3GPP TSG-RAN WG2 #129bis R2-2503175

Wuhan, China, April 7th – 11th, 2025

**Title:** **[**Draft] LS on CB-msg3-EDT

**Response to:**

**Release:** Rel-19

**Wrork Item:** IoT\_NTN\_Ph3-Core

**Source:** MediaTek [to be RAN2]

**To:** RAN1

**Cc:**

**Contact Person:**

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**1. Overall Description**

RAN2 has discussed below objective in IoT NTN WID.

* + Study and specify, if beneficial the following enhancements to reduce the necessary uplink and downlink signaling to complete an Early Data Transmission (EDT) transaction [RAN2]:
		- Msg3 transmission without msg1/ Random Access Response (RAR)
		- Efficient delivery (reduced overhead) of msg4 / RRCEarlyDataComplete
		- Study and specify RRM requirement, if identified [RAN4]

This feature is now referred to as CB-Msg3-EDT procedure (tentatively). RAN2 has agreed to introduce the shared resource configuration in system information for CB-Msg3-EDT procedure. This configuration is used for the UE to transmit Msg3 on a PUSCH channel in a contention-based manner and to receive Msg4. RAN2 assumes that the configuration introduced for PUR could be reused as much as possible in the shared resource configuration for both eMTC and NB-IoT. RAN2 also assumes that the shared resource configuration is per CE level. Since the configuration is mainly L1 parameters, RAN2 kindly request RAN1 help to finalize the signaling design.

RAN2 has reached below agreements related to shared resource configuration.

In RAN2#129

RAN2 #129 Agreements:

1. RAN2 assumes that at least the following will be part of the shared resources configuration for CB-msg3 (FFS on other aspects)

 - Time domain resources for (N)PUSCH occasions: periodicity and start time (e.g., start subframe, start SFN)

 - Frequency domain resources for (N)PUSCH occasions

 - repetition number

 - (N)PDCCH resource

 - MCS

6. As Signalling design Baseline RAN2 assumes the PUR config and the NPRACH config for shared (N)PUSCH config can be used and some of the parameters can be included in a new CB EDT config.

In RAN2#129bis

Agreements;

4. We don’t introduce support for eMTC CE mode B case (it will not be possible to signal resources to be used for this case)

5. We specify support for NB-IoT with 15kHz with no specific enhancements, leaving to NW implementation whether to implement this or not, accepting potential performance degradation.

7. The start of CB-msg3 EDT transmission window is aligned with the start of time domain (N)PUSCH resource.

8. The CB-msg3 EDT transmission window length and periodicity may be different. FFS on possible signalling optimization in case the length and periodicity are the same.

9. RAN2 assumes power ramping should be supported for CB-msg3-EDT (for both eMTC and NB-IoT) should be supported and will ask RAN1 for confirmation and in case which parameters should apply

(CB-Msg3-EDT configuration for eMTC)

10. For eMTC, introduce a new IE (e.g. CB-Msg3-ConfigSIB-r19) for shared resources configuration of CB-Msg3 in SIB2.

11. For eMTC, introduce MPDCCH configuration in shared resources configuration. The fields in IE PUR-MPDCCH-Config-r16 could be reused as baseline. Confirm with RAN1 on the detail parameters (e.g. whether additional narrow band is needed).

12. We will not support TDD related parameters.

13. For eMTC, introduce PUSCH configuration in shared resources configuration. The fields in IE PUR-PUSCH-Config-r16 could be reused as baseline. Confirm with RAN1 on the detail parameters. (e.g. whether pusch-CyclicShift-r16, pusch-NB-MaxTBS-r16 are needed, whether prb-AllocationInfo should be defined as a “set” format with intention to provide a set of shared frequency-domain resources).

14. For eMTC, check with RAN1 if anything is needed for PDSCH configuration in shared resources configuration

15. For eMTC, introduce PUCCH configuration in shared resources configuration. The fields in IE PUR-PUCCH-Config-r16 could be reused as baseline. Confirm with RAN1 on the detail parameters.

(CB-Msg3 configuration for NB-IoT)

16. For NB-IoT, introduce a new IE (e.g. CB-Msg3-ConfigSIB-NB-r19) for shared resources configuration of CB-Msg3 in SIB2-NB and SIB22-NB for non-anchor carrier.

17. For NB-IoT, introduce below physical layer parameters in shared resources configuration as below:

 - Number of resource units for NPUSCH (as in npusch-NumRUsIndex-r16)

 - Number of repetitions for NPUSCH (as in npusch-NumRepetitionsIndex-r16)

 - Set of subcarriers (similar to npusch-SubCarrierSetIndex but change it to a “set”), FFS whether subcarriers are provided as a contiguous set.

 - MCS configuration for NPUSCH (as in npusch-MCS-r16).

 - PDCCH parameters (as in NPDCCH-ConfigDedicated-NB-r13)

 - The non-anchor carrier index for monitoring Msg4. If this field is absent, anchor carrier is assumed to be used.

 NOTE: confirm with RAN1 is needed

Agreements (part3):

1. The CB-msg3-EDT configuration (e.g., number of replicas, number of time resources and number of frequency resources) is CE level specific.

RAN2 kindly asks RAN1 on how to define the L1 parameters for this procedure:

**Q1**: For both eMTC and NB-IoT, RAN2 assumes power ramping should be supported for CB-msg3-EDT. RAN2 would like to confirm with RAN1 on whether to have power ramping on this Msg3 (re-)transmission. If RAN1 confirms, please provide the control parameters for power ramping.

**Q2**: For eMTC, RAN2 agrees to have MPDCCH configuration for shared resource configuration and decides to reuse the parameters from PUR MPDCCH configuration (in IE *PUR-MPDCCH-Config-r16*, as below) as baseline. RAN2 think TDD parameter is not needed and maybe narrowband configuration should be defined as a set, not one single narrow band. RAN2 would like to check with RAN1 on how to define the detail MPDCCH configuration.

PUR-MPDCCH-Config-r16 ::= SEQUENCE {

 mpdcch-FreqHopping-r16 BOOLEAN,

 mpdcch-Narrowband-r16 INTEGER (1..maxAvailNarrowBands-r13),

 mpdcch-PRB-PairsConfig-r16 SEQUENCE{

 numberPRB-Pairs-r16 ENUMERATED {n2, n4, n6, spare1},

 resourceBlockAssignment-r16 BIT STRING (SIZE(4))

 },

 mpdcch-NumRepetition-r16 ENUMERATED {r1, r2, r4, r8, r16, r32, r64, r128, r256},

 mpdcch-StartSF-UESS-r16 CHOICE {

 fdd ENUMERATED {v1, v1dot5, v2, v2dot5, v4, v5, v8, v10},

 ~~tdd ENUMERATED {v1, v2, v4, v5, v8, v10, v20, spare1}~~

 },

 mpdcch-Offset-PUR-SS-r16 ENUMERATED {zero, oneEighth, oneQuarter,

 threeEighth, oneHalf, fiveEighth,

 threeQuarter, sevenEighth}

}

**Q3**: For eMTC, RAN2 agrees to have PUSCH configuration for shared resource configuration and decides to reuse the parameters from PUR PUSCH configuration (in IE *PUR-PUSCH-Config-r16*, as below) as baseline. RAN2 has some questions on some parameters:

* Whether *pusch-CyclicShift-r16* and *pusch-NB-MaxTBS-r16* are needed
* Whether *prb-AllocationInfo* should be defined as a “set” format with intention to provide a set of shared frequency-domain resources

Note that:

* CE mode B related parameters will not be included as RAN2 agreed to preclude CE mode B.
* The power related parameters (*p0-UE-PUSCH-r16* and *alpha-r16*) should be updated based on the result of Q1.

RAN2 would like to check with RAN1 on how to define the detail PUSCH configuration.

PUR-PUSCH-Config-r16 ::= SEQUENCE {

 pur-GrantInfo-r16 CHOICE {

 ce-ModeA SEQUENCE {

 numRUs-r16 BIT STRING (SIZE(2)),

 prb-AllocationInfo-r16 BIT STRING (SIZE(10)),

 mcs-r16 BIT STRING (SIZE(4)),

 numRepetitions-r16 BIT STRING (SIZE(3))

 },

 ~~ce-ModeB SEQUENCE {~~

 ~~subPRB-Allocation-r16 BOOLEAN,~~

 ~~numRUs-r16 BOOLEAN,~~

 ~~prb-AllocationInfo-r16 BIT STRING (SIZE(8)),~~

 ~~mcs-r16 BIT STRING (SIZE(4)),~~

 ~~numRepetitions-r16 BIT STRING (SIZE(3))~~

 ~~}~~

 } OPTIONAL, -- Need ON

 pur-PUSCH-FreqHopping-r16 BOOLEAN,

 p0-UE-PUSCH-r16 INTEGER (-8..7),

 alpha-r16 Alpha-r12,

 pusch-CyclicShift-r16 ENUMERATED {n0, n6},

 pusch-NB-MaxTBS-r16 BOOLEAN,

 ~~locationCE-ModeB-r16 INTEGER (0..5) OPTIONAL – Cond SubPRB~~

}

**Q4**: For eMTC, RAN2 has discussed the PDSCH configuration for shared resource configuration. Some companies think PUR PDSCH configuration is configured according to UE capability, which is not the case for CB-Msg3/Msg4 configuration. So, RAN2 does not know whether the parameters of PUR PDSCH configuration (in *pur-PDSCH-FreqHopping* and *pur-PDSCH-maxTBS* within IE *PUR-Config-r16*) is needed. RAN2 would like to check with RAN1 on whether and how to define the detail PDSCH configuration.

PUR-Config-r16 ::= SEQUENCE {

 <Skip unrelated Part>

 pur-PDSCH-FreqHopping-r16 BOOLEAN,

 <Skip unrelated Part>

 ...,

 [[ pur-PDSCH-maxTBS-r17 BOOLEAN OPTIONAL -- Need ON

 ]]

}

**Q5**: For eMTC, RAN2 agrees to have PUCCH configuration for shared resource configuration and decides to reuse the parameters from PUR PUCCH configuration (in IE *PUR-PUCCH-Config-r16*, as below) as baseline. RAN2 would like to check with RAN1 on how to define the detailed PUCCH configuration.

PUR-PUCCH-Config-r16 ::= SEQUENCE {

 n1PUCCH-AN-r16 INTEGER (0..2047) OPTIONAL, -- Need ON

 pucch-NumRepetitionCE-Format1-r16 ENUMERATED {n1, n2, n4, n8} OPTIONAL -- Need ON

}

**Q6**: For NB-IoT, RAN2 agrees to reuse the physical layer parameters *pur-PhysicalConfig-r16* in *PUR-Config-NB* as baseline. RAN2 assumes to have below parameters:

* Number of resource units for NPUSCH (as in *npusch-NumRUsIndex-r16*)
* Number of repetitions for NPUSCH (as in *npusch-NumRepetitionsIndex-r16*)
* Set of subcarriers (similar to *npusch-SubCarrierSetIndex* but change it to a “set”), FFS whether subcarriers are provided as a contiguous set.
* MCS configuration for NPUSCH (as in *npusch-MCS-r16*).

Note that the power parameters (*p0-UE-NPUSCH-r16* and *alpha-r16*) should be updated according to the result of Q1.

RAN2 would like check with RAN1 on how to define the detail physical layer parameters.

 pur-PhysicalConfig-r16 SEQUENCE {

 carrierConfig-r16 CarrierConfigDedicated-NB-r13,

 npusch-NumRUsIndex-r16 INTEGER (0..7),

 npusch-NumRepetitionsIndex-r16 INTEGER (0..7),

 npusch-SubCarrierSetIndex-r16 CHOICE {

 khz15 INTEGER (0..18),

 khz3dot75 INTEGER (0..47)

 },

 npusch-MCS-r16 CHOICE {

 singleTone INTEGER (0..10),

 multiTone INTEGER (0..13)

 },

 p0-UE-NPUSCH-r16 INTEGER (-8..7),

 alpha-r16 ENUMERATED {al0, al04, al05, al06,

 al07, al08, al09, al1},

 npusch-CyclicShift-r16 ENUMERATED {n0, n6},

 npdcch-Config-r16 NPDCCH-ConfigDedicated-NB-r13

 } OPTIONAL, -- Need ON

**Q7**: For NB-IoT, RAN2 agrees to have NPDCCH configuration for shared resource configuration and decides to reuse the parameters from PUR PDCCH configuration (in IE *NPDCCH-ConfigDedicated-NB-r13*, as below) as baseline. RAN2 would like to check with RAN1 on how to define the detail NPDCCH configuration.

NPDCCH-ConfigDedicated-NB-r13 ::= SEQUENCE {

 npdcch-NumRepetitions-r13 ENUMERATED {r1, r2, r4, r8, r16, r32, r64, r128,

 r256, r512, r1024, r2048,

 spare4, spare3, spare2, spare1},

 npdcch-StartSF-USS-r13 ENUMERATED {v1dot5, v2, v4, v8, v16, v32, v48, v64},

 npdcch-Offset-USS-r13 ENUMERATED {zero, oneEighth, oneFourth, threeEighth}

}

NPDCCH-ConfigDedicated-NB-v1530 ::= SEQUENCE {

 npdcch-StartSF-USS-v1530 ENUMERATED {v96, v128}

}

**Q8**: For both eMTC and NB-IoT, any other L1 parameters are needed for CB-Msg3-EDT procedure in additional to previous discussion?

In addition, RAN2 agrees that:

* Introduce a new RNTI (i.e. CB-RNTI) for CB-Msg4 monitoring and CB-Msg3 scrambling. We include this agreement in the LS to RAN1

RAN2 would like to inform RAN1 on the new RNTI for CB-Msg4 monitoring and CB-Msg3 scrambling. RAN2 has not yet made agreements on how to determine the RNTI, but RAN2 assumes there may be some potential RAN1 specification impact on this.

**2. Actions:**

**ACTION:** RAN2 respectfully requests RAN1 to take above RAN2 progress into account and provide feedback.

**3. Date of Next RAN2 Meetings:**

RAN2#130, Malta, 19-23 May. 2025

RAN2#131, Bangalore, 25-29 Aug. 2025