**3GPP TSG RAN WG1#110bis-e R1-2210393**

**e-Meeting, October 10th – 19th, 2022**

**Agenda item: 8.2**

**Source: Qualcomm Incorporated**

**Title: Summary #1 on email discussion on maintenance of channel access for NR in 52.6 to 71GHz band**

**Document for: Discussion and Decision**

# Introduction

For RAN1 #110bis-e, the following issues are captured from the papers submitted on the maintenance of channel access aspect of Rel.17 work item on extensing NR to 52.6 to 71 GHz band

**Table 1 – Identified issues for Channel Access Aspects**

|  |  |  |
| --- | --- | --- |
| **Issue#** | **Issue** | **References** |
| CA-1  | UL Contention Exempt Short Control Signaling : Duty Cycle and Enable Disable | Nokia, Nokia Shanghai Bell[R1-2210055]Intel Corporation[R1-2209032]Qualcomm Incorporated[R1-2209940]Oppo[R1-2208827][R1-2208826]ZTE, Sanechips[R1-2208705] |
| CA-2 | ChannelAccess-CPExt field Indication within RAR UL Grant and DCI formats 0\_1/1\_1 | NTT DOCOMO, INC.[R1-2210168]Huawei, HiSilicon[R1-2208477] vivo[R1-2208594]ZTE, Sanechips[R1-2208704]xiaomi[R1-2209250]LG Electronics[R1-2209447]Samsung[R1-2209692]Qualcomm Incorporated[R1-2209941]Nokia, Nokia Shanghai Bell [R1-2209432] |
| CA-3 | LBT Upgrade in COT Sharing and COT Resumption after a gap | WILUS Inc.[R1-2210137]CATT[R1-2208935][R1-2208934]Qualcomm Incorporated[R1-2209940]Nokia, Nokia Shanghai Bell[R1-2210053]  |
| CA-4 | Multi-Beam Channel Access : Independent per beam sensing procedure | Huawei, HiSilicon[R1-2208476]LG Electronics[R1-2209445]Samsung[R1-2209693]Huawei, HiSilicon[R1-2209845]Qualcomm Incorporated[R1-2209942]Qualcomm Incorporated[R1-2209943] |
| CA-5 | TCI State for Inter-Frequency RSSI | Ericsson [R1-2209183] [R1-2208182] |
| CA-6 | Sensing Beam for PUCCH or SRS | NTT DOCOMO, INC.[R1-2209868] |
| CA-7 | CSIRS Validation when CSI-RS is contention Exempt | AsusTek [R1-2207495] |
| CA-8 | Failure of Type 2 sensing  | WILUS Inc.[R1-2210136] |
| CA-9 | ED Threshold Editorial | Huawei, HiSilicon[R1-2209819] |
| CA-10 | Editorial*: beamCorrespondenceWithoutUL-BeamSweeping* | OPPO[R1-2208828] |
| CA-11 | Editorial*:* *csi-RS-ValidationWithDCI**CO-DurationsPerCell-r16* | ZTE, Sanechips[R1-2208706]ZTE, Sanechips[R1-2208707] |

Based on the preparation phase email discussion, issues CA-1, CA-2, CA-3, CA-4, and CA-6 will be discussed in this email thread. Additionally CA-10 and CA-11 will be discussed as editor’s alignment CR.

# Issue CA-2: Channel Access Indication in RAR UL Grant and non-fallback DCI

## Discussion

This discussion was addressed in Section 4-1 of [1]. The TP corresponding to ChannelAccess-CPext field in RAR UL grant was main open item.

On implementing the agreement on keeping 2 bits for ChannelAccess-CPext field in RAR UL grant, multiple companies provided CRs (Qualcomm, Huawei, ZTE, LGE, ZTE, Samsung). Samsung CR also includes considerations on PUSCH FDRA considerations. The TP from Samsung is copied blow:

===========================Start of TP 2-1============================

8.2 Random access response - Type-1 random access procedure

=============================== Unchanged Text Omitted ===================================

The ChannelAccess-CPext field indicates a channel access type and CP extension for operation with shared spectrum channel access [15, TS 37.213] in FR1 as defined in Table 7.3.1.1.1-4 in [5, TS 38.212] or Table 7.3.1.1.1-4A in [5, TS 38.212] if *channelAccessMode* = "*semiStatic*" is provided. The ChannelAccess-CPext field indicates a channel access type and CP extension for operation with shared spectrum channel access [15, TS 37.213] in FR2-2 as defined in Table 7.3.1.1.1-4B in [5, TS 38.212] if *ChannelAccessMode2-r17* is provided.

Table 8.2-1: Random Access Response Grant Content field size

|  |  |
| --- | --- |
| RAR grant field | Number of bits |
| Frequency hopping flag | 1 |
| PUSCH frequency resource allocation | 12, for operation with shared spectrum channel access in FR1 or for FR2-2 when *ChannelAccessMode2-r17* is provided14, otherwise |
| PUSCH time resource allocation | 4 |
| MCS | 4 |
| TPC command for PUSCH | 3 |
| CSI request | 1 |
| ChannelAccess-CPext | 2, for operation with shared spectrum channel access in FR1 or for FR2-2 when *ChannelAccessMode2-r17* is provided0, otherwise |

=============================== Unchanged Text Omitted ===================================

8.2A Random access response - Type-2 random access procedure

=============================== Unchanged Text Omitted ===================================

If the UE detects the DCI format 1\_0, with CRC scrambled by the corresponding MsgB-RNTI and LSBs of a SFN field in the DCI format 1\_0, if applicable, are same as corresponding LSBs of the SFN where the UE transmitted PRACH, and the UE receives a transport block in a corresponding PDSCH within the window, the UE passes the transport block to higher layers. The higher layers indicate to the physical layer

- an uplink grant if the RAR message(s) is for fallbackRAR and a random access preamble identity (RAPID) associated with the PRACH transmission is identified, and the UE procedure continues as described in clauses 8.2, 8.3, and 8.4 when the UE detects a RAR UL grant, or

- transmission of a PUCCH with HARQ-ACK information having ACK value if the RAR message(s) is for successRAR, where

- a PUCCH resource for the transmission of the PUCCH is indicated by PUCCH resource indicator field of 4 bits in the successRAR from a PUCCH resource set that is provided by *pucch-ResourceCommon*

- a slot for the PUCCH transmission is indicated by a HARQ Feedback Timing Indicator field of 3 bits in the successRAR having a value $k$ from {1, 2, 3, 4, 5, 6, 7, 8} for $μ\leq 3$, from {7, 8, 12, 16, 20, 24, 28, 32} for $μ=5$, and from {13, 16, 24, 32, 40, 48, 56, 64} for $μ=6$ and, with reference to slots for PUCCH transmission having duration $T\_{slot}$, the slot is determined as $n+k+∆+2^{μ}∙K\_{cell,offset}$, where $n$ is a slot of the PDSCH reception, $∆$ is as defined for PUSCH transmission in Table 6.1.2.1.1-5 of [6, TS 38.214], $μ$ is the SCS configuration of the active UL BWP, and $K\_{cell,offset}$ is provided by *CellSpecific\_Koffset*; otherwise, if not provided, $K\_{cell,offset}=0$

- the UE does not expect the first symbol of the PUCCH transmission to be after the last symbol of the PDSCH reception by a time smaller than $N\_{T,1}+0.5$ msec where $N\_{T,1}$ is the PDSCH processing time for UE processing capability 1 [6, TS 38.214]

- for operation with shared spectrum channel access in FR1, a channel access type and CP extension [15, TS 37.213] for a PUCCH transmission is indicated by a ChannelAccess-CPext field in the successRAR as defined in Table 7.3.1.1.1-4 in [5, TS 38.212] or Table 7.3.1.1.1-4A in [5, TS 38.212] if *channelAccessMode* = "*semiStatic*" is provided

- for operation with shared spectrum channel access in FR2-2, a channel access type and CP extension [15, TS 37.213] for a PUCCH transmission is indicated by a ChannelAccess-CPext field in the successRAR as defined in Table 7.3.1.1.1-4B in [5, TS 38.212] if *ChannelAccessMode2-r17* is provided

- the PUCCH transmission is with a same spatial domain transmission filter and in a same active UL BWP as a last PUSCH transmission

=============================== Unchanged Text Omitted ===================================

8.3 PUSCH scheduled by RAR UL grant

=============================== Unchanged Text Omitted ===================================

The frequency domain resource allocation is by uplink resource allocation type 1 [6, TS 38.214]. For an initial UL BWP size of $N\_{BWP}^{size}$ RBs, a UE processes the frequency domain resource assignment field as follows

- if $N\_{BWP}^{size}\leq 180$, or if $N\_{BWP}^{size}\leq 90$ for operation with shared spectrum channel access in FR1 or for FR2-2 when *ChannelAccessMode2-r17* is provided

- truncate the frequency domain resource assignment field to its $\left⌈log\_{2}\left({N\_{BWP}^{size}∙\left(N\_{BWP}^{size}+1\right)}/{2}\right)\right⌉$ least significant bits and interpret the truncated frequency resource assignment field as for the frequency resource assignment field in DCI format 0\_0 as described in [5, TS 38.212]

- else

- insert

- $\left⌈log\_{2}\left({N\_{BWP}^{size}∙\left(N\_{BWP}^{size}+1\right)}/{2}\right)\right⌉-14$$\left⌈log\_{2}\left({N\_{BWP}^{size}∙\left(N\_{BWP}^{size}+1\right)}/{2}\right)\right⌉-12$ most significant bits, for operation with shared spectrum channel access in FR1 or for FR2-2 when *ChannelAccessMode2-r17* is provided;

- $\left⌈log\_{2}\left({N\_{BWP}^{size}∙\left(N\_{BWP}^{size}+1\right)}/{2}\right)\right⌉-14$ most significant bits, otherwise;

with value set to '0' after the $N\_{UL,hop}$ bits to the frequency domain resource assignment field, where $N\_{UL,hop}=0$ if the frequency hopping flag is set to '0' and $N\_{UL,hop}$ is provided in Table 8.3-1 if the hopping flag bit is set to '1', and interpret the expanded frequency resource assignment field as for the frequency resource assignment field in DCI format 0\_0 as described in [5, TS 38.212]

- end if

=============================== Unchanged Text Omitted ===================================

Proposal 2-1

Adopt CR in R1-2209692 (TP 2-1 above)

|  |  |
| --- | --- |
| Company | View |
| Ericsson | Generally ok with the CR.  |
| Nokia, NSB | We are generally ok with Samsung’s CR. However, the second change in section 8.3. does not seem fully correct. The first equation should probably be deleted.  |
| CATT | OK. |
| Samsung | We support the CR as the proposing company.To Nokia, regarding the first change in section 8.3, we only move the equation from the end to the beginning, to make the whole sentence reads better, and no intention to change its technical meaning.  |
| Qualcomm | Support |
| Huawei, HiSilicon | We agree to the CR in principle, but in addition to Nokia’s comment, we think the following modification is necessary since there is no CP extension indicated by the field and the referenced Table 7.3.1.1.1-4A for operation with shared spectrum channel access in FR2-2: 8.2 Random access response - Type-1 random access procedure=============================== Unchanged Text Omitted ===================================The ChannelAccess-CPext field indicates a channel access type and CP extension for operation with shared spectrum channel access [15, TS 37.213] in FR1 as defined in Table 7.3.1.1.1-4 in [5, TS 38.212] or Table 7.3.1.1.1-4A in [5, TS 38.212] if *channelAccessMode* = "*semiStatic*" is provided. The ChannelAccess-CPext field indicates a channel access type for operation with shared spectrum channel access [15, TS 37.213] in FR2-2 as defined in Table 7.3.1.1.1-4B in [5, TS 38.212] if *ChannelAccessMode2-r17* is provided.…8.2A Random access response - Type-2 random access procedure=============================== Unchanged Text Omitted ===================================…- for operation with shared spectrum channel access in FR2-2, a channel access type [15, TS 37.213] for a PUCCH transmission is indicated by a ChannelAccess-CPext field in the successRAR as defined in Table 7.3.1.1.1-4B in [5, TS 38.212] if *ChannelAccessMode2-r17* is provided… |
| vivo | OK in principle. Same comment as Nokia to the equation. Fine with Huawei’s revision. |
| LG Electronics | We support the CR and in our understanding, Nokia's point is that the equation was moved to the last sentence, but it still remains undeleted in the CR. |

There are also CRs to clarify ChannelAccess-CPext field is not configured in non-fall back DCI in FR2-2 when ChannelAccessMode2-r17 is not configured.

Proposal 2-2

ChannelAccess-CPext field is not configured in non-fallback DCI in FR2-2 when ChannelAccessMode2-r17 is not configured

==== Start of TP 2-2 for 38.212 ===========

7.3.1.1.2 Format 0\_1

**<Unchanged Part Omitted>**

- ChannelAccess-CPext-CAPC – 0, 1, 2, 3, 4, 5 or 6 bits. The bitwidth for this field is determined as $\left⌈log\_{2}(I)\right⌉$ bits, where *I* is the number of entries in the higher layer parameter *ul-AccessConfigListDCI-0-1* or in Table 7.3.1.1.1-4A if *channelAccessMode-r16* = "*semiStatic*" is provided, for operation in a cell with shared spectrum channel access in FR1, or for operation in a cell with shared spectrum channel access in FR2-2 and if *ChannelAccessMode2-r17* is enabled; otherwise 0 bit. One or more entries from Table 7.3.1.1.2-35 or Table 7.3.1.1.2-35A are configured by the higher layer parameter *ul-AccessConfigListDCI-0-1.*

**<Unchanged Part Omitted>**

7.3.1.2.2 Format 1\_1

**<Unchanged Part Omitted>**

* ChannelAccess-CPext – 0, 1, 2, 3 or 4 bits. The bitwidth for this field is determined as $\left⌈log\_{2}(I)\right⌉$ bits, where *I* is the number of entries in the higher layer parameter *ul-AccessConfigListDCI-1-1* or in Table 7.3.1.1.1-4A if *channelAccessMode-r16* = "*semiStatic*" is provided, for operation in a cell with shared spectrum channel access in FR1, or for operation in a cell with shared spectrum channel access in FR2-2 and if *ChannelAccessMode2-r17* is enabled; otherwise 0 bit. One or more entries from Table 7.3.1.2.2-6 or Table 7.3.1.2.2-6A are configured by the higher layer parameter *ul-AccessConfigListDCI-1-1.*

**<Unchanged Part Omitted>**

==End of TP========

==== Start of TP 2-2A for 38.212 ===========

7.3.1.1.2 Format 0\_1

**<Unchanged Part Omitted>**

- ChannelAccess-CPext-CAPC – 0, 1, 2, 3, 4, 5 or 6 bits. The bitwidth for this field is determined as $\left⌈log\_{2}(I)\right⌉$ bits, where *I* is the number of entries in the higher layer parameter *ul-AccessConfigListDCI-0-1* or in Table 7.3.1.1.1-4A if *channelAccessMode-r16* = "*semiStatic*" is provided, for operation in a cell with shared spectrum channel access in FR1, or for operation in FR2-2 when *ChannelAccessMode2-r17* is enabled; otherwise 0 bit. One or more entries from Table 7.3.1.1.2-35 or Table 7.3.1.1.2-35A are configured by the higher layer parameter *ul-AccessConfigListDCI-0-1.*

**<Unchanged Part Omitted>**

7.3.1.2.2 Format 1\_1

**<Unchanged Part Omitted>**

* ChannelAccess-CPext – 0, 1, 2, 3 or 4 bits. The bitwidth for this field is determined as $\left⌈log\_{2}(I)\right⌉$ bits, where *I* is the number of entries in the higher layer parameter *ul-AccessConfigListDCI-1-1* or in Table 7.3.1.1.1-4A if *channelAccessMode-r16* = "*semiStatic*" is provided, for operation in a cell with shared spectrum channel access in FR1, or for operation in FR2-2 when *ChannelAccessMode2-r17* is enabled; otherwise 0 bit. One or more entries from Table 7.3.1.2.2-6 or Table 7.3.1.2.2-6A are configured by the higher layer parameter *ul-AccessConfigListDCI-1-1.*

**<Unchanged Part Omitted>**

==End of TP========

Please provide your view on the proposal 2-2 and TP 2-2

|  |  |
| --- | --- |
| Company | View |
| Ericsson | Editorial changes to simplify the text.ChannelAccess-CPext-CAPC – 0, 1, 2, 3, 4, 5 or 6 bits. The bitwidth for this field is determined as $\left⌈log\_{2}(I)\right⌉$ bits, where *I* is the number of entries in the higher layer parameter *ul-AccessConfigListDCI-0-1* or in Table 7.3.1.1.1-4A if *channelAccessMode-r16* = "*semiStatic*" is provided, for operation in a cell with shared spectrum channel access in FR1, or for operation in FR2-2 when *ChannelAccessMode2-r17* is enabled; otherwise 0 bit. One or more entries from Table 7.3.1.1.2-35 or Table 7.3.1.1.2-35A are configured by the higher layer parameter *ul-AccessConfigListDCI-0-1.*  |
| Nokia, NSB | We are ok with the CR and Ericsson’s modificaitons |
| CATT | Support |
| Samsung | We are ok with the CR and changes from Ericsson.  |
| Intel | OK with the CR and Ericsson’s revised text. |
| Moderator | Ericsson’s edit is captured as TP 2-2A |
| Huawei, HiSilicon | OK with the CR in principle but we think that the changes should follow the same language and style used in 38.212 for the fallback DCI formats 0\_0/1\_0 as follows:“… if *ChannelAccessMode2-r17* **is provided** for operation in a cell in **frequency range 2-2**”Therefore we suggest the following version instead. We note that the intention of Ericsson’s suggested modification would be addressed as well ==== Start of TP 2-2 for 38.212 =========== 7.3.1.1.2 Format 0\_1**<Unchanged Part Omitted>**- ChannelAccess-CPext-CAPC – 0, 1, 2, 3, 4, 5 or 6 bits. The bitwidth for this field is determined as $\left⌈log\_{2}(I)\right⌉$ bits, where *I* is the number of entries in the higher layer parameter *ul-AccessConfigListDCI-0-1* or in Table 7.3.1.1.1-4A if *channelAccessMode-r16* = "*semiStatic*" is provided, for operation in a cell with shared spectrum channel access in FR1, or for operation in a cell in frequency range 2-2 if *ChannelAccessMode2-r17* is provided; otherwise 0 bit. One or more entries from Table 7.3.1.1.2-35 or Table 7.3.1.1.2-35A are configured by the higher layer parameter *ul-AccessConfigListDCI-0-1.* **<Unchanged Part Omitted>**7.3.1.2.2 Format 1\_1**<Unchanged Part Omitted>*** ChannelAccess-CPext – 0, 1, 2, 3 or 4 bits. The bitwidth for this field is determined as $\left⌈log\_{2}(I)\right⌉$ bits, where *I* is the number of entries in the higher layer parameter *ul-AccessConfigListDCI-1-1* or in Table 7.3.1.1.1-4A if *channelAccessMode-r16* = "*semiStatic*" is provided, for operation in a cell with shared spectrum channel access in FR1, or for operation in a cell in frequency range 2-2 if *ChannelAccessMode2-r17* is provided; otherwise 0 bit. One or more entries from Table 7.3.1.2.2-6 or Table 7.3.1.2.2-6A are configured by the higher layer parameter *ul-AccessConfigListDCI-1-1.*

**<Unchanged Part Omitted>**==End of TP========  |
| Xiaomi | OK with HW’s revision. |
| vivo | OK in principle. No strong preference to which version (original, Ericsson’s or Huawei’s revision). |
| LG Electronics | We are ok with Huawei’s revision. |

## Summary of proposals and CRs on Channel Access Indication within Fall-Back DCI and RAR UL Grant

The key proposals from discussion papers are captured below.

|  |  |
| --- | --- |
| Company | Key Proposals/Observations/Positions |
| LGE | Proposal #4: Adopt the following TP in [2] for TS 38.213. |
| Qualcomm | **Proposal 2: Adopt the CR in [10] covering 2 bit indication of ChannelAccess-Cpext, field in RAR UL grant.** |

|  |  |  |  |
| --- | --- | --- | --- |
| Company | Spec | Reason/Summary | Reason/Summary |
| NTT DOCOMO, INC.[R1-2210168]   | 38.212 | Reason for change: | The second bullet in the following agreement in RAN1#109-e is still missing the relevant specificationAgreementIf the UE is configured to operate in no LBT mode• The UE should ignore the channel access field, if present, in fallback DCI• The UE does not expect channel access field to be configured in non-fallback DCI |
|  | Summary of change: | • Capture the second bullet of the agreement above |
| Huawei, HiSilicon[R1-2208477]  | 38.213 | Reason for change: | In RAN1#110 it was agreed that for operation with shared spectrum access in FR2-2, the RAR UL grant includes a 2-bit ChannelAccess-CPext field for explicit indication of one of Type1/2/3 channel access procedures. However, the current specifications in TS 38.213 do not capture the agreement. Similar to the ChannelAccess-CPext field in fallback DCI formats, the 2 bits shall be present only if the *channelAccessMode2-r17* is provided. |
|  | Summary of change: | In the description of the ChannelAccess-CPext field of the RAR UL grant, for Type-1 and Type-2 random access procedures, capture that for operation in FR2-2 and if *channelAccessMode2-r17* is provided, the channelAccess-CPext field size is 2 bits; 0 bit otherwise. The corresponding row of Table 8.2-1 is modified accordingly. |
| ZTE, Sanechips[R1-2208704]  |   |   | According to the following conclusion of RAN1#110 meeting, it was agreed that 2 bit ChannelAccess-Cpext field is included in RAR UL grant.AgreementFor FR2-2, • The ChannelAccess-Cpext field in the fall-back DCI is 2 bit, with explicit signaling for Type 1, Type 2 or Type 3 channel access• The RAR UL grant includes 2 bit  |
|   |   | Revise the spec text related to ChannelAccess-Cpext field in RAR UL grant |
| xiaomi[R1-2209250]   | 38.212 | Reason for change: | No LBT was introduced in R17 for FR 2-2. Based on the description of TS 38.331, when parameter channelAccessMode2-r17 is absent, UE shall not apply any channel access procedure.UE will transmit UL channels in no-LBT mode on shared spectrum, and none of the Type 1/2/3 LBT defined for FR 2-2 will be used.Based on the description of TS 38.212, for a cell operate on shared spectrum, the bit length of ChannelAccess-CPext-CAPC field in DCI 0-1/1-1 is

|  |
| --- |
|  bits, where *I* is the number of entries in the higher layer parameter *ul-AccessConfigListDCI-0-1/1-1*, and *I>=*1. The current TS 38.212 assumes as long as the cell operate on shared spectrum, *ul-AccessConfigListDCI-0-1/1-1* should be configured at least one entry. |

However, for FR2-2,even on shared spectrum, when channelAccessMode2-r17 is absent, UE shall not apply any channel access procedure. And ul-AccessConfigListDCI-0-1/1-1 should not be configured and the bit length of ChannelAccess-CPext-CAPC field in DCI 0-1/1-1 should be 0. |
|  |
|  | Summary of change: | Add in TS 38.212 the restriction that when channelAccessMode2-r17 is absent, ul-AccessConfigListDCI-0-1/1-1 should not be configured and the bit length of ChannelAccess-CPext-CAPC field in DCI 0-1/1-1 is 0. |
| LG Electronics[R1-2209447]  | 38.213 | Reason for change: | The ChannelAccess-Cpext field is present in RAR UL grant for FR 2-2, the length is fixed to two bits. |
|  |  | Summary of change: | Random access response procedure sections 8.2 and 8.2A point to a new table in 38.212 to interpret the ChannelAccess-CPext field in the DCI, namely Table 7.3.1.1.1-4B in TS 38.212 for FR2-2. |
| Samsung[R1-2209692]  | 38.213 | Reason for change: | The second bullet of the following agreement from RAN1#110 has not been captured in the specification yet. |
|  | 38.213 | Summary of change: | AgreementFor FR2-2, The ChannelAccess-Cpext field in the fall-back DCI is 2 bit, with explicit signaling for Type 1, Type 2 or Type 3 channel accessThe RAR UL grant includes 2 bit ChannelAccess-Cpext fieldAdd corresponding use of ChannelAccess-Cpext in TS 38.213.Add corresponding changes for PUSCH frequency resource allocation to align the total number of bits in RAR UL grant.  |
|  |
| Qualcomm Incorporated[R1-2209941]  | 38.213 | Reason for change: | The ChannelAccess-Cpext field is present in RAR UL grant for FR 2-2, the length is fixed to two bits.  |
|  |  | Summary of change: | 1.     Random access reponse procedure sections 8.2 and 8.2A, also point to a new table in 38.212 to interpre the ChannelAccess-CPext field in the DCI, namely Table 7.3.1.1.1-4B in TS 38.212 for FR2-2  |

# Issue CA-1 and CA-3: Short Control Signaling indications, Rule for Channel Access Type Change ( LBT Upgrade) for UE from Type 1 to Type 2 or Type 3 LBT , and COT resumption after a gap

## Discussion

The issue of enforcing the Duty Cycle Constrained was discussed in Section 2 and mechanism to support Enable and Disable was considered in Section 3 of [1].

From the CRs submitted to this meeting, we have the following positions

* The 10% over any 100ms interval to support UL SCS is based on all available msg1/msgA resource configured
	+ LGE, Qualcomm, Nokia
* The 10% over any 100ms interval to support UL SCSt is based on the msg1/msgA resource used by a UE
	+ Vivo, Intel

From the CRs and discussion papers submitted to this meeting, we have the following positions

* 1 bit SIB1 indication for LBT for Msg1 and MsgA
	+ LGE, Qualcomm

The LBT upgrade in COT sharing discussion was part of Section 5 of [1]. COT resumption was discussed as part of Section 8 in [1].

From the CRs and discussion papers submitted to this meeting, we have the following positions

* The decision to switch to Type 2 channel access is based a 1 bit RRC parameter
	+ Qualcomm (for COT sharing and COT Resumption) [R1-2209940]
	+ Wilus ( for COT Sharing) WILUS Inc.[R1-2210137]
* A separate text for channel access procedure upon detection of DCI format 2\_0 for FR2-2
	+ CATT[R1-2208935]
* Text to support COT resumption based on 1 bit RRC parameter
	+ Nokia, Nokia Shanghai Bell[R1-2210053]

In the last meeting, we have the following packages

Discussion 3-1

* Package 1:
	+ Introduce RA-Exempt-r17 in SIB1 to control msg1/msgA (TP 3-A)
		- Setting RA-Exempt-r17 to true is allowed if cell-wise msg1/msgA resource is no more than 10ms out of 100ms (TP 3-B)
	+ Introduce a separate RRC parameter *ul-Type2ChannelAccess-r17* (not in SIB1) to control both (5-1 and 9-1 discussion)
		- Type 1 CA to Type2 or Type 3 CA upgrade when back in gNB COT (TP 3-C)
		- UE uses Type 2 or Type 3 CA to resume COT within its own COT (TP 3-D)
	+ Send LS to RAN2
	+ Support: Nokia, NSB, Qualcomm, LGE
	+ Not preferred, but fine: Intel
* Package 2
	+ Introduce RA-Exempt-r17 in SIB1 to control msg1/msgA (TP 3-A)
		- Send LS to RAN2
		- Setting RA-Exempt-r17 to true is allowed if cell-wise msg1/msgA resource is no more than 10ms out of 100ms (TP 3-B)
	+ Conclude that Type 1 CA to Type2 or Type 3 CA upgrade when back in gNB COT is not supported in Rel.17
	+ Conclude that UE uses Type 2 or Type 3 CA to resume COT within its own COT is not supported in Rel.17
	+ Support: Intel (prefer without TP 3-B, but also fine with it), Qualcomm
	+ Not preferred, but fine: Nokia, NSB
* Package 3
	+ Conclude short control signaling based msg1/msgA transmission is not supported in Rel.17
	+ Conclude that Type 1 CA to Type2 or Type 3 CA upgrade when back in gNB COT is not supported in Rel.17
	+ Conclude that UE uses Type 2 or Type 3 CA to resume COT within its own COT is not supported in Rel.17
	+ Support: Samsung, Qualcomm
	+ Object: Nokia, NSB
* Package 4 (from Ericsson)

introduce 1bit *ul-channelAccess-Exempt-r17* in SIB1 to control LBT type for msg1/msgA, Type 1 CA to Type2/3 CA upgrade within shared COT, and LBT type for resuming COT.

if the bit is set to true: Type 3 CA could be used for msg1/msgA, Type2/3 CA could be used for UL transmissions in shared COT, Type2/3 CA could be used for resuming COT.

* + - if the bit is set to false (main use case is in Japan): Type 3 CA could not be used for msg1/msgA, Type 3 CA could not be used for UL transmissions in shared COT, Type 3 CA could not be used for resuming COT
	+ Support: Ericsson
	+ Not preferred, but fine: Nokia, NSB, Intel

====TP 3-A for 37.213===============

4.4.5       Exempted transmissions from sensing

In regions where channel sensing is required to access a channel for transmission and short control signalling exemption is allowed by regulation, a gNB/UE may transmit the following transmission(s) on a channel without sensing the channel:

-     Transmission(s) of the discovery burst by the gNB

-     If the higher layer parameter *RA-Exempt-r17* is configured, transmission(s) of the first message in a random access procedure by the UE

===End of TP 3-A======================

====TP 3-B for 37.213===============

4.4.5 Exempted transmissions from sensing

\*\*\* Unchanged part omitted\*\*\*

When the gNB transmits the above transmissions without sensing on a channel by utilizing the exemption above, the total duration of such transmission(s) by the gNB shall not occupy the corresponding channel more than $10ms$ over any $100ms$ interval.

When all the UEs in a cell transmit the above transmissions without sensing on a channel by utilizing the exemption above, the total duration of such transmissions by the all the UEs in a cell shall not occupy the corresponding channel more than $10ms$ over any $100ms$ interval.

===End of TP 3-B======================

====TP 3-C for 37.213===============

4.4.4 Channel access procedures in an initiated channel occupancy

<\*\*Unchanged Text Omitted\*\*>

If a gNB shares a channel occupancy initiated by a UE using configured grant PUSCH transmission and the UE is configured by *cg-COT-SharingList-r17*, the gNB may transmit a transmission that follows the configured grant PUSCH transmission by the UE if the following conditions are satisfied:

- If the gNB determines that the 'COT sharing information' in CG-UCI in slot *n* indicates a row index that corresponds to a *CG-COT-Sharing-r17* that provides channel occupancy sharing information, the gNB can share the UE channel occupancy starting from slot $n+O$, where $O=$ *offset-r17* slots, for a duration of $D=$*duration -r17* slots where *duration-r17*, and *offset-r17* are higher layer parameters provided by *CG-COT-Sharing-r17*.

4.4.4.1 Channel access procedures in a shared channel occupancy

If a UE determines the duration in time domain and the location in frequency domain of a remaining channel occupancy initiated by the gNB from a DCI format 2\_0 as described in clause 11.1.1 of [7], the following is applicable:

- The UE may switch from Type 1 channel access procedures as described in clause 4.4.1 to Type 2 channel access procedures as described in clause 4.4.2 if the higher layer parameter *ul-Type2ChannelAccess-r17* is provided. Otherwise, the UE may switch from Type 1 channel access procedures as described in clause 4.4.1 to Type 3 channel access procedures as described in clause 4.4.3 for its corresponding UL transmissions within the determined duration in time and location in frequency domain of the remaining channel occupancy.

===End of TP 3-C======================

====TP 3-D for 37.213===============

4.4.4 Channel access procedures in an initiated channel occupancy

<\*\*Unchanged Text Omitted\*\*>

If a gNB initiates a channel occupancy using the channel access procedures described in clause 4.4.1 on a channel, the gNB may transmit a DL transmission(s) on the channel within the maximum *Channel Occupancy Time* described in Clause 4.4.1 on the channel after the DL transmission(s) initiating the channel occupancy. The followings are applicable to the DL transmission(s):

- Regardless of the duration of the gap between the DL transmission(s) and any previous transmission(s) corresponding to the channel occupancy initiated by the gNB, the DL transmission(s) occurs following the procedures described in Clause 4.4.3; or

- if the gap between the DL transmission(s) and any previous transmission(s) corresponding to the channel occupancy initiated by the gNB is more than a threshold that is determined by the gNB and is at least $8μs$, the DL transmission(s) occurs following the procedures described in Clause 4.4.2.

If a UE initiates a channel occupancy using the channel access procedures described in clause 4.4.1 on a channel, the UE may transmit a UL transmission(s) on the channel within the maximum *Channel Occupancy Time* described in Clause 4.4.1 on the channel after the UL transmission(s) initiating the channel occupancy. The followings are applicable to the UL transmission(s):

- If the higher layer parameter *ul-Type2ChannelAccess-r17* is provided, if the gap between the UL transmission(s) and any previous transmission(s) corresponding to the channel occupancy initiated by the UE is more than 8μs, the UL transmission(s) occurs following the procedures described in Clause 4.4.2.

- Otherwise, regardless of the duration of the gap between the UL transmission(s) and any previous transmission(s) corresponding to the channel occupancy initiated by the UE, the UL transmission(s) occurs following the procedures described in Clause 4.4.3.

===End of TP 3-D======================

Please provide your view on which package you prefer, or there is an alternative you suggest

|  |  |
| --- | --- |
| Company | View |
| Ericsson  | We propose Package 4.Package 4: introduce 1bit *ul-channelAccess-Exempt-r17* in SIB1 to control LBT type for msg1/msgA, Type 1 CA to Type2/3 CA upgrade within shared COT, and LBT type for resuming COT. - if the bit is set to true: Type 3 CA could be used for msg1/msgA, Type2/3 CA could be used for UL transmissions in shared COT, Type2/3 CA could be used for resuming COT.- if the bit is set to false (main use case is in Japan): Type 3 CA could not be used for msg1/msgA, Type 3 CA could not be used for UL transmissions in shared COT, Type 3 CA could not be used for resuming COT. |
| Nokia, NSB | We are supportive of both TP 3-A and 3-B. Furthermore, we are ok with either one of 3-C or 3D. Regarding the packages, we are fine with Package 1. Package 2 is not desirable, but still better than agreeing nothing. Package 4 proposed by Ericsson is also ok for us. We object to Package 3. |
| CATT | Regarding channel access procedure upon detection of DCI format 2\_0 for FR2-2, since there is no beam indication in DCI format 2\_0, the UE can’t determine whether the beam of UL transmission is within the beams of the COT initiated by gNB. Considering the case that gNB performs per-beam LBT over a set of beams before COT and obtains LBT pass over a sub-set of beams, whether the channel access procedure upon detection of DCI format 2\_0 can be applied to the sub-set of beams over LBT failure? If the answer is yes, we have concerns on this case since the UE will perform Type 2/Type 3 LBT before the UL transmission whose beam is not within the COT initiated by gNB. To solve the above issue, we propose the channel access change procedure can be performed as following:* if a UE determines the duration in time domain and the location in frequency domain of a remaining channel occupancy initiated by the gNB from a DCI format 2\_0
	+ Type 1 channel access procedure can be changed to type 2 or type 3 channel access procedures if the reception of **DCI format 2\_0 is no earlier than UL grant** and its corresponding UL transmission is within the determined duration in time and location in frequency domain of the COT.
	+ Otherwise, The UE transmits UL transmission using channel access procedure indicated by UL grant.
 |
| Samsung | At the stage of this CR, we prefer Package 3 without introducing new RRC parameter.  |
| Intel  | We support TP 3-A, and may be OK to support either TP 3-B.Our first preference is for Package 2 without TP 3-B, but we would be also OK with Package 2 as is and Package 4 (proposed by Ericsson). We could leave with Package 1, but we object to Package 3. |
| Huawei, HiSilicon | We are OK with Package 2 along with TP 3-A and TP 3-B (wording can be enhanced). However, although not listed under the packages above, we would be also fine with the much simpler solution to allow the use of Type 2 LBT for LBT Type 1 upgrade in gNB COT or for UE resumption of UE COT if Type 2 LBT is configured as an entry for at least one of non-fallback DCI formats 0\_1/1\_1. We do not agree to introducing an additional RRC parameters for LBT Type 1 upgrade to Type 2/3 or for UE resumption of COT. We also do not agree to combine the control of SCSt of masg1/msgA with these features.  |
| vivo | For the package proposal, we prefer package 4.We don’t support package 1 and 2 due to the concern on the cell-wise configuration of RO and don’t prefer a solution with both SIB and RRC signalling. |
| LG Electronics | We support package 1 and added LGE to the supporting company list. It is worth noting that in Package 1, 1 bit is a SIB1, but the other 1 bit is not in SIB1, so the RRC impact is not large. Currently, Japan is the only country that needs additional LBT for the gap in COT, but package 1 is the most preferred considering forward compatibility and flexibility because it may change in the future. |

## Summary of proposals and CRs on SCS control

The key proposals on signaling to enable contention exempt transmission from discussion papers are captured below.

|  |  |
| --- | --- |
| Company | Key Proposals/Observations/Positions |
| LGE  | Proposal #1: When Contention Exempt Short Control Signaling rules apply to the transmission of msg1 for the 4 step RACH and msgA PRACH for the 2-step RACH, the 10% over any 100ms interval restriction is applicable to all available msg1/msgA PRACH resources configured (not limited to the resources actually used) in a cell.Proposal #2: Whether a short control signaling rule is applicable or not to the configured msg1/msgA PRACH resources can be explicitly indicated by the gNB or implicitly determined by UE by checking duty cycle for the configured ROs (or ROs and POs) resources within the observation period.Proposal #3: Introduce 1 bit in SIB1 to configure the applicability of short control signaling for msg1/msgA and 1 bit in UE-specific RRC signalling to indicate Type 2 or Type 3 LBT for COT resuming in UE-initiated COT or LBT upgrade through DCI format 2\_0 detection in gNB’s COT.1. 1 bit in SIB1 for msg1/msgA SCS applicability configuration
	1. 0 indicates that msg1/msgA cannot be transmitted without LBT
	2. 1 indicates that msg1/msgA can be transmitted without LBT
2. 1 bit in UE-specific RRC signaling to indicate Type 2 or Type 3 LBT for COT resuming in UE-initiated COT or LBT upgrade through DCI format 2\_0 detection in gNB’s COT
	1. 0 indicates that LBT is required before each transmission
	2. Type 2 LBT can be applicable for a gap depending on capability
	3. 1 indicates that LBT is not required before each transmission
	4. Type 3 LBT is used regardless of gap
 |
| Nokia, Nokia Shanghai Bell | ***Proposal 5****: Agree the proposal 5-3-3B from RAN1#109-e:**Introduce 1 bit of RRC signaling (SIB1), where:**• 0 indicates that msg1/msgA cannot be transmitted without LBT and LBT (Type 1 or Type 2 LBT depending on UE capability) should be used in shared COT or resuming COT after a gap (e.g., to cover the Japan case)**• 1 indicates that msg1/msgA can be transmitted without LBT and Type 3 LBT can be used in shared COT or resuming COT after a gap.* |

Following is the overview of draft CRs received on this aspect from the companies.

|  |  |  |  |
| --- | --- | --- | --- |
| Company | Spec | Reason/Summary | Reason/Summary |
| Qualcomm Incorporated[R1-2209940]  | 37.213 | ***Reason for change:*** | To enable SIB1 signaling of uplink contention exemption for short control signaling and RRC signaling to control Channel Access Type upgrade from Type 1 to Type 2 or Type 3  |
| ***Summary of change:*** |        SIB1 parameter setting RA-Exempt-r17 to true is allowed if cell-wise msg1/msgA resource is no more than 10ms out of 100ms       RRC Parameter *ul-Type2ChannelAccess-r17 controls Channel Access Type upgrade when in gNB COT and for resumption of COT*  |

## Summary of proposals and CRs on duty cycle restriction for SCS:

The key proposals on duty cycle constraint for short control signaling from discussion papers are captured below.

|  |  |
| --- | --- |
| Company | Key Proposals/Observations/Positions |
| Qualcomm Technologies Inc | **Proposal 1: Adopt the text proposals A, B C and D in the CR [9] incorporating RRC parameter for indication of contention exemption for short control signaling, as well as a cell wise duty cycle constraint on the configured resources for first message of RACH procedure. The CR further includes a separate RRC parameter to control the LBT upgrade to Type 2 or Type 3 when in gNB COT or resuming own.**  |
| Nokia, Nokia Shanghai Bell | ***Proposal 3****: There is a separate 10% allowance for the gNB, and another one common for all the UEs in the cell.* ***Proposal 4****: UEs may assume that if short control signalling is in use in a cell, the network shall not configure more than 10% of all time resources for msg1/msgA.* |

Following is the overview of draft CRs received on this aspect from the companies.

|  |  |  |  |
| --- | --- | --- | --- |
| Company | Spec | Reason/Summary | Reason/Summary |
| Nokia, Nokia Shanghai Bell[R1-2210055]  | 37.213 | Reason for change: | It is presently unclear how the UE can know when transmissions may occur without channel sensing as short control signalling.  |
|  | 37.213 | Summary of change: | Add the description of how the applicability of short control signaling is determined. |
| Intel Corporation[R1-2209032]  | 37.213 | Reason for change: | Currently the specification text does not provide any procedure on how to signal to a UE whether the short control signalling exemption may be allowed to be used, given that there are regions where this exemption may not be applicable. Furthremore, it is important to note that a UE may not be able to retrieve this information implicitly by implementation, and such information has to be provided explicitly by the network. |
|  | 37.213 | Summary of change: | To indicate to the UE when the short control signalling exemption should be applied. |
| vivo[R1-2208594]  | 37.213 | Reason for change: | The 10% limitation of short control signalling is not clearly included in the spec yet. |
|  | 37.213 | Summary of change: | Adding the 10% limitation for short control signaling as the actually transmitted signaling. |

## Summary of proposals and CRs on LBT upgrade

The key proposals from discussion papers are captured below.

|  |  |
| --- | --- |
| Company | Key Proposals/Observations/Positions |
| Qualcomm Incorporated | **Proposal 1: Adopt the text proposals A, B C and D in the CR [9] incorporating RRC parameter for indication of contention exemption for short control signaling, as well as a cell wise duty cycle constraint on the configured resources for first message of RACH procedure. The CR further includes a separate RRC parameter to control the LBT upgrade to Type 2 or Type 3 when in gNB COT or resuming own.**  |

Following is the overview of draft CRs received on this aspect from the companies.

|  |  |  |  |
| --- | --- | --- | --- |
| WILUS Inc.[R1-2210137]  | 37.213 | ***Reason for change:*** | According to the channel access procedures for shared spectrum operation on FR1, it was specified that the UE may switch from Type 1 channel access procedures to Type 2A channel access procedures upon detection of DCI format 2\_0. Similarly, for FR2-2, it should be specified that the UE may switch from Type 1 channel access procedurs to Type 2 channel access procedure upon detection of DCI format 2\_0 if the higher layer parameter *ul-Type2ChannelAccess-r17* is provided. |
| ***Summary of change:*** | Add new Section 4.4.4.1 with title “*Channel access procedures upon detection of a common DCI*” same as FR1 including that the UE may switch from Type 1 channel access procedurs to Type 2 channel access procedure upon detection of DCI format 2\_0 if the higher layer parameter *ul-Type2ChannelAccess-r17* is provided. |
|  CATT[R1-2208935] | 37.213 | ***Reason for change:*** | For shared spectrum operation on FR1, the UE may switch from Type 1 channel access procedure to type 2A if the scheduled PUSCH duration is within COT duration indicated by format 2\_0, and similar procedure shall be introduced for shared spectrum operation on FR2\_2.For the operation on FR 2\_2, a COT initiated by gNB consists of the duration in time domain, location in frequency domain and beam in spatial domain. Since there is no beam information indicated in format 2\_0, the UE can’t determine the beam in spatial domain of COT initiated by gNB from DCI format 2\_0, and can’t determine whether its corresponding UL transmission is within the COT or not. To solve the above issue, the channel access change procedure can be performed as following:- When the reception of DCI format 2\_0 is no earlier than UL grant and its corresponding UL transmission is within the duration in time and location in frequency domain of the COT initiated by gNB, if its corresponding UL transmission is not within the beam in spatial domain of COT, the UE is not expected to receive DCI format 2\_0.- Otherwise, if a UE determines the duration in time domain and the location in frequency domain of a remaining channel occupancy initiated by the gNB from a DCI format 2\_0n  Type 1 channel access procedure can be changed to type 2 or type 3 channel access procedure if the reception of DCI format 2\_0 is no earlier than UL grant and its corresponding UL transmission is within the determined duration in time and location in frequency domain of the COT.n  Otherwise, The UE transmits UL transmission using channel access procedure indicated by UL grant. |
| ***Summary of change:*** | 1)     Add section 4.4.8 in TS 37.213 to desrbile UE behaviour after receiving DCI format 2\_0.  |
| Qualcomm Incorporated[R1-2209940]  | 37.213 | ***Reason for change:*** | To enable SIB1 signaling of uplink contention exemption for short control signaling and RRC signaling to control Channel Access Type upgrade from Type 1 to Type 2 or Type 3  |
|  |  | ***Summary of change:*** | ·       SIB1 parameter setting RA-Exempt-r17 to true is allowed if cell-wise msg1/msgA resource is no more than 10ms out of 100ms·       RRC Parameter ul-Type2ChannelAccess-r17 controls Channel Access Type upgrade when in gNB COT and for resumption of COT  |

## Summary of proposals and CRs on COT resumption:

Following is the overview of draft CRs received on this aspect from the companies.

|  |  |  |  |
| --- | --- | --- | --- |
| Company | Spec | Reason/Summary | Reason/Summary |
| Nokia, Nokia Shanghai Bell[R1-2210053]  | 37.213 | Reason for change: | For UE operation in FR 2-2 has been agreed at RAN1#109-e to support the case where UE continues transmission in a UE-initiated COT after a gap of Y ms. However, this has not yet been captured in 37.213.The CR also add the condition for when LBT is required for all UL transmissions. |
|  |
| Summary of change: | Add spec text defining UE resumption of UE initiated COT after a transmission gap |

# Issue CA-4: Multi-Beam Channel Access: LBT Procedure for UE Initiated COT, EDT for per beam sensing

## Discussion

Discussion 4-1:

When independent per-beam LBT sensing is performed at UE

* Alt 1. A transmission on a beam is allowed to occur if the corresponding LBT procedure for the beam is successful
	+ Support: CATT, Samsung, Intel, LGE
* Alt 2. A transmission on a beam is allowed to occur if the corresponding LBT procedure for all the beams the transmission (PUCCH or PUSCH) is intended for has been successful
	+ Support: Ericsson, Nokia, NSB, Qualcomm
* Alt 3. Conclude that when independent per-beam LBT sensing is performed at UE, if a transmission is allowed to occur on a subset of beams, where the corresponding LBT procedure for the subset of beams has been successful, is left for UE implementation
	+ Also fine: Samsung, Qualcomm

Please provide your view on the above

|  |  |
| --- | --- |
| Company | View |
| Ericsson | Alt 2.  |
| Nokia, NSB | Alt 2. |
| CATT | To increase the possibility of UL transmission, Alt 1 is preferred. |
| Samsung | Our first preference is Alt 1 to be aligned with gNB behaviour. Second preference is Alt 3 to leave it as implementation.  |
| Intel | We prefer Alt.1. |
| Huawei, HiSilicon | We are OK with either Alt 1 or Alt 2. |
| LG Electronics | We support Alt 1. |

Discussion 4-2:

Regarding the ED threshold for multi-beam sensing

* Alt 1. EDT should be computed separately per sensing beam:
	+ Support: CATT, Qualcomm, Samsung, Intel
* Alt 2. Common EDT should be used across all sensing beams:
	+ Support: Nokia, NSB,
* Alt 3: Left to implementation
	+ Support: Ericsson, Qualcomm

Please provide your view on the above

|  |  |
| --- | --- |
| Company | View |
| Ericsson | Alt2 is the status-quo. We propose Alt 3: it can be left to implementation. This allows companies to use Alt1 if they want to.  |
| Nokia, NSB | Alt 2. |
| CATT | We slight prefer Alt 1. |
| Samsung | We prefer Alt 1.  |
| Intel | We prefer Alt.1. |
| Huawei, HiSilicon | We support Alt 1. |
| LG Electronics | We support Alt 2. |

## Summary of proposals and CRs on on LBT Procedure:

Following is the overview of draft CRs received on this aspect from the companies.

Discussion Paper proposals are as follows.

|  |  |
| --- | --- |
| Company | Key Proposals/Observations/Positions |
| LGE | **Proposal #1: For UE-initiated COT, if a UE intends to transmit UL transmission(s) across multiple transmission beams and performs independent per-beam sensing, the partial beam transmission is allowed when the channel access procedures on the sensing beam(s) corresponding to the UL transmission beam have succeeded.****Proposal #2: Adopt the following TP in [2] for TS 37.213.** |

|  |  |  |  |
| --- | --- | --- | --- |
| Company | Spec | Reason/Summary | Reason/Summary |
| Huawei, HiSilicon[R1-2208476]  | 37.213 | Reason for change: | For initiating a new multi-beam COT, the Type 1 channel access procedure for a respective beam shall start after the end of the previous COT towards the aligned start time of the new COT. Based on current specifications, if a counter N does not reach 0 before the aligned DL start time, the channel cannot be accessed by the gNB on the respective beam and the corresponding transmission(s) would be dropped. For UL, the channel may not be accessed by the UE on all beams and all corresponding transmissions would be dropped. Since it may not be feasible for the gNB/UE to start one or more per-beam Type 1 channel access procedures early enough before the aligned start time, a constraint on the aligned starting time is needed to ensure efficiency of the multi-beam channel access procedures.  |
|  | Summary of change: | In Clause 4.4.6 in TS 37.213, capture that the time duration from the end of any previous transmission(s) by the gNB/UE occupying any beam to the same start time is at least the time required for all the corresponding counters to reach zero assuming the channel is sensed idle in all of the sensing slots.  |
| LG Electronics[R1-2209445]  | 37.213 | Reason for change: | In order to allow a transmission on a beam if the corresponding LBT procedure for all or part of the beams the transmission is intended for has been successful when independent per-beam LBT sensing is performed at UE. |
|  | Summary of change: | Describe in Clause 4.4 that the partial beam transmission is allowed when the channel access procedures on the sensing beam(s) corresponding to the UL transmission beam have succeeded when independent per-beam sensing is performed for UE-initiated COT. |
| Samsung[R1-2209693]  | 37.213 | Reason for change: | UE behavior for determining the beams for transmission is not specified, in multi-beam scenario.  |
|  | Summary of change: | Add UE behavior for determining the beams for transmission is not specified, in multi-beam scenario. |
| Huawei, HiSilicon[R1-2209845]   | 37.213 | Reason for change: | For a COT with MU-MIMO (SDM) transmission or TDM transmission of beams with beam switching, when independent per-beam LBT is performed at the start of the COT, for Pout in EDT determination for a sensing beam, Pout does not need to be the maximum EIRP of all the intended transmissions across all transmission beams. Pout should be rather based on the maximum EIRP of the intended transmissions “covered” by the sensing beam by the node determining EDT during a COT. Higher Pout values can be considered by implementation. |
|  | Summary of change: | In Clause 4.4, clarify that Pout for calculating the per-beam EDT for multi-beam COT is derived from the EIRP corresponding to the intended transmission(s) covered by the sensing beam. |
| Qualcomm Incorporated[R1-2209942]  | 37.213 | Reason for change: | Support UL transmission over LBT passing sensing beams only, except sDCI UL mTRP case, where all composition beams need to pass LBT |
|  | Summary of change: | Add description on what scenario the UL transmission in a subset of sensing beams is allowed |

## Summary of proposals and CRs on EDT determination:

Following is the overview of draft CRs received on this aspect from the companies.

|  |  |  |  |
| --- | --- | --- | --- |
| Company | Spec | Reason/Summary | Reason/Summary |
| Qualcomm Incorporated[R1-2209943]  | 37.213 | ***Reason for change:*** | Specify the EDT determination rule for a COT with MU-MIMO (SDM) transmission or TDM transmission with beam switching, when per beam LBT is performed at the start of the COT. |
|  | ***Summary of change:*** | In Section 4.4, it is clarified to use section 4.4.7 to determine EDT for a sensing beam |

Discussion Paper proposals are as follows.

|  |  |
| --- | --- |
| Company | Key Proposals/Observations/Positions |
| Nokia, Nokia Shanghai Bell | ***Proposal 1:*** *The LBT EDT for UL is determined by the actual LBT bandwidth used by the UE. There is no need for a further CR.****Proposal 2:*** *In case of LBT with independent per beam sensing, EDT determination separately for each sensing beam is not supported. There is no need for a further CR.*  |

# Issue CA-6: Sensing Beam for PUCCH or SRS

## Discussion

R1-2209868 proposes to clarify the UE channel sensing behavior for PUCCH or SRS transmission

Reason for change: Correction on determination of sensing beam to be used prior to PUCCH or SRS in FR2-2.

• Clarify UE behavior on how to determine sensing beam for channel access procedure to be performed prior to PUCCH/SRS transmission in FR2-2

==== TP 5-1 from R1-2209868 for 38.213=====

5.1.5 Antenna ports quasi co-location

\*\*\*\* unchanged part omitted\*\*\*\*\*\*\*\*\*\*\*\*

A UE that has indicated a capability *beamCorrespondenceWithoutUL-BeamSweeping* set to '1', as described in [13, TS 38.306], can determine a spatial domain filter to be used while performing the applicable channel access procedures described in [16, TS 37.213] prior to a UL transmission on the channel as follows:

- if UE is indicated with an SRI corresponding to the UL transmission, the UE may use a spatial domain filter that is same as the spatial domain transmission filter associated with the indicated SRI,

- if UE is configured with a single value for *pucch-SpatialRelationInfoId* for the UL transmission, the UE may use a spatial domain filter that is same as the spatial domain filter associated with *referenceSignal* in the corresponding *pucch-SpatialRelationInfo*,

- if UE is configured with more than one value for *pucch-SpatialRelationInfoId* for the UL transmission, the UE may use a spatial domain filter that is same as the spatial domain filter associated with *referenceSignal* in the activated *pucch-SpatialRelationInfo*,

- if UE is configured with *SRS-spatialRelationInfo* for the UL transmission, the UE may use a spatial domain filter that is same as the spatial domain filter associated with *referenceSignal* in the corresponding *SRS-spatialRelationInfo*

- if UE is configured with *TCI-State* configurations with *DLorJointTCIState* or *UL-TCIState*, the UE may use a spatial domain transmit filter that is same as the spatial domain receive filter the UE may use to receive the DL reference signal associated with the indicated TCI state.

\*\*\*\* unchanged part omitted\*\*\*\*\*\*\*\*\*\*\*\*

======End of TP ==========================

Discussion 5-1

Do you support TP 5-1?

|  |  |
| --- | --- |
| Company | View |
| Ericsson | Ok with the CR update.  |
| Nokia, NSB | We are generally ok with the intent of the CR. However, the PUCCH related part might belong to 38.213 rather the .38214. |
| Samsung | OK with the CR.  |
| Intel | Ok with the CR. |
| Huawei, HiSilicon | We agree with the CR.We do not see a reason why the sensing beam for the PUCCH and SRS transmissions would be treated differently from a PUSCH transmission when *beamCorrespondenceWithoutUL-BeamSweeping* is set to '1' |
| vivo | OK |
| LG Electronics | Ok with the CR. |

## Summary of proposals and CRs for sensing beam for PUCCH or SRS

The key proposals from discussion papers are captured below.

|  |  |
| --- | --- |
| Company | Key Proposals/Observations/Positions |
| NTT DOCOMO, INC | **Proposal 1:** *Adopt the CR proposed in R1-2209868 [2]* |

Following is the overview of draft CRs received on this aspect from the companies.

|  |  |  |  |
| --- | --- | --- | --- |
| Company | Spec | Reason/Summary | Description |
| NTT DOCOMO, INC.[R1-2209868]  | 38.214 | ***Reason for change:*** | Correction on determination of sensing beam to be used prior to PUCCH or SRS in FR2-2. |
| ***Summary of change:*** | ·       Clarify UE behavior on how to determine sensing beam for channel access procedure to be performed prior to PUCCH/SRS transmission in FR2-2 |

# Issue CA-10: Editorial on *beamCorrespondenceWithoutUL-BeamSweeping*

R1-2208828 is alignment CRs on the value for *beamCorrespondenceWithoutUL-BeamSweeping*. The CR is repeated below for convenience:

=================TP for 38.214================

Reason for change: According to TS 38.331 and TS 38.306, when a UE reports a capability using higher-layer parameter *beamCorrespondenceWithoutUL-BeamSweeping*, this higher-layer parameter should be set to ‘supported’. But in current spec TS 38.214, this parameter is set to ‘1’ to indicate this UE capability, which is not aligned with the value provided in TS 38.331.

Summary of changes: Align the value setting of *beamCorrespondenceWithoutUL-BeamSweeping* in TS 38.214 with TS 38.331 and TS 38.306.

===============TP start========================

5.1.5 Antenna ports quasi co-location

<Unchanged parts are omitted>

A UE that has indicated a capability *beamCorrespondenceWithoutUL-BeamSweeping* set to 'supported', as described in [13, TS 38.306], can determine a spatial domain filter to be used while performing the applicable channel access procedures described in [16, TS 37.213] prior to a UL transmission on the channel as follows:

- if UE is indicated with an SRI corresponding to the UL transmission, the UE may use a spatial domain filter that is same as the spatial domain transmission filter associated with the indicated SRI,

- if UE is configured with *TCI-State* configurations with *DLorJointTCIState* or *UL-TCIState*, the UE may use a spatial domain transmit filter that is same as the spatial domain receive filter the UE may use to receive the DL reference signal associated with the indicated TCI state.

<Unchanged parts are omitted>

================End of TP=======================

Discussion 6-1

Do you support the CR in R1-2208828 as an editor’s alignment CR?

|  |  |
| --- | --- |
| Company | View |
| Ericsson | Ok with the proposed changes. |
| Nokia, NSB | We are ok with the change |
| CATT | OK |
| Samsung | OK |
| Intel | OK with the proposed changes. |
| Huawei, HiSilicon | OK with the change |
| vivo | OK for editor alignment CR |
| LG Electronics | OK |

# Issue CA-11: Editorial on csi-RS-ValidationWithDCI and CO-DurationsPerCell-r16

R1-2208706 and R1-2208707 are RRC parameter name alignment CRs. Repeated below for convenience

====TP CA-11-1 for 38.213===

Reason for change: Misalignment of the parameter names of COT duration and CSI-RS validation between TS 38.213 and TS 38.331.

38.331-h20

CO-DurationsPerCell-r16 ::= SEQUENCE {

 servingCellId-r16 ServCellIndex,

 positionInDCI-r16 INTEGER(0..maxSFI-DCI-PayloadSize-1),

 subcarrierSpacing-r16 SubcarrierSpacing,

 co-DurationList-r16 SEQUENCE (SIZE(1..64)) OF CO-Duration-r16

}

csi-RS-ValidationWithDCI-r16 ENUMERATED {enabled}

Summary of changes: Alignment of the parameter names between TS 38.213 and TS 38.331, that is:

1. Change “*csi-RS-ValidationWith-DCI*” to “*csi-RS-ValidationWithDCI*”

Change “*CO-DurationPerCell-r16*” to “*CO-DurationsPerCell-r16*”

==TP start==

11.1 Slot configuration

**<Unchanged parts are omitted>**

For a UE operation with shared spectrum channel access in FR1, or in FR2-2 when the UE is provided *ChannelAccessMode2-r17* = '*enabled*', if the UE is provided *csi-RS-ValidationWithDCI*, is not provided *CO-DurationsPerCell*, and is not provided *SlotFormatCombinationsPerCell*, and if the UE is configured by higher layers to receive a CSI-RS in a set of symbols of a slot, the UE cancels the CSI-RS reception in the set of symbols of the slot if the UE does not detect a DCI format indicating an aperiodic CSI-RS reception or scheduling a PDSCH reception in the set of symbols of the slot.

**<Unchanged parts are omitted>**

11.1.1 UE procedure for determining slot format

**<Unchanged parts are omitted>**

- a location of a channel occupancy duration field in DCI format 2\_0, by *CO-DurationsPerCell*, that indicates a remaining channel occupancy duration for the serving cell starting from a first symbol of a slot where the UE detects the DCI format 2\_0 by providing a value from *co-DurationList*. The channel occupancy duration field includes $max\left\{\left⌈log\_{2}\left(COdurationListSize\right)\right⌉,1\right\}$ bits, where $COdurationListSize$ is the number of values provided by *co-DurationList*. If *CO-DurationsPerCell* is not provided, the remaining channel occupancy duration for the serving cell is a number of slots, starting from the slot where the UE detects the DCI format 2\_0, that the SFI-index field value provides corresponding slot formats

- a reference SCS configuration for *co-DurationList*, by *subcarrierSpacing*

- a location of a search space set group switching flag field in DCI format 2\_0, by *SearchSpaceSwitchTrigger*, that indicates a group from two groups of search space sets for PDCCH monitoring for scheduling for the serving cell or the set of serving cells, provided by *CellGroupsForSwitching*, as described in clause 10.4.

If neither *CO-DurationsPerCell-r16* nor *SlotFormatCombinationsPerCell*are provided and if *channelAccessMode* = "*semiStatic*" is provided, the procedures in this clause apply with assuming a channel occupancy time defined in clause 4.3 of [15, TS 37.213] is the remaining channel occupancy duration if a DL transmission burst(s) is detected within the channel occupancy time.

==End of TP CA-11-1 for 38.213===

====TP CA-11-2 for 38.214===

Reason for change: Misalignment of the parameter names of COT duration and CSI-RS validation between TS 38.214 and TS 38.331.

38.331-h20

CO-DurationsPerCell-r16 ::= SEQUENCE {

 servingCellId-r16 ServCellIndex,

 positionInDCI-r16 INTEGER(0..maxSFI-DCI-PayloadSize-1),

 subcarrierSpacing-r16 SubcarrierSpacing,

 co-DurationList-r16 SEQUENCE (SIZE(1..64)) OF CO-Duration-r16

}

csi-RS-ValidationWithDCI-r16 ENUMERATED {enabled}

Summary of changes: Alignment of the parameter names between TS 38.214 and TS 38.331, that is:

1. Change “*csi-RS-ValidationWith-DCI*” to “*csi-RS-ValidationWithDCI*”

Change “*CO-DurationPerCell-r16*” to “*CO-DurationsPerCell-r16*”==TP start==

==TP start==

5.2.1.4.2 Report Quantity Configurations

**<Unchanged parts are omitted>**

For operation with shared spectrum channel access, if the UE is configured with a *CSI-ReportConfig* with higher layer parameter *reportQuantity* set to 'cri-RI-PMI-CQI ', 'cri-RI-i1', 'cri-RI-i1-CQI', 'cri-RI-CQI' or 'cri-RI-LI-PMI-CQI', the UE shall derive:

- the CSI parameters without averaging two or more instances of any periodic or semi-persistent *nzp-CSI-RS-Resources* in the corresponding *NZP-CSI-RS-ResourceSet* for channel measurement or for interference measurement located in different DL transmissions,

- the instances of the *nzp-CSI-RS-Resources* are not in the same channel occupancy duration indicated by DCI format 2\_0, if the UE is provided at least one of *SlotFormatIndicator* or co*-DurationList*; or

- the instances of the *nzp-CSI-RS-Resources* occur within a set of consecutive symbols which are not all occupied by PDSCH(s) and/or aperiodic CSI-RS(s) indicated by DCI formats, if any, and the corresponding PDCCH(s), if the UE is neither provided with *CO-DurationsPerCell* nor *SlotFormatIndicator*, but is provided with *csi-RS-ValidationWithDCI*

- the interference measurements for computing CSI value based on periodic/semi-persistent CSI-IM measured only in OFDM symbol(s) that fulfill the same conditions under which the UE is expected to receive periodic/semi-persistent CSI-RS as described in Clause 11.1 and Clause 11.1.1 of [6, TS 38.213].

**<Unchanged parts are omitted>**

==End of TP CA-11-2 for 38.214===

Discussion 7-1

Do you support the CR in R1-2208706 as 38.213 editor’s alignment CR and R1-2208707 as 38.214 editor’s alignment CR?

|  |  |
| --- | --- |
| Company | View |
| Ericsson | Ok with the changes |
| Nokia, NSB | We are ok with the change |
| Samsung | OK with the changes. The draft CR for 38.213 seems not including the tracking marks, but could be understood from the reason for change. Hopefully it can be addressed in the final draft CR document.  |
| Intel | As pointed out by Samsung, the CR includes the changes with no tracking marks. Anyway, OK with the proposed changes. |
| Moderator | Sorry about the confusion. The change marks are added back |
| Huawei, HiSilicon | OK with the proposed changes |
| vivo | OK for editor alignment CR |
| LG Electronics | OK  |

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