**3GPP TSG RAN WG1 #100bis R1-2001940**

**e-Meeting, April 20th – 30th, 2020**

**Agenda Item:** 7.2.2.2.5

**Source:** Moderator (LG Electronics)

**Title:** Summary on maintenance of wide-band operation for NR-U

**Document for:** Discussion and decision

# Introduction

This is the summary document for 7.2.2.2.5 on remaining issues of wide-band operation for NR-U, based on the contributions listed in reference section. The identified topics are categorized into three issues, as follows:

* Issue A: RB set configuration
* Issue B: CORESET and search space configuration
* Issue C: DL reception or UL transmission on resource overlapped with intra-cell guard band

Further details for the above issues and preliminary views on the priority for each sub-issue are provided in Sections 2 to 4. The priority for each specific issue is summarized in Section 5. Text proposals corresponding to sub-issues are collected in Appendix A.

# Issue A: RB set configuration

## Issue A1: Determination of FFS values for RRC parameters

One company (LG Electronics [6]) addressed an issue to resolve FFS values for RRC parameters regarding RB set configuration. As captured below from running CR for TS 38.331, it is observed that there are still FFS points for RRC parameters related to intra-cell guard band configuration.

IntraCellGuardBand-r16 ::= SEQUENCE (SIZE (1..ffsValue)) OF GuardBand-r16 -- FFS upper size 4, assuming 100Mhz cell

GuardBand-r16 ::= SEQUENCE {

 startCRB-r16 INTEGER (0..ffsValue), --FFS upper range 275

 nrofCRBs-r16 INTEGER (1..ffsValue)

}

For *IntraCellGuardBand-r16*,

* The number of entries of *GuardBand-r16* can be up to 4 considering 100 MHz is the maximum carrier bandwidth for FR1.

For *GuardBand-r16*,

* The value range of *startCRB-r16* is from 0 to 2474 (=2199+275), considering that
	+ The value range of *offsetToCarrier* RRC parameter indicating offset in frequency domain between Point A (lowest subcarrier of common RB 0) and the lowest usable subcarrier on the carrier in number of PRBs (using the *subcarrierSpacing* defined for this carrier) is defined from 0 to 2199 (=275\*8-1), and
	+ The value range of *carrierBandwidth* RRC parameter indicating the width of a carrier in number of PRBs is defined from 1 to 275
* The value range of *nrofCRBs-r16* is from 1 to 10, considering the table below captured from RAN4 agreement made in RAN4#93.

|  |  |  |
| --- | --- | --- |
| 15 kHz | 30 kHz | 60 kHz |
| Usable RBs | Guard RBs | Usable RBs | Guard RBs | Usable RBs | Guard RBs |
| 104, 105 | 6, 7 | 49, 50, 51 | 5, 6, 7 | [22, 23, 24] | [3, 4, 5] |

Therefore, above RRC parameters can be updated as follows:

IntraCellGuardBand-r16 ::= SEQUENCE (SIZE (1..4)) OF GuardBand-r16 -- FFS upper size 4, assuming 100Mhz cell

GuardBand-r16 ::= SEQUENCE {

 startCRB-r16 INTEGER (0..2474), --FFS upper range 275

 nrofCRBs-r16 INTEGER (1..10)

}

**Comments for priority**

|  |  |  |
| --- | --- | --- |
| Company | Priority (High or Low) | Comments |
| LG Electronics | High | Detailed value ranges can be changed based on discussion. It would be preferable that RAN1 determine value ranges for those RRC parameters and recommend to RAN2 what RAN1 decide. |
| Huawei, HiSilicon | Low | We can wait for more agreement in RAN4. For example, *nrofCRB* may not be necessary to start from 1. |

## Issue A2: Corrections based on RAN1 and RAN2 agreements

Several companies suggested corrections on RB set, considering followings:

1. RAN1 to reflect RAN2 agreement that intra-cell guard band is configured with starting CRB index and size (instead of starting/ending CRB index)
	* Pointed out by Huawei [1], vivo [2], ZTE [3], OPPO [4], LG Electronics [6], Intel [7], Ericsson [8], Nokia [11]
2. Separation of RB set configuration for DL and UL (as per previous RAN1 agreement)
	* Pointed out by Huawei [1], ZTE [3], LG Electronics [6], Ericsson [8], Nokia [11]
3. Error in computing , instead of
	* Pointed out by ZTE [3], LG Electronics [6], Ericsson [8], Qualcomm [15]
4. BWP configured not to include parts of a RB set (as per previous RAN1 agreement)
	* Pointed out by Qualcomm [15]

**Comments for priority**

|  |  |  |
| --- | --- | --- |
| Company | Priority (High or Low) | Comments |
| LG Electronics | High | Corrections reflecting all of above 4 points should be adopted. |
| Huawei, HiSilicon | High |  |
| MediaTek | High | Agree with FL |

## Issue A3: RB set index within a BWP

One company (Ericsson [8]) addressed an issue that RB set is configured per cell but RB set indexing within a BWP is necessary at least for frequency domain resource allocation in the uplink BWP.

**Comments for priority**

|  |  |  |
| --- | --- | --- |
| Company | Priority (High or Low) | Comments |
| LG Electronics | High |  |
| Huawei, HiSilicon | High | It is necessary to complete PUCCH design |
| MediaTek | High |  |

## Issue A4: No guard band configuration

Several companies discussed the issue on no guard band configuration, as follows:

* Huawei [1] proposed to revisit previous RAN1 agreement (intra-cell guard band defined in RAN4 specification by default), and to assume no guard band when *intraCellGuardBandDL-r16* or *intraCellGuardBandUL-r16* is absent
* OPPO [4] proposed that when active UL BWP bandwidth is more than 20 MHz, the zero guard band should not be configured for uplink when interlace is enabled, since UL BWP configured with no guard band contradicts to interlaced PUCCH configured to be confined within a LBT subband.
* MediaTek [5], Ericsson [8], and Sharp [14] proposed that a single RB set is defined for a serving cell configured without intra-cell guard band.
* Nokia [11] proposed to set both of *startCRB-r16* and *nrofCRBs-r16* to 0 for a serving cell without intra-cell guard band.

**Comments for priority**

|  |  |  |
| --- | --- | --- |
| Company | Priority (High or Low) | Comments |
| LG Electronics | High |  |
| Huawei, HiSilicon | Low | It is going to be discussed in RAN2 meeting next week. We can wait for their agreement. |
| MediaTek | High | How to indicate no intra-cell guard band for a serving cell could be up to RAN2 decision. However, a single RB set still has to be defined for a serving cell configured without intra-cell guard band in RAN1 specification, and it is critical.  |

## Issue A5: Relationship between RB set and LBT channel defined in 37.213

One company (OPPO [4]) proposed to clarify that the configured RB set shall not be partially overlapped with a LBT subband in unlicensed spectrum.

**Comments for priority**

|  |  |  |
| --- | --- | --- |
| Company | Priority (High or Low) | Comments |
| LG Electronics | Low |  |
| Huawei, HiSilicon | High | It should be common understanding. It worth clarifying in spec  |
| MediaTek | Low | Not necessary to clarify it in the spec. If gNB chooses to do so, following operations in the RB set partially overlapped with a LBT BW will violate regulation. |

## Issue A6: Reduced nominal channel bandwidth

One company (Nokia [11]) proposed that a reduction of nominal channel bandwidth by 1 PRB can be configured in *intraCellGuardBandDL-r16* or *intraCellGuardBandUL-r16* with *reducedNominalChannelBW-R16*, considering that RAN4 is discussing possibility to reduce nominal channel BW from 51 to 50 for 20 MHz carrier to enable better coexistence of wideband operation with CA

**Comments for priority**

|  |  |  |
| --- | --- | --- |
| Company | Priority (High or Low) | Comments |
| LG Electronics | Low | Further discussion is needed to identify the issue itself. |
| Huawei, HiSilicon | Low | Need more information from RAN4 |
| MediaTek | Low |  |

## Issue A7: Relocation of RB set definition from 38.214 to 38.211

One company (Ericsson [8]) proposed to move text in Section 38.214 Section 7 to 38.211 Section 4.4.6 and to update references in 38.212, 38.213, 38.214, and 38.215 as needed to point to the new section in 38.211.

**Comments for priority**

|  |  |  |
| --- | --- | --- |
| Company | Priority (High or Low) | Comments |
| LG Electronics | Low |  |
| Huawei, HiSilicon | Low | It can be determined by Editors |
| MediaTek | Low |  |

# Issue B: CORESET and search space configuration

## Issue B1: PDCCH candidate and CCE mapping for search space configured with freqMonitorLocations-r16

Several companies (Huawei [1], vivo [2], LG Electronics [6], Panasonic [10], and Sharp [14]) proposed that the number of PDCCH candidates to be monitored (i.e., *nrofCandidates* or *nrofCandidates-SFI*) is assigned per each of RB sets for a search space set configured with *freqMonitorLocations-r16*. It is noted that *nrofCandidates* or *nrofCandidates-SFI* is assigned per CORESET associated with a search space set configured without *freqMonitorLocations-r16*.

In addition, Huawei [1] and Panasonic [10] suggested the enhancement of dropping rule for the case of overbooking of the number of PDCCH candidates and non-overlapping CCEs in a slot, per monitoring location for a search space set configured with *freqMonitorLocations-r16*, instead of per search space set as in Rel-15.

**Comments for priority**

|  |  |  |
| --- | --- | --- |
| Company | Priority (High or Low) | Comments |
| LG Electronics | High | Prioritize to clarify that *nrofCandidates* or *nrofCandidates-SFI* is assigned per each of RB sets for a search space set configured with *freqMonitorLocations-r16*. |
| Huawei, HiSilicon | High | It should be clarified in spec to complete the design of search space with multiple monitoring location in frequency domain |
| MediaTek | High |  |

## Issue B2: Corrections for TS 38.213

Several companies suggested corrections on CORESET and search space configuration, considering followings:

1. Resolution of potential misunderstanding that frequency domain resource of CORESET always starts from RB set 0 even if *freqMonitorLocation-r16* in associated search space does not indicate RB set 0
	* Supported by MediaTek [5], LG Electronics [6], Samsung [9], Nokia [11], Spreadtrum [12]
	* Objected by Huawei [1] (stating that no need to change since the current text on *frequencyDomainResources* in CORESET configuration is clear)
2. Terminology/index alignment between specifications
	* vivo [2] (*freqMonitorLocations-r16*), ZTE [3] (*freqMonitorLocations-r16* and *rb-offset-r16*), LG Electronics [6] (*rb-Offset-r16*, ), Nokia [11] ()

**Comments for priority**

|  |  |  |
| --- | --- | --- |
| Company | Priority (High or Low) | Comments |
| LG Electronics | High | Corrections reflecting all of above 2 points should be adopted. |
| Huawei, HiSilicon | Low | We think the current spec is clear enough.  |
| MediaTek | High | Potential misunderstanding should be clarified in the spec. |

# Issue C: DL reception or UL transmission on resource overlapped with intra-cell guard band

## Issue C1: PDSCH reception

|  |  |
| --- | --- |
| Company | Views |
| Huawei [1] | Proposal 5: When the intra-cell guard band overlapped with frequency domain resource allocation for a PDSCH is determined as Type-2 intra-cell guard band, the PDSCH should not map on these resource. |
| Nokia [11] | For carrier larger than 40MHz, in DL, gNB may configure dynamic rate-matching where rate-matching resource is configured to overlap with intra-cell GBs. However, as per current specification such operation is precluded, see highlighted part of spec below.

|  |
| --- |
| 5.1.4 PDSCH resource mappingWhen receiving the PDSCH scheduled with SI-RNTI and the system information indicator in DCI is set to 0, the UE shall assume that no SS/PBCH block is transmitted in REs used by the UE for a reception of the PDSCH.When receiving the PDSCH scheduled with SI-RNTI and the system information indicator in DCI is set to 1, RA-RNTI, MsgB-RNTI, P-RNTI or TC-RNTI, the UE assumes SS/PBCH block transmission according to *ssb-PositionsInBurst*, and if the PDSCH resource allocation overlaps with PRBs containing SS/PBCH block transmission resources the UE shall assume that the PRBs containing SS/PBCH block transmission resources are not available for PDSCH in the OFDM symbols where SS/PBCH block is transmitted.A UE expects a configuration provided by *ssb-PositionsInBurst* in *ServingCellConfigCommon* to be same as a configuration provided by *ssb-PositionsInBurst* in *SIB1*.When receiving PDSCH scheduled by PDCCH with CRC scrambled by C-RNTI, MCS-C-RNTI, CS-RNTI, or PDSCHs with SPS, the REs corresponding to the configured or dynamically indicated resources in Clauses 5.1.4.1, 5.1.4.2 are not available for PDSCH. Furthermore, the UE assumes SS/PBCH block transmission according to *ssb-PositionsInBurst* if the PDSCH resource allocation overlaps with PRBs containing SS/PBCH block transmission resources, the UE shall assume that the PRBs containing SS/PBCH block transmission resources are not available for PDSCH in the OFDM symbols where SS/PBCH block is transmitted. A UE is not expected to handle the case where PDSCH DM-RS REs are overlapping, even partially, with any RE(s) not available for PDSCH*.* |

 |
| Apple [13] | Proposal 1: * If available RB Sets indictor is provided in a detected DCI format 2\_0 and DL Type 0 resource allocation is used for PDSCH resource allocation,
* If precoding granularity is equal to the values among {2,4}, the UE shall assume the PDSCH and DMRS are not mapped to any PRG that is partially overlapped with a Type 2 intra-CC guard band.
* If precoding granularity is determined as “wideband”, the UE shall assume the PDSCH and DMRS are not mapped to any RB(s) that is partially overlapped with a Type 2 intra-CC guard band.

Proposal 2: * If Available RB set Indicator is not provided and DL Type 0 resource allocation is used for PDSCH resource allocation,
	+ If precoding granularity is equal to the values among {2,4}, UE shall assume the PDSCH and DMRS is not mapped to any PRG that is overlapped with any intra-CC guard band.
	+ If precoding granularity is determined as “wideband”, the UE shall assume the PDSCH and DMRS are not mapped to any RB(s) that is partially overlapped with a Type 2 intra-CC guard band.
 |

**Comments for priority**

|  |  |  |
| --- | --- | --- |
| Company | Priority (High or Low) | Comments |
| LG Electronics | Low | It would be preferable to discuss under DL signal/channel agenda item (7.2.2.1.2), if deemed necessary. |
| Huawei, HiSilicon | High | The behaviour should be clarified when intra cell guard is configured. We are fine to discuss it in DL agenda item. |
| MediaTek | Low | Agree with FL |

## Issue C2: CSI-RS configuration

One company (OPPO [4]) proposed that the configured CSI-RS resource for tracking in unlicensed band shall be restricted within a RB set.

**Comments for priority**

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| --- | --- | --- |
| Company | Priority (High or Low) | Comments |
| LG Electronics | Low | Up to gNB configuration |
| MediaTek | Low | Agree with FL |

## Issue C3: PUSCH transmission

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| --- | --- |
| Company | Views |
| Huawei [1] | Proposal 5: When the intra-cell guard band overlapped with frequency domain resource allocation for a PUSCH is determined as Type-2 intra-cell guard band, the PUSCH should not map on these resource.Observation 3: The intersection of the resource blocks of the indicated interlaces and the indicated set of RB sets and intra-cell guard bands defined in Clause 7 between the indicated RB sets will result zero frequency resource allocation.Proposal 6: For resource allocation type 0, the UE shall determine the resource allocation in frequency domain as an intersection of the resource blocks of the indicated RBG(s) and union of RB set(s) overlapping with the indicated RBG(s) and intra cell guard bands between the adjacent RB sets overlapping with the indicated RBG(s), if any. The corresponding text proposal is in TP#2 in the appendix. |

**Comments for priority**

|  |  |  |
| --- | --- | --- |
| Company | Priority (High or Low) | Comments |
| LG Electronics | Low | It would be preferable to discuss under UL signal/channel agenda item (7.2.2.1.3), if deemed necessary. |
| Huawei, HiSilicon | High | The behaviour should be clarified when intra cell guard is configured. We are fine to discuss it in UL agenda item |
| MediaTek | Low | Agree with FL |

# Summary on the priority for the remaining issues

|  |  |  |
| --- | --- | --- |
| Issue | HIGH priority | LOW priority |
| Issue A: RB set configuration |  |  |
| Issue A1: Determination of FFS values for RRC parameters | LG Electronics | Huawei, HiSilicon |
| Issue A2: Corrections based on RAN1 and RAN2 agreements | LG Electronics, Huawei, HiSilicon, MediaTek |  |
| Issue A3: RB set index within a BWP | LG Electronics, Huawei, HiSilicon, MediaTek |  |
| Issue A4: No guard band configuration | LG Electronics, MediaTek | Huawei, HiSilicon |
| Issue A5: Relationship between RB set and LBT channel defined in 37.213 | Huawei, HiSilicon | LG Electronics, MediaTek |
| Issue A6: Reduced nominal channel bandwidth |  | LG Electronics, Huawei, HiSilicon, MediaTek |
| Issue A7: Relocation of RB set definition from 38.214 to 38.211 |  | LG Electronics, Huawei, HiSilicon, MediaTek |
| Issue B: CORESET and search space configuration |  |  |
| Issue B1: PDCCH candidate and CCE mapping for search space configured with *freqMonitorLocations-r16* | LG Electronics Huawei, HiSilicon, MediaTek |  |
| Issue B2: Corrections for TS 38.213 | LG Electronics, MediaTek | Huawei, HiSilicon |
| Issue C: DL reception or UL transmission on resource overlapped with intra-cell guard band |  |  |
| Issue C1: PDSCH reception | Huawei, HiSilicon | LG Electronics, MediaTek |
| Issue C2: CSI-RS configuration |  | LG Electronics, MediaTek |
| Issue C3: PUSCH transmission | Huawei, HiSilicon | LG Electronics, MediaTek |

# Reference

1. R1-2001538 Maintainance on the wideband operation procedures Huawei, HiSilicon
2. R1-2001656 Remaining issues on wideband operation in NR-U vivo
3. R1-2001709 Remaining issues on the wideband operation for NR-U ZTE, Sanechips
4. R1-2001763 Discussion on the remaining issues of wide-band operations OPPO
5. R1-2001905 Remaining issues on wideband operation for NR-U MediaTek Inc.
6. R1-2001939 Remaining issues of wide-band operation for NR-U LG Electronics
7. R1-2001991 Wideband operation for NR-unlicensed Intel Corporation
8. R1-2002035 Wideband operation Ericsson
9. R1-2002121 Wide-band operation for NR-U Samsung
10. R1-2002198 Remaining issues on Rel-16 NR-U wideband operations Panasonic
11. R1-2002226 Remaining issues on Wideband operation in NR-U Nokia, Nokia Shanghai Bell
12. R1-2002277 Remaining issues in wide-band operation Spreadtrum Communications
13. R1-2002322 Remaining issues of wideband operation Apple
14. R1-2002385 Remaining issues on wide-band operation for NR-U Sharp
15. R1-2002534 TP for Wideband operation for NR-U operation Qualcomm Incorporated

# Appendix A: Text proposals corresponding to sub-issues

## Issue A2

### From vivo [2],

|  |
| --- |
| --------------------------------------------- Start TP1 for Section 7 of TS 38.214 ----------------------------------------For operation with shared spectrum channel access, when the UE is configured with any of *intraCellGuardBandUL-r16* for UL carrier and *intraCellGuardBandDL-r16* for DL carrier, the UE is provided with intra-cell guard bands on a carrier, each defined by start CRB and ~~end~~ number of CRBs, and , respectively. The intra-cell guard bands separate RB-sets, each defined by start and end CRB, and , respectively. UE determines , , and the remaining start and end CRBs as and . When the UE is not configured with *intraCellGuardBandUL-r16,* the UE determines intra-cell guard band and corresponding RB-set according to the [default intra-cell GB pattern from 38.101 corresponding to and carrier size ]. When the UE is not configured with *intraCellGuardBandDL-r16,* the UE determines intra-cell guard band and corresponding RB-set according to the [default intra-cell GB pattern from 38.101 corresponding to and carrier size ].---------------------------------------------- End TP1 for Section 7 of TS 38.214 ---------------------------------------- |

### From ZTE [3],

|  |
| --- |
| ---------------------------------------------- < Start of text proposal for 38.214 [1]> --------------------------------------------**7 UE procedures for transmitting and receiving on a carrier with intra-cell guard bands**For operation with shared spectrum channel access, when the UE is configured with any of *intraCellGuardBandUL-r16* for UL carrier and *intraCellGuardBandDL-r16* for DL carrier, the UE is provided with intra-cell guard bands on a carrier, each defined by start CRB index and size in number of CRBs, and , respectively, with the subscript set to DL and UL for downlink and uplink, respectively. The intra-cell guard bands separate RB-sets, each defined by start and end CRB, and , respectively. UE determines , , and the remaining start and end CRBs as and . When the UE is not configured with *intraCellGuardBandUL-r16,* the UE determines intra-cell guard band and corresponding RB-set according to the [default intra-cell GB pattern from 38.101 corresponding to and carrier size ]. When the UE is not configured with *intraCellGuardBandDL-r16,* the UE determines intra-cell guard band and corresponding RB-set according to the [default intra-cell GB pattern from 38.101 corresponding to and carrier size ]. For a carrier with intra-carrier guard bands, the UE does not expect to receive a BWP configuration by *BWP-Downlink* or *BWP-Uplink* partially overlapping with a RB-set. RB-sets within BWP form a set of cardinality .[The configuration of *intraCellGuardBandDL-r16* and *intraCellGuardBandUL-r16* can indicate to the UE that no intra-cell guard-bands are configured.]----------------------------------------------------- < End of text proposal> ------------------------------------------------------- |

### From LG Electronics [6],

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **<TS 38.213>**12 Bandwidth part operation **<Unchanged parts are omitted>**If a bandwidth part indicator field is configured in DCI format 0\_1 and indicates an active UL BWP with different SCS configuration , or with different number of RB sets, than a current active UL BWP, the UE determines an uplink frequency domain resource allocation Type 2 based on bits and bits that are generated by independently truncating or padding the MSBs and the LSBs [6, TS 38.214] of the frequency domain resource assignment field of DCI format 0\_1, where truncation starts from the MSBs of the X bits or the Y bits, zero-padding prepends zeros to the X bits or the Y bits, and- if the indicated active UL BWP has SCS configuration and the current active BWP has SCS configuration , the MSBs are truncated to bits, or- if the indicated active UL BWP has SCS configuration and the current active BWP has SCS configuration , the MSBs are zero-padded to bits - otherwise, the MSBs are unchangedand- the LSBs are truncated or zero-padded to bits where is a number of RB sets configured for the indicated active UL BWP**<TS 38.214>**6.1.2.2.3 Uplink resource allocation type 2In uplink resource allocation of type 2, the resource block assignment information defined in [5, TS 38.212] indicates to a UE a set of up to *M* interlace indices, and for DCI 0\_1 a set of up to contiguous RB sets, where *M* and interlace indexing are defined in Clause 4.4.4.6 in [4, TS 38.211]. The UE shall determine the resource allocation in frequency domain as an intersection of the resource blocks of the indicated interlaces and the indicated set of RB sets and intra-cell guard bands defined in Clause 7 between the indicated RB sets, if any. For µ=0, the X MSBs of the resource block assignment information indicates to a UE a set of allocated interlace indices , where the indication consists of a resource indication value (*RIV*). For , the resource indication value corresponds to the starting interlace index *m0* and the number of contiguous interlace indices (). The resource indication value is defined by:if thenelseFor , the resource indication value corresponds to the starting interlace index *m0* and the set of values  according to Table 6.1.2.2.3-1.**Table 6.1.2.2.3-1: *m0* and  for .**

|  |  |  |
| --- | --- | --- |
|  | ***m0*** |  |
| 0 | 0 | {0, 5} |
| 1 | 0 | {0, 1, 5, 6} |
| 2 | 1 | {0, 5} |
| 3 | 1 | {0, 1, 2, 3, 5, 6, 7, 8} |
| 4 | 2 | {0, 5} |
| 5 | 2 | {0, 1, 2, 5, 6, 7} |
| 6 | 3 | {0, 5} |
| 7 | 4 | {0, 5} |

For µ=1, the X MSBs of the resource block assignment information comprise a bitmap indicating the interlaces that are allocated to the scheduled UE. The bitmap is of size *M* bits with one bitmap bit per interlace such that each interlace is addressable, where *M* and interlace indexing is defined in Clause 4.4.4.6 in [4, TS 38.211]. The order of interlace bitmap is such that interlace 0 to interlace are mapped from MSB to LSB of the bitmap. An interlace is allocated to the UE if the corresponding bit value in the bitmap is 1; otherwise the interlace is not allocated to the UE.For both µ=0 and µ=1, the the resource block assignment information indicate to a UE a set of contiguously allocated RB sets for PUSCH scheduled by DCI 0\_1 and Type 1 and Type 2 configured grant. The resource allocation field consists of a resource indication value (*RIVRBset*). For , the resource indication value corresponds to the starting RB set () and the number of contiguous RB sets . The resource indication value is defined by;if thenelseIf transform precoding is enabled according to the procedure in Clause 6.1.3, then the UE transmits PUSCH on the lowest-indexed PRBs indicated by the frequency domain resource assignment information. is the largest integer not greater than the number of RBs indicated by the frequency domain resource assignment information that fulfils the conditions in [4, TS 38.211 Clause 6.3.1.4].**<Unchanged parts are omitted>**7 UE procedures for transmitting and receiving on a carrier with intra-cell guard bandsFor operation with shared spectrum channel access, when the UE is configured with any of *intraCellGuardBandUL-r16* for UL carrier and *intraCellGuardBandDL-r16* for DL carrier, the UE is provided with intra-cell guard bands on a carrier, each defined by start CRB and size in number of CRBs, and , respectively, with the subscript set to DL and UL for downlink and uplink, respectively. The intra-cell guard bands separate RB-sets, each defined by start and end CRB, and , respectively. UE determines , , and the remaining start and end CRBs as and . When the UE is not configured with *intraCellGuardBandUL-r16,* the UE determines intra-cell guard band and corresponding RB-set according to the [default intra-cell GB pattern from 38.101 corresponding to and carrier size ]. When the UE is not configured with *intraCellGuardBandDL-r16,* the UE determines intra-cell guard band and corresponding RB-set according to the [default intra-cell GB pattern from 38.101 corresponding to and carrier size ]. For a carrier with intra-carrier guard bands, the UE does not expect to receive a BWP configuration by *BWP-Downlink* or *BWP-Uplink* partially overlapping with a RB-set. RB-sets within BWP form a set of cardinality .[The configuration of *intraCellGuardBandDL-r16* and *intraCellGuardBandUL-r16* can indicate to the UE that no intra-cell guard-bands are configured.] |

### From Intel [7],

|  |
| --- |
| **Text proposal for TS 38.214****7 UE procedures for transmitting and receiving on a carrier with intra-cell guard bands**For operation with shared spectrum channel access, when the UE is configured with any of *intraCellGuardBandUL-r16* for UL carrier and *intraCellGuardBandDL-r16* for DL carrier, the UE is provided with intra-cell guard bands on a carrier, each defined by start CRB, and the number of CRBs , provided by higher layer parameters *startCRB-r16* and *nrofCRBs-r16* respectively. The intra-cell guard bands separate RB-sets, each defined by start and end CRB, and , respectively. UE determines , , and the remaining start and end CRBs as and . When the UE is not configured with *intraCellGuardBandUL-r16,* the UE determines intra-cell guard band and corresponding RB-set according to the [default intra-cell GB pattern from 38.101 corresponding to and carrier size ]. When the UE is not configured with *intraCellGuardBandDL-r16,* the UE determines intra-cell guard band and corresponding RB-set according to the [default intra-cell GB pattern from 38.101 corresponding to and carrier size ]. For a carrier with intra-carrier guard bands, the UE does not expect to receive a BWP configuration by *BWP-Downlink* or *BWP-Uplink* partially overlapping with a RB-set. RB-sets within BWP form a set of cardinality .[The configuration of *intraCellGuardBandDL-r16* and *intraCellGuardBandUL-r16* can indicate to the UE that no intra-cell guard-bands are configured.] |

### From Ericsson [8]

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| --- |
| ----------------------------------------- Text Proposal for 38.214, Section 7 ------------------------------------------\*\*\* Unchanged text omitted \*\*\*For operation with shared spectrum channel access, when the UE is configured with any of *intraCellGuardBandUL-r16* for UL carrier and *intraCellGuardBandDL-r16* for DL carrier, the UE is provided with intra-cell guard bands on a carrier, each defined by start and end CRB, and , respectively. The subscript is set to DL and UL for the downlink and uplink, respectively. The intra-cell guard bands separate RB-sets, each defined by start and end CRB, and , respectively. UE determines , , and the remaining start and end CRBs as and . When the UE is not configured with *intraCellGuardBandUL-r16,* the UE determines intra-cell guard band and corresponding RB-set according to the [default intra-cell GB pattern from 38.101 corresponding to and carrier size ]. When the UE is not configured with *intraCellGuardBandDL-r16,* the UE determines intra-cell guard band and corresponding RB-set according to the [default intra-cell GB pattern from 38.101 corresponding to and carrier size ]. For a carrier with intra-carrier guard bands, the UE does not expect to receive a BWP configuration by *BWP-Downlink* or *BWP-Uplink* partially overlapping with a RB-set. RB-sets within BWP form a set of cardinality .[The configuration of *intraCellGuardBandDL-r16* and *intraCellGuardBandUL-r16* can indicate to the UE that no intra-cell guard-bands are configured.]\*\*\* Unchanged text omitted \*\*\*---------------------------------------------------- End Text Proposal ----------------------------------------------------------------------------------------- Text Proposal for 38.214, Section 6.1.2.2.3 -------------------------------------\*\*\* Unchanged text omitted \*\*\*For both µ=0 and µ=1, bits in the resource block assignment information indicate to a UE a set of contiguously allocated RB sets for PUSCH scheduled by DCI 0\_1 and Type 1 and Type 2 configured grant. The resource allocation field consists of a resource indication value (*RIV*RBset). For , the resource indication value corresponds to the starting RB set () and the number of contiguous RB sets . The resource indication value is defined by;if thenelse\*\*\* Unchanged text omitted \*\*\*---------------------------------------------------- End Text Proposal ---------------------------------------------------------------------------------------------- Text Proposal for 38.xxx, Section y ------------------------------------------\*\*\* Unchanged text omitted \*\*\*For operation with shared spectrum channel access, when the UE is configured with any of *intraCellGuardBandUL-r16* for UL carrier and *intraCellGuardBandDL-r16* for DL carrier, the UE is provided with intra-cell guard bands on a carrier, each defined by start CRB and ~~end~~ a number of CRBs, and , respectively. The intra-cell guard bands separate RB-sets, each defined by start and end CRB, and , respectively. UE determines , , and the remaining start and end CRBs as and . When the UE is not configured with *intraCellGuardBandUL-r16,* the UE determines intra-cell guard band and corresponding RB-set according to the [default intra-cell GB pattern from 38.101 corresponding to and carrier size ]. When the UE is not configured with *intraCellGuardBandDL-r16,* the UE determines intra-cell guard band and corresponding RB-set according to the [default intra-cell GB pattern from 38.101 corresponding to and carrier size ]. For a carrier with intra-carrier guard bands, the UE does not expect to receive a BWP configuration by *BWP-Downlink* or *BWP-Uplink* partially overlapping with a RB-set. RB-sets within BWP form a set of cardinality .[The configuration of *intraCellGuardBandDL-r16* and *intraCellGuardBandUL-r16* can indicate to the UE that no intra-cell guard-bands are configured.] \*\*\* Unchanged text omitted \*\*\*---------------------------------------------------- End Text Proposal ----------------------------------------------------- |

### From Nokia [11],

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| TP for 38.214<unchanged text omitted>6.1.2.2.3 Uplink resource allocation type 2<omitted text>For µ=1, the resource block assignment information includes a bitmap indicating the interlaces that are allocated to the scheduled UE. The bitmap is of size *M* bits with one bitmap bit per interlace such that each interlace is addressable, where *M* and interlace indexing is defined in Section 4.4.4.6 in [4, TS 38.211]. The order of interlace bitmap is such that interlace 0 to interlace are mapped from MSB to LSB of the bitmap. An interlace is allocated to the UE if the corresponding bit value in the bitmap is 1; otherwise the interlace is not allocated to the UE.For both µ=0 and µ=1, bits in the resource block assignment information indicate to a UE a set of contiguously allocated RB sets for PUSCH scheduled by DCI 0\_1 and Type 1 and Type 2 configured grant. The resource allocation field consists of a resource indication value (*RIVRBset*). For , the resource indication value corresponds to the starting RB set () and the number of contiguous RB sets . The resource indication value is defined by;if thenelse<unchanged text omitted>7 UE procedures for transmitting and receiving on a carrier with intra-cell guard bandsFor operation with shared spectrum channel access, when the UE is configured with any of *intraCellGuardBandUL-r16* for x=UL carrier and *intraCellGuardBandDL-r16* for x=DL carrier, the UE is provided with intra-cell guard bands on a carrier, each defined by start and end CRB, and , respectively, with the subscript set to DL and UL for downlink and uplink, respectively. The intra-cell guard bands separate RB-sets, each defined by start and end CRB, and , respectively. UE determines , , and the remaining start and end CRBs as and . RB-set consists of resource blocks. When the UE is not configured with *intraCellGuardBandUL-r16,* the UE determines intra-cell guard band and corresponding RB-set according to the ~~[~~default intra-cell GB pattern from 38.101 corresponding to and carrier size ~~]~~. When the UE is not configured with *intraCellGuardBandDL-r16,* the UE determines intra-cell guard band and corresponding RB-set according to the ~~[~~default intra-cell GB pattern from 38.101 corresponding to and carrier size ~~]~~. For a carrier with intra-carrier guard bands, the UE does not expect to receive a BWP configuration by *BWP-Downlink* or *BWP-Uplink* partially overlapping with a RB-set. RB-sets within BWP form a set of cardinality . |

### From Sharp [14],

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| **Text proposal #2**--------- beginning of text proposal for TS 38.2147 UE procedures for transmitting and receiving on a carrier with intra-cell guard bandsFor operation with shared spectrum channel access, when the UE is configured with any of *intraCellGuardBandUL-r16* for UL carrier and *intraCellGuardBandDL-r16* for DL carrier, the UE is provided with intra-cell guard bands on a carrier, each defined by start and end CRB, and , respectively. The intra-cell guard bands separate RB-sets, each defined by start and end CRB, and , respectively. UE determines , , and the remaining start and end CRBs as and . When the UE is not configured with *intraCellGuardBandUL-r16,* the UE determines intra-cell guard band and corresponding RB-set according to the [default intra-cell GB pattern from 38.101 corresponding to and carrier size ]. When the UE is not configured with *intraCellGuardBandDL-r16,* the UE determines intra-cell guard band and corresponding RB-set according to the [default intra-cell GB pattern from 38.101 corresponding to and carrier size ].For a carrier with intra-carrier guard bands, the UE does not expect to receive a BWP configuration by *BWP-Downlink* or *BWP-Uplink* partially overlapping with a RB-set. RB-sets within BWP form a set of cardinality .The subscript x for ,,,, and are set to DL for downlink, and set to UL for uplink. When there is no risk for confusion, the subscript x may be dropped.[The configuration of *intraCellGuardBandDL-r16* and *intraCellGuardBandUL-r16* can indicate to the UE that no intra-cell guard-bands are configured.]-------- Unchanged contents are omitted--------- end of text proposal  |

### From Qualcomm [15],

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| ====TP for 38.214 7==============7 UE procedures for transmitting and receiving on a carrier with intra-cell guard bandsFor operation with shared spectrum channel access, when the UE is configured with any of *intraCellGuardBandUL-r16* for UL carrier and *intraCellGuardBandDL-r16* for DL carrier, the UE is provided with intra-cell guard bands on a carrier, each defined by start and end CRB, and , respectively. The intra-cell guard bands separate RB-sets, each defined by start and end CRB, and , respectively. UE determines , , and the remaining start and end CRBs as and . When the UE is not configured with *intraCellGuardBandUL-r16,* the UE determines intra-cell guard band and corresponding RB-set according to the [default intra-cell GB pattern from 38.101 corresponding to and carrier size ]. When the UE is not configured with *intraCellGuardBandDL-r16,* the UE determines intra-cell guard band and corresponding RB-set according to the [default intra-cell GB pattern from 38.101 corresponding to and carrier size ]. or a carrier with intra-carrier guard bands, the UE expects , and for .[The configuration of *intraCellGuardBandDL-r16* and *intraCellGuardBandUL-r16* can indicate to the UE that no intra-cell guard-bands are configured.]======================== |

## Issue A3

### From Ericsson [8]

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| ------------------------------------ Text Proposal for 38.214, Section 6.1.2.2.3 -------------------------------------\*\*\* Unchanged text omitted \*\*\*For both µ=0 and µ=1, bits in the resource block assignment information indicate to a UE a set of contiguously allocated RB sets for PUSCH scheduled by DCI 0\_1 and Type 1 and Type 2 configured grant. The resource allocation field consists of a resource indication value (*RIV*RBset). For , the resource indication value corresponds to the starting RB set () and the number of contiguous RB sets . The resource indication value is defined by;if thenelse\*\*\* Unchanged text omitted \*\*\*---------------------------------------------------- End Text Proposal ---------------------------------------------------------------------------------------------- Text Proposal for 38.214, Section 7 ------------------------------------------\*\*\* Unchanged text omitted \*\*\*For operation with shared spectrum channel access, when the UE is configured with any of *intraCellGuardBandUL-r16* for UL carrier and *intraCellGuardBandDL-r16* for DL carrier, the UE is provided with intra-cell guard bands on a carrier, each defined by start and end CRB, and , respectively. The intra-cell guard bands separate RB-sets, each defined by start and end CRB, and , respectively. UE determines , , and the remaining start and end CRBs as and . When the UE is not configured with *intraCellGuardBandUL-r16,* the UE determines intra-cell guard band and corresponding RB-set according to the [default intra-cell GB pattern from 38.101 corresponding to and carrier size ]. When the UE is not configured with *intraCellGuardBandDL-r16,* the UE determines intra-cell guard band and corresponding RB-set according to the [default intra-cell GB pattern from 38.101 corresponding to and carrier size ]. For a carrier with intra-carrier guard band(s), the UE does not expect to receive a BWP configuration by *BWP-Downlink* or *BWP-Uplink* partially overlapping with an RB-set. ~~RB-sets within a BWP form a set of cardinality~~ . A BWP contains a set of contiguous RB-sets indexed by where is the number of RB sets contained in the BWP, and is the common RB set index of the first RB set in the BWP. The common RB set index within a carrier and RB set index within a BWP are related by .[The configuration of *intraCellGuardBandDL-r16* and *intraCellGuardBandUL-r16* can indicate to the UE that no intra-cell guard-bands are configured.]\*\*\* Unchanged text omitted \*\*\*---------------------------------------------------- End Text Proposal ----------------------------------------------------- |

## Issue A4

### From MediaTek [5],

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| ==============================**Text Proposal 2 Starts**================================**7. UE procedures for transmitting and receiving on a carrier with intra-cell guard bands**For operation with shared spectrum channel access, when the UE is configured with any of *intraCellGuardBandUL-r16* for UL carrier and *intraCellGuardBandDL-r16* for DL carrier, the UE is provided with intra-cell guard bands on a carrier, each defined by start and end CRB, and , respectively. The intra-cell guard bands separate RB-sets, each defined by start and end CRB, and , respectively. UE determines , , and the remaining start and end CRBs as and . When the UE is not configured with *intraCellGuardBandUL-r16,* the UE determines intra-cell guard band and corresponding RB-set according to the [default intra-cell GB pattern from 38.101 corresponding to and carrier size ]. When the UE is not configured with *intraCellGuardBandDL-r16,* the UE determines intra-cell guard band and corresponding RB-set according to the [default intra-cell GB pattern from 38.101 corresponding to and carrier size ]. For a carrier with intra-carrier guard bands, the UE does not expect to receive a BWP configuration by *BWP-Downlink* or *BWP-Uplink* partially overlapping with a RB-set. RB-sets within BWP form a set of cardinality .[The configuration of *intraCellGuardBandDL-r16* and *intraCellGuardBandUL-r16* can indicate to the UE that no intra-cell guard-bands are configured.] If a UE is provided with *intraCellGuardBandDL-r16* or *intraCellGuardBandUL-r16* to indicate no intra-cell guard-bands are configured for a DL or UL carrier, the UE determines a single RB-set with and for the carrier and assumes .============================== **Text Proposal 2 Ends**================================== |

### From Ericsson [8],

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| ----------------------------------------- Text Proposal for 38.214, Section 7 ------------------------------------------\*\*\* Unchanged text omitted \*\*\*For operation with shared spectrum channel access, when the UE is configured with any of *intraCellGuardBandUL-r16* for UL carrier and *intraCellGuardBandDL-r16* for DL carrier, the UE is provided with intra-cell guard bands on a carrier, each defined by start and end CRB, and , respectively. The intra-cell guard bands separate RB-sets, each defined by start and end CRB, and , respectively. UE determines , , and the remaining start and end CRBs as and . When the UE is not configured with *intraCellGuardBandUL-r16,* the UE determines intra-cell guard band and corresponding RB-set according to the [default intra-cell GB pattern from 38.101 corresponding to and carrier size ]. When the UE is not configured with *intraCellGuardBandDL-r16,* the UE determines intra-cell guard band and corresponding RB-set according to the [default intra-cell GB pattern from 38.101 corresponding to and carrier size ]. For a carrier with intra-carrier guard bands, the UE does not expect to receive a BWP configuration by *BWP-Downlink* or *BWP-Uplink* partially overlapping with a RB-set. RB-sets within BWP form a set of cardinality .[The configuration of *intraCellGuardBandDL-r16* and *intraCellGuardBandUL-r16* can indicate to the UE that no intra-cell guard-bands are configured.] For a carrier without intra-cell guard bands, the carrier contains a single RB set with start and end CRB indices given by the above expressions with RB set index and number of RB sets .\*\*\* Unchanged text omitted \*\*\*---------------------------------------------------- End Text Proposal ----------------------------------------------------- |

### From Nokia [11],

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| TP for 38.2147 UE procedures for transmitting and receiving on a carrier with intra-cell guard bands<unchanged text omitted> ~~[The configuration of~~ *~~intraCellGuardBandDL-r16~~* ~~and~~ *~~intraCellGuardBandUL-r16~~* ~~can indicate to the UE that no intra-cell guard-bands are configured.]~~When *intraCellGuardBandDL-r16* or *intraCellGuardBandUL-r16* indicates *startCRB-r16*=0 and *nrofCRBs-r16=0,* UE assumes there are no intra-cell guard-bands present on the corresponding carrier. |

### From Sharp [14],

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| **Text proposal #1**--------- beginning of text proposal for TS 38.2147 UE procedures for transmitting and receiving on a carrier with intra-cell guard bandsFor operation with shared spectrum channel access, when the UE is configured with any of *intraCellGuardBandUL-r16* for UL carrier and *intraCellGuardBandDL-r16* for DL carrier, the UE is provided with intra-cell guard bands on a carrier, each defined by a starting and an ending CRB, and , respectively. The UE determines RB-sets, each defined by a starting and an ending CRB, and , respectively. UE determines , , and the remaining starting and ending CRBs as and . When the UE is not configured with *intraCellGuardBandUL-r16,* the UE determines intra-cell guard bands and corresponding RB-sets according to the [default intra-cell GB pattern from 38.101 corresponding to and carrier size ]. When the UE is not configured with *intraCellGuardBandDL-r16,* the UE determines intra-cell guard bands and corresponding RB-sets according to the [default intra-cell GB pattern from 38.101 corresponding to and carrier size ]. For a carrier with intra-cell guard bands, the UE does not expect to receive a BWP configuration by *BWP-Downlink* or *BWP-Uplink* partially overlapping with an RB-set. RB-sets within a BWP form a set of cardinality .-------- Unchanged contents are omitted--------- end of text proposal  |

## Issue A5

### From OPPO [4],

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| ----------------------------------------TP1: Start of 38.214 section 7 --------------------------------------7 UE procedures for transmitting and receiving on a carrier with intra-cell guard bandsFor operation with shared spectrum channel access, when the UE is configured with any of *intraCellGuardBandUL-r16* for UL carrier and *intraCellGuardBandDL-r16* for DL carrier, the UE is provided with intra-cell guard bands on a carrier, each defined by start and end CRB, and , respectively. The intra-cell guard bands separate RB-sets, each defined by start and end CRB, and , respectively. UE determines , , and the remaining start and end CRBs as and . When the UE is not configured with *intraCellGuardBandUL-r16,* the UE determines intra-cell guard band and corresponding RB-set according to the [default intra-cell GB pattern from 38.101 corresponding to and carrier size ]. When the UE is not configured with *intraCellGuardBandDL-r16,* the UE determines intra-cell guard band and corresponding RB-set according to the [default intra-cell GB pattern from 38.101 corresponding to and carrier size ]. For a carrier with intra-carrier guard bands, the UE does not expect to receive a RB set configuration by *intraCellGuardBandDL-r16* or *intraCellGuardBandUL-r16* partially overlapping with a channel on which a channel access procedure is performed in shared spectrum [TS 37.213].For a carrier with intra-carrier guard bands, the UE does not expect to receive a BWP configuration by *BWP-Downlink* or *BWP-Uplink* partially overlapping with a RB-set. RB-sets within BWP form a set of cardinality .[The configuration of *intraCellGuardBandDL-r16* and *intraCellGuardBandUL-r16* can indicate to the UE that no intra-cell guard-bands are configured.]----------------------------------------End of 38.214 section 7 -------------------------------------- |

## Issue A6

### From Nokia [11],

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| TP for 38.2147 UE procedures for transmitting and receiving on a carrier with intra-cell guard bandsFor operation with shared spectrum channel access, when the UE is configured with any of *intraCellGuardBandUL-r16* for x=UL carrier and *intraCellGuardBandDL-r16* for x=DL carrier, the UE is provided with intra-cell guard bands on a carrier, each defined by start and end CRB, and , respectively, with the subscript set to DL and UL for downlink and uplink, respectively. The intra-cell guard bands separate RB-sets, each defined by start and end CRB, and , respectively. UE determines , , and the remaining start and end CRBs as and . RB-set consists of resource blocks. When the UE is not configured with *intraCellGuardBandUL-r16,* the UE determines intra-cell guard band and corresponding RB-set according to the ~~[~~default intra-cell GB pattern from 38.101 corresponding to and carrier size ~~]~~. When the UE is not configured with *intraCellGuardBandDL-r16,* the UE determines intra-cell guard band and corresponding RB-set according to the ~~[~~default intra-cell GB pattern from 38.101 corresponding to and carrier size ~~]~~. For a carrier with intra-carrier guard bands, the UE does not expect to receive a BWP configuration by *BWP-Downlink* or *BWP-Uplink* partially overlapping with a RB-set. RB-sets within BWP form a set of cardinality .~~[The configuration of~~ *~~intraCellGuardBandDL-r16~~* ~~and~~ *~~intraCellGuardBandUL-r16~~* ~~can indicate to the UE that no intra-cell guard-bands are configured.]~~When *intraCellGuardBandDL-r16* or *intraCellGuardBandUL-r16* indicates *startCRB-r16*=0 and *nrofCRBs-r16=0,* UE assumes there are no intra-cell guard-bands present on the corresponding carrier.When UE is provided with parameter *reducedNominalChannelBW-R16* in *intraCellGuardBandDL-r16* or *intraCellGuardBandUL-r16* , UE sets , otherwise . |

## Issue B1

### From Huawei [1],

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| 10.1 UE procedure for determining physical downlink control channel assignment \*\*\* Unchanged text is omitted \*\*\*For all search space sets within a slot , denote by  a set of CSS sets with cardinality of  and by  a set of USS sets with cardinality of . The location of USS sets , , in  is according to an ascending order of the search space set index. Denote by , , the number of counted PDCCH candidates for monitoring for CSS set  and by , , the number of counted PDCCH candidates for monitoring for USS set . Denote by , the number of counted PDCCH candidates for each monitoring location for USS set , if *freqMonitorLocations-r16* is configured.For the CSS sets, a UE monitors  PDCCH candidates requiring a total of  non-overlapping CCEs in a slot. The UE allocates PDCCH candidates for monitoring to USS sets for the primary cell having an active DL BWP with SCS configuration  in a slot if the UE is not provided *PDCCHMonitoringCapabilityConfig* for the primary cell or if the UE is provided *PDCCHMonitoringCapabilityConfig* = *R15 PDCCH monitoring capability* for all serving cells, or in a span if the UE is provided *PDCCHMonitoringCapabilityConfig* = *R16 PDCCH monitoring capability* for the primary cell, according to the following pseudocode. If for the USS sets for scheduling on the primary cell the UE is not provided *CORESETPoolIndex* for first CORESETs, or is provided value 0 for first CORESETs, and is provided value 1 for second CORESETs, and if or , the following pseudocode applies only to USS sets associated with the first CORESETs. A UE does not expect to monitor PDCCH in a USS set without allocated PDCCH candidates for monitoring.Denote by  the set of non-overlapping CCEs for search space set  and by  the cardinality of  where the non-overlapping CCEs for search space set  are determined considering the allocated PDCCH candidates for monitoring for the CSS sets and the allocated PDCCH candidates for monitoring for all search space sets , .Set  Set Set while  AND allocate  PDCCH candidates for monitoring to USS set  ;; ;end whileif *freqMonitorLocations-r16* is configured, there are monitoring locations in frequency domain in the search space set Denote by the set of non-overlapping CCEs in each monitoring location of search space set and by the cardinality of where the non-overlapping CCEs in each monitoring location of search space set are determined considering the allocated PDCCH candidates for monitoring for the CSS sets and the allocated PDCCH candidates for monitoring for all search space sets . Set  ;Set ;Set ;While AND Set ;While AND AND  end whileallocate PDCCH candidates for monitoring to USS set   ; ; end while |

### From vivo [2],

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| ------------------------------------------ Start TP2 for Section 10.1 of TS 38.213 ----------------------------------------For a search space set  associated with CORESET  and configured with *freqMonitorLocations-r16*, it comprises of *K* sub search space set where *K* is the number of RB sets indicated as ‘1’ by *freqMonitorLocations-r16.* For each sub search space set, CCE is indexed according to CORESET ***p*** configuration in each RB set respectively. For a search space set *s* associated with CORESET ***p*** without configuration of *freqMonitorLocations-r16,* ora sub search space set as defined above,the CCE indexes for aggregation level  corresponding to PDCCH candidate  of the search space set in slot  for an active DL BWP of a serving cell corresponding to carrier indicator field value  are given by wherefor any CSS, ; for a USS, , ,  for ,  for ,  for , and ;; is the number of CCEs, numbered from 0 to , in CORESET ;  is the carrier indicator field value if the UE is configured with a carrier indicator field by *CrossCarrierSchedulingConfig* for the serving cell on which PDCCH is monitored; otherwise, including for any CSS, ;, where  is the number of PDCCH candidates the UE is configured to monitor for aggregation level  of a search space set  for a serving cell corresponding to ; for any CSS, ; for a USS,  is the maximum of  over all configured  values for a CCE aggregation level  of search space set  ;the RNTI value used for  is the C-RNTI.------------------------------------------ End TP2 for Section 10.1 of TS 38.213 ---------------------------------------- |

### From Panasonic [10],

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| …If the *monitoringSymbolsWithinSlot* indicates to a UE to monitor PDCCH in a subset of up to three consecutive symbols that are same in every slot where the UE monitors PDCCH for all search space sets, the UE does not expect to be configured with a PDCCH SCS other than 15 kHz if the subset includes at least one symbol after the third symbol. If *freqMonitorLocations-r16* indicates to a UE to monitor the search space set over multiple RB sets, the number of PDCCH candidates is assigned to each RB set.A UE does not expect to be provided a first symbol and a number of consecutive symbols for a CORESET that results to a PDCCH candidate mapping to symbols of different slots.… |

### From Sharp [14],

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| **Text proposal #3**--------- beginning of text proposal for TS 38.21310.1 UE procedure for determining physical downlink control channel assignment -------- Unchanged contents are omittedFor a search space set  associated with CORESET , * if the UE is not provided with *freqMonitorLocations-r16*, the CCE indexes for aggregation level  corresponding to PDCCH candidate  of the search space set in slot  for an active DL BWP of a serving cell corresponding to carrier indicator field value
* if the UE is provided with *freqMonitorLocations-r16* and if the (*k*+1)’th bit in the bitmap in *freqMonitorLocations-r16* is ‘1’, in RB set *k*, the CCE indexes for aggregation level  corresponding to PDCCH candidate  of the search space set in slot  for an active DL BWP of a serving cell corresponding to carrier indicator field value

are given by wherefor any CSS, ; for a USS, , ,  for ,  for ,  for , and ;; is the number of CCEs, numbered from 0 to , in CORESET ;  is the carrier indicator field value if the UE is configured with a carrier indicator field by *CrossCarrierSchedulingConfig* for the serving cell on which PDCCH is monitored; otherwise, including for any CSS, ;, where  is the number of PDCCH candidates the UE is configured to monitor for aggregation level  of a search space set  for a serving cell corresponding to ; for any CSS, ; for a USS,  is the maximum of  over all configured  values for a CCE aggregation level  of search space set  ;the RNTI value used for  is the C-RNTI.-------- Unchanged contents are omitted--------- end of text proposal  |

## Issue B2

### From vivo [2],

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| ------------------------------------------ Start TP3 for Section 10.1 of TS 38.213 ----------------------------------------For each CORESET in a DL BWP of a serving cell, a respective *frequencyDomainResources* provides a bitmap. - if a CORESET is not associated with any search space set configured with *freqMonitorLocations-r16*, the bits of the bitmap have a one-to-one mapping with non-overlapping groups of 6 consecutive PRBs, in ascending order of the PRB index in the DL BWP bandwidth of PRBs with starting common RB position , where the first common RB of the first group of 6 PRBs has common RB index if *rb-offset* is not provided, or the first common RB of the first group of 6 PRBs has common RB index where is provided by *rb-offset.* - if a CORESET is associated with at least one search space set configured with *freqMonitorLocations-r16*, the first bits of the bitmap have a one-to-one mapping with non-overlapping groups of 6 consecutive PRBs, in ascending order of the PRB index in the DL BWP bandwidth of PRBs with starting common RB position , where the first common RB of the first group of 6 PRBs has common RB index . , is a number of available PRBs in the RB set 0 for the DL BWP, and is provided by rb-offset or if rb-offset is not provided.… …* a bitmap by *freqMonitorLocations-r16*, if provided, to indicate one or more RB sets for the search space set , where the MSB in the bitmap corresponds to RB set in the DL BWP. For RB set indicated in the bitmap, the first PRB of the frequency domain monitoring location confined within the RB set is given by , where is the index of first PRB of the RB set , and is provided by rb-offset or if rb-offset is not provided. The frequency domain resource allocation pattern for each monitoring location is determined based on the first bits in *frequencyDomainResources* provided by the associated CORESET configuration.

------------------------------------------ End TP3 for Section 10.1 of TS 38.213 ---------------------------------------- |

### From ZTE [3],

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| ---------------------------------------------- < Start of text proposal for 38.213 [2]> --------------------------------------------10.1 UE procedure for determining physical downlink control channel assignment < Unchanged parts are omitted >For each CORESET in a DL BWP of a serving cell, a respective *frequencyDomainResources* provides a bitmap. - if a CORESET is not associated with any search space set configured with *freqMonitorLocations-r16*, the bits of the bitmap have a one-to-one mapping with non-overlapping groups of 6 consecutive PRBs, in ascending order of the PRB index in the DL BWP bandwidth of PRBs with starting common RB position , where the first common RB of the first group of 6 PRBs has common RB index if *rb-offset-r16* is not provided, or the first common RB of the first group of 6 PRBs has common RB index where is provided by *rb-offset-r16.* - if a CORESET is associated with at least one search space set configured with *freqMonitorLocations-r16*, the first bits of the bitmap have a one-to-one mapping with non-overlapping groups of 6 consecutive PRBs, in ascending order of the PRB index in the DL BWP bandwidth of PRBs with starting common RB position , where the first common RB of the first group of 6 PRBs has common RB index . , is a number of available PRBs in the RB set 0 for the DL BWP, and is provided by *rb-offset-r16* or if *rb-offset-r16* is not provided.< Unchanged parts are omitted >- a bitmap by *freqMonitorLocations-r16*, if provided, to indicate one or more RB sets for the search space set , where the MSB in the bitmap corresponds to RB set in the DL BWP. For RB set indicated in the bitmap, the first PRB of the frequency domain monitoring location confined within the RB set is given by , where is the index of first PRB of the RB set , and is provided by *rb-offset-r16* or if *rb-offset-r16* is not provided. The frequency domain resource allocation pattern for each monitoring location is determined based on the first bits in *frequencyDomainResources* provided by the associated CORESET configuration.< Unchanged parts are omitted >-------------------------------------------------- < End of text proposal> ---------------------------------------------------- |

### From MediaTek [5],

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| =============================**Text Proposal 1 Starts**==================================**10.1 UE procedure for determining physical downlink control channel assignment**\*\*\* Unchanged text is omitted \*\*\*For each CORESET in a DL BWP of a serving cell, a respective *frequencyDomainResources* provides a bitmap. - if a CORESET is not associated with any search space set configured with *freqMonitorLocation-r16*, the bits of the bitmap have a one-to-one mapping with non-overlapping groups of 6 consecutive PRBs, in ascending order of the PRB index in the DL BWP bandwidth of PRBs with starting common RB position , where the first common RB of the first group of 6 PRBs has common RB index if *rb-offset* is not provided, or the first common RB of the first group of 6 PRBs has common RB index where is provided by *rb-offset.* - ~~if a CORESET is associated with at least one search space set configured with~~ *~~freqMonitorLocation-r16~~*~~, the first bits of the bitmap have a one-to-one mapping with non-overlapping groups of 6 consecutive PRBs, in ascending order of the PRB index in the DL BWP bandwidth of PRBs with starting common RB position , where the first common RB of the first group of 6 PRBs has common RB index . , is a number of available PRBs in the RB set 0 for the DL BWP, and is provided by~~ *~~rb-offset~~* ~~or if~~ *~~rb-offset~~* ~~is not provided.~~\*\*\* Unchanged text is omitted \*\*\*For each DL BWP configured to a UE in a serving cell, the UE is provided by higher layers with  search space sets where, for each search space set from the  search space sets, the UE is provided the following by *SearchSpace*: - a search space set index , , by *searchSpaceId* \*\*\* Unchanged text is omitted \*\*\*- a bitmap by *freqMonitorLocation-r16*, if provided, to indicate one or more RB sets for the search space set , where the MSB in the bitmap corresponds to RB set in the DL BWP. For RB set indicated in the bitmap, the first PRB of the frequency domain monitoring location confined within the RB set is given by , where is the index of first PRB of the RB set , and is provided by *rb-offset* or if *rb-offset* is not provided. The frequency domain resource allocation pattern for each monitoring location is determined based on the first bits in *frequencyDomainResources* provided by the associated CORESET configuration, where, is a number of available PRBs in the RB set 0 for the DL BWP. If search-space is not provided with *freqMonitorLocation-r16* and the associated CORESET is associated with at least one another search space set configured with *freqMonitorLocation-r16*, the first bits in *frequencyDomainResources* provided by the associated CORESET configuration have a one-to-one mapping with non-overlapping groups of 6 consecutive PRBs in the RB set 0 for the DL BWP, in ascending order of the PRB index in the DL BWP bandwidth of PRBs with starting common RB index , where the first common RB of the first group of 6 PRBs has common RB index .\*\*\* Unchanged text is omitted \*\*\*============================== **Text Proposal 1 Ends**================================== |

### From LG Electronics [6],

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| 10.1 UE procedure for determining physical downlink control channel assignment **<Unchanged parts are omitted>**For each CORESET in a DL BWP of a serving cell, a respective *frequencyDomainResources* provides a bitmap. - if a CORESET is not associated with any search space set configured with *freqMonitorLocation-r16*, the bits of the bitmap have a one-to-one mapping with non-overlapping groups of 6 consecutive PRBs, in ascending order of the PRB index in the DL BWP bandwidth of PRBs with starting common RB position , where the first common RB of the first group of 6 PRBs has common RB index if *rb-Offset-r16* is not provided, or the first common RB of the first group of 6 PRBs has common RB index where is provided by *rb-Offset-r16.* - if a CORESET is associated with at least one search space set configured with *freqMonitorLocation-r16*, the first bits of the bitmap have a one-to-one mapping with non-overlapping groups of 6 consecutive PRBs, in ascending order of the PRB index in each RB set *k* with starting common RB position as described in [6, TS 38.214], where the first common RB of the first group of 6 PRBs has common RB index and RB set *k* is indicated in *freqMonitoringLocation-r16* if provided with associated search space, otherwise, . , is a number of available PRBs in the RB set 0 for the DL BWP, and is provided by *rb-Offset-r16* or if *rb-Offset-r16* is not provided.**<Unchanged parts are omitted>**- a bitmap by *freqMonitorLocation-r16*, if provided, to indicate one or more RB sets for the search space set , where the MSB in the bitmap corresponds to RB set in the DL BWP. For RB set indicated in the bitmap, the first PRB of the frequency domain monitoring location confined within the RB set is given by , where is the index of first PRB of the RB set as described in [6, TS 38.214], and is provided by *rb-Offset-r16* or if *rb-Offset-r16* is not provided. The frequency domain resource allocation pattern for each monitoring location is determined based on the first bits in *frequencyDomainResources* provided by the associated CORESET configuration. |

### From Samsung [9],

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| ============================== Start of TP for TS 38.213 ==============================10.1 UE procedure for determining physical downlink control channel assignment============================= Unchanged Texts Omitted ==============================For each CORESET in a DL BWP of a serving cell, a respective *frequencyDomainResources* provides a bitmap. - if a CORESET is not associated with any search space set configured with *freqMonitorLocation-r16*, the bits of the bitmap have a one-to-one mapping with non-overlapping groups of 6 consecutive PRBs, in ascending order of the PRB index in the DL BWP bandwidth of PRBs with starting common RB position , where the first common RB of the first group of 6 PRBs has common RB index if *rb-offset* is not provided, or the first common RB of the first group of 6 PRBs has common RB index where is provided by *rb-offset.* - if a CORESET is associated with at least one search space set configured with *freqMonitorLocation-r16*, the first bits of the bitmap have a one-to-one mapping with non-overlapping groups of 6 consecutive PRBs, in ascending order of the PRB index in each RB-set indicated in *freqMonitorLocation-r16* with starting common [7, TS 38.214], where the first common RB of the first group of 6 PRBs has common RB index. , is a number of available PRBs in the RB set 0 for the DL BWP, and is provided by *rb-offset* or if *rb-offset* is not provided.============================= Unchanged Texts Omitted ============================================================= End of TP for TS 38.213 ============================== |

### From Nokia [11],

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| TP to TS38.21310.1 UE procedure for determining physical downlink control channel assignment <unchanged text omitted >For each CORESET in a DL BWP of a serving cell, a respective *frequencyDomainResources* provides a bitmap. - if a CORESET is not associated with any search space set configured with *freqMonitorLocation-r16*, the bits of the bitmap have a one-to-one mapping with non-overlapping groups of 6 consecutive PRBs, in ascending order of the PRB index in the DL BWP bandwidth of PRBs with starting common RB position , where the first common RB of the first group of 6 PRBs has common RB index if *rb-offset* is not provided, or the first common RB of the first group of 6 PRBs has common RB index where is provided by *rb-offset.* - if a CORESET is associated with at least one search space set configured with *freqMonitorLocation-r16*, the first bits of the bitmap have a one-to-one mapping with non-overlapping groups of 6 consecutive PRBs, in ascending order of the PRB index each RB-set x indicated in *freqMonitorLocation-r16* withstarting common ~~the DL BWP bandwidth of PRBs with starting common RB position~~ , where the first common RB of the first group of 6 PRBs has common RB index . , is a number of available PRBs in the RB set k=0 for the DL BWP, and is provided by *rb-offset* or if *rb-offset* is not provided.For a CORESET other than a CORESET with index 0, - if a UE has not been provided a configuration of TCI state(s) by *tci-StatesPDCCH-ToAddList* and *tci-StatesPDCCH-ToReleaseList* for the CORESET, or has been provided initial configuration of more than one TCI states for the CORESET by *tci-StatesPDCCH-ToAddList* and *tci-StatesPDCCH-ToReleaseList* but has not received a MAC CE activation command for one of the TCI states as described in [11, TS 38.321], the UE assumes that the DM-RS antenna port associated with PDCCH receptions is quasi co-located with the SS/PBCH block the UE identified during the initial access procedure; - if a UE has been provided a configuration of more than one TCI states by *tci-StatesPDCCH-ToAddList* and *tci-StatesPDCCH-ToReleaseList* for the CORESET as part of Reconfiguration with sync procedure as described in [12, TS 38.331] but has not received a MAC CE activation command for one of the TCI states as described in [11, TS 38.321], the UE assumes that the DM-RS antenna port associated with PDCCH receptions is quasi co-located with the SS/PBCH block or the CSI-RS resource the UE identified during the random access procedure initiated by the Reconfiguration with sync procedure as described in [12, TS 38.331].For a CORESET with index 0, the UE assumes that a DM-RS antenna port for PDCCH receptions in the CORESET is quasi co-located with - the one or more DL RS configured by a TCI state, where the TCI state is indicated by a MAC CE activation command for the CORESET, if any, or- a SS/PBCH block the UE identified during a most recent random access procedure not initiated by a PDCCH order that triggers a contention-free random access procedure, if no MAC CE activation command indicating a TCI state for the CORESET is received after the most recent random access procedure.For a CORESET other than a CORESET with index 0, if a UE is provided a single TCI state for a CORESET, or if the UE receives a MAC CE activation command for one of the provided TCI states for a CORESET, the UE assumes that the DM-RS antenna port associated with PDCCH receptions in the CORESET is quasi co-located with the one or more DL RS configured by the TCI state. For a CORESET with index 0, the UE expects that QCL-TypeD of a CSI-RS in a TCI state indicated by a MAC CE activation command for the CORESET is provided by a SS/PBCH block- if the UE receives a MAC CE activation command for one of the TCI states, the UE applies the activation command in the first slot that is after slot  where  is the slot where the UE would transmit a PUCCH with HARQ-ACK information for the PDSCH providing the activation command and  is the SCS configuration for the PUCCH. The active BWP is defined as the active BWP in the slot when the activation command is applied.For each DL BWP configured to a UE in a serving cell, the UE is provided by higher layers with  search space sets where, for each search space set from the  search space sets, the UE is provided the following by *SearchSpace*: - a search space set index , , by *searchSpaceId* - an association between the search space set  and a CORESET  by *controlResourceSetId* - a PDCCH monitoring periodicity of  slots and a PDCCH monitoring offset of  slots, by *monitoringSlotPeriodicityAndOffset*- a PDCCH monitoring pattern within a slot, indicating first symbol(s) of the CORESET within a slot for PDCCH monitoring, by *monitoringSymbolsWithinSlot* - a duration of  slots indicating a number of slots that the search space set  exists by *duration* - a number of PDCCH candidates  per CCE aggregation level  by *aggregationLevel1*, *aggregationLevel2*, *aggregationLevel4*, *aggregationLevel8*, and *aggregationLevel16*, for CCE aggregation level 1, CCE aggregation level 2, CCE aggregation level 4, CCE aggregation level 8, and CCE aggregation level 16, respectively- an indication that search space set  is either a CSS set or a USS set by *searchSpaceType* - if search space set  is a CSS set - an indication by *dci-Format0-0-AndFormat1-0* to monitor PDCCH candidates for DCI format 0\_0 and DCI format 1\_0 - an indication by *dci-Format2-0* to monitor one or two PDCCH candidates for DCI format 2\_0 and a corresponding CCE aggregation level- an indication by *dci-Format2-1* to monitor PDCCH candidates for DCI format 2\_1- an indication by *dci-Format2-2* to monitor PDCCH candidates for DCI format 2\_2- an indication by *dci-Format2-3* to monitor PDCCH candidates for DCI format 2\_3- an indication by *dci-Format2-4* to monitor PDCCH candidates for DCI format 2\_4- an indication by *dci-Format2-6* to monitor PDCCH candidates for DCI format 2\_6- if search space set  is a USS set, an indication by *dci-Formats* to monitor PDCCH candidates either for DCI format 0\_0 and DCI format 1\_0, or for DCI format 0\_1 and DCI format 1\_1, or an indication by *dci-Formats-Rel16* to monitor PDCCH candidates for DCI format 0\_0 and DCI format 1\_0, or for DCI format 0\_1 and DCI format 1\_1, or for DCI format 0\_2 and DCI format 1\_2, or, if a UE indicates a corresponding capability, for DCI format 0\_1, DCI format 1\_1, DCI format 0\_2, and DCI format 1\_2, or for DCI format 3\_0, or for DCI format 3\_1, or for DCI format 3\_0 and DCI format 3\_1 - a bitmap by *freqMonitorLocation-r16*, if provided, to indicate one or more RB sets for the search space set , where the MSB in the bitmap corresponds to RB set in the DL BWP. For RB set indicated in the bitmap, the first PRB of the frequency domain monitoring location confined within the RB set is given by , where is the index of first PRB of the RB set , and is provided by *rb-offset* or if *rb-offset* is not provided. The frequency domain resource allocation pattern for each monitoring location is determined based on the first bits in *frequencyDomainResources* provided by the associated CORESET configuration.<unchanged text omitted> |

### From Spreadtrum [12]

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| -------------------------------------- Text Proposal for 38.213, Section 10.1 -----------------------------------------\*\*\* Unchanged text omitted \*\*\*For each CORESET in a DL BWP of a serving cell, a respective *frequencyDomainResources* provides a bitmap. * if a CORESET is not associated with any search space set configured with *freqMonitorLocation-r16*, the bits of the bitmap have a one-to-one mapping with non-overlapping groups of 6 consecutive PRBs, in ascending order of the PRB index in the DL BWP bandwidth of PRBs with starting common RB position , where the first common RB of the first group of 6 PRBs has common RB index if *rb-offset* is not provided, or the first common RB of the first group of 6 PRBs has common RB index where is provided by *rb-offset.*
* if a CORESET is associated with at least one search space set configured with *freqMonitorLocation-r16*, the first bits of the bitmap have a one-to-one mapping with non-overlapping groups of 6 consecutive PRBs, in ascending order of the PRB index in the DL BWP bandwidth of PRBs with starting common RB position , where the first common RB of the first group of 6 PRBs has common RB index . , is a number of available PRBs in the RB set 0 for the DL BWP, and is provided by *rb-offset* or if *rb-offset* is not provided.
* If a CORESET is associated with at least one search space set configured with *freqMonitorLocation-r16,* and the search space set configured with *freqMonitorLocation-r16* indicates that CORESET is not in RB-set 0*,* the UE ignores the configuration of *freqMonitorLocations-r16* in RB-set 0 and follows the configuration of *frequencyDomainResources* in RB-set 0.

\*\*\* Unchanged text omitted \*\*\*----------------------------------------------------- End Text Proposal ------------------------------------------------------ |

## Issue C1

### From Nokia [11],

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| 5.1.4 PDSCH resource mappingWhen receiving the PDSCH scheduled with SI-RNTI and the system information indicator in DCI is set to 0, the UE shall assume that no SS/PBCH block is transmitted in REs used by the UE for a reception of the PDSCH.When receiving the PDSCH scheduled with SI-RNTI and the system information indicator in DCI is set to 1, RA-RNTI, MsgB-RNTI, P-RNTI or TC-RNTI, the UE assumes SS/PBCH block transmission according to *ssb-PositionsInBurst*, and if the PDSCH resource allocation overlaps with PRBs containing SS/PBCH block transmission resources the UE shall assume that the PRBs containing SS/PBCH block transmission resources are not available for PDSCH in the OFDM symbols where SS/PBCH block is transmitted.A UE expects a configuration provided by *ssb-PositionsInBurst* in *ServingCellConfigCommon* to be same as a configuration provided by *ssb-PositionsInBurst* in *SIB1*.When receiving PDSCH scheduled by PDCCH with CRC scrambled by C-RNTI, MCS-C-RNTI, CS-RNTI, or PDSCHs with SPS, the REs corresponding to the configured or dynamically indicated resources in Clauses 5.1.4.1, 5.1.4.2 are not available for PDSCH. Furthermore, the UE assumes SS/PBCH block transmission according to *ssb-PositionsInBurst* if the PDSCH resource allocation overlaps with PRBs containing SS/PBCH block transmission resources, the UE shall assume that the PRBs containing SS/PBCH block transmission resources are not available for PDSCH in the OFDM symbols where SS/PBCH block is transmitted. A UE is not expected to handle the case where PDSCH DM-RS REs are overlapping, even partially, with any RE(s) not available for PDSCH, unless PDSCH DM-RS REs collide with resource of *RateMatchPattern* configured to be fully overlapping with an intra-cell GB defined in sub-clause 7. |

### From Apple [13],

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| >>> Text Proposal TP1 for 38.214, Section 7>>>7 UE procedures for transmitting and receiving on a carrier with intra-cell guard bands\*\*\* Unchanged text omitted \*\*\*For a carrier with intra-carrier guard bands, the UE does not expect to receive a BWP configuration by *BWP-Downlink* or *BWP-Uplink* partially overlapping with a RB-set. RB-sets within BWP form a set of cardinality .For a carrier with intra-carrier guard bands, the UE assumes that any PRG that are fully/partially overlapped with an intra-carrier guard band is not used for downlink resource allocation type 0 if the availability of corresponding RB-set of the intra-carrier guard band is not provided to UE by DCI format 2\_0 and precoding granularity is determined as one of the values among {2,4}. For a carrier with intra-carrier guard bands, the UE assumes that any PRB that are fully/partially overlapped with an intra-carrier guard band is not used for downlink resource allocation type 0 if the availability of corresponding RB-set of the intra-carrier guard band is not provided to UE by DCI format 2\_0 and precoding granularity is determined as “wideband”. For a carrier with intra-carrier guard bands, the UE assumes that any PRG that are fully/partially overlapped with an intra-carrier guard band is not used for downlink resource allocation type 0 if precoding granularity is determined as one of the values among {2,4} and the availability of corresponding RB-set is provided to UE by Available RB set Indicator field in a DCI format 2\_0 which indicates at least one of two corresponding RB-sets of the intra-carrier guard band is not available for PDSCH . For a carrier with intra-carrier guard bands, the UE assumes that any PRB that are fully/partially overlapped with an intra-carrier guard band is not used for downlink resource allocation type 0 if precoding granularity is determined as “wideband” and the availability of corresponding RB-set is provided to UE by Available RB set Indicator field in a DCI format 2\_0 which indicates at least one of two corresponding RB-sets of the intra-carrier guard band is not available for PDSCH . >>> End Text Proposal >>> |

## Issue C2

### From OPPO [4],

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| ----------------------------------------TP2: Start of 38.214 section 5.1.6.1.1 --------------------------------------5.1.6.1.1 CSI-RS for tracking**<Unchanged text is omitted>**Each CSI-RS resource, defined in Subclause 7.4.1.5.3 of [4, TS 38.211], is configured by the higher layer parameter *NZP-CSI-RS-Resource* with the following restrictions:- the time-domain locations of the two CSI-RS resources in a slot, or of the four CSI-RS resources in two consecutive slots (which are the same across two consecutive slots), as defined by higher layer parameter *CSI-RS-resourceMapping*, is given by one of- , , or for frequency range 1 and frequency range 2,- , , , , , or for frequency range 2.- a single port CSI-RS resource with density given by Table 7.4.1.5.3-1 from [4, TS 38.211] and higher layer parameter *density* configured by *CSI-RS-ResourceMapping.*- the bandwidth of the CSI-RS resource, as given by the higher layer parameter *freqBand* configured by *CSI-RS-ResourceMapping*, is the minimum of 52 and resource blocks, or is equal to resource blocks. For operation with shared spectrum channel access, *freqBand* configured by *CSI-RS-ResourceMapping*, is the minimum of 48 and resource blocks within a RB set, or is equal to resource blocks.**<Unchanged text is omitted>**----------------------------------------End of 38.214 section 5.1.6.1.1 -------------------------------------- |

## Issue C3

### From Huawei [1],

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| TP#2: TS38.214v16.0.06.1.2.2.1 Uplink resource allocation type 0In uplink resource allocation of type 0, the resource block assignment information includes a bitmap indicating the Resource Block Groups (RBGs) that are allocated to the scheduled UE where a RBG is a set of consecutive virtual resource blocks defined by higher layer parameter *rbg-Size* configured in *pusch-Config* and the size of the bandwidth part as defined in Table 6.1.2.2.1-1. For operation with shared spectrum channel access mechansim, The UE shall determine the resource allocation in frequency domain as an intersection of the resource blocks of the indicated RBGs and the union of RB sets overlapping with the indicated RBGs and intra-cell guard bands defined in Clause 7 between the adjacent RB sets overlapping with the indicated RBGs, if any.\*\*\* Unchanged text is omitted \*\*\*6.1.2.2.3 Uplink resource allocation type 2In uplink resource allocation of type 2, the resource block assignment information defined in [5, TS 38.212] indicates to a UE a set of up to *M* interlace indices, and a set of up to *N* RB sets, where *M* and interlace indexing are defined in Clause 4.4.4.6 in [4, TS 38.211]. The UE shall determine the resource allocation in frequency domain as an intersection of the resource blocks of the indicated interlaces and the union of indicated set of RB sets and intra-cell guard bands defined in Clause 7 between the indicated RB sets, if any. \*\*\* Unchanged text is omitted \*\*\* |

# Appendix B: Previous agreements

Agreement: (RAN1#92bis)

* At least for band where absence of Wi-Fi cannot be guaranteed (e.g. by regulation), LBT can be performed in units of 20 MHz.
	+ FFS: details on how to perform LBT for as single carrier with bandwidth greater than 20 MHz, i.e., integer multiples of 20 MHz.

Agreement: (RAN1#94bis)

* NR-U should support that a serving cell can be configured with bandwidth larger than 20 MHz.
	+ For DL operation, the following options for BWP-based operation within a carrier with bandwidth larger than 20 MHz can be considered.
		- Option 1a: Multiple BWPs configured, multiple BWPs activated, transmission of PDSCH on one or more BWPs
		- Option 1b: Multiple BWPs configured, multiple BWPs activated, transmission of PDSCH on single BWP
		- Option 2: Multiple BWPs can be configured, single BWP activated, gNB transmits PDSCH on a single BWP if CCA is successful at gNB for the whole BWP
		- Option 3: Multiple BWPs can be configured, single BWP activated, gNB transmits PDSCH on parts or whole of single BWP where CCA is successful at gNB
	+ Note: CCA is declared to be successful or not in multiples of 20 MHz.
	+ FFS for UL operation including some or all of above options can be applied
* Note: Capture the following in TR only after further discussion for down-selecting from the options in RAN1#95.

Agreement: (RAN1#95)

* For wideband operation for both DL and UL,
	+ Bandwidth larger than 20 MHz can be supported with multiple serving cells.
	+ NR-U should support that a serving cell can be configured with bandwidth larger than 20 MHz.
* For DL operation, the following options for BWP-based operation within a carrier with bandwidth larger than 20 MHz can be considered.
	+ Option 1a: Multiple BWPs configured, multiple BWPs activated, transmission of PDSCH on one or more BWPs
	+ Option 1b: Multiple BWPs configured, multiple BWPs activated, transmission of PDSCH on single BWP
	+ Option 2: Multiple BWPs can be configured, single BWP activated, gNB transmits PDSCH on a single BWP if CCA is successful at gNB for the whole BWP
	+ Option 3: Multiple BWPs can be configured, single BWP activated, gNB transmits PDSCH on parts or whole of single BWP where CCA is successful at gNB
* For UL operation, the following options for BWP-based operation within a carrier with bandwidth larger than 20 MHz can be considered.
	+ Option 1a: Multiple BWPs configured, multiple BWPs activated, transmission of PUSCH on one or more BWPs
	+ Option 1b: Multiple BWPs configured, multiple BWPs activated, transmission of PUSCH on single BWP
	+ Option 2: Multiple BWPs can be configured, single BWP activated, UE transmits PUSCH on a single BWP if CCA is successful at UE for the whole BWP
	+ Option 3: Multiple BWPs can be configured, single BWP activated, UE transmits PUSCH on parts or whole of single BWP where CCA is successful at UE
* It is noted that CCA is declared to be successful or not in multiples of 20 MHz.
* Detailed design and potential selection from the above options can be further discussed when specifications are developed considering protocol and RF aspects.

Agreement: (RAN1#AH1901)

* For wideband operation in DL with a single serving cell operation within a carrier with bandwidth larger than 20 MHz
	+ Multiple BWPs can be configured, single BWP activated, gNB may transmit PDSCH on parts or whole of single active BWP where CCA is successful at gNB (i.e., option 2 and 3 from previous agreement)
		- FFS: Restrictions on supportable gaps and combinations of gaps between discontiguous blocks where
			* each block spans contiguous (one or) multiple successful LBT sub-bands
			* each gap spans one or multiple contiguous unsuccessful LBT sub-bands
		- FFS: Transmission bandwidth adaptation delay, potentially different delay for e.g., different number of supported gaps, different transmission bandwidths and different positions of the LBT sub-bands where transmissions occur
		- FFS: Limit on the occupied LBT sub-bands due to regulation and coexistence considerations (not intended to imply that regulation and coexistence considerations will not be addressed)
		- FFS: Whether/how to indicate gNB’s transmitted LBT sub-bands
		- FFS: Enhancements to PDCCH/PDSCH configuration/transmission for the parts of BWP where gNB does not transmit due to CCA failure
* Send LS to RAN4 to inform above decision with the description that RAN1 requires RAN4’s feedback on the first three FFS parts in addition to what was requested in earlier LSs.

Agreement: (RAN1#AH1901)

Operation with multiple active BWPs for a carrier on unlicensed bands is not supported for DL or UL at least in Rel-16 NR-U WI.

* Inform RAN2 of this decision

**Agreement:** (RAN4#90bis)

* It is feasible to operate single carrier wideband operation when when LBT is successful in all LBT sub-bands
	+ FFS whether guardbands are needed in between LBT sub-bands or not
* Mode 2 (Single wideband carrier when LBT is successful in a subset of the LBT sub-bands which are contiguous) is feasible at least if PRBs within the guardband of two contiguous LBT sub-bands are not scheduled by gNB.
	+ FFS filter adaptation time if PRBs within the guardband of two contiguous LBT sub-bands are scheduled by gNB.
	+ is feasible at least for WiFi-like requirements for in-carrier leakage (e.g. 20dbr).
	+ FFS what regional regulatory requirements apply in LBT sub-bands where LBT fails.
		- RAN4 will investigate the feasibility whether regional regulatory requirements are met or not for in-carrier leakage.
* Mode 3 (Single wideband carrier when LBT is successful in a subset of the LBT sub-bands which are non-contiguous)
	+ is feasible at least if PRBs within the guardband of two contiguous LBT sub-bands are not scheduled by gNB.
	+ is feasible at least for WiFi-like requirements for in-carrier leakage (e.g. 20dbr).
	+ FFS what regional regulatory requirements apply in LBT sub-bands where LBT fails.
		- RAN4 will investigate the feasibility whether regional regulatory requirements are met or not for in-carrier leakage.
	+ FFS what level of in-carrier leakage and blocking requirements can be met at the BS and UE
	+ FFS how to specify this in RAN4
	+ FFS filter adaptation time if PRBs within the guardband of two contiguous LBT sub-bands are scheduled by gNB.

Agreement: (RAN1#96bis)

For UL transmissions in a serving cell with carrier bandwidth greater than LBT bandwidth, for the case where UE performs CCA before UL transmission, support at least Alt. 1 among the following alternatives

* Alt. 1: UE transmits the PUSCH only if CCA is successful at UE in all LBT bandwidths of the scheduled PUSCH.
* Alt. 2: UE transmits the PUSCH in all or a subset of LBT bandwidths of the scheduled PUSCH for which CCA is successful at the UE.
	+ Decision on whether this alternative is supported will depend on feedback from RAN4
	+ FFS on restrictions to the subset of LBT bandwidths, e.g., only contiguous LBT bandwidths allowed, based on feedback from RAN4
* Necessity of guard bands within the scheduled PUSCH should be determined by RAN4
* FFS: Whether this applies also to configured grant PUSCH
* FFS: Whether this applies also to PUCCH

Agreement: (RAN1#96bis)

* Support a mechanism for a UE to detect gNB is transmitting across
* Multiple carriers
* Multiple LBT bandwidths in a carrier.
* The following mechanisms are to be considered:
* Option 1: Explicit indication via PDCCH
	+ FFS: The type of PDCCH (e.g., group common PDCCH or UE-specific PDCCH)
	+ FFS: Signaling details of the indication
* Option 2: Explicit indication via selection of a PDCCH DM-RS sequence from a set of PDCCH DM-RS sequences
	+ FFS: Details of the indication
* Option 3: Via UE implementation, i.e., implicit method based on NR-based signal such as DM-RS and/or corresponding PDCCH detection
	+ FFS: Which signals/channels or combination of signals/channels could be used by the UE
* Note: Above options are not mutually exclusive

Agreement: (RAN1#97)

When GC-PDCCH is configured, explicit indication via GC-PDCCH is supported as a mechanism to inform the UE that one or more carriers and/or LBT bandwidths are not available or available for DL reception, at least for slot(s) that are not at the beginning of DL transmission burst.

* FFS: Signalling details of the indication, including e.g., the time domain validity of the indication
* FFS: Whether and how to support the mechanism at the beginning of DL transmission burst
* FFS: Whether and how to handle the case when GC-PDCCH is not configured or not received by the UE

Conclusion: (RAN1#97)

A UE can receive a PDSCH scheduled within an LBT bandwidth or over multiple LBT bandwidths as per Rel-15 and current agreements in Rel-16.

Conclusion: (RAN1#98)

The following are unchanged from Rel-15 for PDCCH.

* The maximum number of monitored PDCCH candidates per slot and per serving cell.
* The maximum number of non-overlapped CCEs per slot and per serving cell.
* CCE-to-REG mapping rule and hashing function.

Agreement: (RAN1#98)

For CORESET configuration in a serving cell with carrier bandwidth greater than LBT bandwidth,

* For the case where a CORESET is confined within a LBT bandwidth, the search space set configuration associated with the CORESET can have multiple monitoring locations in the frequency domain (per LBT bandwidth)
	+ Send an LS to RAN2 informing them of this agreement and providing clarifications on the above if necessary
* Note: For scenarios in which gNB transmits PDCCH/PDSCH on a single BWP if CCA is successful at gNB for the whole BWP, CORESET(s) need not all be confined within an LBT bandwidth, and no specification impact is foreseen

Agreement: (RAN1#98bis)

For a search space set configuration associated with multiple monitoring locations in the frequency domain (as per the previous agreement defining such a search space set associated with a CORESET confined within an LBT bandwidth):

* PRBs allocated by *frequencyDomainResources* in the CORESET configuration are confined within one of LBT bandwidths within the BWP corresponding to the CORESET.
* Within the search space set configuration associated with the CORESET, each of the one or more monitoring locations in the frequency domain corresponds to (and is confined within) an LBT bandwidth and has a frequency domain resource allocation pattern that is replicated from the pattern configured in the CORESET.
* CORESET parameters other than frequency domain resource allocation pattern are identical for each of the one or more monitoring locations in the frequency domain.
* Include this and the prior agreement on this issue in an LS to RAN2

Agreement: (RAN1#98bis)

The intra-carrier guard bands on a carrier can be semi-statically adjusted with an RB level granularity. The RAN4 minimum guard band requirements are used as the guard bands when no semi-static adjustment is applied.

* The guard bands adjustments do not affect the already agreed restrictions on PUCCH resource allocation.
* FFS: Whether and how to handle the case where the intra-carrier guard bands are part of a resource allocation

Agreement: (RAN1#98bis)

* For UL transmissions in a serving cell with carrier bandwidth greater than the LBT bandwidth, for the case where UE performs CCA before UL transmission, UE transmits on the UL only if CCA is successful at UE in all LBT bandwidths that overlap with the resource allocation for the UL transmission
* The UE is not expected to receive resource allocations in discontiguous LBT bandwidths within a wideband carrier
	+ This does not preclude such resource allocation in discontiguous LBT bandwidths being supported by specifications managed by RAN1 in Rel-16.

Agreement: (RAN1#99)

UE determines the number of RB sets (corresponding to LBT bandwidths) and the available PRBs in each RB set, both for DL and UL, based on,

* If configured, the RRC parameters *intraCellGuardBandDL-r16* and *intraCellGuardBandUL-r16* (if UL is configured)configure the lists of intra-carrier guard-bands per cell, e.g.,
	+ If *intraCellGuardBandDL-r16* or *intraCellGuardBandUL-r16* are given as {, }, …, {, } where *GB* is given by CRB index, the UE determines
		- The number of RB sets for a cell: N
		- The available PRBs in each RB set: [, -1] for RB set #1, [+1, -1] for RB set #2,…, [+1, ] for RB set#N, where and corresponds to starting and ending RB index of cell, respectively.
		- Note: {, }, …, {, } may be provided separately for DL and UL
* If *intraCellGuardBandDL-r16* is not configured, then {, }, …, {, } is derived from the RAN4 specifications
	+ Note: This supersedes a previous agreement
* If *intraCellGuardBandUL-r16* is not configured, then {, }, …, {, } is derived from the RAN4 specifications
	+ Note: This supersedes a previous agreement
* Note: This addresses the FFS in sections 5.1.2.2 and 6.1.2.2 in 38.214.

Agreement: (RAN1#99)

For the frequency domain resource allocation that is provided with *frequencyDomainResources* in CORESET configuration,

* Introduce a new RRC parameter *rb-Offset* (with the value range of 0,1,…,5) in *ControlResoureSet* IE.
	+ If *rb-Offset* is not configured, *rb-Offset* is 0
* The bits of the 45-bit bitmap *frequencyDomainResources* have a one-to-one mapping with non-overlapping groups of 6 consecutive PRBs, in ascending order of the PRB index in the BWP with the starting PRB position as {the first PRB index in the BWP + *rb-Offset*} for a CORESET.
* FFS: For multi-cluster CORESET configuration, *rb-Offset* also applies to the RB offset between the starting PRB index of the first 6 PRB group and the first PRB index in each RB set. Full 6 PRB groups are counted till the end of the RB set. The bits in *frequencyDomainResources* sequentially maps to the 6 RB groups in all RB sets in the BWP.
* Note: Cluster above implies a group of resource blocks that are not contiguous in frequency

Conclusion: (RAN1#99)

For a legacy CORESET configuration, the UE can expect to process PDCCH as per Rel-15 behaviour

Agreement: (RAN1#99)

For a search space set configuration with multiple monitoring locations in the frequency domain,

* Within the *SearchSpace* IE, the agreed RRC parameter *freqMonitorLocations-r16* provides a bitmap (where the first bit in the bitmap corresponds to the first RB set in the BWP, and the second bit corresponds to the second RB set, and so on). For a RB set indicated in the bitmap, the first PRB of the frequency domain monitoring location confined within the RB set is aligned with {the first PRB of the RB set + *rb-Offset* provided by the associated CORESET configuration}.
* The frequency domain resource allocation pattern for each monitoring location is determined based on the first A bits in *frequencyDomainResources* provided by the associated CORESET configuration, where A = floor({the number of available PRBs in the first RB set (accounting for *rb-Offset*) for the BWP}/6).

Agreement: (RAN1#99)

* The RRC parameters *intraCellGuardBandDL-r16* and *intraCellGuardBandUL-r16* include a mechanism to indicate that no intra-carrier guard-bands are configured
	+ Note: This configuration may be used for the case where transmission only occurs in a BWP if LBT is successful in all RB sets within the BWP
* For a carrier with intra-carrier guard bands, the UE does not expect that the dedicated BWP is configured to include parts of a RB set.

Agreement: (RAN1#99)

If a UE is configured with a CSI-RS spanning over multiple LBT bandwidths,

* The UE assumes that the CSI-RS is not transmitted if the UE is monitoring DCI format 2\_0 carrying an LBT BW indication and detects the DCI format 2\_0 indicating any of corresponding LBT bandwidths is not available for DL reception.

Agreement: (RAN1#99)

For CSI-RS for tracking in unlicensed spectrum,

* Text proposal for section 5.1.6.1.1 in TS 38.214:
	+ The bandwidth of the CSI-RS resource, as given by the higher layer parameter freqBand configured by CSI-RS-ResourceMapping, is the minimum of 48 and NBWP,i size resource blocks, or is equal to NBWP,i size resource blocks.

Agreement: (RAN1#100-e)

* If CORESET p is not configured with rb-offset, and is not associated with any search space set configured withfreqMonitorLocation-r16,
	+ The bits of the 45-bit bitmap *frequencyDomainResources* of the CORESET *p* have a one-to-one mapping with non-overlapping groups of 6 consecutive PRBs, in ascending order of the PRB index in the DL BWP with the starting common RB position , where the first common RB of the first group of 6 consecutive RBs has common RB index , i.e., same as in Rel-15.
* If CORESET p is not configured with rb-offset, and is associated with at least one search space set configured with freqMonitorLocation-r16,
	+ The bits of the first A bits of the 45-bit bitmap *frequencyDomainResources* of the CORESET *p* have a one-to-one mapping with non-overlapping groups of 6 consecutive PRBs, in ascending order of the PRB index in the DL BWP with the starting common RB position , where the first common RB of the first group of 6 consecutive RBs has common RB index , where the UE assumes the default value *rb-Offset* = 0.
* If CORESET p is configured with rb-offset, and is not associated with any search space set configured with freqMonitorLocation-r16,
	+ The bits of the 45-bit bitmap *frequencyDomainResources* of the CORESET *p* have a one-to-one mapping with non-overlapping groups of 6 consecutive PRBs, in ascending order of the PRB index in the DL BWP with the starting common RB position , where the first common RB of the first group of 6 consecutive RBs has common RB index .
* If CORESET p is configured with rb-offset, and is associated with at least one search space set configured with freqMonitorLocation-r16,
	+ The bits of the first A bits of the 45-bit bitmap *frequencyDomainResources* of the CORESET *p* have a one-to-one mapping with non-overlapping groups of 6 consecutive PRBs, in ascending order of the PRB index in the DL BWP with the starting common RB position , where the first common RB of the first group of 6 consecutive RBs has common RB index .
* Note: A bits in above bullets is defined as floor({the number of available PRBs in the first RB set (accounting for *rb-Offset*) for the BWP}/6), as per previous agreement.
* TS 38.213 editor to implement this agreement