3GPP TSG-RAN WG2 Meeting #116bis-e draftR2-2201788

**Electronic Meeting, Jan 17th - 25th 2022**

**Source: Document Rapporteur (Ericsson)**

**Title: RAN2 agreements for Rel-17 NB-IoT and LTE-MTC**

**Agenda Item: 9.1.1**

**Document for: Endorsement**

# 1 Introduction

This document lists RAN2 agreements made for Rel-17 “Additional enhancements for NB-IoT and LTE-M” work item (WI code NB\_IOTenh4\_LTE\_eMTC6; WID in [RP-201306](http://3gpp.org/ftp/tsg_ran/TSG_RAN/TSGR_88e/Docs/RP-201306.zip)), until and including the RAN2#116bis-e, January 17th – 25th 2022.

NOTE: Email agreements for CRs/specific topics are not listed in this document.

# 2 Additional enhancements for NB-IoT and LTE-MTC

## 2.1 Organizational

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| RAN2#111-e agreements:* Will maintain a document similar to the one used in R16 for capturing agreements.
* The endorsed report can be provided in R2-2008309.
* [Post111-e][350][NBIOT/eMTC R17] Capture the agreements (Ericsson)
	+ - Scope: Capture the agreements.
		- Intended outcome: endorsed report in R2-2008309
		- Deadline: Friday, 2020-09-04 13:00 UTC

RAN2#112-e agreements: None (except for this document, see clause 5)RAN2#113-e agreements: None (except for this document, see clause 5)RAN2#113bis-e agreements: None (except for this document, see clause 5)RAN2#114-e agreements: None (except for this document, see clause 5)RAN2#115-e agreements: None (except for this document, see clause 5)RAN2#116-e agreements: None (except for this document, see clause 5)RAN2#116bis-e agreements: None (except for this document, see clause 5) |

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

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| RAN2#111-e agreements:* Study current RLF procedure to understand the time taken to select the cell for access. Start and end points FFS.
* Support neighbour cell measurements in RRC\_CONNECTED, at least for intra-frequency.
	+ - FFS inter-frequency
		- FFS whether measurements are done on the anchor carrier
		- FFS how neighbour cell measurement is triggered
		- FFS how to perform neighbour cell measurements
* Working assumption: Neighbour cell measurement results are not reported to the network in RRC\_CONNECTED.
	+ - FFS whether and when other information can be sent

RAN2#112-e agreements:* Enhancements to the random-access procedure are not considered.
* The solution includes reduction of the time between declaration of RLF and the start of the random-access procedure (points C and D)
* FFS whether the solution includes reduction of the time between out-of-sync detection and declaration of RLF (points B and C)

RAN2#113-e agreements:* Neighbour cells measurement (detection and measurements) are performed only on the anchor carrier.
* The solution is optional

[R2-2102165](http://ftp.3gpp.org/tsg_ran/WG2_RL2/TSGR2_113-e/Docs/R2-2102165.zip) LS on neighbour cell measurement in NB-IoT RRC\_CONNECTED state LS out Rel-17 To: RAN4. NB\_IOTenh4\_LTE\_eMTC6-CoreRAN2#113bis-e agreements: NoneRAN2#114-e agreements:* The criteria to start measurements is based on a combination of serving cell quality threshold (option b) and variance of the serving cell quality (option c)
* Configuration of the criteria to start the measurements is supported.
	+ - FFS whether any further information needs to be provided by NW
* FFS whether any assistance information from UE is needed.
* FFS if/how to support ‘early’ RLF.

RAN2#115-e agreements:* The configuration of the criteria for starting the measurements include a serving cell NRSRP threshold. FFS how to address variance (as agreed last meeting)
* It is useful to have a shorter T310 timer for UEs supporting this enhancement, but FFS whether this is best achieved with the existing dedicated signalling or based on a new condition
* Prioritisation of carriers/cells to measure is left to the UE implementation.
* FFS: whether to provide a separate criteria for inter-frequency measurements (i.e., needing re-tuning) considering that they will take longer and should start earlier.
* Legacy relaxed monitoring criteria is reused to address the variance part of the criteria to start the measurements.
	+ - FFS: Whether it is enabled by the provision of separate SSearchDeltaP and TSearchDeltaP parameters from RRC\_IDLE.
* The conditions where the UE is required to perform measurements are specified. No requirement on when to stop measurements is needed.
* The configuration of the criteria for starting the measurements is provided via broadcast signalling.
* Provision of information regarding which cells/carriers to be considered is not supported. It is up to UE implementation to choose and prioritize carrier/cell list for measurement.
* Report of the cells measured in RRC\_IDLE to assist measurement configuration is not supported.
* Report of information about connected measurements during the RRC Connection re-establishment procedure for network optimisation is not supported.
* There is no need to specify which subframes can be used for measurements beyond them not being needed for PDCCH monitoring or data transmission / reception.
* Support for connected mode measurement is optional with capability signalling.
* FFS: Whether to support an indication from the UE that it starts/ stops performing measurement

RAN2#116-e agreements:* NW signals two separate thresholds for intra- and inter-frequency measurements.
* The values of s-SearchDeltaP and TSearchDeltaP may be different in RRC\_CONNECTED and RRC\_IDLE, they are signalled in a separate set of parameters.
* s-SearchDeltaP has the same value range as the existing RRC\_IDLE parameter
* FFS how to specify the state change
* [FFS] An indication that the UE starts measurement is not introduced.
* No enhancement is introduced to have a shorter T310 timer for mobile UEs supporting connected mode measurement.
* For RRC\_CONNECTED state, TSearchDeltaP is configured via SIB.
* Working assumption: For RRC\_CONNECTED state, TSearchDeltaP range is 10 – 60 seconds.
* For RRC\_CONNECTED state, no default value for TSearchDeltaP.
* No limit for how long UE can remain in relaxed neighbour cell monitoring state while it is in RRC\_CONNECTED state.
* For RRC\_CONNECTED state, the RRC\_IDLE state SSearchDeltaP is not used if the RRC\_CONNECTED state SSearchDeltaP is not provided.
* Relaxed neighbour cell monitoring is enabled in RRC\_CONNECTED state if TSearchDeltaP and SSearchDeltaP for RRC\_CONNECTED state are provided.

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).
* FFS: whether the RRC\_CONNECTED state reference level is derived by taking the RRC\_IDLE state reference level and adjusted by *nrs-PowerOffsetNonAnchor* for the connected mode carrier.
* FFS: whether UE reports to NW when the criteria is met.
* 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.
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## 2.3 NB-IoT carrier selection based on the coverage level, and associated carrier specific configuration

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| RAN2#111-e agreements:* Paging carrier selection Improvements based on CE level is considered
* Paging carrier selection Improvements based on DRX cycle may be considered
	+ - whether DRX cycle is considered as part of CE level (Rmax) or can be also considered separately
* Enhancements for NPRACH Carrier selection carrier may be considered
* Paging carrier selection Improvements solely based on WUS or GWUS is not considered
* FFS service based

RAN2#112-e agreements: NoneRAN2#113-e agreements:* Select between one of the options:
	+ - Option 1: UE selects a paging carrier based on a rule configured by the network
		- Option 2: NW configures a specific paging carrier
* Working assumption: For both options, when coverage changes, mechanism that requires UE to report the update of coverage is not introduced.

RAN2#113bis-e agreements: NoneRAN2#114-e agreements:* Rel-17 paging carriers and the legacy paging carriers should be exclusive.
* RAN2 assumes S1AP/NGAP update is not needed.
* Carrier selection criteria does not include power boosting or service
* FFS: For option 1, whether DRX can be part of the carrier selection criteria
* Rel-17 paging carrier configuration is provided in broadcast signalling.
* Select between the following sub-options:
	+ - Option 1c: Network enables UE to select a Rel-17 paging carrier by providing the coverage information (CEL/Rmax) for the carrier selection to the UE in dedicated signalling
		- Option 2a: NW indicates the carrier to use explicitly via dedicated signalling based on information determined within the NW.
		- FFS for both options whether there is a report from the UE to suggest a carrier or provide a metric report
* Working assumption: UE metric for determining carrier suitability and selection is based on measured NRSRP. FFS whether to use a hysteresis/longer averaging/timer
* For option 1, upon cell change, FFS:
	+ - Alt 1: based on previously determined CEL and broadcasted paging carrier configuration in the new cell.
		- Alt 2: UE needs to perform fallback mechanism.
* For option 2, upon cell change, UE needs to perform fallback mechanism.
* Whenever the R17 coverage-based carrier criteria is met, UE uses the R17 coverage based carrier, otherwise UE should use the fallback mechanism
* For both options, fall back carrier is legacy paging carrier based on UE\_ID

RAN2#115-e agreements:* Support coverage or carrier specific DRX configurations, FFS details.
* UE capability for Rel-17 paging carrier selection should be introduced
* UE metric for determining carrier suitability and selection is based on NRSRP.
* Use a hysteresis/longer averaging/timer for UE metric based on NRSRP.
* FFS whether to introduce new UE report and/or whether to mandate support of existing Msg5 reporting.

RAN2#116-e agreements:* DRX is not used a criterion that needs to be explicitly considered for paging carrier selection.
* Option 1c with Alt2 (fallback when cell change) is supported

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*.
* FFS whether to send LS to RAN3 (at the start of the next meeting)
* 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.
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## 2.4 Other

### NB-IoT 16-QAM for unicast in UL and DL

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| RAN2#113bis-e agreements:* Working assumption: For the UE supporting 16-QAM, the L2 buffer size is 12000 bytes.
* Working assumption: Support of 16-QAM has separate UE capabilities for DL and UL

RAN2#114-e agreements: NoneRAN2#115-e agreements:* Confirm the working assumption: The support of 16-QAM uses separate UE capabilities for DL and UL.
* 16QAM is configured via dedicated signaling separately for UL and DL.
* A NPUSCH 16QAM activation indication is needed in PUR configuration.

RAN2#116-e agreements:* Confirm the working assumption of 12000 bytes for DL 16QAM for NB-IoT

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.
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### LTE-MTC 14 HARQ processes in DL for HD-FDD Cat M1 UEs

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| RAN2#113bis-e agreements:* 14 HARQ activation is configured by dedicated RRC signalling.
* Working assumption: No change to current L2 buffer size requirement

RAN2#114-e agreements: NoneRAN2#115-e agreements:* Confirm the working assumption: No change to current L2 buffer size requirement for HD-FDD Cat M1 UEs supporting 14 HARQ processes in DL.

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.
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### LTE-MTC Max DL TBS of 1736 bits for HD-FDD Cat. M1 UEs in CE mode A only

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| RAN2#113bis-e agreements:* DL TBS of 1736 bits is configured by dedicated RRC signalling.
* FFS: Whether to update L2 buffer size requirement

RAN2#114-e agreements: NoneRAN2#115-e agreements:* The table 4.1A-1 in TS 36.306 for DL Category M1 needs to be updated to indicate 1736 bits TBS and 43008 soft channel bits.
* Max DL TBS of 1736 bits can be supported for PUR.
* FFS EDT support.

RAN2#116-e agreements:* No change to existing L2 buffer requirements for supporting 1736bits TBS for eMTC.

RAN2#116bis-e agreements:* Support for maximum DL TBS of 1736 bits is indicated without EPC/5GC differentiation
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# 3 References: List of approved outgoing Rel-17 LSs

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| **Tdoc** | **Meeting** | **Title** | **WI** | **To** | **Cc** |
| R2-2102165 | RAN2#113-e | LS on neighbour cell measurement in NB-IoT RRC\_CONNECTED state | NB\_IOTenh4\_LTE\_eMTC6-Core | RAN4 |  |
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# 4 References: Reports from the breakout session

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| **Meeting** | **Date** | **Title** | **Tdoc** |
| RAN2#111-e, Online | 17-28 August 2020 | Report NB-IoT breakout session | R2-2008127 |
| RAN2#112-e, Online | 2-13 November 2020 | Report NB-IoT breakout session | R2-2010707 |
| RAN2#113-e, Online | Jan 25 - Feb 5 2021 | Report NB-IoT breakout session | R2-2101957 |
| RAN2#113bis-e, Online | 12 - 20 April 2021 | Report NB-IoT breakout session | R2-2104307 |
| RAN2#114-e, Online | 19 – 27 May 2021 | Report NB-IoT breakout session | R2-2106477 |
| RAN2#115-e, Online | 9 - 27 August 2021 | Report NB-IoT breakout session | R2-2108837 |
| RAN2#116-e, Online | 1 – 12 November 2021 | Report NB-IoT breakout session | R2-2111297 |
| RAN2##116bis-e, Online | 17 – 25 January 2022 | Report NB-IoT breakout session | R2-2201667 |

# 5 Change history

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| **Tdoc** | **Title** | **Comment** |
| R2-2008309 | RAN2 agreements for Rel-17 additional enhancements for NB-IoT & LTE-MTC | Post RAN2#111-e  |
| R2-2010911 | RAN2 agreements for Rel-17 additional enhancements for NB-IoT & LTE-MTC | Post RAN2#112-e |
| R2-2102164 | RAN2 agreements for Rel-17 additional enhancements for NB-IoT & LTE-MTC | Post RAN2#113-e |
| R2-2104451 | RAN2 agreements for Rel-17 additional enhancements for NB-IoT & LTE-MTC | Post RAN2#113bis-e |
| R2-2106602 | RAN2 agreements for Rel-17 additional enhancements for NB-IoT & LTE-MTC | Post RAN2#114-e |
| R2-2108974 | RAN2 agreements for Rel-17 additional enhancements for NB-IoT & LTE-MTC | Post RAN2#115-e |
| R2-2111396 | RAN2 agreements for Rel-17 additional enhancements for NB-IoT & LTE-MTC | Post RAN2#116-e |
| R2-2201788 | RAN2 agreements for Rel-17 additional enhancements for NB-IoT & LTE-MTC | Post RAN2#116bis-e |