8 values). * Previous agreement can be refined as below: * In SIB, coverage specific nB is supported, e.g., a common nB value is configured for the R17 paging carrier(s) with same ~~Rmax (npdcch-NumRepetitionPaging)~~ coverage level   [R2-2203582](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_117-e/Docs/R2-2203582.zip) Reply LS to RAN3 on coverage-based carrier selection RAN2 LS out Rel-17 To:RAN3 |

**NB-IoT: 16-QAM for unicast in UL and DL**

RAN2 discussed 16-QAM for unicast in UL and DL and made the following agreements.

|  |
| --- |
| RAN2#117-e agreements:   * UE does not provide CQI report for 16QAM in MSG3. * 16QAM feature is not supported for MT-EDT. * Legacy Downlink Channel Quality Report Command MAC CE is reused to trigger the channel quality report for 16QAM. (revisit only if RAN1 revise their agreements) * When UE is configured with 16 QAM then the new table is used. (revisit only if RAN1 revise their agreements) |

**eMTC: 14-HARQ processes in DL, for HD-FDD Cat M1 UEs**

RAN2 did not discussed 14-HARQ processes in DL, for HD-FDD Cat M1 UEs.

**eMTC: maximum DL TBS of 1736 bits**

RAN2 discussed maximum DL TBS of 1736 bits and made the following agreements.

|  |
| --- |
| RAN2#117-e agreements:   * RAN2 confirm that DL TBS of 1736 bits can be supported in multi-TB scheduling. * DL TBS of 1736 bits is not supported in SC-PTM. * DL TBS of 1736 bits is not supported in EDT. |

#### 2.2.2 Remaining Open issues

None.

## 2.3 RAN3

#### 2.3.1 Agreements

**RAN3#114bis-e meeting agreements**

The paged gNB/eNB should receive an indication whether the coverage -based paging carrier selection is supported and will be used or not for the UE.

Send an LS to RAN2 to ask whether the paged eNB is able to know such information based on the inter-node RRC containers (i.e. UERadioPagingInformation-NB and *UEPagingCoverageInformation-NB*) received in S1AP/NGAP: PAGING message or whether they want RAN3 to include it in RAN3 IE.

**RAN3#115-e meeting agreements**

Chair to report to RAN that WI is completed.

No need for RAN3 to introduce related new S1AP/NGAP IEs.

Adding reference to TS 36.300 in NGAP Paging procedural text will be done by Rapp clean up Correction.

#### 2.3.2 Remaining Open issues

None.

## 2.4 RAN4

#### 2.4.1 Agreements

**For RF core part：**

In **RAN4#101-bis-e**, 8 contribution papers were submitted. And the draft CR for the addition of NB-IoT 16QAM to TS 36.101 in R4-2201832 and to TS 36.141 in R4-2202296 were endorsed.

In **RAN4#102-e**, 5 contribution papers were submitted, and the following agreements were achieved.

* NB-IoT 16QAM:

The CR to TS36.104 Addition of NB-IoT 16QMA in R4-2204077 and the CR to TS36.141 Addition of NB-IoT 16QAM in R4-2204078 were approved. The objective of NB-IoT 16QAM is completed.

* LTE-MTC:

WF on feasibility study on max power reduction for PRACH, PUCCH, and full-PRB PUSCH in R4-2206480 was approved. The following proposals were made:

**Proposal 1: The status report for this work item indicates that the following have been studied:**

* **Benefits and drawbacks of power reduction for PRACH, PUCCH, and full-PRB PUSCH, with a maximum reduction of e.g. 3 dB below sub-PRB PUSCH power for UEs supporting PUSCH sub-PRB resource allocation**
* **Potential approaches that could be taken for specifying power reduction for PRACH, PUCCH, and full-PRB PUSCH, with a maximum reduction of e.g. 3 dB below sub-PRB PUSCH power for UEs supporting** **PUSCH sub-PRB resource allocation**

**Proposal 2: RAN4 recommends that the WID objective is modified to focus on the “study the feasibility” aspect:**

* + For UEs supporting PUSCH sub-PRB resource allocation, study the feasibility of  ~~and if found feasible~~ specifying support of power reduction for PRACH, PUCCH, and full-PRB PUSCH, with a maximum reduction of e.g. 3 dB below sub-PRB PUSCH power. [LTE-MTC] [RAN4]

According to usual 3GPP procedures, companies could aim to progress the specification of this work in TEI18, if there is sufficient support.

**For RRM core part：**

**RAN4#101-bis-e:**

In RAN4#101-bis-e meeting, following agreements were achieved:

**Issue 1-1-1: Intra-frequency requirement when DRX is not configure**

Agreement:

Tdetect\_intra = 1400 ms

Tmeasure\_intra = 800 ms for NRS-based measurement

Tmeasure\_intra = 1600 ms for NSSS-based measurement

**Issue 1-1-2: Intra-frequency requirement when DRX is configured**

Agreement:

Tdetect\_intra = 6 DRX cycles

Tmeasure\_intra = 5 DRX cycle

**Issue 1-2-1: General – How to formulate inter-frequency measurement**

Agreement:

* Define inter-frequency measurement requirements based on number of available samples in available measurement occasions.
* Number of samples are determined based on agreed time in LS reply and sampling rate.
* UE can process multiple samples within in one measurement occasion at a time
* FFS：Add addition assumption on minimum length of measurement occasions to avoid high overhead which will be discussed in issue 1-2-3

**Issue 1-2-2: General – How to formulate inter-frequency detection**

Agreement:

* Define inter-frequency detection requirements based on number of available samples in available measurement occasions.
* Number of samples are determined based on agreed time in LS reply and NPSS/NSSS interval.
* UE can process multiple samples within in one measurement occasion at a time
* FFS: Add addition assumption on minimum length of measurement occasions to avoid high overhead which will be discussed in issue 1-2-3

**Issue 1-2-3: Condition on inter-frequency measurement**

**Sub-1: Interruption due to data traffic**

FFS:

Option 1: The measurement period requirements for inter-frequency cell detection and measurements in connected mode shall apply assuming no UL/DL scheduling for the UE during the measurement period.

**Sub-2: Minimum length per occasion**

FFS:

Option 1

Minimum length of occasion for measurements:  50 ms

Minimum length of occasion for cell detection:  200 ms

Option 2

Minimum length of occasion for cell detection is 21 ms.

Minimum length of occasion for NRS based measurement is 11 ms, and 21ms for NSSS based measurement.

**Sub-3: Assumed sampling rate for measurement**

Agreement:

* Assumed sampling rate for measurement is 20 ms for NRS and 40 ms for NSSS

**Sub-4: Whether to have minimum spacing between occasions.**

Agreement:

* No need to require a minimum spacing between measurement occasions

**Issue 1-2-4: Detailed requirements for inter-frequency measurement**

Agreement：

Requirements for inter-frequency measurement on a carrier different from serving carrier requirements is defined as:

Tmeasure\_inter = ∑(i=1)N Min(5000,Ta,i )ms,

* where Ta,i is the interval between available measurement samples in measurement occasions according to the conditions for inter-frequency measurement. And UE is not required to monitor NRS and NSSS more frequent than once per 20ms and once per 40ms, where Ta,i ≥ 20 ms for NRS and Ta,i ≥ 40 ms for NSSS.
* N = 60 for NRS-based measurement and 40 for NSSS based measurement.
* UE will restart the measurement when the interval between two samples are larger than 5000 ms, and the delay requirements are extended accordingly.
* The requirements apply when the Tmeasure\_inter is less than X seconds. X is FFS.

**Issue 1-2-5: Detailed requirements for inter-frequency detection:**

Agreement：

Requirements for inter-frequency detection on a carrier different from serving carrier requirements is defined as:

Tdetect\_inter = ∑(i=1)N Min(5000,Ta,i )ms,

* where Ta,i is the interval between available measurement samples in measurement occasions according to the conditions for inter-frequency measurement. And UE is not required to monitor NPSS/NSSS more frequent than once per 40ms, where Ta,i ≥ 40 ms, and N = 70.
* UE will restart the detection when the interval between two samples are larger than 5000 ms, and the delay requirements are extended accordingly.
* The requirements apply when the Tdetect\_inter is less than X seconds. X is FFS.

**Issue 1-3-1: Requirements when UE is required to monitor multiple carriers**

Agreement:

* Requirements for cell detection and measurement when UE is required to monitor multiple carriers are defined as:
  + Tdetect = Tdetect \_intra+Nfreq\* Tdetect\_inter
  + Tmeasure = Tmeasure \_intra+Nfreq\* Tmeasure\_inter
* Where Nfreq is number of inter-frequency layers to be measured according to the measurement capability.

**Issue 1-3-2: Carriers for neighbour cell measurement**

FFS:

Option 1:

The UE continues measuring on at least one neighbour cell detected in RRC\_IDLE/INACTIVE modes at least once every 5 seconds after transition to RRC\_CONNECTED state provided that it belongs to the serving carrier frequency and meets the side condition (Es/Iot >= -6 dB).

**Issue 1-4-1: Whether to deprioritize defining requirements when serving cell in enhanced coverage.**

Agreement:

* Define CONNECTED mode neighbour cell measurement requirements when the serving cell is in enhanced coverage

**Issue 1-5-1: Whether to have additional triggering conditions**

FFS:

Option 1: In addition to the already agreed triggering conditions, the UE shall initiate the neighbour cell measurements if K number of out-of-sync indications are detected in the cell.

**Issue 1-6-1: Whether to indicate when UE needs to start inter-f measurements**

Agreements:

It is within in RAN2 scope and no need to further discuss in RAN4

**Issue 2-1-1: Capture channel quality reporting table for 16-QAM in TS 36.133**

Agreement:

* Capture the mapping table for channel quality reporting of 16-QAM in TS 36.133, and the corresponding performance requirements will be discussed in Demod session.

**Issue 2-1-2: Capture core requirements of channel quality reporting for 16-QAM in TS 36.133**

Agreement:

* The core requirements related to channel quality reporting for 16-QAM (e.g. measurement resource and/or period) will be discussed in Demod session, and the corresponding requirements can be captured in TS 36.133

**RAN4#102-e:**

In RAN4#102-e meeting, the following agreements were achieved:

**Issue 1-1-1: Minimum length of occasion for cell detection and measurement**

Minimum length of occasion for measurements is 50 ms

Minimum length of occasion for cell detection is 200 ms

**Issue 1-2-1: Continue measurement on neighbour cell detected in RRC\_IDLE/INACTIVE modes**

Follow the neighbour cell measurement defined in RAN2, and whether UE continues measurement on cells detected in RRC\_IDLE/INACTIVE mode is left to UE implementation without spec impact.

**Issue 1-3-1: Whether to have additional triggering conditions**

Do not define additional triggering conditions

**For Demod part:**

**RAN4#101-bis-e:**

In RAN 4#101-bis-e meeting, following agreements were achieved:

**CQI requirements:**

Define the CQI requirements for 16QAM NPDSCH

Consider the following assumptions on CQI measurement resource as baseline and then capture them in TS 36.133 after RAN4 confirms it in next meeting:

RAN4 assume the reported NPDSCH MCS and repetition shall be derived from the channel quality measured from the time UE finish the decode of Downlink Channel Quality report MAC CE to the end of NPDCCH carrying the uplink grant of channel quality report. Note UL transmission period and RF switching period is excluded from the measurement period.

**Whether to define demodulation requirements for NPUSCH format 1 with 16QAM**

* Define NPUSCH format 1 requirements with 16QAM and single-TB scheduling.

**Whether to introduce BS performance requirement for Rel-17 LTE-MTC**

* Not introduce BS performance requirements for Rel-17 LTE-MTC

**RAN4#102-e:**

In RAN4#102-e meeting, the following agreements were achieved:

**Performance requirements to be defined**

Introduce NPDSCH demodulation test with 16QAM, with:

* Propagation condition: EPA5
* Test metric: 70% max TP

**Duplex mode for NPDSCH performance with 16QAM**

Introduce NPDSCH demodulation test with 16QAM for HD-FDD and TDD

**Channel quality reporting requirements**

The DL channel quality provides the serving eNB with the information about,

- 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 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 NPDSCH and NPDCCH.
* If there is no candidateRep to satisfy the condition, the reported candidateRep should correspond to noMeasurement.

**Test setup for CQI reporting definition test**

* Applicability: Cat-NB2 UE capable of 16QAM
* Deployment mode: stand-alone
* Carrier type: Non anchor carrier (to avoid overhead)
* Number of NRS ports: 1
* Antenna configuration: 1x1
* Propagation condition: AWGN
* No HARQ retransmission

**SNR test point for CQI test**

* RAN4 sets SNR test point for NB-IoT CQI reporting test so that the reported value corresponds to 16QAM, i.e, candidateRep-K to candidateRep-O.

**Scheduling pattern for HD-FDD CQI reporting test**

* Rmax (npdcch-NumRepetitions): 4
* G (nPDCCH-startSF-USS): 2
* Repetition numbers of NPDCCH and NPUSCH: 1
* ISF=1 for NPDSCH and IRU=NPUSCH format 1 to transmit MAC CE
* CQI reporting period: 40ms
* CQI delay: 14ms

**CQI reporting test for TDD**

* RAN4 defines the CQI reporting test for TDD

**NPUSCH requirements**

* RV: {0, 2, 0, 2}
* Max number of HARQ transmission: 4

**Whether to define performance requirements to verify UE supporting 14 HARQ processes**

* Specify the PDSCH demodulation requirements for support of 14 HARQ processes, but more analysis is needed to decide to introduce new dedicated PDSCH demodulation requirements or reuse the existing requirements for support of 10 HARQ processes.

**Whether to define performance requirements to verify UE supporting 1736 bits TBS and corresponding soft buffer**

Not define performance requirements to verify UE support of 1736 bits TBS and corresponding soft buffer

#### 2.4.2 Remaining Open issues

**For core part:**

None

**For performance part:**

Specify necessary performance requirements, measurement accuracy requirements and test cases related to the above-mentioned enhancements and core requirements. [NB-IoT][LTE-MTC]

## 2.5 RAN5

#### 2.5.1 Agreements

#### 2.5.2 Remaining Open issues

#### 2.5.3 Remaining Open issues with cross-WG dependencies

## 2.6 RAN6

#### 2.6.1 Agreements

#### 2.6.2 Remaining Open issues

## 3. Detailed progress in SA/CT WGs since last TSG meeting (for all involved WGs)

NOTE: This section only needs to be filled in for WI/SIs where there is a corresponding relevant WI/SI in SA/CT.

## 3.1 SAx/CTs

#### 3.1.1 Agreements with cross-TSG impacts

#### 3.1.2 Remaining Open issues with cross-TSG impacts

NOTE: This section should also flag any critical dependencies that need TSG attention.

## 4. References

NOTE: This can be e.g. a list of all related Tdocs in the affected WGs since last TSG, references to LSs, produced TRs/TSs, the work/study item description or status reports of previous TSGs.

1. R1-2200976 Support of 16QAM for unicast in UL and DL in NB-IoT Huawei, HiSilicon
2. R1-2200977 Support of 14-HARQ processes in DL for HD-FDD MTC UEs Huawei, HiSilicon
3. R1-2201135 Discussion on remaining issues for NB-IoT 16QAM ZTE, Sanechips
4. R1-2201407 Support of 16-QAM for unicast in UL and DL for NB-IoT Nokia, Nokia Shanghai Bell
5. R1-2201650 Support of 16-QAM for NB-IoT Qualcomm Incorporated
6. R1-2201894 Remaining issues for introduction of 14-HARQ processes in DL for eMTC ZTE, Sanechips
7. R1-2201968 Support 16QAM for NBIoT Lenovo, Motorola Mobility
8. R1-2202076 Remaining issue for support 16QAM in NB-IOT R17 MediaTek Inc.
9. R1-2202277 Support of 16-QAM for unicast in UL and DL in NB-IoT Ericsson
10. R1-2202278 Support of 14 HARQ processes in DL in LTE-MTC Ericsson
11. R1-2202280 Clarification on the support of 16-QAM for NB-IoT in TS 36.212 Ericsson
12. R1-2202281 Clarification on the support of 16-QAM for NB-IoT in TS 36.213 Ericsson
13. R1-2202369 Support of 14-HARQ processes in DL for eMTC Nokia, Nokia Shanghai Bell
14. R1-2202477 Further considerations on Rel-17 NB-IoT and eMTC enhancements Huawei, HiSilicon
15. R1-2202634 Feature Lead Summary [108-e-R17-NB-IoT-eMTC-02]: 1st checkpoint Moderator (Ericsson)
16. R1-2202635 Feature Lead Summary [108-e-R17-NB-IoT-eMTC-02]: Final checkpoint Moderator (Ericsson)
17. R1-2202878 Feature lead summary on 108-e-LTE-Rel17-NB-IoT-eMTC-01 Moderator (Huawei)
18. R1-2202879 Draft LS on use of CQI table for NB-IoT DL 16QAM Moderator (Huawei)
19. R1-2202880 LS on use of CQI table for NB-IoT DL 16QAM RAN1, Huawei
20. R1-2202881 Text proposals for NB-IoT 16QAM Moderator (Huawei)
21. R1-2202888 Clarification on PDSCH scheduling delay for 14-HARQ processes Moderator (ZTE), Sanechips, Ericsson, Lenovo
22. R1-2202889 Correction of parameter name for 14-HARQ processes Moderator (ZTE), Sanechips, Ericsson, Lenovo
23. R1-2202939 RAN1 agreements of Additional enhancements for NB-IoT and LTE-MTC WI rapporteur (Huawei)
24. R1-2202971 Correction to additional enhancements for NB-IoT and LTE-MTC Ericsson
25. R1-2202972 Correction to additional enhancements for NB-IoT and LTE-MTC FUTUREWEI
26. R1-2202974 Corrections to Additional Enhancements for NB-IoT and LTE-MTC Motorola Mobility
27. R2-2200027 [Running CR] Introduction of NB-IoT/eMTC Enhancements Qualcomm Incorporated
28. R2-2200028 Report of [Post116-e][310][NBIOT/eMTC] RLF measurements Qualcomm Incorporated
29. R2-2200029 Running CR: Introduction of additional enhancements for NB-IoT and eMTC ZTE Corporation, Sanechips
30. R2-2200030 Report of [Post116-e][311] NB-IoT carrier selection ZTE Corporation, Sanechips
31. R2-2200048 Running CR: Introduction of Rel-17 enhancements for NB-IoT and eMTC Huawei
32. R2-2200058 [Running CR] Introduction of NB-IoT/eMTC Enhancements Nokia
33. R2-2200090 LS on updated Rel-17 RAN1 UE features list for LTE (R1-2112901; contact: NTT DOCOMO, AT&T) RAN1
34. R2-2200093 LS on channel quality reporting for NB-IoT (R1-2112971; contact: Huawei) RAN1
35. R2-2200681 Remaining FFSs on connected mode measurement ZTE Corporation, Sanechips
36. R2-2200682 Remaining FFSs on CEL-based paging carrier selection ZTE Corporation, Sanechips
37. R2-2200683 Remaining FFSs on 16QAM for NB-IoT and 1736bits TBS for eMTC ZTE Corporation, Sanechips
38. R2-2200866 Discussion on the issue for Random Access on multicarrier for NB-IoT CMCC
39. R2-2200867 Solution for random access issue on multiCarrier in NB-IoT CMCC
40. R2-2200868 Solution for random access issue on multiCarrier in NB-IoT CMCC
41. R2-2200922 Discussion on details of paging carrier selection MediaTek Inc.
42. R2-2201020 Consideration on open issues for neighbour cell measurement in RRC connected state Qualcomm Incorporated
43. R2-2201021 Paging carrier selection with hysteresis Qualcomm Incorporated
44. R2-2201022 Signalling for coverage-based paging carrier selection Qualcomm Incorporated
45. R2-2201448 Introduction of Rel-17 enhancements for NB-IoT and eMTC Huawei, HiSilicon
46. R2-2201449 CQI reporting for 16QAM DL Huawei, HiSilicon
47. R2-2201450 UE capabilities and FDD/TDD, EPC/5GC differentiation Huawei, HiSilicon
48. R2-2201786 Report of [AT116bis-e][301][NBIOT/eMTC R17] Carrier selection (ZTE) ZTE (email discussion rapporteur)
49. R2-2201787 [AT116bis-e][303][NBIOT/eMTC R17] UE Capabilities (Huawei) Huawei
50. R2-2201788 Running CR: Introduction of Rel-17 enhancements for NB-IoT and eMTC Huawei
51. R2-2201789 Running CR: Introduction of Rel-17 enhancements for NB-IoT and eMTC Huawei
52. R2-2201790 [Running CR] Introduction of NB-IoT/eMTC Enhancements Qualcomm Incorporated
53. R2-2201791 [Running CR] Introduction of NB-IoT/eMTC Enhancements Nokia
54. R2-2201792 Running CR: Introduction of additional enhancements for NB-IoT and eMTC ZTE Corporation, Sanechips
55. R2-2201793 Report of [AT116bis-e][302][NBIOT/eMTC R17] RLF Measurements (Qualcomm) Qualcomm Incorporated
56. R2-2201794 [Post116bis-e][309][NBIOT/eMTC R17] RLF measurements open issues (Qualcomm) Qualcomm Incorporated
57. R2-2201795 Report of [Post116bis-e][310][NBIOT/eMTC R17] Carrier Selection open issues (ZTE) ZTE (email discussion rapporteur)
58. R2-2201796 [311][NBIOT/eMTC R17] Capabilities open issues (Huawei) Huawei, HiSilicon
59. R2-2201797 "Report on [Post116bis-e][312][NBIOT/eMTC R17] Other open issues (Ericsso" Ericsson
60. R2-2202047 RAN2 agreements for Rel-17 NB-IoT and LTE-MTC Document Rapporteur (Ericsson)
61. R2-2202427 Introduction of NB-IoT/eMTC Enhancements Qualcomm Incorporated
62. R2-2202739 Report of [Pre117e-301] Carrier selection open issues ZTE Corporation, Sanechips
63. R2-2202743 36306 running CR for NB-IoT eMTC ZTE Corporation, Sanechips
64. R2-2202745 ASN.1 issue and RAN3 impact of carrier selection ZTE Corporation, Sanechips
65. R2-2203216 Introduction of Rel-17 enhancements for NB-IoT and eMTC Huawei, HiSilicon
66. R2-2203217 Introduction of Rel-17 enhancements for NB-IoT and eMTC Huawei, HiSilicon
67. R2-2203218 Report of [Pre117-e][302][NBIOT/eMTC R17] Capabilities open issues (Huawei) Huawei, HiSilicon
68. R2-2203575 Report of [AT117-e][301][NBIOT/eMTC R17] Carrier selection (ZTE) ZTE (email discussion rapporteur)
69. R2-2203576 Reply LS to RAN3 on coverage based carrier selection RAN2
70. R2-2203577 Introduction of NB-IoT/eMTC Enhancements Qualcomm Incorporated
71. R2-2203578 36306 running CR for NB-IoT eMTC ZTE Corporation, Sanechips
72. R2-2203579 Introduction of Rel-17 enhancements for NB-IoT and eMTC Huawei, HiSilicon
73. R2-2203580 Introduction of Rel-17 enhancements for NB-IoT and eMTC Huawei, HiSilicon
74. R2-2203581 Introduction of Enhancements for NB-IoT/eMTC Nokia
75. R2-2203582 Reply LS to RAN3 on coverage based carrier selection RAN2
76. R2-2203583 Introduction of 16QAM Ericsson
77. R2-2203740 LS on use of CQI table for NB-IoT DL 16QAM (R1-2202880; contact: Huawei) RAN1
78. R2-2203742 LS on UE capability for 16QAM for NB-IoT (R1-2202893; contact: Qualcomm) RAN1
79. R2-2203745 LS on updated Rel-17 RAN1 UE features list for LTE (R1-2202924; contact: NTT DOCOMO) RAN1
80. R2-2203756 Introduction of Enhancements for NB-IoT/eMTC Nokia
81. R4-2200415 Proposals on BS RF requirements for support of 16QAM in NB-IoT Nokia, Nokia Shanghai Bell
82. R4-2201714 BS RF impact analysis on R17 NB\_IoT Ericsson
83. R4-2201831 Remaining issues for NB-IoT 16QAM BS RF requirements Huawei,HiSilicon
84. R4-2201832 Draft CR to TS36104 Addition of NB-IoT 16QAM Huawei,HiSilicon
85. R4-2201833 Draft CR to TS36141 Addition of NB-IoT 16QAM Huawei,HiSilicon
86. R4-2202296 Draft CR to TS 36.141: Addition of NB-IoT 16QAM Huawei, HiSilicon, Nokia, Nokia Shanghai Bell
87. R4-2201287 On max power reduction for PRACH, PUCCH, and full-PRB PUSCH Sony
88. R4-2201715 RF impact analysis on R17 eMTC WID Ericsson
89. R4-2204042 On max power reduction for PRACH, PUCCH, and full-PRB PUSCH Sony
90. R4-2204077 CR to TS16104 Addition of NB-IoT 16QAM Huawei, HiSilicon, Ericsson, Nokia, Nokia Shanghai Bell
91. R4-2204078 CR to TS16141 Addition of NB-IoT 16QAM Huawei, HiSilicon, Nokia, Nokia Shanghai Bell, Ericsson
92. R4-2205546 RF impact analysis on R17 eMTC WID Ericsson
93. R4-2206480 WF on feasibility study on max power reduction for PRACH, PUCCH, and full-PRB PUSCH Sony
94. R4-2202746 Email discussion summary: [101-bis-e][229] NB\_IOTenh4\_LTE\_eMTC6\_RRM Moderator (Huawei)
95. R4-2202764 WF on RRM requirements for Rel-17 NB-IoT and LTE-MTC Huawei, HiSilicon
96. R4-2200764 On NB-IoT neighbor cell measurements in RRC\_CONNECTED Qualcomm Incorporated
97. R4-2201208 Discussion on RRM requirements for Rel-17 NB-IoT Huawei, HiSilicon
98. R4-2202717 Draft CR on including channel quality table for 16 QAM for Rel-17 NB-IoT Huawei, HiSilicon
99. R4-2201866 Discussions on remaining issues of RRM requirements for NB-IoT Ericsson
100. R4-2207078 Email discussion summary: [102-e][237] NB\_IOTenh4\_LTE\_eMTC6\_RRM\_NWM Moderator (Huawei)
101. R4-2207034 WF on RRM requirements for Rel-17 NB-IoT and LTE-MTC Huawei, Hisilicon
102. R4-2204470 On NB-IoT neighbor cell measurements in RRC\_CONNECTED Qualcomm Incorporated
103. R4-2204882 Discussion on RRM requirements for Rel-17 NB-IoT Huawei, Hisilicon
104. R4-2207035 Draft CR on intra-frequency measurement requirements for Rel-17 NB-IoT Huawei, Hisilicon
105. R4-2207083 Big CR: RRM requirements for Rel-17 NB-IoT and eMTC Huawei, Hisilicon
106. R4-2207036 Draft CR on Connected mode inter-frequency neighbor cell measurement before RLF for Rel-17 NB-IoT Ericsson
107. R4-2205635 Discussions on remaining issues of RRM requirements for NB-IoT Ericsson
108. R4-2207037 draft CR: Introduction of channel quality report for NB-IoT supporting 16QAM Ericsson
109. R3-220195 Support of Carrier Selection based on coverage level Nokia, Nokia Shanghai Bell
110. R3-220196 Support of Carrier Selection based on coverage level Nokia, Nokia Shanghai Bell
111. R3-220225 (TP to TS36.413) Support CEL based paging carrier selection ZTE
112. R3-220226 BLCR to TS38.413 for introduction of CEL based paging carrier selection ZTE
113. R3-220423 (TPs to TS 36.413, 38.413) CE based Carrier Selection for NB-IoT Huawei
114. R3-220446 Discussion on Rel-17 NB-IoT Carrier selection Ericsson
115. R3-221047 CB: # NBIoTMTC1\_CarrierSelect - Summary of email discussion Nokia - moderator
116. R3-221162 LS on Coverage-Based Carrier Selection Nokia, Nokia Shanghai Bell
117. R3-221811 Support of Carrier Selection based on coverage level Nokia, Nokia Shanghai Bell
118. R3-221939 (TP to TS36.413 and TS38.413) Support CEL based paging carrier selection ZTE
119. R3-222156 (TPs to TS 36.413, 38.413) CE based Carrier Selection for NB-IoT Huawei
120. R3-222459 CB: # NBIoTMTC1\_CarrierSelect - Summary of email discussion Huawei - moderator
121. R3-222642 Reply LS to RAN3 on coverage-based carrier selection RAN2

10.01.2022 minor adaptations for RAN #95e

04.10.2021 minor adaptations for RAN #94e

08.08.2021 minor adaptations for RAN #93e

17.05.2021 minor adaptations for RAN #92e

28.01.2021 minor adaptations for RAN #91e

09.11.2020 minor adaptations for RAN #90e

31.08.2020 minor adaptations for RAN #89e

20.04.2020 minor adaptations for RAN #88e

18.02.2020 minor adaptations for RAN #87e

14.11.2019 minor adaptations for RAN #86

18.08.2019 minor adaptations for RAN #85

12.05.2019 minor adaptations for RAN #84

27.02.2019 minor adaptations for RAN #83

21.11.2018 completion levels with colours added (for RAN #82)

v04.81 31.07.2018 simplification of template and addition of cross-TSG aspects (for RAN #81)

v04.80 21.05.2018 minor adaptations for RAN #80

v04.79 26.02.2018 minor adaptations for RAN #79

v04.78 18.11.2017 minor adaptations for RAN #78

v04.77 06.08.2017 minor adaptations for RAN #77

v04.76 15.05.2017 minor adaptations for RAN #76

v04.75 31.01.2017 minor adaptations for RAN #75

v04.74 28.10.2016 minor adaptations for RAN #74

v04.73 01.09.2016 adaptations for RAN #73 (time units in extra Excel table, RAN6 reporting included)

v04.72 26.05.2016 adaptations for RAN #72 (introduction of NR & GERAN TUs)

v04.71 10.02.2016 minor adaptations for RAN #71

v04.70 30.10.2015 minor adaptations for RAN #70

v04.69 12.08.2015 minor adaptations for RAN #69

v04.68 21.05.2015 minor adaptations for RAN #68

v04.67 01.02.2015 minor adaptations for RAN #67

v04.66 16.11.2014 minor adaptations for RAN #66

v04.65 16.08.2014 minor adaptations for RAN #65

v04.64 22.05.2014 minor adaptations for RAN #64

v04.63 24.01.2014 restructuring for RAN #63 to cover Core & Perf. in one doc file

v03.62 11.11.2013 section 1.2.3 adapted for RAN #62

v03 11.08.2013 section 1.2.3 added on time budget

v02 07.05.2010 history added, some spelling corrections

v01 13.11.2009 First version of the template