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**Agenda item:** 7.1.3.1

**Source:** LG Electronics

**Title:** Remaining issues on downlink control channel

**Document for:** Discussion and decision

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## **1. Introduction**

In this contribution, we discuss some issues related to PDCCH structure, search space, and GC-PDCCH. Section 2.1 ~ 2.7 are related to PDCCH structure and search space, and Section 2.8 & 2.9 are related to GC-PDCCH.

## **2. Discussions**

### **2.1. TCI state for SSB/CORESET#0/SS#0**

In last meeting, it was agreed that NW and UE maintain the same understanding on SSB/CORESET#0/SS#0 in connected mode for non-broadcast PDCCH and for broadcast PDCCH, and how to have same understanding between NW and UE is FFS. In addition, following alternatives were proposed for the FFS point;

Alt. 1: Broadcast PDCCH uses selected SSB as a QCL source, and configured TCI states for CORESET#0 are used for reception of unicast data scheduled by PDCCH on search spaces other than SS#0.

Alt. 1': A TCI state can be configured for CORESET#0 where the QCL reference is only an SSB. The configured TCI state is used for broadcast/non-broadcast data reception in the SS set(s) associated with the CORESET#0.

Alt. 2: The selected SSB is the most recent one between MAC-CE and SSB selected as part of CBRA or CFRA.

Alt. 3: Any search space associated with the CORESET#0 cannot be used for unicast PDCCH with QCL Type D after RRC connection is established.

Alt 3': In addition to Alt. 3, align 6 PRB grid between CORESET#0 and other CORESETs in order to configure TCI state to the resources included in CORESET#0.

As mentioned in last meeting, there are pros and cons on each alternative; for example, flexibility in TCI state configuration, RRC impact, available number of CORESETs, restriction of TCI state pool configuration, etc. Considering various aspects, Alt.2 is preferred slightly among proposed alternatives. However, this may require new procedure of MAC CE update without additional RRC signaling. To minimize the impact, another alternative is to utilize configured TCI states and CFRA/CBRA procedure. For example, TCI state of CORESET #0 can be updated based on lowest indexed TCI state configured for PDSCH and CFRA/CBRA procedure whichever is the most recent.

As the TCI state in the TCI pool can be reconfigured by existing RRC signaling, flexibility of TCI state configuration on CORESET#0 can be guaranteed and there is no impact to RRC, the number of CORESETs and TCI pool configuration. So, we propose the TCI state of CORESET#0/SS set#0 is the most recent one between default TCI state and SSB selected as part of CBRA or CFRA. In addition, at least for CORESET#0/SS set#0, the default TCI state can be restricted to SSB, i.e., lowest index TCI state among TCI states associated with SSB in TCI pool.

**Proposal 1: The TCI state of CORESET#0/SS set#0 is the most recent one between default TCI state**

and SSB selected as part of CBRA or CFRA.

**Proposal 2: The default TCI state is determined by lowest indexed TCI state in the TCI pool. The default TCI state for CORESET#0/SS set#0 is only an SSB.**

## 2.2. QCL assumption between overlapped CORESETs in time domain

According to previous agreements, each CORESET can have own spatial QCL (i.e., TCI state), and different CORESETs can be overlapped on time and/or frequency domain. It means that CORESETs with different QCL assumptions can be overlapped on a same symbol. Because a UE determines an Rx beam used for monitoring each CORESET by considering TCI state of each CORESET, if multiple CORESETs with different QCL assumptions overlaps on time domain resources (e.g., OFDM symbol), a UE should support multiple Rx beams or select one Rx beam (or TCI state) by a certain selection rule.

Option 1) Monitoring skip of lower prioritized CORESET

The CORESET selection rule can be applied when CORESETs with different spatial QCLs are overlapped on time resources, and a UE can skip monitoring candidates included in non-selected CORESET. The priority of each CORESET can be determined by, for example, CORESET ID, the number of SS sets associated with a CORESET, associated search space type, etc. In addition, existing PDCCH mapping rule can be used for determining priority, for example, CSSs has higher priority than USSs, and lower indexed SS set is prior to higher indexed SS set. This option is simple, but PDCCH transmission/reception opportunity cannot be guaranteed in some resources.

Option 2) Representative spatial QCL for overlapped CORESETs

The priority rule as mentioned in option 1 is also used to option 2. In option 2, instead of dropping CORESET(s) with lower priority, QCL assumption (i.e., TCI state) of a CORESET with lower priority follows a CORESET with higher priority. In other words, same spatial QCL is assumed on overlapped CORESETs, and the representative QCL can be selected by using CORESET priority as mentioned in option 1. A UE can assume that QCL assumptions for overlapped CORESETs follow the highest priority CORESET's QCL. This option can provide more PDCCH transmission/reception opportunity, but the PDCCH performance of CORESET with lower priority may be decreased because of mismatch between Tx beam and Rx beam.

Option 3) No overlap between CORESETs with different spatial QCLs

A UE can assume that the network doesn't schedule overlapped CORESETs with different spatial QCLs. However, it is not sure that the overlap can always be avoided by scheduling.

For a simplicity, we prefer option 1. In option 1, a UE can monitor overlapped CORESETs with different TCIs, if the QCL source of the different TCI states for each CORESET is same. Additionally, this solution can be applied before PDCCH mapping for BD/CCE complexity handling, i.e., a CORESET which is not monitored by the option 1 is not considered to the number of BDs/CCs in the slot.

**Proposal 3: If CORESETs with different TCI states are overlapped in time domain, a UE does not expect PDCCH monitoring on a CORESET with lower priority.**

It is however noted that conditions to determine two CORESETs are colliding with different QCL assumption need to be clarified. For example, whether a CORESET configured with a CSI-RS/QCL type D and another CORESET with a SSB/QCL type D where the CSI-RS is QCLed with the SSB are considered as CORESETs with different QCL assumption or not needs to be clarified.

## 2.3. BFR CORESET/SS set

The BFR CORESET and associated SS set are configured for beam failure recovery procedure. This CORESET/SS set is activated by beam failure recovery procedure, and a UE is not expected to monitor

PDCCH candidates in the CORESET before beam failure recovery procedure (e.g., PRACH transmission) and after new CORESET/SS set configuration(s) or TCI update. On the other hands, it is not sure whether PDCCH monitoring in existing CORESETs (i.e., CORESETs which are configured to monitor before BFR procedure) is performed during monitoring window of BFR CORESET. In our view, as some common information (such as SFI, system information, paging ...) may not be monitored in the BFR CORESET, it is desirable that a UE can monitor PDCCH candidates in the existing CORESETs even during monitoring window of BFR CORESET.

**Proposal 4: A UE is assumed to continue monitoring on other active CORESETs (than BFR-CORESET) during BFR procedure.**

It is expected that TCI state of a CORESET (if configured) will be updated only via explicit configuration. Thus, during BFR procedure, the UE may monitor a CORESET with outdated TCI state. When BFR-CORESET and other CORESET(s) are monitored on the same time resource with potentially different QCL/TCI information (and thus potentially lead different Rx beam), some handling is necessary. A simple solution is that a UE can skip monitoring old CORESET, if BFR CORESET overlaps with old CORESET in time domain. This is to prioritize BFR-CORESET in case of collision.

Another issue is whether to count CCEs/BDs for BFR-SS under UE's channel estimation/BD limit. If it is not accounted, it may be that the total number of required CCEs can be much higher than what UE can support during BFR, we propose to count CCEs/BDs of BFR-SS as well when monitored. If this is assumed, some clarification is necessary. According to previous agreement, CSS has a higher priority compared to USS for PDCCH mapping, and it is assumed that the number of BDs/CCEs for CSSs doesn't exceed each limit. But, in a slot configured to monitor BFR CORESET, the number of BDs/CCEs for BFR CORESET should be considered to PDCCH mapping rule. In order to solve this problem, BFR CORESET/SS set should have highest priority (regardless of SS type) on PDCCH mapping rule, and existing PDCCH mapping rule can be applied to other SS sets. If this is applied, unless it is ensured that the sum of CCEs of CSS and BFR-SS does not exceed UE's limit, CSS(s) may need to be dropped when BFR-SS is monitored. Not to incur too much configuration flexibility, we propose to drop CSS(s) based on SS set index when BFR-SS is monitored.

**Proposal 5: If BFR CORESET overlaps with other CORESET(s) in time domain, a UE is not required to monitor PDCCH candidates in other CORESET(s) at least in case QCL information is different between BFR-CORESET and other CORESET(s).**

**Proposal 6: The BFR CORESET/SS set has highest priority (regardless of SS type) for PDCCH candidate mapping rule when monitored. CSS(s) associated with other CORESET(s) may be dropped based on SS set index when BFR SS is monitored.**

## 2.4. BD/CE complexity in CA cases

### Clarification of previous agreements

In last meeting, it was agreed how to determine the limit of BDs and CCEs for self-scheduling with different numerologies as follows;

#### Agreements:

- For self-scheduling with different numerologies, and the number of DL-CCs is more than 4 and with up to T DL-CCs where the UE reports BD capability of  $y < T$ , the limit of BDs/CCEs per CC per slot is
  - (Working assumption) The total number of BDs/CCEs across CCs per numerology is based on UE BD capability. It can be split across CCs for the given numerology, subject to the non-CA limit on each CC.
    - If a UE is configured with DL-CCs of  $X_0, X_1, X_2, X_3$ , where  $X_i$  denotes the number of DL-CCs with the numerology  $i$ , the limit of (BDs or CCEs) for the DL-CCs with the numerology  $i$  is given by  $\text{Floor}\{X_i / (X_0 + X_1 + X_2 + X_3) * (M_i \text{ or } N_i) * y\}$  per slot of the numerology  $i$
- For SCell, NW ensures no overbooking based on non-CA case occurs

In this agreement, the numerology of each DL CC is not clear, because each DL CC can have multiple BWPs and each BWP can have own numerology. In order to clarify the numerology of DL CC, we propose the numerology of active BWP is regarded as the numerology of the DL CC. In other words, the value of  $X_1, X_2, X_3$  and  $X_4$  can be updated or be different per BWP combinations across CCs. For each BWP

configuration, the limit in BD and channel estimation by search space/CORESET configurations is expected to be handled based on the numerology configured in that BWP. The actual limit is computed based on the currently active BWP in each activated carrier.

Second issue is the limit of BDs and CCEs for PCell. As shown in the agreement, NW ensures no overbooking based on non-CA case occurs for SCells. In our understanding, it means overbooking is allowed for PCell, and PDCCH mapping rule for BD/CE complexity handling is applied to PCell. Following options can be considered to determine the limit of PCell;

Option 1) The limit of non-CA case

For a PCell, in order to allow more scheduling flexibility, a limit for non-CA case can be applied. In this option, the total BD and channel estimation to SCell(s) and PCell with numerology  $i$  is determined by  $\text{Floor}\{(X_i/(X_0+X_1+X_2+X_3))*(M_i \text{ or } N_i)*y\}$ , and the limit of (BDs/CCEs) for a PCell can be given by  $\min\{\text{configured number of BDs/CCEs to PCell, limit of non-CA case for numerology } i\}$ . If Option 1 is used, the total number of BD/channel estimation which can be allocated to SCell(s) with numerology  $i$  is determined by  $\text{Floor}\{(X_i/(X_0+X_1+X_2+X_3))*(M_i \text{ or } N_i)*y\} - \min\{\text{configured number of BDs/CCEs to PCell, limit of non-CA case for numerology } i\}$ .

Option 2) The limit based on agreed formula

In this option, it can be assumed that the limit of PCell is determined by “ $\text{limit}_{\text{PCell}} / X_{\text{PCell}}$ ” assuming BD/channel estimation budgets are evenly distributed across cells with the same numerology  $i$ . (where  $\text{limit}_{\text{PCell}}$  means the limit of the numerology including PCell,  $X_{\text{PCell}}$  means the number of DL-CCs with the numerology including PCell.) Then, for SCells using the numerology, the limit is given by “ $\text{limit}_{\text{PCell}} - \text{limit}_{\text{PCell}} / X_{\text{PCell}}$ ”.

In order to achieve scheduling flexibility of PCell, option 1 is preferable. In addition, the number of BDs/channel estimations configured to SCell with a numerology  $i$  may not be evenly distributed across SCells. It's up to the network to ensure the total does not exceed the maximum and for each carrier, non-CA limit applies. As long as both conditions are met, any number of BDs/channel estimation to a cell is supported.

**Proposal 7: The numerology of currently active BWP is regarded as the numerology of the DL CC.**

**Proposal 8: A UE assumes the overbooking is allowed to PCell. The limit of (BDs or CCEs) for the PCell is same with non-CA case on the numerology.**

#### **The limit of BDs/CCEs for cross-carrier scheduling**

For cross-carrier scheduling, DCIs for scheduled cells are transmitted/received in a scheduling cell, so it is desirable that the limits of BDs/CCEs for scheduled cells are also derived based on a numerology of the scheduling cell. For example, if cross-carrier scheduling is applied to 3 CCs, and the numerologies for each cell are 15kHz for scheduling cell, 30kHz for scheduled cell #1, and 60kHz for scheduled cell #2, respectively, then a UE can assume 3 cells with 15kHz for determining the limit of BDs/CCEs. Then, the limit of each numerology is given by  $\text{Floor}\{X_i / (X_0 + X_1 + X_2 + X_3) * (M_i \text{ or } N_i) * y\}$  per slot of the numerology  $i$ . In other words, instead of numerology configured to scheduled carrier, numerology configured to scheduling carrier in case of cross-carrier scheduling is used.

**Proposal 9: For cross-carrier scheduling with different numerologies, a UE can assume that a numerology of scheduling CC is applied to scheduled CC(s) for determining the limit of BDs/CCEs.**

Furthermore, whether cross-carrier scheduling is supported or not can be signaled per band combination. Thus, when a number of carriers are configured, depending on UE capability, cross-carrier scheduling may or may not be supported. When cross-carrier scheduling is supported in that band combination, it is assumed that the reported value  $y$  in that band combination can be applied for both self-carrier and cross-carrier scheduling.

## 2.5. Scheduling availability of UE during measurements

Agreements in last RAN4 meeting are as follows:

- RAN4 defines requirements regarding scheduling availability during SSB based L3 measurement, SSB based RLM, CSI-RS based RLM, SSB based L1-RSRP measurement, CSI-RS based L1-RSRP measurement, SSB based beam failure detection and CSI-RS based beam failure detection in Rel-15.
  - RAN4 also defines requirements regarding scheduling availability during CSI-RS based L3 measurement if RRM requirements for CSI-RS based L3 measurement are defined in Rel-15.
- For requirements regarding scheduling availability during SSB based RLM, CSI-RS based RLM, SSB based L1-RSRP measurement, CSI-RS based L1-RSRP measurement, SSB based beam failure detection and CSI-RS based beam failure detection, scheduling restriction due to those procedures is not applied to any other symbols than RS symbols to be monitored.

In the agreement, “scheduling availability” may mean that a UE is not expect to transmit PUCCH/PUSCH or receive PDCCH/PDSCH on time domain resources configured for measurement. On the other hand, as mentioned in second bullet, scheduling restriction due to those procedures is not applied to any other symbols than RS symbols to be monitored. In our understanding, it means symbols not overlapped with measurement resources can be used for PDSCH/PDCCH reception. From the control channel perspective, it should be clarified whether a CORESET/search space which is partially overlapped in time domain with measurement resource (listed in RAN4 agreement) is available or not. We can consider following options for handling the cases;

Option 1) Skip PDCCH monitoring on search space sets associated with the CORESET (overlapped with measurement resources)

This option is simple, but opportunity for DL/UL transmission/reception might be decreased by dense measurements. Especially, this option can affect URLLC performance, e.g., performance of availability and reliability enhancement by PDCCH repetition is impacted by CORESET skipping.

Option 2) PDCCH rate matching (symbol-level rate matching)

A UE can assume PDCCH is rate matched on the symbol(s) which includes measurement resources. This option can utilize residual resource of a CORESET (overlapped with measurement resources), but higher aggregation levels are required for PDCCH performance since effective coding rate is increased.

Option 3) CORESET resizing

If a CORESET is overlapped with the symbol(s) which includes measurement resources, duration of the CORESET can be decreased to the number of available symbol(s). Because this option can maintain the coding ration of each AL, available resources in the CORESET can be used effectively compared to option 2.

Though Option 1 is simple, the performance impact may not be negligible for URLLC. We can at least support Option 1 for eMBB case, and further discuss whether to adopt different behaviors for URLLC.

**Proposal 10: For eMBB, a CORESET overlapped with measurement resources (listed in RAN4 agreement) is not monitored.**

## 2.6. TCI assumption for PDSCH

In TS38.214 (Section 5.1.5), assumption of TCI state for PDSCH reception is defined as follows;

For both the cases when <i>tcj-PresentInDCI</i> is set to 'enabled' and <i>tcj-PresentInDCI</i> is not configured, if the offset between the reception of the DL DCI and the corresponding PDSCH is less than the threshold <i>Threshold-Sched-Offset</i> , the UE may assume that the DM-RS ports of PDSCH of a serving cell are quasi co-located with the RS(s) in the TCI state with respect to the QCL parameter(s) used for PDCCH quasi co-location indication of the lowest <i>CORESET-ID</i> in the latest slot in which one or
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**more CORESETs within the active BWP of the serving cell are configured for the UE.** If none of configured TCI states contains 'QCL-TypeD', the UE shall obtain the other QCL assumptions from the indicated TCI states for its scheduled PDSCH irrespective of the time offset between the reception of the DL DCI and the corresponding PDSCH.

According to the description, if the parameter of “*Threshold-Sched-Offset*” is larger than 1 slot, TCI state of PDSCH scheduled by self-slot scheduling is determined by TCI state of CORESET in previous slot. In our view, it is undesirable operation, because CORESETs monitored in different slots can have different TCI states. For example, if a UE monitor USS with a certain TCI state based on CSI-RS in slot #n and CSS with a certain TCI state based on SSB in slot #(n+1), the UE assume TCI state of PDSCH in slot #(n+1) scheduled by CSS in slot #(n+1) is based on CSI-RS. If multiple UEs monitor same PDCCH, each UE has different understanding for TCI state of the PDSCH. In addition, TCI assumption described in current spec is not suitable to low latency service such as URLLC. Therefore, we propose that a UE assume TCI state of PDSCH (when the offset between the reception of the DL DCI and the corresponding PDSCH is less than the threshold) follows a TCI state of most recent monitored CORESET. If multiple CORESETs are overlapped on same time domain resource, a UE can select a CORESET for determining TCI state of PDSCH by a rule, e.g., CORESET with lowest index, CORESET associated with a SS set with lowest index.

**Proposal 11:** For both the cases when *tci-PresentInDCI* is set to 'enabled' and *tci-PresentInDCI* is not configured, if the offset between the reception of the DL DCI and the corresponding PDSCH is less than the threshold *Threshold-Sched-Offset*, **the UE may assume that the DM-RS ports of PDSCH of a serving cell are quasi co-located with the RS(s) in the TCI state with respect to the QCL parameter(s) used for PDCCH quasi co-location indication of the lowest CORESET-ID in the latest monitoring occasion in which one or more CORESETs within the active BWP of the serving cell are configured for the UE.**

## 2.7. Reference point for PDCCH DMRS mapping

In general, DMRS sequence of PDCCH is generated over the common resource block grid, and the part of the sequence will be actually mapped on the physical resource blocks depending on the PDCCH scheduling and precoder granularity configuration. Considering common search space shared by different UEs with different active BWP, it would be beneficial to have the same reference point for DMRS generation. Meanwhile, since the information for the common RB grid is given by SIB1, NR supports that the DMRS sequence of PDCCH scheduling SIB1 is generated over the initial DL BWP instead of the common RB grid. To be specific, according to the latest version of the specification, when the CORESET where PDCCH is received is configured by PBCH or SIB1, the reference point of subcarrier index for PDCCH DMRS is set to subcarrier 0 of the lowest-numbered RB in the CORESET.

Meanwhile, it is necessary to consider the case where UE receives PDCCH in common search space in CORESET 0 in another serving cell such as PCell or SCell. Furthermore, after handover, UE can receive PDCCH in common search space in CORESET 0 in the target serving cell. Since those serving cells could be operated as PCell for another UEs, PDCCH DMRS in the CORESET 0 in each serving cell will be generated from the subcarrier 0 of the lowest-numbered RB in the CORESET 0. On the other hands, in case of PCell/SCell addition or handover, the CORESET 0 will be given by RRC signalling (e.g. *controlResourceSetZero* in *PDCCH-ConfigCommon*). In that point of view, it is necessary to modify the term “CORESET configured by PBCH or SIB1” in to the term “CORESET 0 for a given serving cell”.

### Proposal 12: Adopt following text proposal for TS 38.211

----- Begin Text Proposal Section 7.4.1.3.2 of 38.211 -----  
< Unchanged parts are omitted >  
The reference point for  $k$  is  
- subcarrier 0 of the lowest-numbered resource block in the CORESET if ~~the CORESET is~~

~~configured by the PBCH or SIB1~~ the PDCCH is decoded in CORESET 0,

- subcarrier 0 in common resource block 0 otherwise

< Unchanged parts are omitted >

----- End Text Proposal Section 7.4.1.3.2 of 38.211 -----

## 2.8. GC PDCCH with the mmWave

It is understood that GC PDCCH can be also configured in FR2 if the UE supports. Compared to single beam case, in multi-beam case, the behavior needs to be further clarified when a UE is reconfigured with beams.

In transmitting dynamic SFI, it can be considered to have common SFI among different beams and potentially different contents across beams. The latter can have potential benefits in terms of UE power saving as the network can indicate ‘intended’ beam directions of future scheduling where UEs not configured with such beams can skip monitoring control/uplink transmissions. This enhancement can be further considered in power consumption study in our view. For Rel-15, it would be simple that a UE can assume the same SFI is delivered regardless of beams. In other words, when a UE switches beams, SFI information can be carried over regardless.

In current search space configuration, a UE is configured with TCI state for a CORESET. Though a TCI state may not be configured to a CORESET where SS set for dynamic SFI is associated, it is still necessary how the network efficiently support multiple UEs with potentially different beams. For example, current SS set configuration for SFI includes periodicity and candidates. As the network has multiple beams to support, though a UE monitors only one beam at a time, the network may need to transmit repetition of dynamic SFI over multiple beams. If a UE switches from SSB#X to SSB#Y, if the network keeps the same monitoring occasion for that UE, the network may need to schedule SFI for SSB#X and SSB#Y on the same monitoring occasion. Though the network reconfigure monitoring occasion for dynamic SFI when the UE switches beams, it can be very inefficient.

To mitigate this issue, another possible approaches is to have ‘monitoring duration’ per monitoring periodicity for dynamic SFI transmission. Instead of fixing one monitoring instance every interval, a UE may monitor multiple instances. By this way, the overhead at UE side increases, but the network has flexibility in scheduling SFIs for multiple beams based on currently active beams.

RAN2 has agreed to introduce monitoring duration for search space configuration at least for paging, etc because of the similar reason. We propose to clarify that search space for dynamic SFI can also utilize monitoring duration where a UE monitors multiple instances per interval.

**Proposal 13: Search space for dynamic SFI can configure monitoring duration.**

The similar issue applies also to group common TPC commands. It is safe to assume that an index for a UE is agonistic to beam index. In other words, a UE can assume the same TPC entry regardless of serving beam.

**Proposal 14: For group common DCI, it is assumed that contents are beam agnostic in Rel-15.**

As SS#0 is a search space set with beam sweeping, another possible approach is to allow dynamic SFI transmission in SS#0. This may restrict the periodicity of SFI transmission, yet, beam sweeping of dynamic SFI transmission can be achieved with low overhead. Nonetheless, if multiple group common DCIs need to be transmitted in multi-beam scenarios, monitoring durations are necessary to allow beam switching of UEs and flexibility at gNB side.

## 2.9. Response to the LS R1-1808173 “LS on additional TDD configuration periodicities”

From RAN2, additional periodicities of 3ms and 4ms are considered for semi-static D/U assignment. Actually it has already been agreed that periodicities of 3ms and 4ms is not truly necessary for semi-static D/U assignment in RAN1 and subframe shifting is enough to form specific resource format. Furthermore, for the semi-static D/U assignment, there are two kinds of configurations such as cell-specific semi-static D/U assignment and UE-specific semi-static D/U assignment. With these configurations, almost intended formats can be achieved. And also, with GC PDCCH, more flexible resource format can be formed. It would be waste to make additional values or combinations ignoring existing features.

**Proposal 15: It is not necessary to define addition periodicity for semi-static D/U assignment.**

### 3. Conclusion

In this contribution, followings are proposed

**Proposal 1: The TCI state of CORESET#0/SS set#0 is the most recent one between default TCI state and SSB selected as part of CBRA or CFRA.**

**Proposal 2: The default TCI state is determined by lowest indexed TCI state in the TCI pool. The default TCI state for CORESET#0/SS set#0 is only an SSB.**

**Proposal 3: If CORESETs with different TCI states are overlapped in time domain, a UE does not expect PDCCH monitoring on a CORESET with lower priority.**

**Proposal 4: A UE is assumed to continue monitoring on other active CORESETs (than BFR-CORESET) during BFR procedure.**

**Proposal 5: If BFR CORESET overlaps with other CORESET(s) in time domain, a UE is not required to monitor PDCCH candidates in other CORESET(s) at least in case QCL information is different between BFR-CORESET and other CORESET(s).**

**Proposal 6: The BFR CORESET/SS set has highest priority (regardless of SS type) for PDCCH candidate mapping rule when monitored. CSS(s) associated with other CORESET(s) may be dropped based on SS set index when BFR SS is monitored.**

**Proposal 7: The numerology of currently active BWP is regarded as the numerology of the DL CC.**

**Proposal 8: A UE assumes the overbooking is allowed to PCell. The limit of (BDs or CCEs) for the PCell is same with non-CA case on the numerology.**

**Proposal 9: For cross-carrier scheduling with different numerologies, a UE can assume that a numerology of scheduling CC is applied to scheduled CC(s) for determining the limit of BDs/CCEs.**

**Proposal 10: For eMBB, a CORESET overlapped with measurement resources (listed in RAN4 agreement) is not monitored.**

**Proposal 11: For both the cases when *tcj-PresentInDCI* is set to 'enabled' and *tcj-PresentInDCI* is not configured, if the offset between the reception of the DL DCI and the corresponding PDSCH is less than the threshold *Threshold-Sched-Offset*, the UE may assume that the DM-RS ports of PDSCH of a serving cell are quasi co-located with the RS(s) in the TCI state with respect to the QCL parameter(s) used for PDCCH quasi co-location indication of the lowest *CORESET-ID* in the latest monitoring occasion in which one or more CORESETs within the active BWP of the serving cell are configured for the UE.**

**Proposal 12: Adopt following text proposal for TS 38.211**

----- Begin Text Proposal Section 7.4.1.3.2 of 38.211 -----

< Unchanged parts are omitted >

The reference point for  $k$  is

- subcarrier 0 of the lowest-numbered resource block in the CORESET if ~~the CORESET is configured by the PBCH or SIB1~~ the PDCCH is decoded in CORESET 0,

- subcarrier 0 in common resource block 0 otherwise

< Unchanged parts are omitted >

----- End Text Proposal Section 7.4.1.3.2 of 38.211 -----

**Proposal 13: Search space for dynamic SFI can configure monitoring duration.**

**Proposal 14: For group common DCI, it is assumed that contents are beam agnostic in Rel-15.**

**Proposal 15: It is not necessary to define addition periodicity for semi-static D/U assignment.**