**3GPP TSG RAN WG1 #107-e R1-21nnnnn**

**e-Meeting, November 11th – 19th, 2021**

**Agenda item:** 8.16

**Source:** Moderators (AT&T, NTT DOCOMO, INC.)

**Title:** Updated RAN1 UE features list for Rel-17 LTE after RAN1 #107-e

**Document for:** Information

1. Introduction

This contribution includes the updated RAN1 UE features list for Rel-17 LTE after RAN1 #107-e.

1. NB\_IOTenh4\_LTE\_eMTC6

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| Features | Index | Feature group | Components | Prerequisite feature groups | Need for the eNB to know if the feature is supported | [Need for the UE to know if the feature is supported (only for V2X WI, where the PC5-RRC capability signalling is delivered between the UEs)] | **Consequence if the feature is not supported by the UE** | **Type****(the ‘type’ definition from UE features should be based on the granularity of 1) Per UE or 2) Per Band or 3) Per BC or 4) Per FS or 5) Per FSPC)** | Need of FDD/TDD differentiation | Capability interpretation for mixture of FDD/TDD | Note | Mandatory/Optional |
| 1. NB\_IOTenh4\_LTE\_eMTC6 | 1-1 | 16-QAM for unicast NPDSCH | 1. Reception of unicast NPDSCH modulated with 16-QAM2. CQI report to support 16-QAM modulation3. Downlink power allocation for 16-QAM | Category NB-2 | Yes | N/A | The network cannot schedule a unicast NPDSCH modulated with 16-QAM for the UE | Per UE | [Yes] | N/A | It is RAN1 assumption that 16-QAM for unicast in DL is compatible with all other NB-IoT features in connected-mode plus PUR | Optional with capability signaling |
| 1. NB\_IOTenh4\_LTE\_eMTC6 | 1-2 | 16-QAM for unicast NPUSCH | 1. Transmission of unicast NPUSCH modulated with 16-QAM2. New term in the UE’s transmit power control equation. | Category NB-2 | Yes | N/A | The network cannot schedule a unicast NPUSCH modulated with 16-QAM for the UE | Per UE | [Yes] | N/A | It is RAN1 assumption that 16-QAM for unicast in UL is compatible with all other NB-IoT features in connected-mode plus PUR | Optional with capability signaling |
| 1. NB\_IOTenh4\_LTE\_eMTC6 | 1-3 | 14 HARQ processes for PDSCH for HD-FDD Cat. M1 UEs | 1. Support of 14 DL HARQ processes for unicast in HD-FDD in CE mode A in RRC\_CONNECTED2. PDSCH scheduling delay3. HARQ-ACK delay solution with Alt-1 and Alt-2e | 1. Category M12. HD-FDD | Yes | N/A | The network cannot enable 14 HARQ processes for the UE | Per UE | FDD only | N/A | * PDSCH scheduling delay:
	+ 2 BL/CE DL subframes.
	+ 1 BL/CE DL subframe + 1 subframe + 3 BL/CE UL subframes + 1 subframe + 1 BL/CE DL subframe.
	+ 1 subframe + 3 BL/CE UL subframes + 1 subframe + 2 BL/CE DL subframes.
* HARQ-ACK delay:
	+ Alt-1: The HARQ-ACK delay is determined through an expression consisting of different subframe types (Using a similar principle as the PDSCH scheduling delay).
	+ Alt-2e: The HARQ-ACK delay is determined following the legacy approach. That is, the “HARQ-ACK delay” is kept expressed in terms of “absolute subframes”.

For component 3, UE reports one of {Alt-1, Alt-1 and Alt-2e} | Optional with capability signaling |
| 1. NB\_IOTenh4\_LTE\_eMTC6 | 1-4 | A maximum DL TBS of 1736 bits for HD-FDD Cat. M1 UEs in CE mode A only | 1. Support of 1736 bits max DL TBS for unicast in HD-FDD in CE mode A in RRC\_CONNECTED | 1. Category M12. HD-FDD | Yes | N/A | The network cannot schedule a PDSCH with TBS larger than 1000 bits for Cat. M1 UEs | Per UE | FDD only | N/A |  | Optional with capability signaling |

1. LTE\_NBIOT\_eMTC\_NTN

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| Features | Index | Feature group | Components | Prerequisite feature groups | Need for the eNB to know if the feature is supported | [Need for the UE to know if the feature is supported (only for V2X WI, where the PC5-RRC capability signalling is delivered between the UEs)] | **Consequence if the feature is not supported by the UE** | **Type****(the ‘type’ definition from UE features should be based on the granularity of 1) Per UE or 2) Per Band or 3) Per BC or 4) Per FS or 5) Per FSPC)** | Need of FDD/TDD differentiation | Capability interpretation for mixture of FDD/TDD | Note | Mandatory/Optional |
| 2. LTE\_NBIOT\_eMTC\_NTN | 2-1 | Basic IoT over NTN support | 1. UE derives its position based on its GNSS measurements[1-1. UE report the validity duration of GNSS]2. Receive serving satellite ephemeris in either state vector format or orbital element format 4. UE specific TA calculation in RRC\_IDLE and RRC\_CONNECTED state based on its GNSS-acquired position and the serving satellite ephemeris6. UE applies common TA in RRC\_IDLE and RRC\_CONNECTED according to the parameters provided by the network (UE considers common TA as 0 if the parameter is not provided)[7. For TA update in RRC\_CONNECTED state, combination of both open (i.e. UE autonomous TA estimation, and common TA estimation) and closed (i.e., received TA commands) control loops]8. In RRC\_IDLE and RRC\_CONNECTED state, UE calculates frequency pre-compensation to counter shift the Doppler experienced on the service link [in DL] [and] [in UL]10. Support a validity timer of UL synchronization is configured by the network 13. UE applies cell specific K\_offset in timing relationship enhancements14.UE estimates UE-gNB RTT[15. delaying the starts of ra-ResponseWindow][16. UE receives cell specific K\_mac]17. In RRC\_IDLE state and RRC\_CONNECTED state, pre-compensate the calculated frequency offset and TA in uplink transmissions |  | Yes | N/A | Release 17 UE cannot access [NTN/satellite] | [per UE/per band] | No | No | FFS: whether this feature group needs to be separate for eMTC and NB-IoT | Optional with capability signallingFor UEs supporting NB-IoT/eMTC NTN, it must indicate this FG is supported[Note: This UE feature group is applicable only for IoT-NTN cell, for terrestrial cell this feature is not supported] |
| 2. LTE\_NBIOT\_eMTC\_NTN | 2-1a | Segment duration configuration | Support segment duration configuration by the network  |  | Yes | N/A | Release 17 UE cannot access [NTN/satellite] | [Per UE/per band] | No | No | For UEs support NSGO scenarios, it must indicate this FG is supported. | Optional with capability signalling[Note: This UE feature group is applicable only for IoT-NTN cell, for terrestrial cell this feature is not supported] |
| 2. LTE\_NBIOT\_eMTC\_NTN | 2-2 | Enhancing timing relationships using a time offset | 1. UE applies UE specific K\_offset in timing relationship enhancements
 | 2-1 [, 2-3] | Yes  | N/A | UE does not know the offset to apply for UL transmission  | [per UE/per band] | No | No | The K\_offset is a scheduling offset used for the identified timing relationships that need to be modified for IoT NTN. For IoT NTN, support cell-specific Koffset configuration for use during initial access.For IoT NTN, support the use of UE-specific Koffset in CONNECTED mode.FFS: whether this feature group needs to be separate for eMTC and NB-IoTFFS: differentiation based on orbits such as LEO/MEO/GEO | Optional with capability signallingFFS: For UEs supporting NB-IoT/eMTC NTN, it must indicate this FG is supported |
| 2. LTE\_NBIOT\_eMTC\_NTN | 2-3 | UE specific TA pre-compensation reporting | 1. [Support reporting of information about the UE specific TA pre-compensation]
 | 2-1 | Yes | No | UL scheduling for FDD-HD: Use of UE-specific TA and/or K\_offset to avoid UL-DL collisions in FDD-HD | [per UE/per band] | No | No | UE-specific TA reporting is supported in IoT-NTNFFS: Detailed contents of reportFFS: whether this feature group needs to be separate for eMTC and NB-IoTFFS: differentiation based on orbits such as LEO/MEO/GEO | Optional with capability signallingFFS: For UEs supporting NB-IoT/eMTC NTN, it must indicate this FG is supported |

1. LTE\_terr\_bcast\_bands\_part1

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| Features | Index | Feature group | Components | Prerequisite feature groups | Need for the eNB to know if the feature is supported | [Need for the UE to know if the feature is supported (only for V2X WI, where the PC5-RRC capability signalling is delivered between the UEs)] | **Consequence if the feature is not supported by the UE** | **Type****(the ‘type’ definition from UE features should be based on the granularity of 1) Per UE or 2) Per Band or 3) Per BC or 4) Per FS or 5) Per FSPC)** | Need of FDD/TDD differentiation | Capability interpretation for mixture of FDD/TDD | Note | Mandatory/Optional |
| 3. LTE\_terr\_bcast\_bands\_part1 | 3-1 | Support of new channel bandwidth for PMCH | [TBD: whether separate components are neded for different bandwidths] | Support of dedicated MBMS cells | Yes |  | UE cannot receive MBMS in the corresponding MBSFN area | Per band | N/A | N/A |  | Optional with capability signaling |

1. [NR\_SL\_enh]

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| 4. [NR\_SL\_enh] | 4-1 | [Receiving NR sidelink of PSCCH/PSSCHPSFCH/S-SSB] | 1) UE can receive NR PSCCH/PSSCH/PSFCH/S-SSB. | None | [Yes] | [No] |  | [Per band] | N.A. | N.A. |  | Optional with capability signalling.FFS: For UE supports LTE Uu configuring NR sidelink, UE must indicate this FG is supported. |
| 4-2 | [Receiving NR sidelink of PSFCH/S-SSB only] | 1) UE can receive NR PSFCH/S-SSB only. | None | [Yes] | [No] |  | [Per band] | N.A. | N.A. |  | Optional with capability signalling.FFS: For UE supports LTE Uu configuring NR sidelink, UE must indicate this FG is supported. |
| 4-3 | Transmitting NR sidelink mode 2 with full sensing | 1) UE can transmit PSCCH/PSSCH using NR sidelink mode 2 with full sensing configured by LTE Uu.2) UE supports the sensing and resource allocation operation as specified in Rel-16. | [4-1] | [Yes] | [No] | [UE can perfom random resource selection only] | [Per band] | N.A. | N.A. |  | Optional with capability signalling.FFS: For UE supports LTE Uu configuring NR sidelink, UE must indicate this FG is supported. |
| 4-4 | Transmitting NR sidelink mode 2 with partial sensing | 1) UE can transmit PSCCH/PSSCH using NR sidelink mode 2 with partial sensing configured by LTE Uu.2) UE can perform periodic-based partial sensing and resource allocation operation.3) UE can perform contiguous partial sensing and resource allocation operation. | [4-1], [4-3] | [Yes] | [No] | UE does not support trasmissoin according to the partial sensing and resource allocation | [Per band] | N.A. | N.A. |  | Optional with capability signalling.FFS: For UE supports LTE Uu configuring NR sidelink, UE must indicate this FG is supported. |
| 4-5 | Inter-UE coordination in NR sidelink mode 2 | 1) UE can transmit and receive inter-UE coordination information of preferred resource set/non-preferred resource set and use the received information in its own resource (re-)selection in NR sidelink mode 2.2) UE can transmit and receive inter-UE coordination information of presence of expected/potential resource conflict and use the received information in its own resource re-selection in NR sidelink mode 2.3) UE can transmit and received an explicit request for inter-UE coordination information of [FFS: preferred resource set only or both preferred resource set and non-preferred resource set]. | [4-1] | [Yes] | [Yes] | UE does not support inter-UE coordination in NR sidelink mode 2. | [Per band] | N.A. | N.A. |  | Optional with capability signalling.FFS: For UE supports LTE Uu configuring NR sidelink, UE must indicate this FG is supported. |