**3GPP TSG RAN WG1#102-e R1-200xxxx**

**e-Meeting, August 17th – 28th, 2020**

**Agenda Item: 7.2.2.1.2**

**Source: Moderator (Lenovo)**

**Title: Email discussion [102-e-NR-unlic-NRU-DL\_Signals\_and\_Channels-01] on DCI format 2\_0 fields, Slot Format determination and UE behaviour**

**Document for: Discussion, Decision**

# Introduction

According to the guidance by RAN1 (vice-)chairman, this email discussion is to be finalised by **20 August**; if necessary, followed by endorsing the corresponding TPs by **26 August**.

# Summary of Discussion and Suggestions

TBD…

# Discussion

Companies are invited to comment on the questions below.

## SFI (+other fields) presence configurability in DCI format 2\_0 (B5)

RAN1#101-e was heading towards further discussion based on the following, however without reaching a conclusion:

Alt 1

* For LBE and FBE,
  + The configuration of *AvailableRB-SetPerCell-r16* requires the presence of at least one of SFI field and *co-DurationPerCell* field.
  + No other conditions are introduced

Alt 2

* No restriction on the configurability of {*AvailableRB-SetPerCell-r16*, SFI, *co-DurationPerCell*, search space set switching flag} for DCI format 2\_0
* For FBE,
  + If *AvailableRB-SetPerCell-r16* is configured but neither SFI nor *co-DurationPerCell* is configured for DCI format 2\_0, the availability or unavailability for an RB set remains until the end of FFP (excluding idle period).
* For LBE,
  + If *AvailableRB-SetPerCell-r16* is configured but neither SFI nor *co-DurationPerCell* is configured for DCI format 2\_0, the availability or unavailability for an RB set is valid for [1] slot.

Alt 3

* For FBE,
  + No conditions on the configurability of {*AvailableRB-SetPerCell-r16*, SFI, *co-DurationPerCell*, search space set switching flag}
* For LBE,
  + The configuration of *AvailableRB-SetPerCell-r16* requires the presence of at least one of SFI field and *co-DurationPerCell* field.
  + No other conditions are introduced

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| **Regarding independent configurability or any dependency of the following fields:**  *slotFormatCombToAddModList*, *availableRB-SetPerCell-r16,* *co-DurationPerCell-r16* and *searchSpaceSwitchTrigger-r16*  **Q1a: What is your view on any dependency for LBE?** | |
| **Company** | **Comment** |
| LG Electronics | Our first preference is Alt 1 commonly for LBE and FBE, that is, at least one of SFI and CO duration fields needs to be configured if RB set indicator is configured. However, if we allow implicit CO ending for FBE without SFI and CO duration fields, our second preference is to go with Alt 2. If CO ending can be implicitly determined as FFP ending for FBE, gNB may have a restriction that the same set of RB sets needs to be kept as available within the whole FFP. In case this kind of restriction is permitted, the similar limitation should be able to be applicable to LBE as well. |
| Qualcomm | We prefer Alt 3. For LBE, providing frequency domain COT but not time domain COT has no meaning. Setting a fixed number as in Alt 2 is quite artificial. |
| vivo | Alt. 3. |

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| **Regarding independent configurability or any dependency of the following fields:**  *slotFormatCombToAddModList*, *availableRB-SetPerCell-r16,* *co-DurationPerCell-r16* and *searchSpaceSwitchTrigger-r16*  **Q1b: What is your view on any dependency for FBE?** | |
| **Company** | **Comment** |
| LG Electronics | Our first preference is Alt 1 commonly for LBE and FBE, that is, at least one of SFI and CO duration fields needs to be configured if RB set indicator is configured. |
| Qualcomm | We prefer Alt 3. For FBE, given the clear definition of COT from regulation, we should not mandate the configuration of either SFI or *co-DurationPerCell-r16* when providing frequency domain COT. |
| vivo | Alt. 3 |

## General Slot Format determination and corresponding UE behaviour, including special values in e.g. "available RB set indication" (B11+B1)

### UE behaviour if all RB sets are indicated as unavailable

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| **Q2: Do you agree to Huawei's, OPPO's or Sharp's proposals:**  Huawei:  Proposal 3: When UE detect a DCI format 2\_0 carrying available RB set indicator indicating all RB sets are unavailable (all ‘0’) including the RB set where the detected DCI format 2\_0 locates, UE will assume the current available RB set indication is not valid and continue monitoring PDCCH candidates on these RB sets if configured. The corresponding text proposal is in TP#3 in the appendix.  Proposal 4: When UE detect a DCI format 2\_0 carrying available RB set indicator indicating all RB sets are unavailable (all ‘0’) including the RB set where the detected DCI format 2\_0 locates, UE assumes the RB set where the detected DCI format 2\_0 locates remains available until the end of the indicated channel occupancy duration. The corresponding text proposal is in TP#2 in the appendix.  OPPO:  For RB set indication in DCI format 2\_0, a special state of the available RB sets indicating “all the RB sets are not available” can be used to indicate the unprepared available RB sets information.  Sharp:  UE behaviours for RB sets for which the gNB is not aware of LBT status should follow the behaviour for outside CO durations.  TS38.213 to capture the special value (i.e. all ‘0’) of the RB set indicator value for a self-indication case when the gNB is not aware of LBT status of other RB sets.  **Please provide reasons for supporting or not supporting the proposal.** | |
| **Company** | **Comment** |
| LG Electronics | Support Proposal 3 from Huawei in terms of PDCCH monitoring. From our understanding, Proposal 3 from Huawei seems to be aligned with LG’s proposal in Q3. The point is that for a carrier where DCI format 2\_0 is detected and includes all zero state for carriers including the carrier, UE keeps monitoring PDCCH for those carriers. |
| Qualcomm | Not clear the difference between HW proposal 3, Oppo proposal and Sharp proposal. HW proposal 4 is more aggressive though. We agree all “0” available RB sets can mean keep monitoring all RB sets. |
| vivo | Understand the intention but it seems optimization. Without this proposal, it could also work well by implementation, e.g. prepare multiple copies by gNB or skip this transmission. Furthermore, how often will this case happen when there is no enough time to prepare the RB set information? The COT could start with UE specific PDCCH and DCI 2\_0 is transmitted later. In this case, it could have enough time to prepare the DCI 2\_0. When the period for DCI 2\_0 is large, the case without enough preparation time happens seldom; when it is small, skipping one DCI 2\_0 transmission doesn’t hurt much. |

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| **Q3: Do you agree to LG's proposal:**  If a UE is monitoring a DCI format 2\_0 indicating available RB sets for the first carrier and also for the second carrier and the UE detects the DCI format 2\_0 on the first carrier,  - If the bitmap corresponding to the first carrier is signalled to all ‘0’,   The UE recognizes that DL burst has just started to be transmitted for the first carrier and also for the second carrier where the corresponding bitmap is signalled to all ‘0’, and the UE expects that available RB sets for the first and second carriers may be updated during this DL burst.  - Otherwise,   For the second carrier where the corresponding bitmap is signalled to all ‘0’, the UE does not expect any DL receptions on the second carrier during channel occupancy time.  **Please provide reasons for supporting or not supporting the proposal.** | |
| **Company** | **Comment** |
| LG Electronics | Further explanation for better understanding of our proposal:    As shown above figure, if a UE detects DCI format 2\_0 in carrier #1 in slot#n, the UE will keep monitoring PDCCH for carriers #1 and #2. On the other hand, if a UE detects DCI format 2\_0 in carrier #1 in slot#n+2, the UE will keep monitoring PDCCH for carrier #1 and skip PDCCH monitoring for carrier #2. |
| Qualcomm | Do not see why we need this special processing for the cross carrier indication for avialable RB sets. Reuse LGE’s example, in slot n+2, it is still possible that carrier 1 started a COT back in slot n, and carrier #2 is attempting to start a COT in n+2. This may happen if the carriers are far apart (one in 5GHz band and one in 6GHz band for example, so the gNB can transmit and receive at the same time). In this case, all ‘0’ for carrier #2 can still indicate to the UE to keep monitoring. The behavior proposed in more like a power saving feature for some CA combinations. We don’t believe we should optimize on that at this phase. |
| vivo | Not needed as we explained in Q2. |

### Indication of LBT failed cell

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| **Q4: Do you agree to OPPO's proposals:**  For RB set indication in DCI format 2\_0, a special state of the SFI structure can be introduced to indicate the LBT failed cell.  **Please provide reasons for supporting or not supporting the proposal.** | |
| **Company** | **Comment** |
| LG Electronics | It can be resolved by setting all zero RB set indicator for LBT failed cell, without introducing a special state of SFI. |
| Qualcomm | Agree with LGE |
| vivo | Agree with LGE |

### If UE is not configured to detect available RB set indicator

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| **Q5: Do you agree to Huawei's or Qualcomm's proposal:**  Huawei:  When UE is not configured to detect available RB set indicator or UE fails to detect DCI format 2\_0 carrying available RB set indicator, UE should monitor PDCCH based on search space configuration assuming all RB set are available. The corresponding text proposal is in TP#3 in the appendix.  Qualcomm:  For a cell with multiple LBT bandwidth but availableRB-setPerCell-r16 not configured, the UE will consider all RB sets are in the COT when DCI 2\_0 is detected.  **Please provide reasons for supporting or not supporting the proposal.** | |
| **Company** | **Comment** |
| LG Electronics | We have the corresponding proposal in our Tdoc R1-2006299, as follows:  **Proposal #3: RB set indicator field for a serving cell in DCI format 2\_0 may not be configured only if the serving cell is configured with a single RB set or no guard band and if DCI format 2\_0 for the serving cell is configured to be monitored on the serving cell.**  However, Huawei’s proposal is acceptable to us.  One question to Qualcomm’s proposal for clarification: Is that proposal only for PDCCH monitoring purpose, or also for COT sharing purpose? If it can be tied with COT sharing purpose, UE may change LBT type within CO by assuming all RB sets are available. If this is the case, gNB may be allowed to transmit only when it succeeds LBT for all RB sets. |
| Qualcomm | What we propose is a super-set of what HW is proposing. Yes as LGE suggested, it will require gNB to pass LBT on all RB sets to transmit, and also requires the gNB to send on all RB sets as well to keep the COT for COT sharing purpose. Our concern is, without this, the COT sharing at least for RRC configure UL transmission may not work as the UE does not know which RB set is available.  On the other hand, if there are strong concern with our proposal, we can support HW’s proposal as well, assuming in that case, gNB will not configure RRC configured UL transmissions that currently rely on availableRB-setPerCell-r16 to validate. |
| vivo | Agree with the UE behavior in the HW proposal but we are not clear of the spec impact. Based on our understanding, the UE behavior of skipping PDCCH monitoring is depending on RB set indicator. If it is not configured, UE naturally will monitor PDCCH in all RB sets according to current spec. |

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| **Q6: Do you agree to Nokia's or Sharp's proposal:**  Adopt the following clarification for 38.213 on optionality of fields in DCI 2\_0   |  | | --- | | Nokia TP for TS38.21311.1.1 UE procedure for determining slot format This clause apply for a serving cell that is included in a set of serving cells configured to a UE by corresponding parameter(s)  - *slotFormatCombToAddModList* and *slotFormatCombToReleaseList*.  - *availableRB-SetToAddModList-r16*,  - *searchSpaceSwitchTriggerToAddModList-r16*, or  - *co-DurationPerCellList-r16.*  If a UE is configured by higher layers with parameter *SlotFormatIndicator*, the UE is provided a SFI-RNTI by *sfi-RNTI* and with a payload size of DCI format 2\_0 by *dci-PayloadSize*.  The UE is also provided in one or more serving cells with a configuration for a search space set and a corresponding CORESET  for monitoring  PDCCH candidates for DCI format 2\_0 with a CCE aggregation level of  CCEs as described in Clause 10.1. The  PDCCH candidates are the first  PDCCH candidates for CCE aggregation level  for search space set  in CORESET .  <unchanged text omitted > |  |  | | --- | | **Sharp Text proposal #2**  --------- beginning of text proposal for TS 38.213  11.1.1 UE procedure for determining slot format  This clause applies for a serving cell that is included in a set of serving cells configured to a UE by either *slotFormatCombToAddModList* and *slotFormatCombToReleaseList*, *availableRB-SetsToAddModList-r16* and *availableRB-SetsToRelease-r16*, *searchSpaceSwitchTriggerToAddModList-r16* and *searchSpaceSwitchTriggerToReleaseList-r16*, or *co-DurationsPerCell ToAddModList-r16* and *co-DurationsPerCellToReleaseList-r16*.  If a UE is configured by higher layers with parameter *SlotFormatIndicator*, the UE is provided a SFI-RNTI by *sfi-RNTI* and with a payload size of DCI format 2\_0 by *dci-PayloadSize*.  **<omitted>** |   FL Note: Agreeing to any of these does not imply that there are no configurability restrictions (see Q1a/Q1b) | |
| **Company** | **Comment** |
| LG Electronics | In our opinion, these two TPs are not tightly tied with Q1a/Q1b. In other words, even though we endorse one of these two TPs, some sentences can be added (e.g., in the same section) to state configurability restrictions among 4 corresponding fields. In that sense, we support Sharp’s proposal. |
| Qualcomm | Sharp’s version seems to be more complete. |
| vivo | Support Sharp’s TP |

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| **Q7: Do you agree to OPPO's proposal:**  If RB-set indicator is not configured, but SFI or CO-duration is configured in DCI format 2\_0 for a serving cell, UE assumes that all the RB sets of the serving cell are available for DL reception within the gNB COT.  **Please provide reasons for supporting or not supporting the proposal.** | |
| **Company** | **Comment** |
| LG Electronics | Seems that Q7 is similar to Q5. |
| Qualcomm | Agree with LGE’s observation |
| vivo | See response to Q5 |

### Other

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| **Q8: Do you agree to vivo's proposal to indicate a channel occupancy duration of 0 by SFI value 255:**  When COT duration field is not configured but SFI is configured in DCI 2\_0, one special entry of SFI (i.e. index 255 SFI) is used to indicate that the DCI 2\_0 carrying SFI is COT duration=0, e.g. in UE’s initiated COT. Adopt TP1 to capture the above proposal.Please provide reasons for supporting or not supporting the proposal.   |  | | --- | | --------------------------------------**TP1**: Start TP for Section 11.1.1 of TS 38.213 ------------------------------------  a location of a channel occupancy duration field in DCI format 2\_0, by CO-DurationPerCell-r16, that indicates a remaining channel occupancy duration for the serving cell starting from a first symbol of a slot where the UE detects the DCI format 2\_0 by providing a value from CO-DurationList-r16. The channel occupancy duration field includes bits, where is the number of values provided by CO-DurationList-r16. If CO-DurationPerCell-r16 is not provided, the remaining channel occupancy duration for the serving cell is a number of slots, starting from the slot where the UE detects the DCI format 2\_0, that the SFI-index field value provides corresponding slot formats with at least one slot format is not index 255; otherwise the remaining channel occupancy duration is 0.  --------------------------------------**TP1**: End TP for Section 11.1.1 of TS 38.213--------------------------------------- | | |
| **Company** | **Comment** |
| LG Electronics | Not support. The motivation of special handling of UE-initiated COT is not clear and the original intention of wildcard (i.e., 255 index) can disappear if we adopt this proposal. |
| Qualcomm | Not support. SFI 255 has special meaning that is still valid for NR-U and should not be replaced |
| vivo | The intention here is to solve the DCI 2\_0 transmission in UE’s initiated COT when COT duration field is not configured. In this case, SFI is used to indicate COT length. However, SFI can’t indicate COT duration 0 according to current spec. If SFI indicates a length in UE’s initiated COT, it may convey wrong information to other UEs that triggered unexpected behavior not compliant to regulations. We think this problem needs to be solved and SFI 255 is a good candidate. We don’t see serious problem to use SFI 255 for this purpose. |

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| **Q9: Do you agree to Sharp's proposal:**  UE with DCI format 2\_0 carrying search space set group switching flag field only should follow behaviours defined in subclause 11.1.   |  | | --- | | **Text proposal #4**  --------- beginning of text proposal for TS 38.213  11.1.1 UE procedure for determining slot format  This clause applies for a serving cell that is included in a set of serving cells configured to a UE by *slotFormatCombToAddModList* and *slotFormatCombToReleaseList*.  If a UE is configured by higher layers with parameter *SlotFormatIndicator*, the UE is provided a SFI-RNTI by *sfi-RNTI* and with a payload size of DCI format 2\_0 by *dci-PayloadSize*.  The UE is also provided in one or more serving cells with a configuration for a search space set and a corresponding CORESET  for monitoring  PDCCH candidates for DCI format 2\_0 with a CCE aggregation level of  CCEs as described in Clause 10.1. The  PDCCH candidates are the first  PDCCH candidates for CCE aggregation level  for search space set  in CORESET .  For each serving cell in the set of serving cells, the UE can be provided:  - an identity of the serving cell by *servingCellId*  - a location of a SFI-index field in DCI format 2\_0 by *positionInDCI*  - a set of slot format combinations by *slotFormatCombinations*, where each slot format combination in the set of slot format combinations includes  - one or more slot formats indicated by a respective *slotFormats* for the slot format combination, and  - a mapping for the slot format combination provided by *slotFormats* to a corresponding SFI-index field value in DCI format 2\_0 provided by *slotFormatCombinationId*  - for unpaired spectrum operation, a reference SCS configuration  by *subcarrierSpacing* and, when a supplementary UL carrier is configured for the serving cell, a reference SCS configuration  by *subcarrierSpacing2* for the supplementary UL carrier  - for paired spectrum operation, a reference SCS configuration  for a DL BWP by *subcarrierSpacing* and a reference SCS configuration  for an UL BWP by *subcarrierSpacing2*  - a location of an available RB set indicator field in DCI format 2\_0 that is  - one bit, if *intraCellGuardBandDL-r16* for the serving cell indicates no intra-cell guard-bands are configured, where a value of '1' indicates that the serving cell is available for receptions, a value of '0' indicates that the serving cell is not available for receptions, by *availableRB-SetPerCell-r16*, and the serving cell remains available or unavailable for reception until the end of the indicated channel occupancy duration  - a bitmap having a one-to-one mapping with the RB sets [6, TS 38.214] of the serving cell, if *intraCellGuardBandDL-r16* for the serving cell indicates intra-cell guard-bands are configured, where the bitmap includes bits and is the number of RB sets in the serving cell, a value of '1' indicates that an RB set is available for receptions, a value of '0' indicates that an RB set is not available for receptions, by *availableRB-SetPerCell-r16* and a RB set remains available or unavailable for receptions until the end of the indicated channel occupancy duration  - a location of a channel occupancy duration field in DCI format 2\_0, by *CO-DurationPerCell-r16*, that indicates a remaining channel occupancy duration for the serving cell starting from a first symbol of a slot where the UE detects the DCI format 2\_0 by providing a value from *CO-DurationList-r16*. The channel occupancy duration field includes bits, where is the number of values provided by *CO-DurationList-r16*. If *CO-DurationPerCell-r16* is not provided, the remaining channel occupancy duration for the serving cell is a number of slots, starting from the slot where the UE detects the DCI format 2\_0, that the SFI-index field value provides corresponding slot formats  - a location of a search space set group switching flag field in DCI format 2\_0, by *SearchSpaceSwitchTrigger-r16*, that indicates a group from two groups of search space sets for PDCCH monitoring for scheduling on the serving cell as described in Clause 10.4.  If a UE is not provided the set of serving cells by *slotFormatCombToAddModList* and *slotFormatCombToReleaseList*, *availableRB-SetsToAddModList-r16* and *availableRB-SetsToRelease-r16*, or *co-DurationsPerCell ToAddModList-r16* and *co-DurationsPerCellToReleaseList-r16*, the UE performs transmissions and receptions as described in Clause 11.1. |   **Please provide reasons for supporting or not supporting the proposal.** | |
| **Company** | **Comment** |
| LG Electronics | With the understanding that the behavior of UE for this case is the same as for the case that SFI is not configured in Rel-15/16, we’re supportive for this TP. |
| Qualcomm | Understand the proposal is trying to clarify for a case that only *SearchSpaceSwitchTrigger-r16* is configured. Not clear to us if we need this clarification. Without this case, we can already support configuring *SearchSpaceSwitchTrigger-r16* only in DCI 2\_0. |
| vivo | Understand the intention but the TP may not be needed. |

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| **Q10: Do you agree to Huawei's proposal:**  If SFI is not configured, UE behaviours for inside CO duration should be the same as in subclause 11.1.   |  | | --- | | **Text proposal #5**  --------- beginning of text proposal for TS 38.213  11.1.1 UE procedure for determining slot format  **<omitted>**  For operation with shared spectrum channel access, if a UE is configured by higher layers to receive a CSI-RS and the UE is provided *CO-DurationPerCell-r16* and is not provided *SlotFormatIndicator*, for a set of symbols of a slot that are indicated as downlink or flexible by *tdd-UL-DL-ConfigurationCommon* or *tdd*-*UL-DL-ConfigurationDedicated*, or when *tdd-UL-DL-ConfigurationCommon* and *tdd*-*UL-DL-ConfigurationDedicated* are not provided, the UE cancels the CSI-RS reception in the set of symbols of the slot that are not within the indicated remaining channel occupancy duration.  For operation with shared spectrum channel access, if a UE is not provided a location of a SFI-index field in DCI format 2\_0 by *positionInDCI*, the UE transmits or receives on a set of symbols according to subclause 11.1 if the set of symbols is indicated by the DCI format 2\_0 as being within a remaining channel occupancy duration by a channel occupancy duration field. |   **Please provide reasons for supporting or not supporting the proposal.** | |
| **Company** | **Comment** |
| LG Electronics | This seems correlated with CSI-RS validation issues in the other email thread. It is understood that RRC parameter *CSI-RS-ValidationWith-DCI-r16* can be reused also for this case. |
| Qualcomm | Understand the intention, but not clear to us if this clarification is necessary. Without SFI, the UE is already following 11.1 |
| vivo | Agree with Qualcomm |

# Relevant TDocs and proposals

## SFI (+other fields) presence configurability in DCI format 2\_0 (B5)

### vivo (R1-2005331)

In previous meetings, the most focus is how to indicate the COT duration when gNB is initiating the COT. Actually, GC-PDCCH could also be transmitted in UE’s initiated COT. In this case, if COT duration in GC-PDCCH indicates a COT end beyond the last symbol of GC-PDCCH, a UE will switch Cat 4 LBT to Cat 2 LBT but this is not expected in UE’s initiated COT. Thus, the indicated COT end shouldn’t be beyond the last symbol of GC-PDCCH carrying DCI 2\_0 when it is located within UE’s initiated COT. If COT duration field is configured in DCI 2\_0, it could be configured as ‘0’ to satisfy the above limitations easily. However, if COT duration field is not configured but SFI is configured, the duration of SFI indication length will represent the COT duration which is at least one slot long. So, using a special entry of SFI (i.e. 255) is needed to indicate that it is in UE’s initiated COT (i.e. COT duration = 0).



**Figure 1** GC-PDCCH in UE’s initiated COT

**Proposal 1: When COT duration field is not configured but SFI is configured in DCI 2\_0, one special entry of SFI (i.e. index 255 SFI) is used to indicate that the DCI 2\_0 carrying SFI is COT duration=0, e.g. in UE’s initiated COT. Adopt TP1 to capture the above proposal.**

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| --------------------------------------**TP1**: Start TP for Section 11.1.1 of TS 38.213 ------------------------------------  a location of a channel occupancy duration field in DCI format 2\_0, by CO-DurationPerCell-r16, that indicates a remaining channel occupancy duration for the serving cell starting from a first symbol of a slot where the UE detects the DCI format 2\_0 by providing a value from CO-DurationList-r16. The channel occupancy duration field includes bits, where is the number of values provided by CO-DurationList-r16. If CO-DurationPerCell-r16 is not provided, the remaining channel occupancy duration for the serving cell is a number of slots, starting from the slot where the UE detects the DCI format 2\_0, that the SFI-index field value provides corresponding slot formats with at least one slot format is not index 255; otherwise the remaining channel occupancy duration is 0.  --------------------------------------**TP1**: End TP for Section 11.1.1 of TS 38.213--------------------------------------- |

### ZTE (R1-2005598)

Rel-16 NR-U has introduced three new fields: RB-set indicator, SSS group switching flag, CO-duration indicator for inclusion in DCI format 2\_0 depend on the configurability of the following high layer parameters respectively: *availableRB-SetPerCell-r16*, *searchSpaceSwitchTrigger-r16* and *co-DurationPerCell-r16*. Both these new fields and the SFI field introduced in Rel-15 NR are optional fields in DCI format 2\_0.

Firstly, SSS group switching flag field can be configured independently with other three fields in DCI format 2\_0. For LBE, RB-set indicator should be configured together with either SFI or CO-duration indicator to make it meaningful. In other words, one of SFI and CO-duration indicator should be configured in case of RB-set indicator presence in DCI format 2\_0. While for FBE, even if remaining COT duration is not indicated via SFI or CO-duration indicator, it can also be obtained by FFP configuration and DL detection. Thus no conditions for configurability of RB-set indicator and other two fields i.e. SFI and CO-duration indicator should be introduced.

If RAN1 agrees that above configurability conditions for four fields in DCI format 2\_0 are feasible, RAN1 should inform RAN2 to make some modifications on configuring *slotFormatCombToAddModList*, *availableRB-SetPerCell-r16* and *co-DurationPerCell-r16* in TS 38.331.

**Proposal 2: RAN1 could determine the following configuration relationships between four fields in DCI format 2\_0, and send a LS to RAN2 for make some restrictions on configuring *slotFormatCombToAddModList*, *availableRB-SetPerCell-r16,* *co-DurationPerCell-r16* and *searchSpaceSwitchTrigger-r16* in TS 38.331.**

* **SSS group switching flag field can be configured independently with other three fields in DCI format 2\_0.**
* **For LBE, one of SFI field and CO-duration indicator field should be configured in case of RB-set indicator field presence in DCI format 2\_0.**
* **For FBE, no conditions for configurability of RB-set indicator field and other two fields i.e. SFI and CO-duration indicator should be introduced.**

### OPPO (R1-2006018)

In RAN1 meeting #100e, whether SFI indication can be configurable or not in DCI format 2\_0 is discussed. In our view, SFI indication can be configurable with restriction in LBE case. For example, if RB set indicator is configured, then the UE is expected at least one of SFI indication and COT duration indication is configured, considering that the RB set indicator is used to indicate an RB set remains available or unavailable until the end of the indicated COT duration. In FBE case, SFI indication can be configurable without restriction. If neither SFI indication nor COT duration indication is configured, the COT duration can be determined by the configured FFP period.

***Proposal 5:*** *In LBE, the UE is expected to be configured with at least one of SFI indication and COT duration indication if RB set indicator is configured.*

### Spreadtrum (R1-2006273)

In the last meeting, it was agreed that the SFI field can be configured in DCI 2\_0 as in Rel-15. One remaining issue is whether one or more conditions of the configuration of the field in DCI 2\_0 should be specified.

For LBE, either *co-DurationPerCell-r16* or *SFI field* should be configured in case of *AvailableRB-SetPerCell-r16* presence in DCI 2\_0, otherwise the *AvailableRB-SetPerCell-r16* will make no sense.

For FBE, the COT duration could be derived from the value of FFP, therefore, any one of *co-DurationPerCell-r16, SFI field* or *AvailableRB-SetPerCell-r16* can be independently configured.

**Proposal 2:**

* **For LBE, either *co-DurationPerCell-r16* or *SFI field* should be configured in case of *AvailableRB-SetPerCell-r16* presence in DCI 2\_0.**
* **For FBE, any one of *co-DurationPerCell-r16, SFI field* or *AvailableRB-SetPerCell-r16* can be independently configured.**

### LG (R1-2006299)

In RAN1#101-e meeting, the following agreement was made for configurability of several fields in DCI format 2\_0.

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| Agreement:  The presence of the SFI field can be configured in DCI 2\_0   * FFS: Conditions under which SFI field must be present depending on what other fields are configured. Example: Available RB-set indicator is configured but COT duration indicator is not configured. |

For FFS point above, the following three alternatives were discussed through RAN1 email reflector.

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| Alt 1   * For LBE and FBE,   + The configuration of *AvailableRB-SetPerCell-r16* requires the presence of at least one of SFI field and *co-DurationPerCell* field.   + No other conditions are introduced   Alt 2   * No restriction on the configurability of {*AvailableRB-SetPerCell-r16*, SFI, *co-DurationPerCell*, search space set switching flag} for DCI format 2\_0 * For FBE,   + If *AvailableRB-SetPerCell-r16* is configured but neither SFI nor *co-DurationPerCell* is configured for DCI format 2\_0, the availability or unavailability for an RB set remains until the end of FFP (excluding idle period). * For LBE,   + If *AvailableRB-SetPerCell-r16* is configured but neither SFI nor *co-DurationPerCell* is configured for DCI format 2\_0, the availability or unavailability for an RB set is valid for [1] slot.   Alt 3   * For FBE,   + No conditions on the configurability of {*AvailableRB-SetPerCell-r16*, SFI, *co-DurationPerCell*, search space set switching flag} * For LBE,   + The configuration of *AvailableRB-SetPerCell-r16* requires the presence of at least one of SFI field and *co-DurationPerCell* field.   + No other conditions are introduced |

Alt 1 or 2 is preferred since they can provide commonality for FBE and LBE cases. Between Alt 1 and Alt 2, Alt 1 is slightly preferred considering its simplicity and less impact on specification.

**Proposal #2: Regardless of FBE or LBE, the configuration of *AvailableRB-SetPerCell-r16* requires the presence of at least one of *SlotFormatIndicator* and *CO-DurationPerCell-r16*.**

* **Without RB set indicator field**

In RAN1#100-e meeting, UE behaviour for the carrier not configured with RB set indicator field was discussed. In our view, this case is allowed only when the carrier is configured with a single RB set or is not configured with any RB set (i.e., no guard band configuration). In other words, UE is expected that RB set indicator field should be configured for a carrier configured with more than one RB sets. One additional condition to allow no RB set indicator field for a carrier could be when DCI format 2\_0 is configured to be monitored on the carrier. For instance, in case of cross-carrier indication of DCI format 2\_0 for a zero guard band carrier, if RB set indicator field is not configured for the carrier, it could be ambiguous to indicate that the carrier is not available for DL reception.

**Proposal #3: RB set indicator field for a serving cell in DCI format 2\_0 may not be configured only if the serving cell is configured with a single RB set or no guard band and if DCI format 2\_0 for the serving cell is configured to be monitored on the serving cell.**

### ETRI (R1-2006350)

In RAN1 #101-e, there was intensive discussion on configurability of the fields in DCI format 2\_0 [1]. As an outcome, one agreement supporting the configurability of the SFI field was made as follows:

Agreement:

The presence of the SFI field can be configured in DCI 2\_0

* FFS: Conditions under which SFI field must be present depending on what other fields are configured. Example: Available RB-set indicator is configured but COT duration indicator is not configured.

However, the condition for the presence of the remaining fields, i.e., *AvailableRB-SetPerCell-r16*, *searchSpaceSwitchTrigger-r16*, and *co-DurationPerCell-r16*, has not been concluded yet. In RAN1 #99, the following agreement was made.

Agreement:

The indication of available LBT bandwidth is valid until the end of the determined channel occupancy.

In LBE, this agreement can be converted into a condition that “*AvailableRB-SetPerCell-r16* should be configured together with either SFI or *co-DurationPerCell-r16*.” No additional restriction seems necessary for LBE in the presence/absence of the fields in DCI format 2\_0.

**Proposal 4**: In LBE, when UE is configured to monitor DCI format 2\_0, *AvailableRB-SetPerCell-r16* is configured together with either *SlotFormatCombinationsPerCell* or *co-DurationPerCell-r16*.

In FBE, our view is that the COT and the idle period are determined based on the configured FFP structure. A COT starts at the first symbol of a FFP and ends at the last symbol of the FFP non-overlapping with the idle period. If UE detects a DL signal/channel in a FFP, the UE assumes that the whole COT duration in the FFP is occupied and performs DL and UL transmissions within the COT. Therefore, in FBE, *co-DurationPerCell-r16* field is not necessary. Also, *AvailableRB-SetPerCell-r16* can be configured independently with the end-of-COT indication.

However, in the current specification, while there is a description that the maximum channel occupancy time is 0.95\*Tx, it is not clear how UE assumes the exact duration of an actual COT (not the maximum COT). Thus, it is proposed to clarify the meaning of the FFP structure as “actual COT + idle period” in the specification. Please also refer to our companion tdoc [2].

**Proposal 5**: In FBE, either *co-DurationPerCell-r16* field in DCI format 2\_0 is not used, or UE expects that *co-DurationPerCell-r16* always indicates the last symbol of a COT.

## General Slot Format determination and corresponding UE behaviour, including special values in e.g. "available RB set indication" (B11+B1)

### Huawei (R1-2005807)

In TS 38.213 v16.1.0 [2], the following text was captured.

If a UE is provided *availableRB-SetPerCell-r16,* the UE is not required to monitor PDCCH candidates that overlap with any RB from RB sets that are indicated as unavailable for receptions by DCI format 2\_0 as described in Clause 11.1.1.

When UE is not configured to detect available RB set indicator or UE fails to detect DCI format 2\_0 carrying available RB set indicator, UE should monitor PDCCH on each RB set on which the search space is configured.

***Proposal 2: When UE is not configured to detect available RB set indicator or UE fails to detect DCI format 2\_0 carrying available RB set indicator, UE should monitor PDCCH based on search space configuration assuming all RB set are available. The corresponding text proposal is in TP#3 in the appendix.***

If the transmission occasion of DCI format 2\_0 carrying available RB set indicators locates at beginning of a DL COT, gNB is not able to update the fields according immediately after LBT. It is beneficial to define a mechanism to indicate UE the values of available RB set indicator fields in the detected DCI format 2\_0 is not valid and will be updated later. UE will still monitor PDCCH in each RB set until receiving an available RB set indicator with valid indication. A contradiction indication mechanism can be used in such case. For example, gNB is indicating all RB sets are not available in a DCI format 2\_0 (all “1” in available RB set indicator field) while UE detects the DCI format 2\_0 in at least one of the RB set. In order to avoid ambiguity, gNB should avoid configure UE to detect DCI format 2\_0 on a RB set which does not overlap with any RB sets indicated by available RB set indictors. It is also not good to indicate all RB set are available (all “0”) in such case, although the behavior of PDCCH monitor is same. It will impact LBT type switch to be discussed in the follow paragraphs.

***Proposal 3: When UE detect a DCI format 2\_0 carrying available RB set indicator indicating all RB sets are unavailable (all ‘0’) including the RB set where the detected DCI format 2\_0 locates, UE will assume the current available RB set indication is not valid and continue monitoring PDCCH candidates on these RB sets if configured. The corresponding text proposal is in TP#3 in the appendix.***

In RAN1#99 [3], the following agreement was reached.

*Agreement:*

* *UE determines if a Cat 4 UL transmission can be switched to Cat 2 LBT with 25 us duration within a gNB initiated COT in indicated available LBT bandwidths, based on the indicated remaining channel occupancy duration.*
* *Note: If UEs with configured grant UL transmissions may apply the switch to Cat. 2, the gNB ensures that the COT is acquired using the highest CAPC*

When gNB transmits Available RB Set Indicator immediately after LBT succeed, gNB will indicate all RB sets are not available due to lack of time to update the DCI content. According to the agreement, UE is not allowed to switch CAT4 LBT to CAT2 LBT in all RB sets even if on the RB set where DCI format 2\_0 is detected. In order to improve the efficiency of channel access, UE should be allowed to switch CAT4 LBT to CAT2 LBT on the same RB set(s) where DCI format 2\_0 carrying available RB set indicator is detected when available RB set indicator indicate all RB set are not available for reception.

***Proposal 4: When UE detect a DCI format 2\_0 carrying available RB set indicator indicating all RB sets are unavailable (all ‘0’) including the RB set where the detected DCI format 2\_0 locates, UE assumes the RB set where the detected DCI format 2\_0 locates remains available until the end of the indicated channel occupancy duration. The corresponding text proposal is in TP#2 in the appendix.***

### Nokia (R1-2005905)

In RAN1#101e we agreed:

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| Agreement:  The presence of the SFI field can be configured in DCI 2\_0   * FFS: Conditions under which SFI field must be present depending on what other fields are configured. Example: Available RB-set indicator is configured but COT duration indicator is not configured. |

Based on above agreement, all the DCI fields within DCU format 2\_0 are optional in R16. It should be clarified that clauses in 11.1.1 are applicable only if corresponding parameters of DCI format 2\_0 were configured.

**Proposal-1:** *Adopt the following clarification for 38.213 on optionality of fields in DCI 2\_0*

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| TP for TS38.21311.1.1 UE procedure for determining slot format This clause apply for a serving cell that is included in a set of serving cells configured to a UE by corresponding parameter(s)  - *slotFormatCombToAddModList* and *slotFormatCombToReleaseList*.  - *availableRB-SetToAddModList-r16*,  - *searchSpaceSwitchTriggerToAddModList-r16*, or  - *co-DurationPerCellList-r16.*  If a UE is configured by higher layers with parameter *SlotFormatIndicator*, the UE is provided a SFI-RNTI by *sfi-RNTI* and with a payload size of DCI format 2\_0 by *dci-PayloadSize*.  The UE is also provided in one or more serving cells with a configuration for a search space set and a corresponding CORESET  for monitoring  PDCCH candidates for DCI format 2\_0 with a CCE aggregation level of  CCEs as described in Clause 10.1. The  PDCCH candidates are the first  PDCCH candidates for CCE aggregation level  for search space set  in CORESET .  <unchanged text omitted > |

### OPPO (R1-2006018)

In this last meeting, we have discussed some use cases in which the UE needs to determine the RB availability based on detected DCI 2\_0, but the agreements were not reached. In this section, we would discuss the following cases: 1) SFI and COT are configured but RB availability is not configured; 2) SFI is configured, but COT and RB availability are not configured; 3) COT is configured, but SFI and RB availability are not configured.

Following the RAN1 previous agreement, when COT and SFI are both configured in the DCI 2\_0, the UE should follow COT indicator to determine the COT duration. Moreover, when RB availability is not configured in DCI 2\_0, the UE can assume all the RB sets are available for reception in the gNB COT.

***Proposal 4****: If RB-set indicator is not configured, but SFI or CO-duration is configured in DCI format 2\_0 for a serving cell, UE assumes that all the RB sets of the serving cell are available for DL reception within the gNB COT.*

In the previous RAN1 meetings, the following agreements regarding DCI format 2\_0 were achieved:

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| Agreement:  Support bit field corresponding to available LBT bandwidths in GC-PDCCH (add a bitmap in the GC-PDCCH DCI)  Agreement:  When the COT duration field is not configured to the UE in DCI format 2\_0, the UE may assume that the duration of the COT is the same as the duration for which SFI is provided in DCI format 2\_0.  Agreement:  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. |

DCI format 2\_0 can be used to indicate the SFI structure and the available RB sets for more than one cells. For each cell, the locations of these bit-fields in the DCI are RRC configured. Once configured, these bit-fields will be transmitted in the DCI, so UE should be indicated in the DCI for the following two cases:

* Case 1: the incorrect available RB sets information in DCI format 2\_0 if it is transmitted at the beginning of one COT while gNB does not have enough time to prepare this information.
* Case 2: the incorrect information of SFI structure and available RB sets in DCI format 2\_0 for the cell which does not pass LBT.

There was discussion that one special state of the available RB sets bit-field may be used to indicate the above case 1. This is applicable, and considering that the UE may assume the CSI-RS is transmitted if it receives the DCI format 2\_0 carrying an indication of “all the RB sets are available”, the special state of “all the RB sets are available” cannot be used to avoid confusion. Hence, the special state of “all the RB sets are not available” can be used, and if UE receives such indication, it is expected to monitor PDCCH occasions in all the RB sets.

On the other hand, to indicate the above case 2, one special state of the SFI structure bit-field may be introduced to indicate the cell which does not pass LBT. If UE receives this indication, it may ignore the information indicated in this DCI format 2\_0 for the cell.

***Proposal 8:*** *For RB set indication in DCI format 2\_0, a special state of the available RB sets indicating “all the RB sets are not available” can be used to indicate the unprepared available RB sets information.*

***Proposal 9:*** *For RB set indication in DCI format 2\_0, a special state of the SFI structure can be introduced to indicate the LBT failed cell.*

### Spreadtrum (R1-2006273)

In last two meetings, several companies proposed to use special states/indications at the beginning of the COT to indicate the available RB sets. The reason is that after successful LBT, gNB may not have enough time to prepare the exact available RB set indication immediately. However, we believe that the current specification can be used to handle this situation by configuring appropriate values for available RB-set indication and/or COT duration field. For example, gNB may indicate a COT duration of 0 ms at the beginning of COT, and update whenever RB set availability information is available. In that case, UE will not switch the LBT type for its configured UL transmission. And for PDCCH monitoring, the UE still monitor the PDCCH in RB sets indicated by “FreqMonitoringLocation-r16”.

Even if special states/indications are defined, how does the UE assume the availability of the RB set(s) when it receives a special state indicated through DCI 2\_0? If UE assume all RB sets are available, for PDCCH monitoring, the UE still needs to monitor the PDCCH in RB sets indicated by “FreqMonitoringLocation-r16”. This behavior is the same as when the UE does not receive the RB set indication carried in DCI 2\_0. If UE assumes all the RB sets are not available, then UE may skip PDCCH monitoring which seems meaningless. If UE assumes that only the RB set carrying DCI 2\_0 is available, the UE may monitor PDCCH or switch LBT type in the RB set, but this will restrict the flexibility of scheduling on gNB side.

Consequently, we consider it is not necessary to define special states/indications in “available RB set indication” to indicate the available RB sets at the beginning of the COT.

**Proposal 3: It is not necessary to define special states/indications in “available RB set indication” to indicate the available RB sets at the beginning of the COT.**

### LG (R1-2006299)

* **All zero state interpretation of RB set indicator field**

DCI format 2\_0 for NR-U can be used for notifying available RB sets, in addition to channel occupancy duration, search space set group switching, and slot format (as in Rel-15). Especially for indicating available RB sets, the UE can be provided with a location of a bitmap in DCI format 2\_0, having a one-to-one mapping with a set of RB sets of the serving cell, where a value of '1' indicates that an RB set is available for receptions and a value of '0' indicates that an RB set is not available for receptions, by *availableRB-SetPerCell-r16*, and the bitmap in DCI format 2\_0. The RB set remains available or unavailable until the end of the indicated channel occupancy duration, as described in TS 38.213 section 11.1.1.

First of all, it should be clarified how to inform in which RB set(s) serving gNB is transmitting at the beginning in its DL burst. The serving gNB may not have sufficient processing time to signal its actually transmitting RB set(s) since gNB cannot predict LBT outcome before starting to transmit DL burst. For this case, the serving gNB can indicate that this slot is at the beginning of its DL burst by using all zero state for the bitmap. It should be noted that transmission of DCI format 2\_0 at the beginning of DL burst could be beneficial for UL cancellation by using SFI index field or for SS set switching by using switching flag and CO duration field.

Secondly, the interpretation of all zero state for the bitmap may depend on whether the code point of bitmap indicating available RB sets for its own carrier corresponds to all ‘0’ or not. Figure 1 depicts one example of DCI format 2\_0 with available RB sets for both of carriers #1 and #2, where gNB grabs the channel only for carrier #1 with 2 RB sets but not for carrier #2. In Slot#n, gNB transmits DCI format 2\_0 with all zero state for carriers #1 and #2. If a UE detects DCI format 2\_0 transmitted in carrier #1, the UE recognizes that all zero state for the same carrier #1 and also for the other carrier #2 represents the beginning of DL burst. On the other hand, in Slot#n+2, since the code point of bitmap for carrier #1 corresponds to ‘11’ (not all zero state), the UE can consider that all zero state for the other carrier #2 represents the gNB cannot access the channel due to LBT failure.



**Figure 1. Example of DCI format 2\_0 notifying available RB sets for multiple carriers**

**Proposal #4: If a UE is monitoring a DCI format 2\_0 indicating available RB sets for the first carrier and also for the second carrier and the UE detects the DCI format 2\_0 on the first carrier,**

* **If the bitmap corresponding to the first carrier is signalled to all ‘0’,**
  + **The UE recognizes that DL burst has just started to be transmitted for the first carrier and also for the second carrier where the corresponding bitmap is signalled to all ‘0’, and the UE expects that available RB sets for the first and second carriers may be updated during this DL burst.**
* **Otherwise,**
  + **For the second carrier where the corresponding bitmap is signalled to all ‘0’, the UE does not expect any DL receptions on the second carrier during channel occupancy time.**

Considering that above Proposal #3 would have an impact only for PDCCH monitoring behaviour, the following text proposal can be suggested.

**Proposal #5: Adopt the following text proposal in TS 38.213 section 10.**

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| 10 UE procedure for receiving control information  **<Unchanged texts are omitted>**  If a UE is provided *availableRB-SetPerCell-r16,* the UE is not required to monitor PDCCH candidates that overlap with any RB from RB sets that are indicated as unavailable for receptions by DCI format 2\_0 as described in Clause 11.1.1, except that all RB set(s) for a serving cell where DCI format 2\_0 is detected are indicated as unavailable for receptions. |

### Sharp (R1-2006553)

In RAN1#101\_e meeting, the following agreement was made.

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| Agreement:  The presence of the SFI field can be configured in DCI 2\_0   * FFS: Conditions under which SFI field must be present depending on what other fields are configured. Example: Available RB-set indicator is configured but COT duration indicator is not configured. |

On the other hand, the first paragraph of subclause 11.1.1 in TS38.213 says that this clause applies for the set of serving cells configured by *slotFormatCombToAddModList* and *slotFormatCombToReleaseList*. In other words, according to the current specification, if SFI is not configured, the procedure in subclause 11.1.1 does not apply irrespective of whether the other fields such as CO duration indication and available RB-set, are configured or not. This is not aligned with common understanding, because subclause 11.1.1 is the only place defining CO duration indication and available RB-set. Therefore, the specification should be update such that the UE configured with monitoring of DCI format 2\_0 without SFI can follow the procedure defined in subclause 11.1.1.

**Proposal 2:**

* **The UE configured with monitoring of DCI format 2\_0 without SFI should follow the procedure defined in subclause 11.1.1.**
  + **Adopt the following Text proposal #2.**

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| **Text proposal #2**  --------- beginning of text proposal for TS 38.213  11.1.1 UE procedure for determining slot format  This clause applies for a serving cell that is included in a set of serving cells configured to a UE by either *slotFormatCombToAddModList* and *slotFormatCombToReleaseList*, *availableRB-SetsToAddModList-r16* and *availableRB-SetsToRelease-r16*, *searchSpaceSwitchTriggerToAddModList-r16* and *searchSpaceSwitchTriggerToReleaseList-r16*, or *co-DurationsPerCell ToAddModList-r16* and *co-DurationsPerCellToReleaseList-r16*.  If a UE is configured by higher layers with parameter *SlotFormatIndicator*, the UE is provided a SFI-RNTI by *sfi-RNTI* and with a payload size of DCI format 2\_0 by *dci-PayloadSize*.  **<omitted>** |

Subclause 11.1.1 in TS38.213 describe transmission / reception behaviours for UEs configured with monitoring of DCI format 2\_0, the behaviours are defined by using SFI, CO duration indication and/or available RB set indication. On the other hand, there is one more possibility, which is the case where search space set group switching flag field is configured in DCI format 2\_0 but any other information field is not configured in the DCi format 2\_0. The transmission / reception behaviours with DCI format 2\_0 carrying search space set group switching flag field only should follow the one without DCI format 2\_0 monitoring.

**Proposal 4:**

* **UE with DCI format 2\_0 carrying search space set group switching flag field only should follow behaviours defined in subclause 11.1.**
  + **Adopt the following Text proposal #4.**

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| **Text proposal #4**  --------- beginning of text proposal for TS 38.213  11.1.1 UE procedure for determining slot format  This clause applies for a serving cell that is included in a set of serving cells configured to a UE by *slotFormatCombToAddModList* and *slotFormatCombToReleaseList*.  If a UE is configured by higher layers with parameter *SlotFormatIndicator*, the UE is provided a SFI-RNTI by *sfi-RNTI* and with a payload size of DCI format 2\_0 by *dci-PayloadSize*.  The UE is also provided in one or more serving cells with a configuration for a search space set and a corresponding CORESET  for monitoring  PDCCH candidates for DCI format 2\_0 with a CCE aggregation level of  CCEs as described in Clause 10.1. The  PDCCH candidates are the first  PDCCH candidates for CCE aggregation level  for search space set  in CORESET .  For each serving cell in the set of serving cells, the UE can be provided:  - an identity of the serving cell by *servingCellId*  - a location of a SFI-index field in DCI format 2\_0 by *positionInDCI*  - a set of slot format combinations by *slotFormatCombinations*, where each slot format combination in the set of slot format combinations includes  - one or more slot formats indicated by a respective *slotFormats* for the slot format combination, and  - a mapping for the slot format combination provided by *slotFormats* to a corresponding SFI-index field value in DCI format 2\_0 provided by *slotFormatCombinationId*  - for unpaired spectrum operation, a reference SCS configuration  by *subcarrierSpacing* and, when a supplementary UL carrier is configured for the serving cell, a reference SCS configuration  by *subcarrierSpacing2* for the supplementary UL carrier  - for paired spectrum operation, a reference SCS configuration  for a DL BWP by *subcarrierSpacing* and a reference SCS configuration  for an UL BWP by *subcarrierSpacing2*  - a location of an available RB set indicator field in DCI format 2\_0 that is  - one bit, if *intraCellGuardBandDL-r16* for the serving cell indicates no intra-cell guard-bands are configured, where a value of '1' indicates that the serving cell is available for receptions, a value of '0' indicates that the serving cell is not available for receptions, by *availableRB-SetPerCell-r16*, and the serving cell remains available or unavailable for reception until the end of the indicated channel occupancy duration  - a bitmap having a one-to-one mapping with the RB sets [6, TS 38.214] of the serving cell, if *intraCellGuardBandDL-r16* for the serving cell indicates intra-cell guard-bands are configured, where the bitmap includes bits and is the number of RB sets in the serving cell, a value of '1' indicates that an RB set is available for receptions, a value of '0' indicates that an RB set is not available for receptions, by *availableRB-SetPerCell-r16* and a RB set remains available or unavailable for receptions until the end of the indicated channel occupancy duration  - a location of a channel occupancy duration field in DCI format 2\_0, by *CO-DurationPerCell-r16*, that indicates a remaining channel occupancy duration for the serving cell starting from a first symbol of a slot where the UE detects the DCI format 2\_0 by providing a value from *CO-DurationList-r16*. The channel occupancy duration field includes bits, where is the number of values provided by *CO-DurationList-r16*. If *CO-DurationPerCell-r16* is not provided, the remaining channel occupancy duration for the serving cell is a number of slots, starting from the slot where the UE detects the DCI format 2\_0, that the SFI-index field value provides corresponding slot formats  - a location of a search space set group switching flag field in DCI format 2\_0, by *SearchSpaceSwitchTrigger-r16*, that indicates a group from two groups of search space sets for PDCCH monitoring for scheduling on the serving cell as described in Clause 10.4.  If a UE is not provided the set of serving cells by *slotFormatCombToAddModList* and *slotFormatCombToReleaseList*, *availableRB-SetsToAddModList-r16* and *availableRB-SetsToRelease-r16*, or *co-DurationsPerCell ToAddModList-r16* and *co-DurationsPerCellToReleaseList-r16*, the UE performs transmissions and receptions as described in Clause 11.1. |

In RAN1#102\_e, it was discussed CSI-RS validation when DCI format 2\_0 contains COT duration, but not SFI. It was agreed that, when DCI 2\_0 contains COT duration, but not SFI, UE cancels the reception of CSI-RS configured by higher layers at least on flexible symbols (including the case where no semi-static TDD configuration is provided to the UE) if the CSI-RS location is outside the CO duration indicated by the COT duration field. However, in the current specification, UE behaviours for inside of the CO duration when DCI 2\_0 contains COT duration but not SFI is missing. The most straightforward solution would be to follow the behaviours without monitoring of DCI format 2\_0.

**Proposal 5:**

* **If SFI is not configured, UE behaviours for inside CO duration should be the same as in subclause 11.1.**
  + **Adopt the following Text proposal #5.**

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| **Text proposal #5**  --------- beginning of text proposal for TS 38.213  11.1.1 UE procedure for determining slot format  **<omitted>**  For operation with shared spectrum channel access, if a UE is configured by higher layers to receive a CSI-RS and the UE is provided *CO-DurationPerCell-r16* and is not provided *SlotFormatIndicator*, for a set of symbols of a slot that are indicated as downlink or flexible by *tdd-UL-DL-ConfigurationCommon* or *tdd*-*UL-DL-ConfigurationDedicated*, or when *tdd-UL-DL-ConfigurationCommon* and *tdd*-*UL-DL-ConfigurationDedicated* are not provided, the UE cancels the CSI-RS reception in the set of symbols of the slot that are not within the indicated remaining channel occupancy duration.  For operation with shared spectrum channel access, if a UE is not provided a location of a SFI-index field in DCI format 2\_0 by *positionInDCI*, the UE transmits or receives on a set of symbols according to subclause 11.1 if the set of symbols is indicated by the DCI format 2\_0 as being within a remaining channel occupancy duration by a channel occupancy duration field. |

In RAN1#100\_e, it was actively discussed whether/how to introduce a special value of RB set indicator [3]. The main motivation is to inform UEs of that the gNB is not aware of availability of other RB sets than the one where the DCI format 2\_0 is detected, which happens when the gNB generates DCI format 2\_0 before getting channel access. There are several proposals [4][5][6]. They have similar principle for self-indicating case, i.e. DCI format 2\_0 on a serving cell indicates the availability of RB sets within the same serving cell, as follows. From our perspective, this is reasonable.

* The value of all ‘0’ indicates that the gNB is not aware of availability of other RB sets than the one where the DCI format 2\_0 is detected.

Meanwhile, companies had different views on cross-indicating cases.

* Option 1: Same as self-indicating case, i.e. the value of all ‘0’ indicates that the gNB is not aware of availability of other RB sets than the one where the DCI format 2\_0 is detected.
* Option 2: Unlike self-indicating case, i.e. the value of all ‘0’ indicates that all RB sets are not available.
* Option 3: If CO duration is not set to zero, the value of all ‘0’ indicates that all RB sets are not available. If CO duration is set to zero, it means that the gNB is not aware of availability of all RB sets in the serving cell.

For cross-carrier indicating case, there is a possibility that all RB sets are not available, which should be informed of UEs. At the same time, informing unawareness of availability is also useful even in cross-carrier indicating case. Therefore, we support Option 3 in principle.

For UE behaviours for the case the gNB is not aware of availability of a given RB set, it can be the same as for outside of CO.

Without defining the special value of the RB set indicator, it is difficult to handle the case when the gNB needs to transmit DCI 2\_0 but is not aware of LBT status at the moment of the DCI 2\_0 creation.

* For the solution to indicating all RB sets are available, it does not work, because it results in incorrect UL LBT type switch on the RB set where LBT fails.
* For the solution to indicating only RB set including DCI format 2\_0 is available, it will restrict the following DL transmission only limited to one RB set, even if the gNB succeeds LBT on the other RB sets.
* For the solution of COT duration set to zero length, it causes notification of incorrect COT duration for the RB set including DCI format 2\_0, which prevents UL LBT type switch on that RB set.
* For the solution of not transmit DCI format 2\_0, it is very problematic, because it is not possible for gNB to indicate other fields such as SFI, COT duration, SS switch flag.

**Proposal 6:**

* **UE behaviours for RB sets for which the gNB is not aware of LBT status should follow the behaviour for outside CO durations.**
* **TS38.213 to capture the special value (i.e. all ‘0’) of the RB set indicator value for a self-indication case when the gNB is not aware of LBT status of other RB sets.**
  + **Adopt the following Text proposal #6.**

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| **Text proposal #6**  --------- beginning of text proposal for TS 38.213  11.1.1 UE procedure for determining slot format  This clause applies for a serving cell that is included in a set of serving cells configured to a UE by *slotFormatCombToAddModList* and *slotFormatCombToReleaseList*.  If a UE is configured by higher layers with parameter *SlotFormatIndicator*, the UE is provided a SFI-RNTI by *sfi-RNTI* and with a payload size of DCI format 2\_0 by *dci-PayloadSize*.  The UE is also provided in one or more serving cells with a configuration for a search space set and a corresponding CORESET  for monitoring  PDCCH candidates for DCI format 2\_0 with a CCE aggregation level of  CCEs as described in Clause 10.1. The  PDCCH candidates are the first  PDCCH candidates for CCE aggregation level  for search space set  in CORESET .  For each serving cell in the set of serving cells, the UE can be provided:  - an identity of the serving cell by *servingCellId*  - a location of a SFI-index field in DCI format 2\_0 by *positionInDCI*  - a set of slot format combinations by *slotFormatCombinations*, where each slot format combination in the set of slot format combinations includes  - one or more slot formats indicated by a respective *slotFormats* for the slot format combination, and  - a mapping for the slot format combination provided by *slotFormats* to a corresponding SFI-index field value in DCI format 2\_0 provided by *slotFormatCombinationId*  - for unpaired spectrum operation, a reference SCS configuration  by *subcarrierSpacing* and, when a supplementary UL carrier is configured for the serving cell, a reference SCS configuration  by *subcarrierSpacing2* for the supplementary UL carrier  - for paired spectrum operation, a reference SCS configuration  for a DL BWP by *subcarrierSpacing* and a reference SCS configuration  for an UL BWP by *subcarrierSpacing2*  - a location of an available RB set indicator field in DCI format 2\_0 that is  - one bit, if *intraCellGuardBandDL-r16* for the serving cell indicates no intra-cell guard-bands are configured, where a value of '1' indicates that the serving cell is available for receptions, a value of '0' indicates that the serving cell is not available for receptions, by *availableRB-SetPerCell-r16*, and the serving cell remains available or unavailable for reception until the end of the indicated channel occupancy duration  - a bitmap having a one-to-one mapping with the RB sets [6, TS 38.214] of the serving cell, if *intraCellGuardBandDL-r16* for the serving cell indicates intra-cell guard-bands are configured, where the bitmap includes bits and is the number of RB sets in the serving cell, a value of '1' indicates that an RB set is available for receptions, a value of '0' indicates that an RB set is not available for receptions, by *availableRB-SetPerCell-r16*, and an RB set remains available or unavailable for receptions until the end of the indicated channel occupancy duration  - a location of a channel occupancy duration field in DCI format 2\_0, by *CO-DurationPerCell-r16*, that indicates a remaining channel occupancy duration for the serving cell starting from a first symbol of a slot where the UE detects the DCI format 2\_0 by providing a value from *CO-DurationList-r16*. The channel occupancy duration field includes bits, where is the number of values provided by *CO-DurationList-r16*. If *CO-DurationPerCell-r16* is not provided, the remaining channel occupancy duration for the serving cell is a number of slots, starting from the slot where the UE detects the DCI format 2\_0, that the SFI-index field value provides corresponding slot formats  - a location of a search space set group switching field in DCI format 2\_0, by *SearchSpaceSwitchTrigger-r16*, that indicates a group from two groups of search space sets for PDCCH monitoring for scheduling on the serving cell as described in Clause 10.4.  If a UE detects DCI format 2\_0 in a serving cell that the RB set indicator field value provides availability of RB sets for the serving cell, and if all bits corresponding to all RB sets of the serving cell are set to '0', the UE shall consider  - the RB set where the DCI format 2\_0 is detected is indicated as being available for receptions, and  - the UE has not detected a DCI format 2\_0 providing a slot format for the other RB set(s).  A SFI-index field value in a DCI format 2\_0 indicates to a UE a slot format for each slot in a number of slots for each DL BWP or each UL BWP starting from a slot where the UE detects the DCI format 2\_0. The number of slots is equal to or larger than a PDCCH monitoring periodicity for DCI format 2\_0. The SFI-index field includes  bits where maxSFIindex is the maximum value of the values provided by corresponding *slotFormatCombinationId*. A slot format is identified by a corresponding format index as provided in Table 11.1.1-1 where 'D' denotes a downlink symbol, 'U' denotes an uplink symbol, and 'F' denotes a flexible symbol. |

### Qualcomm (R1-2006836)

When a UE is configured with DCI 2\_0 monitoring for a shared spectrum cell with multiple LBT bandwidth, if the *availableRB-setPerCell-r16* is configured, UE can figure out which RB set is available, which may impact CSI-RS reception and RRC configured UL transmission validation. However, it is not yet defined if the DCI 2\_0 monitoring is configured, but *availableRB-setPerCell-r16* is not configured for a cell with multiple LBT bandwidth. There is no way for a UE to blindly detect which LBT bandwidth is available. Therefore, we propose for this case, the UE will consider all RB sets transmitted and included in COT.

**Proposal : For a cell with multiple LBT bandwidth but** ***availableRB-setPerCell-r16* not configured, the UE will consider all RB sets are in the COT when DCI 2\_0 is detected.**

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| ===========TP for 38.213 11.1.1 ==================  11.1.1 UE procedure for determining slot format  \*\*\* Unchanged text is omitted \*\*\*  For each serving cell in the set of serving cells, the UE can be provided:  - an identity of the serving cell by *servingCellId*  - a location of a SFI-index field in DCI format 2\_0 by *positionInDCI*  - a set of slot format combinations by *slotFormatCombinations*, where each slot format combination in the set of slot format combinations includes  - one or more slot formats indicated by a respective *slotFormats* for the slot format combination, and  - a mapping for the slot format combination provided by *slotFormats* to a corresponding SFI-index field value in DCI format 2\_0 provided by *slotFormatCombinationId*  - for unpaired spectrum operation, a reference SCS configuration  by *subcarrierSpacing* and, when a supplementary UL carrier is configured for the serving cell, a reference SCS configuration  by *subcarrierSpacing2* for the supplementary UL carrier  - for paired spectrum operation, a reference SCS configuration  for a DL BWP by *subcarrierSpacing* and a reference SCS configuration  for an UL BWP by *subcarrierSpacing2*  - a location of an available RB set indicator field in DCI format 2\_0 that is  - one bit, if *intraCellGuardBandDL-r16* for the serving cell indicates no intra-cell guard-bands are configured, where a value of '1' indicates that the serving cell is available for receptions, a value of '0' indicates that the serving cell is not available for receptions, by *availableRB-SetPerCell-r16*, and the serving cell remains available or unavailable for reception until the end of the indicated channel occupancy duration  - a bitmap having a one-to-one mapping with the RB sets [6, TS 38.214] of the serving cell, if *intraCellGuardBandDL-r16* for the serving cell indicates intra-cell guard-bands are configured, where the bitmap includes bits and is the number of RB sets in the serving cell, a value of '1' indicates that an RB set is available for receptions, a value of '0' indicates that an RB set is not available for receptions, by *availableRB-SetPerCell-r16*, and an RB set remains available or unavailable for receptions until the end of the indicated channel occupancy duration  - If *availableRB-SetPerCell-r16* is not provided, all RB sets in the active BWP are considered available for receptions.  - a location of a channel occupancy duration field in DCI format 2\_0, by *CO-DurationPerCell-r16*, that indicates a remaining channel occupancy duration for the serving cell starting from a first symbol of a slot where the UE detects the DCI format 2\_0 by providing a value from *CO-DurationList-r16*. The channel occupancy duration field includes bits, where is the number of values provided by *CO-DurationList-r16*. If *CO-DurationPerCell-r16* is not provided, the remaining channel occupancy duration for the serving cell is a number of slots, starting from the slot where the UE detects the DCI format 2\_0, that the SFI-index field value provides corresponding slot formats  - a location of a search space set group switching field in DCI format 2\_0, by *SearchSpaceSwitchTrigger-r16*, that indicates a group from two groups of search space sets for PDCCH monitoring for scheduling on the serving cell as described in Clause 10.4.  \*\*\* Unchanged text is omitted \*\*\*  ================================================= |