**3GPP TSG RAN WG1#103-e R1-200xxxx**

**e-Meeting, October 26th – November 13th, 2020**

**Agenda Item: 7.2.2**

**Source: Moderator (Lenovo)**

**Title: Email discussion [103-e-NR-NRU-02] on issues DL-B6, DL-D1 and DL-G1 in R1-2008888**

**Document for: Discussion, Decision**

# Introduction

According to the guidance by RAN1 (vice-)chairman, this email discussion is to be finalised by **29 October**; if necessary, followed by endorsing the corresponding TPs by **5 November**.

# Summary of Discussion and Suggestions

For Q1:

**Proposal NRU02-1:**

If neither *CO-DurationPerCell-r16* nor *slotFormatCombinationId* are provided in DCI format 2\_0 and if *ChannelAccessMode-r16* = *semistatic*, the UE assumes the COT ends before the start of the next fixed frame period.

Many companies show support for the following proposal, and no company raised explicit concerns on the following proposal:

**Proposal NRU02-2:**

If *CO-DurationPerCell-r16* or *slotFormatCombinationId* are provided in DCI format 2\_0 and if *ChannelAccessMode-r16* = *semistatic*, the UE does not expect the indicated COT duration, by CO-duration or SFI field, to end later than before the start of the next fixed frame period.

**FL Suggestion:**

Adopt proposals NRU02-1 and NRU02-2, and proceed with TP/CR drafting discussion.

For Q2:

Concerns have been raised on the wording of Samsung's/LG's TP. On the other hand, no explicit concerns have been raised against Nokia's TP, though some improved wording is suggested by many companies.

**FL Suggestion:**

Adopt the following proposal.

**Proposal NRU02-3:**

Proceed with CR discussion based on Nokia's TP (R1-2008204, P4), considering the removal of 'indicated'.

For Q3:

Opinions are not converging yet, and support for solutions is more or less evenly split.

**FL Suggestion:**

More discussion is necessary including suggested modifications to the original options and potential compromise solutions.

# Discussion

Companies are invited to comment on the questions below.

## COT duration indication/ determination (DL-B6)

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| **Q1: How should the UE obtain the COT duration in semi-static channel access mode (a.k.a. FBE)?**

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| R1-2007607, P3 [Huawei]:In FBE, UE can obtain COT duration from SFI or COT duration indicator in DCI format 2\_0. UE can also derive COT duration acquired by gNB from the FFP configuration if neither SFI nor COT duration indicator is configured. The corresponding text proposal is in TP#2 in the appendix.R1-2008126, P2/P3 [Samsung]:For FBE, a UE assumes gNB channel occupancy time equals to FFP as long as the UE detects any DL signals within a FFP. Adopt the following TP for TS 37.213.

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| ======================== Start of TP for TS 37.213 ==========================4.3 Channel access procedures for semi-static channel occupancyChannel assess procedures based on semi-static channel occupancy as described in this Clause, are intended for environments where the absence of other technologies is guaranteed e.g., by level of regulations, private premises policies, etc. If a gNB provides UE(s) with higher layer parameters *ChannelAccessMode-r16 ='semistatic'* by SIB1 or dedicated configuration, a periodic channel occupancy can be initiated by the gNB every within every two consecutive radio frames, starting from the even indexed radio frame at with a maximum channel occupancy time , where *period* in , is a higher layer parameter provided in *SemiStaticChannelAccessConfig* and *.*If a UE detects a DL transmission burst(s) in a Tx period, the UE assumes the channel occupancy time is within the Tx period. ========================= End of TP for TS 37.213 ========================= |

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R1-2008204, P1 [Nokia]:Adopt the TP for 38.213 sub-clause 11.1.1 to reflect RAN1#102 agreements

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| TP for TS38.21311.1.1 UE procedure for determining slot format<unchanged text omitted>a location of an available RB set indicator field in DCI format 2\_0 that is - one bit, if *intraCellGuardBandDL-r16* for the serving cell indicates no intra-cell guard-bands are configured, where a value of '1' indicates that the serving cell is available for receptions, a value of '0' indicates that the serving cell is not available for receptions, by *availableRB-SetPerCell-r16*, and the serving cell remains available or unavailable for reception until the end of the indicated channel occupancy duration, if provided, otherwise, until the end ofthe 95 percent of remaining channel occupancy period provided by *semiStaticChannelAccessConfig-r16*.- a bitmap having a one-to-one mapping with the RB sets [6, TS 38.214] of the serving cell, if *intraCellGuardBandDL-r16* for the serving cell indicates intra-cell guard-bands are configured, where the bitmap includes bits and is the number of RB sets in the serving cell, a value of '1' indicates that an RB set is available for receptions, a value of '0' indicates that an RB set is not available for receptions, by *availableRB-SetPerCell-r16* and a RB set remains available or unavailable for receptions until the end of the indicated channel occupancy duration, if provided, otherwise, until the end ofthe 95 percent of remaining channel occupancy period provided by *semiStaticChannelAccessConfig-r16*.* <unchanged text omitted>
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R1-2008384, P1 [Sharp]If neither SFI-index field nor CO duration field is configured, COT for FBE (i.e. COT defined in Clause 4.3 of TS37.213) should be considered as being within “indicated channel occupancy duration” if any DL burst is detected in the COT. Adopt Text proposal #1.

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| **Text proposal #1**--------- beginning of text proposal for TS 38.213 11.1 Slot configuration**<omitted>**If a UE is provided *ChannelAccessMode-r16 ='dynamic'* and is provided *availableRB-SetsToAddModList-r16* and *availableRB-SetsToRelease-r16*, the UE expects to be provided *co-DurationsPerCell ToAddModList-r16* and *co-DurationsPerCellToReleaseList-r16* and/or *slotFormatCombToAddModList* and *slotFormatCombToReleaseList*.If neither *CO-DurationPerCell-r16* nor *slotFormatCombinationId* is provided and if *ChannelAccessMode-r16* = *semistatic* is provided, the procedures in Clause 11.1.1 apply with assuming a channel occupancy time as being indicated as the remaining channel occupancy duration if a DL transmission burst(s) is detected within the channel occupancy time.**<omitted>** |

R1-2008602, P1-2 [Qualcomm]:When COT duration is not explicitly configured for a semi-static channel access system, the UE assumes the COT ends at the beginning of the idle period in the same fixed frame period.If COT duration is explicitly configured, UE does not expect the COT duration to indicate the COT ends later than the beginning of the idle period in the same fixed frame period that the COT duration information is detected.

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| =====================38.213 11.1.1=================---------unchanged text omitted------------------* a location of a channel occupancy duration field in DCI format 2\_0, by *CO-DurationPerCell-r16*, 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-r16*. The channel occupancy duration field includes bits, where is the number of values provided by *CO-DurationList-r16*. If *CO-DurationPerCell-r16* 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
	+ If a gNB provides UE(s) with higher layer parameters *ChannelAccessMode-r16 ='semistatic'*, and *CO-DurationPerCell-r16* is not configured, the UE assumes the COT duration end at before the start of the next periodic channel occupancy starting position [4.3 of 37.213].
	+ If a gNB provides UE(s) with higher layer parameters *ChannelAccessMode-r16 ='semistatic'*, and *CO-DurationPerCell-r16* is configured, the UE does not expect the COT duration to end later than before the start of the next periodic channel occupancy starting position [4.3 of 37.213].

---------unchanged text omitted------------------ |

**Please provide your views on the proposals.** |
| **Company** | **Comment** |
| OPPO | Sharp and Huawei’s proposal seem more reasonable, and Sharp’s TP can be the starting point for further discussion.  |
| vivo | Support the principle that “*When COT duration is not explicitly configured for a semi-static channel access system, the UE assumes the COT ends at the beginning of the idle period in the same fixed frame period*”. We could agree the technique proposal first and then go to TP phase. |
| LG Electronics | Agree with OPPO that Sharp’s TP can be used for starting point. One more aspect to be added is that the COT duration lasts until the end of a maximum COT length defined in 37.213. In this sense, slight modification from Sharp’s TP can be made as follows:If neither *CO-DurationPerCell-r16* nor *slotFormatCombinationId* is provided and if *ChannelAccessMode-r16* = *semistatic* is provided, the procedures in Clause 11.1.1 apply with assuming that remaining channel occupancy duration is indicated until the end of a maximum channel occupancy time, as defined in [4.3 of 37.213] |
| Nokia, NSB | Based on last meeting agreement, CO-duration is not needed for RB-set indication, it should be clarified that if SFI nor CO-duration is present, UE assumes remaining channel occupancy duration based on FFP. Also QC’s restriction on indicted remaining channel occupancy within FFP only makes sense.Therefore, we suggest to agree first on the following proposals and only then discuss the way we capture (i.e. TP)Proposal-1: When CO-duration nor SFI field is present in DCI format 2\_0 and a UE is provided higher layer parameter ChannelAccessMode-r16 ='semistatic' , UE assumes remaining channel occupancy ends before the start of the next periodic channel occupancy starting position [4.3 of 37.213].* TP FFS

Proposal-2: When CO-duration or SFI field is present in DCI format 2\_0 and a UE is provided higher layer parameter ChannelAccessMode-r16 ='semistatic', , the UE does not expect the indicated COT duration, by CO-duration or SFI field, to end later than before the start of the next periodic channel occupancy starting position [4.3 of 37.213].* TP FFS
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| Sharp | We would like to ask to companies if the following is aligned with their understanding.

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|  | SFI-index field | CO duration field | For FBE, “indicated channel occupancy duration” in Clause 11.1.1 of TS38.213 (e.g. for available RB set length, for CSI-RS validation, etc) is identified by: |
| Case 1 | Configured | Configured | CO duration field value(already defined in Clause 11.1.1).“COT for FBE” isn’t used. |
| Case 2 | Configured | Not configured | SFI-index value (already defined in Clause 11.1.1).“COT for FBE” isn’t used. |
| Case 3 | Not configured | Configured | CO duration field value (already defined in Clause 11.1.1).“COT for FBE” isn’t used. |
| Case 4 | Not configured | Not configured | “COT for FBE” if any DL burst is detected in the COT. |

Given that the above is the common understanding, we prefer Sharp’s TP.Regarding the point raised by LG, the following modification can be considered.If neither *CO-DurationPerCell-r16* nor *slotFormatCombinationId* is provided and if *ChannelAccessMode-r16* = *semistatic* is provided, the procedures in Clause 11.1.1 apply with assuming a channel occupancy time defined in [4.3 of 37.213] as being indicated as the remaining channel occupancy duration if a DL transmission burst(s) is detected within the channel occupancy time. |
| Samsung | The intention of our TP is also to cover the case when UE does not detect DCI format 2\_0 (with/without CO-duration and/or SFI field in 2\_0). Because UE assumption of gNB’s channel occupancy is not clearly specified when UE does not detect the DCI 2\_0 but detects other DL signal/channel. In such case, we believe UE should assume that gNB occupies channel until the end of Tx duration, which should be clarified. |
| Qualcomm | Our first preference is actually Samsung proposal, i.e., the COT is fixed to be till the end of the FFP, except the idle period. For initial access PRACH transmission, this is already the case. There is no need to have different COT understanding for different transmissions.If this cannot be agreed, we are fine with Nokia proposals too.  |
| Ericsson | We agree with Samsung. FBE is different from LBE. All is needed to determine whether a COT is initiated. When that is determined, the Ue assumption on maximum COT for the current FFP before the idle period that can share with gNB. Hence, there is no need to indicate to the UE duration of an initiated COT.We support Samsung TP. It is important to adopt Samsung TP to have a clear understanding.Among other TPs, we think we should adopt Nokia’s TP. The reason is different from Samsung TP. Nokia’s TP covers the case, when COT duration is not indicated, which is the case for FBE as explained above.Hence, both TPS are needed. Summary:Support both Samsung TP and Nokia TP.  |
| Sharp | There seems to be 3 cases to be discussed in terms of UE behaviors defined in 11.1.1 in 38.213.**Case1: FBE without configuration of SFI or CO-duration field**So far, all the companies think a remaining channel occupancy ends right before the idle period of the FFP if the UE detects any DL in the FFP.**Case2: FBE with detection of at least one of SFI and CO-duration field**Nokia is proposing that “the UE does not expect the indicated COT duration by the detected CO-duration or SFI field to exceed the start of the idle period. In our view this is reasonable.**Case3: FBE with configuration of at least one of SFI and CO-duration field but no detection of any of them.**Option 1) There is no remaining channel occupancy, regardless of a detection of DL in the FFP.Option 2) A remaining channel occupancy ends right before the idle period of the FFP, if the UE detects any DL in the FFP (as proposed by Samsung).Actually, we do not have a strong preference between Option 1 and 2. But, with Option 2, even if the network configured CO-duration field, it has to always assume that some UEs might fail to detect DCI format 2\_0. This assumption leads to the consequence that the gNB scheduling and the UE behavior would be the same as when CO-duration field is not configured. Therefore, we do not see any motivation to configure CO-duration field for FBE. We’d like to know the other companies’ views. |
| ZTE, Sanechips | We agree with the TP modified by Sharp. But the specific TP can be discussed in the draft TP phase. |
| Huawei, HiSilicon | As well as the TP from Sharp, the following changes should be considered in TS38.213 section 11.1.1 because the COT duration is no longer indicated only.- a bitmap having a one-to-one mapping with the RB sets [6, TS 38.214] of the serving cell, if *intraCellGuardBandDL-r16* for the serving cell indicates intra-cell guard-bands are configured, where the bitmap includes bits and is the number of RB sets in the serving cell, a value of '1' indicates that an RB set is available for receptions, a value of '0' indicates that an RB set is not available for receptions, by *availableRB-SetPerCell-r16* and a RB set remains available or unavailable for receptions until the end of channel occupancy duration |
| LG Electronics | We totally agree with Sharp’s view.Regarding Samsung’s TP:* For initial access PRACH, it’s already clear initial access UE is allowed to transmit PRACH in case the UE detects any DL signal/channel within the same FFP.
* For DCI 2\_0 missing case, we should separate two different cases; 1) neither SFI nor CO-duration is provided, 2) SFI or CO-duration is provided. For the first case, it’s OK for UE to assume end-of-COT as FFP-ending. On the other hand, for the second case, gNB may intend to grab the channel occupancy shorter than FFP duration.

In that sense, we think Samsung’s TP is so broad that it can be misunderstood that gNB always has to occupy channel until the end of FFP.If we need to capture a UE behavior when UE does not detect DCI 2\_0 in case neither of SFI nor CO-duration is provided, it would be better to precisely specify that behavior, instead of Samsung’s TP.To summarize, we are fine with either of Nokia’s or Sharp’s, but have concern with Samsung’s TP. |
| Lenovo, Motorola Mobility | We support proposals by Samsung and Nokia. We would like to clarify that Samsung's TP does not impose any new attempts to detect DL signals. |
| Sharp | For Samsung’s TP, we have the following comments:Currently, the term “channel occupancy” in 37.213 and “channel occupancy duration” in 38.213 are based on different definitions. “Channel occupancy” in 37.213 is defined in Clause 4.0 as “A *channel occupancy* refers to transmission(s) on channel(s) by eNB/gNB/UE(s) after performing the corresponding channel access procedures in this clause.” In other words, in 37.213 channel occupancy is tied to transmission(s). On the other hand, “channel occupancy duration” in 38.213 is defined by a channel occupancy duration field and SFI-index field in DCI format 2\_0, which is not tied to “transmission(s)” but is just an indicated duration.The thing is the specs have not specified any linkage between them yet for FBE (The linkage for LBE is defined in Clause 4.2.1.0.0 of 37.213). What we should do now is to define the linkage for FBE. Looking at Samsung’s TP, their intention is a kind of re-defining of “channel occupancy time”, which does not help to define the linkage. On the contrary, it may cause confusion, because it looks conflicting with the original definition of “channel occupancy time” in 37.213 (i.e. the total time of transmission(s) and gaps <=25us). |

### Second round discussion

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| **Q1a:****Proposal NRU02-1:**If neither *CO-DurationPerCell-r16* nor *slotFormatCombinationId* are provided in DCI format 2\_0 and if *ChannelAccessMode-r16* = *semistatic*, the UE assumes the COT ends before the start of the next fixed frame period.**In addition, there has been discussion to clarifying the following case:****FBE with configuration of at least one of SFI and CO-duration field but no detection of any of them.**Solution Option 1) There is no remaining channel occupancy, regardless of a detection of DL in the FFP.Solution Option 2) A remaining channel occupancy ends right before the idle period of the FFP, if the UE detects any DL in the FFP (as proposed by Samsung).Including recent opinions exchanged over the email reflector indicate a tendency towards option 1.**Can we agree Proposal NRU02-1 and agree/conclude that Option 1 is adopted? Can the following TP be endorsed?**

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| --------- beginning of text proposal for TS 38.213 11.1 Slot configuration**<omitted>**If a UE is provided *ChannelAccessMode-r16 ='dynamic'* and is provided *availableRB-SetsToAddModList-r16* and *availableRB-SetsToRelease-r16*, the UE expects to be provided *co-DurationsPerCell ToAddModList-r16* and *co-DurationsPerCellToReleaseList-r16* and/or *slotFormatCombToAddModList* and *slotFormatCombToReleaseList*.If neither *CO-DurationPerCell-r16* nor *slotFormatCombinationId* is provided and if *ChannelAccessMode-r16* = *semistatic* is provided, the procedures in Clause 11.1.1 apply with assuming a channel occupancy time defined in [4.3 of 37.213] as being indicated as the remaining channel occupancy duration if a DL transmission burst(s) is detected within the channel occupancy time.**<omitted>** |

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| **Company** | **Comment** |
| LG Electronics | Support |
| Nokia, NSB | Small editorial suggestion:If neither *CO-DurationPerCell-r16* nor *slotFormatCombinationId* is provided and if *ChannelAccessMode-r16* = *semistatic* is provided, the procedures in Clause 11.1.1 apply with assuming a channel occupancy time defined in [4.3 of 37.213] ~~as being indicated as~~ is the indicated remaining channel occupancy duration if a DL transmission burst(s) is detected within the channel occupancy time. |

## Reception/Measurement/Validation (DL-D1/DL-B6)

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| **Q2:**R1-2008126, P1 [Samsung] , R1-2008041, P1 [LG]::Adopt the following TP for TS 38.213.

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| ======================== Start of TP for TS 38.213 =========================11.1.1 UE procedure for determining slot format======================= Unchanged Texts Omitted =========================For operation with shared spectrum channel access, if a UE is configured by higher layers to receive a CSI-RS and the UE is provided *CO-DurationPerCell-r16*, for a set of symbols of a slot that are indicated as downlink or flexible by *tdd-UL-DL-ConfigurationCommon* or *tdd*-*UL-DL-ConfigurationDedicated*, or when *tdd-UL-DL-ConfigurationCommon* and *tdd*-*UL-DL-ConfigurationDedicated* are not provided, the UE cancels the CSI-RS reception in the set of symbols of the slot that are not within the indicated remaining channel occupancy duration. If the UE detects a DCI format 2\_0 providing a downlink or flexible slot format for the set of symbols of the slot that are not within the indicated remaining channel occupancy duration, the UE shall ignore the slot format for the set of symbols of the slot.======================= Unchanged Texts Omitted ================================================ End of TP for TS 38.213 ======================== |

R1-2008204, P4 [Nokia]:Adopt the following clarification for TS38.213 for sub-clause 11.1.1

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| For a set of symbols of a slot indicated to a UE as flexible by *tdd-UL-DL-ConfigurationCommon* and *tdd-UL-DL-ConfigurationDedicated* if provided, or when *tdd-UL-DL-ConfigurationCommon* and *tdd-UL-DL-ConfigurationDedicated* are not provided to the UE, and if the UE detects a DCI format 2\_0 providing a format for the slot using a slot format value other than 255 - ….- if the UE is configured by higher layers to receive PDSCH or CSI-RS in the set of symbols of the slot, the UE receives the PDSCH or the CSI-RS in the set of symbols of the slot only if an SFI-index field value in DCI format 2\_0 indicates the set of symbols of the slot as downlink and, if applicable, the set of symbols is within indicated remaining channel occupancy.  |

**Please provide your views on the proposals.** |
| **Company** | **Comment** |
| OPPO | Agree with Samsung’ TP and fine with Nokia’s TP in principle.  |
| Vivo | Agree with Nokia’s TP. |
| LG Electronics | Prefer Samsung’s TP, since it can resolve specification conflict issue and in addition, ignoring flexible symbols outside COT can provide more flexibility to gNB. |
| Nokia, NSB | Either of TPs does the job.  |
| Sharp | R1-2008204, P4 [Nokia] should be discussed with R1-2008126, P1 [Samsung] and R1-2008041, P1 [LG]. We are fine with either one. |
| Samsung | Support our TP as proponent. |
| Qualcomm | Prefer Nokia’s TP.For Samsung’s TP, we think it should be “the UE shall ignore the CSI-RS reception for the set of symbols of the slot.” |
| Ericsson | The issue with Samsung/LG TP is that it stated to ignore slot format. We agree with QC that it is better to describe the corresponding functionality.In all three TPs, it is mentioned “indicated” remaining channel occupancy. We should remove “indicated” since for FBE we don’t need to indicate COT. It would be sufficient to mention “remaining channel occupancy”. How the UE determines “the remaining channel occupancy” depends on if LBE or FBE used, etc. Nokia’s TP is preferred with removal of “indicated”.- if the UE is configured by higher layers to receive PDSCH or CSI-RS in the set of symbols of the slot, the UE receives the PDSCH or the CSI-RS in the set of symbols of the slot only if an SFI-index field value in DCI format 2\_0 indicates the set of symbols of the slot as downlink and, if applicable, the set of symbols is within ~~indicated~~ remaining channel occupancy.  |
| ZTE, Sanechips | This issue has been discussed in the last meeting and has no any consensus. But if most companies think this issue needs to be discussed further, we can respect your opinions. For Nokia’s TP, it is acceptable for us with minor modification:Modified TP based on Nokia’s TPFor a set of symbols of a slot indicated to a UE as flexible by *tdd-UL-DL-ConfigurationCommon* and *tdd-UL-DL-ConfigurationDedicated* if provided, or when *tdd-UL-DL-ConfigurationCommon* and *tdd-UL-DL-ConfigurationDedicated* are not provided to the UE, and if the UE detects a DCI format 2\_0 providing a format for the slot using a slot format value other than 255 - ….- if the UE is configured by higher layers to receive PDSCH or CSI-RS in the set of symbols of the slot, the UE receives the PDSCH or the CSI-RS in the set of symbols of the slot only if an SFI-index field value in DCI format 2\_0 indicates the set of symbols of the slot as downlink and, if applicable, the set of symbols is within indicated remaining channel occupancy duration.  |
| Huawei, HiSilicon | Either TP is fine. Also agree with Ericsson’s comment that the word of “indicated” should be removed from “indicated remaining channel occupancy duration” because COT duration is not indicated in FBE. |
| Lenovo, Motorola Mobility | We share Ericsson’s view. |
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### Second round discussion

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| **Q2a:****Is the following Proposal agreeable:****Proposal NRU02-2:**If *CO-DurationPerCell-r16* or *slotFormatCombinationId* are provided in DCI format 2\_0 and if *ChannelAccessMode-r16* = *semistatic*, the UE does not expect the indicated COT duration, by CO-duration or SFI field,  to end later than before the start of the next fixed frame period.**If above proposal is agreeable, do we need a TP to reflect the agreement, or should the above rather be a conclusion of the issue without the need of a spec change? Note that the following could be a base TP (**TS38.213 sub-clause 11.1.1) **for inclusion in the specs (based on Nokia’s TP).**

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| For a set of symbols of a slot indicated to a UE as flexible by *tdd-UL-DL-ConfigurationCommon* and *tdd-UL-DL-ConfigurationDedicated* if provided, or when *tdd-UL-DL-ConfigurationCommon* and *tdd-UL-DL-ConfigurationDedicated* are not provided to the UE, and if the UE detects a DCI format 2\_0 providing a format for the slot using a slot format value other than 255 - ….- if the UE is configured by higher layers to receive PDSCH or CSI-RS in the set of symbols of the slot, the UE receives the PDSCH or the CSI-RS in the set of symbols of the slot only if an SFI-index field value in DCI format 2\_0 indicates the set of symbols of the slot as downlink and, if applicable, the set of symbols is within remaining channel occupancy.  |

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| **Company** | **Comment** |
| LG Electronics | Support Nokia’s TP. For NRU02-2, we don’t expect any spec change even though it can be agreed as a conclusion. |
| Nokia, NSB | I got bit confused, how is the Nokia TP related to **Proposal NRU02-2 😊**In any case, we support our TP with (indicated removed) as well. And we support the proposal 2-2 as well, we are fine with having it as conclusion. |

## UE behaviour for deactivation of semi-persistent CSI-RS reporting (DL-G1)

During RAN4 #95 it was agreed to clarify the UE ehavior in case of receiving the MAC-CE deactivation command for semi-persistent CSI reporting, in case of UL LBT failure for sending the HARQ-ACK.

The following options had been discussed in RAN1 #102-e (cf. R1-2005220, R1-2007260):

**Option 1**
If UE cannot transmit HARQ-ACK on MAC-CE deactivation due to UL CCA failure, UE continues to be in its previous state, i.e., it should measure and report L1-RSRP until it successfully transmits HARQ-ACK

**Option 1bis**
If UE cannot transmit HARQ-ACK on MAC-CE deactivation due to UL CCA failure, UE continues to be in its previous state, however it is up to UE implementation whether it continues measure and report L1-RSRP or report stale L1-RSRP until it successfully transmits HARQ-ACK

**Option 2**
For semi-persistent CSI reporting with PUCCH, if UE cannot transmit HARQ-ACK on the MAC CE deactivation due to the UL LBT failures, UE continues the L1-RSRP measurements but delay the L1-RSRP reporting. If UE does not receive deactivation command during the delay period, UE restarts to transmit L1-RSRP reporting.

**Option 3**
Delay the L1-RSRP reporting when the HARQ feedback cannot be transmitted after receiving the MAC CE deactivation command. A time limit shall be defined when the L1-RSRP reporting is delayed. When exceeding the time limits, UE shall abandon the stored measurement results, where the time limit is FFS. The UE shall also abandon the measurement results when the HARQ feedback is retransmitted for the deactivation command

**Option 4**
For semi-persistent CSI reporting with PUCCH, if UE cannot transmit HARQ-ACK on the MAC CE deactivation due to the UL LBT failure, the UE performs deactivation at the original MAC action time.

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| **Q3: What should be the UE behaviour for the case mentioned by RAN4?**R1-2007607, O2 [Huawei]:All three options [FL NOTE: Option 1/2/3] can solve the ambiguity issue between gNB and UE on the CSI-RS-based measurement and reporting. Option 1 has least standard impact from Rel-15.R1-2007979, P2 [Ericsson]:Support Option 4 and send LS reply to RAN4R1-2008204, P5 [Nokia]:To enable gNB to re-send MAC-CE in case of PUCCH decoding failure or LBT failure occurs, prolong the MAC-CE processing delay from 3ms to X ms (FFS: X)**Please share your view on above listed proposals or how to define the UE ehavior.** |
| **Company** | **Comment** |
| OPPO | Support option 4.  |
| Vivo | Support Option 1 with the following reason:First, I would like to list the possible cases that may happen:Case 1: UE decodes MAC CE successfully + UE sends PUCCH on slot *n* upon LBT success + gNB decode PUCCH successfully;Case 2: UE decodes MAC CE successfully + UE sends PUCCH on slot *n* upon LBT success + gNB fails to decode the PUCCH;Case 3: UE decodes MAC CE successfully + UE fails to send PUCCH on slot *n* due to LBT failure + gNB won’t decode the PUCCH;Case 4: UE fails to decode MAC CE + UE won’t send PUCCH on slot *n* + gNB won’t decode the PUCCH.Second, the behavior of gNB and UE are listed in the following table for Option 1 and Option 4 respectively. It is clearly observed that Option 1 has ambiguity issue for Case 2 and Option 4 has ambiguity issue for Case 4. Besides, the ambiguity time is almost the same, i.e. from the first slot that is after slot until successful reception of HARQ ACK for MAC CE retransmission .

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|  | Option 1 | Option 4 |
| Case 1 | gNB&UE: Deactivation of SP-CSI reporting from the first slot that is after slot No ambiguity | gNB&UE: Deactivation of SP-CSI reporting from the first slot that is after slot No ambiguity |
| Case 2 | gNB: No deactivation of SP-CSI reporting reception from the first slot that is after slot and wait for HARQ ACK retransmission. After a while, there is no any HARQ ACK received, gNB retransmit MAC CE.UE: Deactivation of SP-CSI reporting reception from the first slot that is after slot Ambiguity from the first slot that is after slot until successful reception of HARQ ACK for MAC CE retransmission  | gNB: Deactivation of SP-CSI reporting reception from the first slot that is after slot UE: Deactivation of SP-CSI reporting from the first slot that is after slot No ambiguity |
| Case 3 | gNB: No deactivation of SP-CSI reporting reception from the first slot that is after slot and wait for HARQ ACK retransmission.UE: No deactivation of SP-CSI reporting from the first slot that is after slot and retransmit HARQ ACK in next opportunity. No ambiguity but deactivation delayed | gNB: Deactivation of SP-CSI reporting reception from the first slot that is after slot UE: Deactivation of SP-CSI reporting reception from the first slot that is after slot No ambiguity |
| Case 4 | gNB: No deactivation of SP-CSI reporting reception from the first slot that is after slot and wait for HARQ ACK retransmission. After a while, there is no any HARQ ACK received, gNB retransmit MAC CE.UE: No deactivation of SP-CSI reportingNo ambiguity but deactivation delayed | gNB: Deactivation of SP-CSI reporting reception from the first slot that is after slot and wait for HARQ ACK retransmission. After a while, there is no any HARQ ACK received, gNB retransmit MAC CE.UE: No deactivation of SP-CSI reporting.Ambiguity from the first slot that is after slot until successful reception of HARQ ACK for MAC CE retransmission  |

Finally, to make the decision, the question boils down to how often will Case 2 and Case 4 occur? As we know, the target BLER for PUCCH is less than 1% while that for PDSCH carrying MAC CE is around 10%. Therefore, it is clearly Option 1 is better than Option 4 since it could solve more ambiguity cases. |
| Nokia, NSB | We are not OK with Option 4 due to adding complexity at gNB, and our preference is still Option 1. However, we also think that if MAC-CE delay of application is increased to e.g. 10-20 ms for NR-U, at least for Scell deactivation and SP-CSI on PUCCH, then ambiguity can be handled with low complexity on both gNB and UE side. This could be potential compromise. |
| Qualcomm | We support option 4 for UE complexity reason. |
| Ericsson | We support Option 4 for the following reasons:* Option 4 requires no spec change.
	+ We observe that the Rel-15 spec contains a multitude of other MAC-CE use cases besides activation/deactivation of SP-CSI on PUCCH. 38.321 Section 6.1.3 contains a long list of MAC-CE messages, and 38.214 contains related procedure text in multiple locations regarding the timing of when these messages should be applied at the MAC layer. It would be highly undesirable to have a unique solution just for deactivation of SP-CSI reporting on PUCCH. Why should this use case be treated differently than all of the others?
	+ The relevant section of the 38.214 spec on timing of activation/deactivation of SP-CSI reporting on PUCCH is 5.2.1.5.2 which contains the following paragraph:
	+ While this paragraph says “activation” it actually applies to both activation and deactivation of SP-CSI reporting due to the structure of the MAC-CE message. As shown in the extract from 38.321 below, the MAC-CE message includes a 4-bit field for activating/deactivating SP-CSI reporting on PUCCH for up to 4 configured Report Settings. A ‘1’ indicates activation for a particular Report Setting and a ‘0’ indicates deactivation.

For semi-persistent reporting on PUCCH, the PUCCH resource used for transmitting the CSI report are configured by *reportConfigType*. Semi-persistent reporting on PUCCH is activated by an activation command as described in clause 6.1.3.16 of [10, TS 38.321], which selects one of the semi-persistent Reporting Settings for use by the UE on the PUCCH. When the UE would transmit a PUCCH with HARQ-ACK information in slot *n* corresponding to the PDSCH carrying the activation command, the indicated semi-persistent Reporting Setting should be applied starting from the first slot that is after slot where ** is the SCS configuration for the PUCCH. * + The highlighted wording above is exactly Option 4. “Would transmit a PUCCH” is interpreted as “would transmit a PUCCH if LBT had been successful” and the remaining highlighted text refers to the “original MAC-CE action time” stated in Option 4.
* Option 4 simplifies UE processing
	+ This option allows a separation of PHY and MAC at the UE, thus allowing MAC processing to behave as in in Rel-15 and not be dependent on LBT outcome (performed in radio hardware).
* Option 4 does not place additional processing burden on the gNB relative to Option 1
	+ Fundamentally, the gNB implementation must be able to take into account uncertainty on whether the UE has deactivated SP-CSI for both Option 1 and Option 4. This can happen even if the UE passes LBT and is able to transmit PUCCH (e.g., PUCCH decoding failure ag the gNB). To account for this uncertainty, the gNB will need to try two hypotheses for reception of PUCCH resources in the future (after slot n) to account for the fact that CSI may or may not be multiplexed (the gNB doesn’t know). This is needed so the gNB doesn’t fail to decode other important HARQ-ACK/NACKs that may be multiplexed on PUCCH. This must happen until the gNB is able to confirm that the UE deactivated SP-CSI, e.g., by re-transmitting another MAC-CE deactivation and eventually successfully receiving another ACK. So, if the gNB needs to account for the uncertainty anyway, it doesn’t matter whether or not the UE uses Option 1 or Option 4. Hence, if Option 4 is simpler from a UE perspective, it makes sense to adopt such a solution.

Question to proponents of Option 1: It is not clear how the UE reports L1-RSRP when LBT is failing for PUCCH.Question to vivo: In all of cases 2, 3, and 4, the gNB fails to decode PUCCH. It does not know if it is because of LBT failure at the UE, PDSCH decoding failure of MAC-CE, or just a missed detection of PUCCH. It is not clear that the gNB action would be any different for any of these cases, and it is not clear that Option 1 would result in any different processing at the gNB compared to Option 4.It feels like an optimization to make a spec change for this one case of MAC-CE compared to the multitude of other MAC-CE use cases. |
| ZTE, Sanechips | In our view, Option 1 and Option4 are acceptable for us. But if “at the original MAC action time” in Option 4 can be understood as the time corresponding to the first slot that is after slot and n is the slot corresponding to PUCCH transmission if LBT has been successful , then we tend to support option 4. |
| Huawei, HiSilicon | We support option 1 as it follows Rel-15 design. The implementation at gNB can be maintained. The compromised solution from Nokia is also acceptable. |
| Lenovo, Motorola Mobility | We prefer the UE to continue sending the reports (like Option 1). The point of the acknowledgement is to establish that a) the UE is not transmitting the report any longer, and b) the corresponding resource can be reassigned for other purposes by the gNB.However we acknowledge that if the UE received a deactivation command, obviously the gNB does not see a need for updating the measurement any longer. So in case the UE cannot transmit the acknowledgement due to LBT failure, it should still be okay to stop the measurement procedure right away and report one of the abundant "not valid" values as already defined in 38.133 Table 10.1.6.1-1.An additional benefit is that this can be understood by the gNB that the deactivation command was received but acknowledgement could not be sent.In summary:If UE cannot transmit HARQ-ACK on MAC-CE deactivation due to UL CCA failure, UE stops measuring L-RSRP but continues to report L1-RSRP (using the existing "not valid" content) until it successfully transmits HARQ-ACK. |
| Ericsson 2 | There seems to be conflicting views on what is the "no spec change" option.In our understanding, Option 4 is the no-spec change option, not Option 1.Consider Rel-15 (licensed operation) where vivo's Case 1, 2, or 4 apply. The relevant paragraph from 38.214 is in Section 5.2.1.5.2:*When the UE would transmit a PUCCH with HARQ-ACK information in slot n corresponding to the PDSCH carrying the activation command, the indicated semi-persistent Reporting Setting should be applied starting from the first slot that is after slot where  is the SCS configuration for the PUCCH.*Note that this paragraph applies to both activation and deactivation as we describe in our previous comment above, and in more detail in our contribution.According to this paragraph of the spec, for Case 1 and 2, the UE continues to be in its previous state, thus will measure/report SP-CSI up until slot n + 3 ms. For Case 4, the UE continues to measure/report up to slot n1 + 3 ms, where n1 > n is the slot in which the UE would transmit PUCCH with HARQ-ACK corresponding to a successfully received re-transmission of the MAC-CE deactivation message on PDSCH. So, in all three cases, the UE continues to be in its previous state, and thus measure/report up to slot n + 3 ms. It does not stop measuring/reporting at slot n (or n1).Now if we consider unlicensed operation, vivo's Case 3 is the new case to consider (LBT failure in slot n where the UE would transmit PUCCH). According to Option 4, "*if UE cannot transmit HARQ-ACK on the MAC CE deactivation due to the UL LBT failure, the UE performs deactivation at the original MAC action time.*" Our understanding of this wording is that the UE continues to report up to slot n + 3ms, and stops reporting in the first slot after that.So, in answer to ZTE's question, yes, the original MAC action times is indeed the first slot that is after slot .In contrast, Option 1 says "*If UE cannot transmit HARQ-ACK on MAC-CE deactivation due to UL CCA failure, UE continues to be in its previous state, i.e., it should measure and report L1-RSRP until it successfully transmits HARQ-ACK.*"With Option 1, this means the UE stops measuring/reporting at slot n, not slot n + 3ms as the current spec says.In summary, Option 4 is the "no spec change" option, not Option 1. I feel we at least need to achieve common understanding on this point before debating the various options. |
| vivo | According to Ericsson’s 2nd round comments, it seems that there is need to have some clarification for Option 1 and Option 4 first. In our understanding, the key difference between them is how to define the slot n instead of whether to have +3ms:Option 1: From UE side, the slot n is the slot where UE transmits HARQ-ACK on MAC-CE deactivation successfully;From gNB side, the slot n is the slot where gNB receives HARQ-ACK on MAC-CE deactivation successfully;Option 4: From UE side, the slot n is the first slot where UE plans to transmit HARQ-ACK on MAC-CE deactivation;From gNB side, the slot n is the slot where gNB receives HARQ-ACK on MAC-CE deactivation successfully or doesn’t receive anything on PUCCH resource corresponding to the sending MAC-CE deactivation PDSCH. Whether Option 1 or Option 4, the indicated semi-persistent Reporting Setting should be applied starting from the first slot that is after slot where **is the SCS configuration for the PUCCH. This understanding seems different with what Ericsson mentioned above (i.e “the UE stops measuring/reporting at slot n, not slot n + 3ms as the current spec says.”). Based on the above understanding, I would say Option 4 is not aligned with current spec/gNB implementation at least for Case 4, i.e. UE fails to decode MAC CE and doesn’t send PUCCH. In licensed case, gNB will consider this DTX state as NACK and assume UE will not stop measuring and reporting. However, for Option 4, gNB will consider DTX state as ACK and assume UE will stop measuring and reporting. In contrast, Option 1 is aligned with current spec that the deactivation will be only applied when HARQ-ACK information is transmitted/received. In answer to Ericsson’s question below:*In all of cases 2, 3, and 4, the gNB fails to decode PUCCH. It does not know if it is because of LBT failure at the UE, PDSCH decoding failure of MAC-CE, or just a missed detection of PUCCH. It is not clear that the gNB action would be any different for any of these cases, and it is not clear that Option 1 would result in any different processing at the gNB compared to Option 4.*gNB follows the defined behavior and doesn’t need to distinguish case 2, 3 and 4. As you see in the table in our 1st round comment, the behavior for case 2, 3 and 4 at gNB side is the same, i.e. no deactivation. Regarding gNB processing, I am not sure that current gNB implementation will take any uncertainty into account as Ericsson mentions (i.e. the gNB will need to try two hypotheses for reception of PUCCH resources in the future (after slot n) to account for the fact that CSI may or may not be multiplexed (the gNB doesn’t know)) since the ambiguity happens for Case 2 is rare and it could be quite small. This could be also maintained by Option 1. However, if we go for Option 4, the ratio of Case 4 is around 10%, gNB must take this into account and try two hypotheses for future PUCCH reception and some PUSCH reception. Question to ZTE: For if “at the original MAC action time” in Option 4 can be understood as the time corresponding to the first slot that is after slot and n is the slot corresponding to PUCCH transmission if LBT has been successful, should this be exactly Option 1 if the above clarification is correct?In summary, the understanding of Option 1 and Option 4 should be clarified (especially the key difference). If our understanding is correct, Option 1 is more aligned with the behavior in NR Rel-15.  |
| Nokia NSB | We disagree with Ericsson that the spec is clear. The spec can be interpreted either way Option 1 or Option 4. This will not move us anywhere. Again, we proposed to relax the timeline of application from n+3ms to n+Xms to facilitate low complex handling of LBT failure at gNB and UE. Any issues with this proposal?And if we cannot converge, then RAN1 can just reply to RAN4 that RAN1 specification is not clear when considering LBT failure and there is no consensus on how to clarify it in RAN1 either.  |
| Ericsson 3 | I would like to respond to one thing specifically in vivo's reply before discussing further:Vivo: *Whether Option 1 or Option 4, the indicated semi-persistent Reporting Setting should be applied starting from the first slot that is after slot where is the SCS configuration for the PUCCH. This understanding seems different with what Ericsson mentioned above (i.e “the UE stops measuring/reporting at slot n, not slot n + 3ms as the current spec says.”).* This is a misunderstanding of what we provided in our response. We made this statement about Option 1. Please see clarifying text in red in our previous "Ericsson 2" response above. |