**3GPP TSG RAN WG1 #110bis-e R1-2209792**

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

**Agenda Item: 8.16.2**

**Source: Moderator (AT&T)**

**Title: Summary of UE features topics 2**

**Document for: Discussion/Decision**

# Introduction

This document presents the summary of email discussion [110bis-e-R17-UE-features-02] during RAN1 #110bis-e.

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| [110bis-e-R17-UE-features-02] Email discussion on Rel-17 UE features topics 2 by October 19 – Ralf (AT&T)   * NR-MIMO, NR from 52.6GHz to 71 GHz, NR-NTN, positioning, eIAB, DSS, IoT over NTN, 1024QAM |

The following was discussed during RAN1 #110bis-e within the scope of [110bis-e-R17-UE-features-02]. All proposals are based on the latest RAN1 UE features lists for Rel-17 in [1] and [2] for NR and LTE, respectively.

# Summary of Contributions Submitted to RAN1 #110bis-e

The following is the moderator’s summary of contributions submitted to RAN1 #110bis-e in this agenda item.

## NR\_FeMIMO

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| 23. NR\_FeMIMO | 23-1-1 | Unified TCI with joint DL/UL TCI update for intra-cell beam management | 1. Joint DL/UL TCI update with their components: (configuration mechanism, QCL rules, applicable source and target signals) 2. The maximum number of configured joint TCI states per BWP per CC in a band 3. One MAC-CE activated joint TCI state per CC in a band 4. TCI state indication for update and activationa) MAC CE based TCI state indication for one active TCI state 5. The maximum number of MAC-CE activated joint TCI states across all CC(s) in a band |  | Yes |  | Unified TCI with joint DL/UL TCI update for intra-cell beam management is not supported | Per band | n/a | n/a | n/a | Component 2 candidate value {8, 12, 16, 24, 32, 48, 64, 128}  Component 5 candidate value {1, 2, 4, 8, 16}  If a UE supports FG 23-1-1a, the signalled component values (except component 5) also apply to inter-cell beam management  Note: activated joint TCI state(s) include all PDCCH/PDSCH receptions and PUSCH/PUCCH transmissions | Optional with capability signalling |

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| Company | Summary |
| Qualcomm [7] | * Separate FG for separate DL/UL TCI + intra-cell beam management * Separate FG for separate DL/UL TCI + inter-cell beam management * As starting point, the contents of above new FGs can be similar to FG 23-1-1, FG 23-1-1a, and FG 23-1-1b |

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| 23. NR\_FeMIMO | 23-1-1a | Unified TCI with joint DL/UL TCI update for inter-cell beam management | 1. Support of unified TCI with joint DL/UL TCI update for inter-cell beam management  2. Support K additional MAC-CE indicated joint TCI states per CC in a band  3. Support K additional MAC-CE activated joint TCI states across all CC(s) in a band | 23-1-2, 23-1-1 | Yes |  | Unified TCI with joint DL/UL TCI update for inter-cell beam management is not supported | Per band | n/a | n/a | n/a | Component candidate values for K: {0,1,2,4}  Note: A UE that supports 23-1-1a supports K additional MAC-CE activated joint TCI states across all CC(s) in a band in addition to the maximum number of MAC-CE activated joint TCI states across all CC(s) in a band signalled in FG 23-1-1. The signalled value in component 3 of 23-1-1a plus the signalled value in component 5 of 23-1-1 determine the maximum number of MAC-CE activated joint TCI states across all CC(s) in a band that are applied to intra and inter-cell beam management jointly. | Optional with capability signalling |

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| Company | Summary |
| Ericsson [8] | The following was included in the LS to RAN2 after RAN1#110:   |  |  |  |  | | --- | --- | --- | --- | | 23. NR\_FeMIMO | 23-1-1a | Unified TCI with joint DL/UL TCI update for inter-cell beam management | 1. Support of unified TCI with joint DL/UL TCI update for inter-cell beam management  2. Support K additional MAC-CE indicated joint TCI states per CC in a band  3. Support K additional MAC-CE activated joint TCI states across all CC(s) in a band |   Note that columns 5-14 have been deleted. This was subsequently added to 38.306:   | ***unifiedJointTCI-InterCell-r17***  Indicates the support of Unified TCI with joint DL/UL TCI update for inter-cell beam management including following parameters:  - *additionalMAC-CE-PerCC-r17* indicates the number of K additional MAC-CEs to indicate joint TCI states per CC in a band.  - *additionalMAC-CE-AcrossCC-r17* indicates the number of K additional MAC-CE activated joint TCI states across all CC(s) in a band.  NOTE: A UE that supports *unifiedJointTCI-InterCell-r17* supports K additional MAC-CE activated joint TCI states across all CC(s) in a band in addition to the maximum number of MAC-CE activated joint TCI states across all CC(s) in a band signalled in *unifiedJointTCI-r17*. | Band | No | N/A | N/A | | --- | --- | --- | --- | --- |   However, there was a typo in the LS from RAN1 for component 2: the correct formulation is provided below:   |  |  |  |  | | --- | --- | --- | --- | | 23. NR\_FeMIMO | 23-1-1a | Unified TCI with joint DL/UL TCI update for inter-cell beam management | 1. Support of unified TCI with joint DL/UL TCI update for inter-cell beam management  2. Support K additional MAC-CE ~~indicated~~ activated joint TCI states per CC in a band  3. Support K additional MAC-CE activated joint TCI states across all CC(s) in a band |   With this update, the same formulation is used for component 2 and 3.   1. Update the description of component 2 of FG 23-1-1a by replacing “indicated” with “activated” |

**Other**

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| Company | Summary |
| Apple [5] | In Rel-17 FeMIMO, we introduced two inter-cell operation enhancement especially regarding SSB measurement, one for inter-cell beam management (BM), and the other one is for inter-cell multi-TRP operation.   * Inter-cell beam management (BM) is covered by FG23-1-2 * Inter-cell multi-TRP operation is covered by FG23-4   It is important to note that inter-cell BM and inter-cell multi-TRP should be two indepdent UE features since these two features are very likely to be deployed independently. For example, inter-cell BM can be deployed without deploying inter-cell multi-TRP. As results, component 2 and 3 in FG23-4 regarding X1 and X2 should be replicated for inter-cell BM. We proposal to add the following new FG,   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 23. NR\_FeMIMO | 23-1-2a | Inter-cell beam measurement and reporting | 1. The maximum number of configured additional PCIs per CC is X1 (Case 1) when each configuration of SSB time domain positions and periodicity of the additional PCIs is the same as SSB time domain positions and periodicity of the serving cell PCI  2. The maximum number of configured additional PCIs per CC is X2 (Case 2) when the configurations of SSB time domain positions and periodicity of the additional PCIs is not according to Case 1 | FG23-1-2 | Yes |  |  | per band | n/a | n/a | n/a | Component 1 candidate values: {1,2,3,4,5,6,7}  Component 2 candidate values: {0,1,2,3,4,5,6,7}  Note: case1 and case2 cannot be enabled simultaneously as any configuration that is not based on Case 1 is defined as Case 2 | Optional with capability signalling |  * We propose to introduce FG23-7-6 for the support of CSI-IMR  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 23. NR\_FeMIMO | 23-7-6 | Support of CSI-IM for CSI enhancement for multi-TRP | Support CSI-IM for CSI enhancement for Multi-TRP | 23-7-1 | Yes |  |  | Per UE | n/a | Yes | n/a |  | Optional with capability signalling | |
| Qualcomm [7] | In RAN1 meeting #106bis-e, there is an existing RAN1 agreement for an optional UE feature for the support DCI format 1\_0 for scheduling PDSCH with either one TCI or two TCI states when scheduling offset is larger than the threshold. UE applies either both TCI states of the scheduling CORESET (i.e SFN PDSCH) or the apply the single TCI state of the CORESET (i.e., single TCI PDSCH). This FG is missing in UE FG group for HST (FG 23-6) and should be reflected.   |  | | --- | | **Agreement**  For PDSCH reception scheduled by DCI format 1\_0, [1\_1 and 1\_2], if the time offset between the reception of the DL DCI and the corresponding PDSCH is equal or larger than the threshold timeDurationForQCL   * Support configuration when there is no TCI field in the DCI scheduling PDSCH   + UE applies the state(s) of the scheduling CORESET when receiving the PDSCH     - if there are two active TCI states for the CORESET, UE applies the both QCL assumption of the CORESET that schedules the PDSCH when receiving the PDSCH     - otherwise, UE applies the one active TCI state of the CORESET when receiving the PDSCH * FFS if the time offset between the reception of the DL DCI and the corresponding PDSCH is smaller than the threshold *timeDurationForQCL*   This is a UE optional feature. |   ***Proposal 3-1***: Add FG 23-6-7 for the HST-SFN FGs to support UE determining a single or two TCI states of the PDSCH, scheduled by DCI format 1\_0, based the scheduling CORESET whether the CORESET is activated with one or two TCI states when the time offset between the reception of the DL DCI and the corresponding PDSCH is equal or larger than the threshold *timeDurationForQCL*   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 23. NR\_FeMIMO | 23-6-7 | Support DCI format 1\_0 scheduling PDSCH with single or two TCI states based on the scheduling CORESET when time offset is larger than the threshold | Support determining single TCI state or two TCI states for PDSCH scheduled by DCI format 1\_0 based on the scheduling CORESET when time offset is larger than the threshold |  | Yes | N/A |  | Per band | n/a | n/a |  |  | Optional with capability signalling | |

## NR\_ext\_to\_71GHz

**Other**

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| Company | Summary |
| ZTE/Sanechips [4] | In RAN1 #108-e meeting, the extending multiple PDSCH/PUSCH scheduling by single DCI to other SCSs has been captured in the note of the following agreement. Wherein, multiple PDSCH/PUSCH scheduling by single DCI have been supported for 120/480/960 kHz in FR2-2 and 120 kHz in FR2-1.  **Agreement: Adopt the following changes highlighted in chromatic fonts, while keeping the yellow highlighting, if any, as shown**   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 24. NR\_ext\_to\_71GHz | 24-1d | Multiple PDSCH scheduling by single DCI for 120kHz in FR2-2 | 1. Multi-PDSCH scheduling by single DCI for the operation with 120 kHz SCS  2. HARQ enhancements [for both type 1 and type 2 HARQ codebook] for supporting multi-PDSCH scheduling with singe DCI | 24-1 | Yes | N/A | Multiple PDSCH scheduling by single DCI for 120kHz is not supported in FR2-2 | Per band | N/A | N/A | N/A | ~~FFS: to extend this FG to other frequency ranges~~ | Optional with capability signalling | | 24. NR\_ext\_to\_71GHz | 24-1f | Multiple PDSCH scheduling by single DCI for 120kHz in FR2-1 | 1. Multi-PDSCH scheduling by single DCI for the operation with 120 kHz SCS  2. HARQ enhancements [for both type 1 and type 2 HARQ codebook] for supporting multi-PDSCH scheduling with singe DCI |  | Yes | N/A | Multiple PDSCH scheduling by single DCI for 120kHz is not supported in FR2-1 | Per band | N/A | N/A | N/A |  | Optional with capability signalling |  * Continue discussion on extending 24-1f to other SCSs   **Agreement: Adopt the following changes highlighted in chromatic fonts, while keeping the yellow highlighting, if any, as shown**   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 24. NR\_ext\_to\_71GHz | 24-1e | Multiple PUSCH scheduling by single DCI for 120kHz in FR2-2 | 1. Multi-PUSCH scheduling by single DCI for the operation with 120 kHz SCS | 24-1a | Yes | N/A | Multiple PUSCH scheduling by single DCI for 120kHz is not supported in FR2-2 | Per band | N/A | N/A | N/A | ~~FFS: to extend this FG to other frequency ranges~~ | Optional with capability signalling | | 24. NR\_ext\_to\_71GHz | 24-1g | Multiple PUSCH scheduling by single DCI for 120kHz in FR2-1 | 1. Multi-PUSCH scheduling by single DCI for the operation with 120 kHz SCS with non-contiguous allocation |  | Yes | N/A | Multiple PUSCH scheduling by single DCI for 120kHz is not supported in FR2-1 with non-contiguous allocation | Per band | N/A | N/A | N/A |  | Optional with capability signalling |  * Continue discussion on extending 24-1g to other SCSs   In RAN1 #109-e meeting, extending multiple PDSCH/PUSCH scheduling by single DCI to 60 kHz in FR2-1 and 15/30/60 kHz in FR1 was discussed and the possible proposal is as follows. However, it was unfortunate that no consensus was reached on this feature within the last limited time. In RAN1 #110-e meeting, this feature has not been discussed.  **Possible Proposal: Introduce the following new FGs**   |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 24. NR\_ext\_to\_71GHz | 24-1h | Multiple PDSCH scheduling by single DCI for 60kHz in FR2-1 | 1. Multi-PDSCH scheduling by single DCI for the operation with 60 kHz SCSs in FR2-1  2. HARQ enhancements for both type 1 and type 2 HARQ codebook for supporting multi-PDSCH scheduling with singe DCI | Yes | N/A | Multiple PDSCH scheduling by single DCI for 15/30/60kHz is not supported in FR2-1 | Per band | N/A | N/A | N/A |  | Optional with capability signalling | | 24. NR\_ext\_to\_71GHz | 24-1i | Multiple PDSCH scheduling by single DCI for for 15/30/60kHz in FR1 | 1. Multi-PDSCH scheduling by single DCI for the operation with 15/30/60 kHz SCSs in FR1  2. HARQ enhancements for both type 1 and type 2 HARQ codebook for supporting multi-PDSCH scheduling with singe DCI | Yes | N/A | Multiple PDSCH scheduling by single DCI for 15/30/60kHz is not supported in FR1 | Per band | N/A | N/A | N/A |  | Optional with capability signalling | | 24. NR\_ext\_to\_71GHz | 24-1j | Multiple PUSCH scheduling by single DCI for 60kHz in FR2-1 | 1. Multi-PUSCH scheduling by single DCI for the operation with 60 kHz SCSs with non-contiguous allocation in FR2-1 | Yes | N/A | Multiple PUSCH scheduling by single DCI for 15/30/60kHz is not supported in FR2-1 with non-contiguous allocation | Per band | N/A | N/A | N/A |  | Optional with capability signalling | | 24. NR\_ext\_to\_71GHz | 24-1k | Multiple PUSCH scheduling by single DCI for 15/30/60kHz in FR1 | 1. Multi-PUSCH scheduling by single DCI for the operation with 15/30/60 kHz SCSs with non-contiguous allocation in FR1 | Yes | N/A | Multiple PUSCH scheduling by single DCI for 15/30/60kHz is not supported in FR1 with non-contiguous allocation | Per band | N/A | N/A | N/A |  | Optional with capability signalling |   In this meeting, it is necessary to further discuss applicability of this feature and agree extending it to other SCSs (e.g., 60 kHz in FR2-1 and 15/30/60 kHz in FR1) considering that it is band-agnostic and beneficial to degrade the overhead of DCI signalling. Given that, we recommend extending the applicability of this feature to 60 kHz in FR2-1 and 15/30/60 kHz in FR1 and no differentiation licensed and unlicensed spectrum.  ***Proposal 1:*** *It is recommended to extend the applicability of multiple PDSCH/PUSCH scheduling by single DCI to 60 kHz in FR2-1 and 15/30/60 kHz in FR1.*  ***Proposal 2:*** *Adopt the following new FGs on multiple PDSCH/PUSCH scheduling by single DCI:*   |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 24. NR\_ext\_to\_71GHz | 24-1h | Multiple PDSCH scheduling by single DCI for 60kHz in FR2-1 | 1. Multi-PDSCH scheduling by single DCI for the operation with 60 kHz SCSs in FR2-1  2. HARQ enhancements for both type 1 and type 2 HARQ codebook for supporting multi-PDSCH scheduling with singe DCI | Yes | N/A | Multiple PDSCH scheduling by single DCI for 15/30/60kHz is not supported in FR2-1 | Per band | N/A | N/A | N/A |  | Optional with capability signalling | | 24. NR\_ext\_to\_71GHz | 24-1i | Multiple PDSCH scheduling by single DCI for for 15/30/60kHz in FR1 | 1. Multi-PDSCH scheduling by single DCI for the operation with 15/30/60 kHz SCSs in FR1  2. HARQ enhancements for both type 1 and type 2 HARQ codebook for supporting multi-PDSCH scheduling with singe DCI | Yes | N/A | Multiple PDSCH scheduling by single DCI for 15/30/60kHz is not supported in FR1 | Per band | N/A | N/A | N/A |  | Optional with capability signalling | | 24. NR\_ext\_to\_71GHz | 24-1j | Multiple PUSCH scheduling by single DCI for 60kHz in FR2-1 | 1. Multi-PUSCH scheduling by single DCI for the operation with 60 kHz SCSs with non-contiguous allocation in FR2-1 | Yes | N/A | Multiple PUSCH scheduling by single DCI for 15/30/60kHz is not supported in FR2-1 with non-contiguous allocation | Per band | N/A | N/A | N/A |  | Optional with capability signalling | | 24. NR\_ext\_to\_71GHz | 24-1k | Multiple PUSCH scheduling by single DCI for 15/30/60kHz in FR1 | 1. Multi-PUSCH scheduling by single DCI for the operation with 15/30/60 kHz SCSs with non-contiguous allocation in FR1 | Yes | N/A | Multiple PUSCH scheduling by single DCI for 15/30/60kHz is not supported in FR1 with non-contiguous allocation | Per band | N/A | N/A | N/A |  | Optional with capability signalling | |

## NR\_NTN\_solutions

Void

## IoT over NTN

Void

## NR\_IAB\_enh

Void

## NR\_DSS

Void

## LTE\_NR\_DC\_enh2

Void

## NR\_pos\_enh

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| 27. NR\_pos\_enh | 27-3-2 | DL PRS measurement outside MG and in a PRS processing window | 1. Supported PRS processing types subject to the UE determining that DL PRS to be higher priority for PRS measurement outside MG and in a PRS processing window  2. Support of priority handing options of PRS: Option1, Option2 or Option3   * 1. Option 1: UE may indicates support of two priority states.      1. State 1: PRS is higher priority than all PDCCH/PDSCH/CSI-RS      2. State 2: PRS is lower priority than all PDCCH/PDSCH/CSI-RS   2. Option 2: UE may indicate support of three priority states      1. State 1: PRS is higher priority than all PDCCH/PDSCH/CSI-RS      2. State 2: PRS is lower priority than PDCCH and URLLC PDSCH and higher priority than other PDSCH/CSI-RS         1. Note: The URLLC channel corresponds a dynamically scheduled PDSCH whose PUCCH resource for carrying ACK/NAK is marked as high-priority.      3. State 3: PRS is lower priority than all PDCCH/PDSCH/CSI-RS   3. Option 3: UE may indicate support of single priority state      1. State 1: PRS is higher priority than all PDCCH/PDSCH/CSI-RS | 13-1 | Yes |  | DL PRS measurement outside MG and in a PRS processing window is not supported | per band | n/a | n/a | n/a | Component 1 candidate values: One or more of {Type 1A, Type 1B, Type 2}  Component 2 candidate values: {option1, option2, option3}  Need for location server to know if the feature is supported  Note: Component 2 can be reported per supported band for each type supported by the UE, details left to RAN2  Note:   * Type 1A refers to the determination of prioritization between DL PRS and other DL signals/channels in all OFDM symbols within the PRS processing window. The DL signals/channels from all DL CCs (per UE) are affected across LTE and NR * Type 1B refers to the determination of prioritization between DL PRS and other DL signals/channels in all OFDM symbols within the PRS processing window. The DL signals/channels from a certain band are affected * Type 2 refers to the determination of prioritization between DL PRS and other DL signals/channels only in DL PRS symbols within the PRS processing window   Note: When the UE determines higher priority for other DL signals/channels over the PRS measurement/processing, the UE is not expected to measure/process DL PRS which is applicable to all of the above capability options  Note: Within a PRS processing window, UE measurement is inside the active DL BWP with PRS having the same numerology as the active DL BWP  Note: Support of configuration of PRS processing window in RRC and support of using DL MAC CE to activate/deactivate the PRS processing window for PRS measurements is part of the FG , but no dedicated signaling is required.  A UE that supports FG 27-3-3 must indicate this FG is supported | Optional with capability signaling |

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| Company | Summary |
| Huawei/HiSilicon [3] | In RAN1#110, the following TP/CR was endorsed that actually changed the description of the priority states. The result is the aligned state description regardless of the supported priority options.   |  | | --- | | Agreement  Endorse the TP of proposal 2.2-1b in R1-2207826 regarding capturing the priority states to clause 5.1.6.5 of TS 38.214.  Final CR in R1-2208017. |   Changes in R1-2208017.   |  | | --- | | \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* Unchanged Text Omitted \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*  The UE is expected to measure the DL PRS outside the measurement gap, subject to UE capability, if the DL PRS is inside the active DL BWP and has the same numerology as the active DL BWP and is within the DL PRS processing window indicated by higher layer parameter [*PRSProcessingWindow*]. The UE is not expected to measure the DL PRS outside the measurement gap if the expected received timing difference between the DL PRS from the non-serving cell and that from the serving cell, determined by the higher layer parameters *nr-DL-PRS-ExpectedRSTD* and *nr-DL-PRS-ExpectedRSTD-Uncertainty,* is larger than maximum Rx timing difference provided by [UE capability]*.* For receiving the DL PRS outside the measurement gap and within the DL PRS processing window, the UE determines the DL PRS priority as indicated by higher layer parameter [*PRS-priority-indicator*] subject to UE capability or as implied by UE capability:  - with value *‘st1’* where the DL PRS is higher priority than all the DL signal/channels except SSB, or  - with value *‘st2’* where the DL PRS is lower priority than PDCCH and the PDSCH scheduled by DCI formats 1\_1 or 1\_2 with the priority indicator field in the corresponding DCI format set to 1, and is higher priority than other DL signals/channels except SSB, or  - with value *‘st3’* where the DL PRS is lower priority than all the DL signals/channels except SSB.  Inside one instance of the [*PRSProcessingWindow*] the UE is only expected to measure a single DL PRS positioning frequency layer.  \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* Unchanged Text Omitted \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* |   According to the text in TS 38.214, we think that the current description of FG 27-3-2 needs some revisions to resolve any potential ambiguity, due to the following reasons.   * State 2 of Option 1 in FG 27-3-2 is now not aligned with “st2” description of TS 38.214. * State 2 of Option 2 in terms of the URLLC channel in FG 27-3-2 is not aligned with “st2” description.   + FG 27-3-2: The URLLC channel corresponds a dynamically scheduled PDSCH whose PUCCH resource for carrying ACK/NAK is marked as high-priority.   + TS 38.214: The PDSCH scheduled by DCI formats 1\_1 or 1\_2 with the priority indicator field in the corresponding DCI format set to 1.   Therefore, our suggestion is as proposed below.  ***Proposal 1: Change the description of FG 27-3-2 to align with TS 38.214.***   |  |  |  |  |  | | --- | --- | --- | --- | --- | | 27. NR\_pos\_enh | 27-3-2 | DL PRS measurement outside MG and in a PRS processing window | 1. Supported PRS processing types subject to the UE determining that DL PRS to be higher priority for PRS measurement outside MG and in a PRS processing window  2. Support of priority handing options of PRS: Option1, Option2 or Option3   * 1. Option 1: Support of “st1” and “st3” defined in clause 5.1.6.5 of TS 38.214.   2. Option 2: Support of “st1”, “st2”, and “st3” defined in clause 5.1.6.5 of TS 38.214.   3. Option 3: Support of “st1” only defined in clause 5.1.6.5 of TS 38.214. | 13-1 | |

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| 27. NR\_pos\_enh | 27-3-3 | DL PRS Processing Capability outside MG - buffering capability | 1. DL PRS buffering capability  a) Type 1 – sub-slot/symbol level buffering  b) Type 2 – slot level buffering  2a. Duration of DL PRS symbols N in units of ms a UE can process every T ms assuming maximum DL PRS bandwidth in MHz, which is supported and reported by UE  2b. Duration of DL PRS symbols N2 in units of ms a UE can process inT2 ms assuming maximum DL PRS bandwidth in MHz, which is supported and reported by UE  3. Max number of DL PRS resources that UE can process in a slot  4. Maximum DL PRS bandwidth in MHz, which is supported and reported by UE for PRS measurement outside MG within the PPW | 27-3-2 | Yes |  | DL PRS measurement outside MG and in a PRS processing window is not supported | Per band | n/a | n/a | n/a | Component 1 candidate values: {Type 1, Type 2}  Component 2a candidate values:   1. T: {1, 2, 4, 8, 16, 20, 30, 40, 80, 160, 320, 640, 1280} ms 2. N: {0.125, 0.25, 0.5, 1, 2, 4, 6, 8, 12, 16, 20, 25, 30, 32, 35, 40, 45, 50} ms   Candidate 2b component values:  a) N2: {0.125, 0.25, 0.5, 1, 2, 3, 4, 5, 6, 8, 12} ms  b) T2: {4, 5, 6, 8} ms  Component 3 candidate values:  FR1 bands: {1, 2, 4, 6, 8, 12, 16, 24, 32, 48, 64} for each SCS: 15kHz, 30kHz, 60kHz  FR2 bands: {1, 2, 4, 6, 8, 12, 16, 24, 32, 48, 64} for each SCS: 60kHz, 120kHz  Component 4 candidate values:  FR1 bands: {5, 10, 20, 40, 50, 80, 100}  FR2 bands: {50, 100, 200, 400}  Need for location server to know if the feature is supported  Note 1:The (N, T) UE capabilities are interpreted as legacy (N, T) in FG 13-1, and the UE is expected to receive the PRS within the PRS processing window and but the processing of the received PRS may be outside a PRS processing window.    The (N2, T2) UE capabilities are interpreted such that the UE is capable of measuring up to N2 ms PRS within a PPW and is capable of completing the PRS processing within the PPW, e.g., if the time duration from the last symbol of the measured PRS resource(s) inside the PPW, to the end of PPW is not smaller than T2 ms    Note 3: UE shall support either component 2a and component 2b , but not both for each supported type in a band  Note 4: A UE shall declare PRS processing capabilities of each of the supported Type-1A, Type-1B, Type-2” capabilities in case it supports multiple types in a band  A UE that supports FG 27-3-2 must indicate this FG is supported | Optional with capability signaling |
| 27. NR\_pos\_enh | 27-6 | DL PRS processing capabilities in RRC inactive state | 1. DL PRS buffering capability  a) Type 1 – sub-slot/symbol level buffering  b) Type 2 – slot level buffering  2. Duration of DL PRS symbols N in units of ms a UE can process every T ms assuming maximum DL PRS bandwidth in MHz, which is supported and reported by UE  3. Max number of DL PRS resources that UE can process in a slot |  | No |  | DL PRS processing in RRC inactive state is not supported | Per band | n/a | n/a | n/a | Component 1 candidate values: {Type 1, Type 2}  Component 2 candidate values:  T: {8, 16, 20, 30, 40, 80, 160, 320, 640, 1280} ms  N: {0.125, 0.25, 0.5, 1, 2, 4, 6, 8, 12, 16, 20, 25, 30, 32, 35, 40, 45, 50} ms  Component 3 candidate values:  FR1 bands: {1, 2, 4, 6, 8, 12, 16, 24, 32, 48, 64} for each SCS: 15kHz, 30kHz, 60kHz  FR2 bands: {1, 2, 4, 6, 8, 12, 16, 24, 32, 48, 64} for each SCS: 60kHz, 120kHz  Need for location server to know if the feature is supported  Note: Having the PRS processing capabilities in RRC\_INACTIVE state does not imply that LMF is aware of or controlling UE RRC state | Optional with capability signaling |

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| Company | Summary |
| NTT Docomo [6] | Although NR UE features for Rel-17 Positioning liaised to RAN2 at the end of the last RAN1 meeting are quite stable, there is an issue raised by RAN2 LS incoming to this meeting [2]. That is, whether Rel-17 Positioning can be supported in FR2-2 band or not. More specifically, RAN2 asks RAN1 the following question.  *Question: Can SRS for positioning/DL-PRS with 480/960 kHz SCS be supported in FR2-2 in R17?*  Seeing the exact capabilities for Rel-17 Positioning, we view them applicable to FR2-2 band itself, especially if the FR2-2 operation is supported/configured with 120 kHz SCS. Some Rel-17 Positioning capabilities (e.g., FG27-3-3 or FG27-6) have a component with a value per SCS, while it clearly supports 120 kHz.  However, the question from RAN2 is not related to the whole FR2-2 band/operation but related to an operation with 480/960 kHz SCS. Our answer for this particular question is ‘No’ at this moment, since e.g., FG27-3-3 and FG27-6 cannot report their component 3 for such larger SCSs as per the current definition. At least the two FGs are not available for FR2-2 operation with 480 or 960 kHz SCS.  **Observation 1: The answer to RAN2 LS R1-2208325 is ‘no’ at this moment, i.e., there are some Rel-17 Positioning features (i.e., FG27-3-3 and FG27-6) which is not available for FR2-2 operation with 480 or 960 kHz SCS from RAN1 perspective**  Here we have to discuss at least how to treat FG27-3-3 and FG27-6 when FR2-2 is considered. One approach is not to change anything about these FGs, which results in no support of the FGs in FR2-2 band with 480/960 kHz operation in our understanding. It may not be much aligned with the understanding in RAN2 on the usage of FR2-2 because, as per the RAN2 LS, it seems there is a common understanding in RAN2 that FR2-2 is assumed to be applicable to other Rel-17 features in general. From our perspective, RAN1 also share the same understanding.  Another approach would then be, to fix this issue by updating RAN1 UE capability for Positioning. For example, it can be considered to update FG27-3-3 and FG27-6 such that component 3 can be reported even for the larger SCSs. Alternately, the value reported for 120 kHz SCS can be used for larger SCSs. If updating the existing FGs is not preferred, then we can consider additional FGs that is equivalent to FG27-3-3 and FG27-6 but to be dedicated for larger SCSs only.  Note that, in our understanding, FG27-3-3 and FG27-6 are sub-features of FG13-1 in Rel-16, which is anyway not applicable to larger SCSs due to the exact same reason as what we described above. Meanwhile, any change on Rel-16 UE feature may not be within the scope of the discussion. Anyway, it may be straightforward to apply the selected way forward for FG27-3-3/27-6 to FG13-1.  **Proposal 1:** **On the support of FG27-3-3 and FG27-6 in FR2-2 band with 480/960 kHz SCS, either of the following ways forward can be considered:**   * **Alt-1: No change for support of larger SCS (i.e., FG27-3-3/27-6 is not supported for the operation in FR2-2 with 480 or 960 kHz SCS** * **Alt-2: Update FG27-3-3 and/or FG27-6 so that they can report component 3 even for 480 and/or 960 kHz SCS** * **Alt-3: Define new FG to report DL-PRS processing capability per 480 kHz SCS slot and/or 960 kHz SCS slot** |

**Other**

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| Company | Summary |
| Huawei/HiSilicon [3] | In the current FG 27-3-1, the M-sample measurement in RRC\_CONNECTED state does not differentiate the gap-less and gap-based measurement. However, given that the PRS synchronization conditions are more stringent for gapless/PPW-based PRS measurement than the gap-based PRS measurement, different UE architectures may be used for processing PRS within the MG and within the PPW, which results in the need to have different capabilities on the M-sample measurement.   |  |  |  |  |  | | --- | --- | --- | --- | --- | | 27. NR\_pos\_enh | 27-3-1 | M-sample measurements in RRC\_CONNECTED | The capability to support reporting a measurement based on measuring M=1 or 2 samples (instances) of a DL PRS resource set | 13-1 |   Consider the backward compatibility issue, we suggest to introduce the M-sample capability within the PPW in a backward compatible way.   * If UE indicate support of FG 27-3-1, and UE does not indicate support of the new FG for PPW   + **[Legacy]** UE supports M-sample PRS measurement in the MG and in the PPW. * If UE does not indicate support of FG 27-3-1, and UE does not indicate support of the new FG for PPW   + **[Legacy]** UE does not support M-sample PRS measurement in the MG or in the PPW. * If UE does not indicate support of FG 27-3-1, and UE indicate support of the new FG for PPW   + **[New]** UE only supports M-sample measurement in the PPW. * If UE indicate support of FG 27-3-1, and UE indicate support of the new FG for PPW   + **[Error]** Given that supporting FG 27-3-1 already entails supporting PRS measurement within the PPW, this should be considered as an error case.   Therefore, we have the following proposal.  ***Proposal 2: Introduce the following FG 27-3-1a.***   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 27. NR\_pos\_enh | 27-3-1a | M-sample measurements in RRC\_CONNECTED within the PRS processing window | The capability to support reporting a measurement based on measuring M=1 or 2 samples (instances) of a DL PRS resource set within the PRS processing window.  Note: UE may indicate support of the feature only if UE does not support FG 27-3-1. | 13-1, 27-3-3 | No |  | If the UE does not provide the capability, support of M-sample PRS measurement in the PPW is according to the FG 27-3-1. | Per band | n/a | n/a | n/a | Need for location server to know if the feature is supported  Note: this feature is supported for both UE-assisted and UE based positioning | Optional with capability signaling | |

## NR\_DL1024QAM\_FR1

Void

# Discussion Items during RAN1 #110bis-e — First Checkpoint

After review of contributions submitted to RAN1 #110bis-e in this agenda item, the following topics were identified by the moderator for discussion during RAN1 #110bis-e.

**General comments**

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| Company | Comments/Questions/Suggestions |
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## NR\_FeMIMO

### FG 23-1-1a

After review of contributions submitted to RAN1 #110bis-e in this agenda item, the following is proposed by the moderator. Companies submitted the following views on the moderator’s proposals.

**Proposal: Adopt the following changes highlighted in chromatic fonts, while keeping the yellow highlighting, if any, as shown**

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| 23. NR\_FeMIMO | 23-1-1a | Unified TCI with joint DL/UL TCI update for inter-cell beam management | 1. Support of unified TCI with joint DL/UL TCI update for inter-cell beam management  2. Support K additional MAC-CE ~~indicated~~ activated joint TCI states per CC in a band  3. Support K additional MAC-CE activated joint TCI states across all CC(s) in a band | 23-1-2, 23-1-1 | Yes |  | Unified TCI with joint DL/UL TCI update for inter-cell beam management is not supported | Per band | n/a | n/a | n/a | Component candidate values for K: {0,1,2,4}  Note: A UE that supports 23-1-1a supports K additional MAC-CE activated joint TCI states across all CC(s) in a band in addition to the maximum number of MAC-CE activated joint TCI states across all CC(s) in a band signalled in FG 23-1-1. The signalled value in component 3 of 23-1-1a plus the signalled value in component 5 of 23-1-1 determine the maximum number of MAC-CE activated joint TCI states across all CC(s) in a band that are applied to intra and inter-cell beam management jointly. | Optional with capability signalling |

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| Company | Comments/Questions/Suggestions |
| Apple | We are fine the proposed change |
| NTT DOCOMO | Fine. |
| Ericsson | Support |
| LG | Fine with the modification |
| ZTE | Support |
| Intel | ok |
| Huawei, HiSilicon | OK with the modification |

### New FG: Inter-cell beam measurement and reporting

After review of contributions submitted to RAN1 #110bis-e in this agenda item, the following is proposed by the moderator. Companies submitted the following views on the moderator’s proposals.

**Proposal:** **Introduce the following new row/FG**

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| 23. NR\_FeMIMO | 23-1-2a | Inter-cell beam measurement and reporting | 1. The maximum number of configured additional PCIs per CC is X1 (Case 1) when each configuration of SSB time domain positions and periodicity of the additional PCIs is the same as SSB time domain positions and periodicity of the serving cell PCI  2. The maximum number of configured additional PCIs per CC is X2 (Case 2) when the configurations of SSB time domain positions and periodicity of the additional PCIs is not according to Case 1 | FG23-1-2 | Yes |  |  | per band | n/a | n/a | n/a | Component 1 candidate values: {1,2,3,4,5,6,7}  Component 2 candidate values: {0,1,2,3,4,5,6,7}  Note: case1 and case2 cannot be enabled simultaneously as any configuration that is not based on Case 1 is defined as Case 2 | Optional with capability signalling |

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| Company | Comments/Questions/Suggestions |
| Apple | We support the proposed FG23-1-2a to separate inter-cell beam measurement and inter-cell mTRP |
| Intel | ~~Support in principle~~ |
| Nokia, NSB | Do not support. It is not clear from the description what this new FG would mean on top of FG23-1-2. |
| NTT DOCOMO | Not agree. For L1/L2 inter cell mobility, component 3 of FD23-1-2 already captures the number of configured additional PCIs.  3. The maximum number of RRC-configured PCI(s) different from serving cell PCI for L1-RSRP measurement  Also, the agreement of X1 and X2 was made in M-TRP inter cell session, which is not applied to L1/L2 inter cell mobility. |
| Ericsson | Do not support. FG 23-1-2 describes inter-cell beam measurements, and has a different structure compared to the proposed FG 23-1-2a. Component 3 in FG 23-1-2 coincides with component 2 in the proposed FG 23-1-2a (although the value candidate values don’t match) |
| LG | Not support. We have a similar view with DOCOMO and Ericsson that the component 3 in FG23-1-2 is sufficient for the max number of PCI(s) and the corresponding capabilities are included in FG for inter-cell MTRP operation (i.e. FG23-4) |
| ZTE | Not support. We share the same views as NTT DOCOMO, E/// and LG. |
| Intel | It is not clear if X1, X2 is necessary for a UE to perform SSB measurements from non-serving cell (originally X1, X2 was motivated by PDSCH rate-matching for multi-DCI) |
| Huawei, HiSilicon | We support the proposal. |

### New FG: Support of CSI-IM for CSI enhancement for multi-TRP

After review of contributions submitted to RAN1 #110bis-e in this agenda item, the following is proposed by the moderator. Companies submitted the following views on the moderator’s proposals.

**Proposal: Introduce the following new row/FG**

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| 23. NR\_FeMIMO | 23-7-6 | Support of CSI-IM for CSI enhancement for multi-TRP | Support CSI-IM for CSI enhancement for Multi-TRP | 23-7-1 | Yes |  |  | Per UE | n/a | Yes | n/a |  | Optional with capability signalling |

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| --- | --- |
| Company | Comments/Questions/Suggestions |
| Samsung | Support in principle as there is no UE capability which explicitly mentioned on supporting CSI-IM for NCJT CSI. |
| Apple | We support the proposed FG23-7-6 |
| Nokia, NSB | OK |
| DOCOMO | Not support.  Without support of CSI-IM, we could not understand how UE could derive CSI? CSI-IM is needed for CSI. No need to introduce UE capability for it. |
| ZTE | Not support. If our understanding is correct, for CSI/CQI report, CSI-IM should be mandatorily support for CQI determination. That means that the UE should support CSI-IM if supporting mTRP-CSI. |
| Intel | In our view there is no need to support additional UE capability on CSI-IM for MTRP CSI. |
| Huawei, HiSilicon | We have no clear understanding about what new FG will really enable or disable, and the importance. We disagree with further new FG in such a late stage |
| Ericsson | We do not support this proposal. If CSI-IM for NC-JT is an optional capability, how does the UE perform interference measurement for the baseline capability 23-7-1 (e.g., for a UE that doesn’t support this proposed capability). |
| Samsung | @Docomo, ZTE, Intel, Huawei, Ericsson  Thanks for your view. Just want to ask and clarify.  Our understanding is that CSI-IM can be supported by Rel-15 UE capability, FG 2-33, which is mandatory with capability signaling, so CSI-IM itself can be supported as mandatory.  However, for the case of CSI-IM for NCJT (which a single CSI-IM can be associated with CMR pair for NCJT), if the above new FG 23-7-6 is not supported, then is it correct understanding that CSI-IM for NCJT can be supported by a UE if the UE reports FG 23-7-1? |

### New FG: Support DCI format 1\_0 scheduling PDSCH with single or two TCI states based on the scheduling CORESET when time offset is larger than the threshold

After review of contributions submitted to RAN1 #110bis-e in this agenda item, the following is proposed by the moderator. Companies submitted the following views on the moderator’s proposals.

**Proposal:** **Introduce the following new row/FG**

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| 23. NR\_FeMIMO | 23-6-7 | Support DCI format 1\_0 scheduling PDSCH with single or two TCI states based on the scheduling CORESET when time offset is larger than the threshold | Support determining single TCI state or two TCI states for PDSCH scheduled by DCI format 1\_0 based on the scheduling CORESET when time offset is larger than the threshold |  | Yes | N/A |  | Per band | n/a | n/a |  |  | Optional with capability signalling |

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| Company | Comments/Questions/Suggestions |
| Samsung | Our view is that this is already supported by component 2 in FG 23-6-4 as follows:  FG 23-6-4: Default DL beam setup for SFN  2. Support PDSCH reception using default beam for Rel-17 enhanced SFN scheme when TCI field is not present in DCI when PDSCH is scheduled with offset equal or larger than the threshold, if applicable |
| Apple | We think explanation from Samsung is valid |
| Nokia, NSB | Agree with Samsung and Apple above, this FG is not needed. |
| NTT DOCOMO | Not support. We believe UE should be able to receive PDSCH scheduled by DCI format 1\_0 without separate UE capability. |
| Ericsson | We don’t think this is included in FG23-6-4. Open for discussion. |
| ZTE | Share similar view with companies that this FG is not needed. |
| Intel | Okay |
| QC | If companies think that proposed FG for DCI format 1\_0 is part of FG 23-6-4, this then should be clarified as below. Our view is that that component 2 was mainly added for DCI format 1\_1 and 1\_2. But we are okay to clarify that if this is common understanding.   |  | | --- | | FG 23-6-4: Default DL beam setup for SFN  2. Support PDSCH reception using default beam for Rel-17 enhanced SFN scheme when TCI field is not present in any DCI format when PDSCH is scheduled with offset equal or larger than the threshold, if applicable |   Replying to DOCOMO with some clarification, UE will always be able to receive PDSCH by DCI format 1\_0 (this is mandatory feature). What we are saying if UE support this feature, then DCI 1\_0 can schedule SFN PDSCH (ie. with two TCI states) or single-TCI PDSCH. Otherwise, If UE doesn’t support this feature (as per RAN1 agreement), then DCI format 1\_0 is as legacy (single TCI PDSCH). |
| Samsung | If companies have aligned understanding that Component 2 in FG 23-6-4 already covers all DCI foramts (DCI format 1\_0/1\_1/1\_2), then we are fine to revise the wording of Component 2 in FG 23-6-4 as follows:   |  | | --- | | FG 23-6-4: Default DL beam setup for SFN  2. Support PDSCH reception using default beam for Rel-17 enhanced SFN scheme when TCI field is not present in DCI format 1\_0/1\_1/1\_2 when PDSCH is scheduled with offset equal or larger than the threshold, if applicable | |
| NTT DOCOMO | Thank Qualcomm for explanation. As long as it is clarified that DCI format 1\_0 can schedule single TCI PDSCH (legacy), regardless of the FG, we are fine. We prefer Samsung’s update. |
| Ericsson | If here we are discussing purely UE feature, it should be fine to add the DCI format 1\_0 to the FG23-6-4, but maybe we need to double check the current spec for possible impact with this change. I remember there’s some difference on the behavior of fallback DCI and dedicated DCI in HST discussion. |

## NR\_ext\_to\_71GHz

### New FG: Multiple PDSCH/PUSCH scheduling by single DCI

After review of contributions submitted to RAN1 #110bis-e in this agenda item, the following is proposed by the moderator. Companies submitted the following views on the moderator’s proposals.

**Proposal: Introduce the following new row/FG**

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| 24. NR\_ext\_to\_71GHz | 24-1h | Multiple PDSCH scheduling by single DCI for 60kHz in FR2-1 | 1. Multi-PDSCH scheduling by single DCI for the operation with 60 kHz SCSs in FR2-1  2. HARQ enhancements for both type 1 and type 2 HARQ codebook for supporting multi-PDSCH scheduling with singe DCI |  | Yes | N/A | Multiple PDSCH scheduling by single DCI for 15/30/60kHz is not supported in FR2-1 | Per band | N/A | N/A | N/A |  | Optional with capability signalling |
| 24. NR\_ext\_to\_71GHz | 24-1i | Multiple PDSCH scheduling by single DCI for 15/30/60kHz in FR1 | 1. Multi-PDSCH scheduling by single DCI for the operation with 15/30/60 kHz SCSs in FR1  2. HARQ enhancements for both type 1 and type 2 HARQ codebook for supporting multi-PDSCH scheduling with singe DCI |  | Yes | N/A | Multiple PDSCH scheduling by single DCI for 15/30/60kHz is not supported in FR1 | Per band | N/A | N/A | N/A |  | Optional with capability signalling |
| 24. NR\_ext\_to\_71GHz | 24-1j | Multiple PUSCH scheduling by single DCI for 60kHz in FR2-1 | 1. Multi-PUSCH scheduling by single DCI for the operation with 60 kHz SCSs with non-contiguous allocation in FR2-1 |  | Yes | N/A | Multiple PUSCH scheduling by single DCI for 15/30/60kHz is not supported in FR2-1 with non-contiguous allocation | Per band | N/A | N/A | N/A |  | Optional with capability signalling |
| 24. NR\_ext\_to\_71GHz | 24-1k | Multiple PUSCH scheduling by single DCI for 15/30/60kHz in FR1 | 1. Multi-PUSCH scheduling by single DCI for the operation with 15/30/60 kHz SCSs with non-contiguous allocation in FR1 |  | Yes | N/A | Multiple PUSCH scheduling by single DCI for 15/30/60kHz is not supported in FR1 with non-contiguous allocation | Per band | N/A | N/A | N/A |  | Optional with capability signalling |

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| Company | Comments/Questions/Suggestions |
| Ericsson | We support extending multi-PDSH and multi-PUSCH to FR1 and FR2-1. These are general "tools in the toolbox" and no spec impact is incurred by extending them to the other frequency ranges. |
| Apple | We are fine with the extension given that there are no spec changes   * For 24-1h, the description for the “Consequence if the feature is not supported by the UE” column should be corrected: “Multiple PDSCH scheduling by single DCI for ~~15/30~~/60kHz is not supported in FR2-1” * For 24-1j, the description for the “Consequence if the feature is not supported by the UE” column should be corrected: “Multiple PUSCH scheduling by single DCI for ~~15/30~~/60kHz is not supported in FR2-1 with non-contiguous allocation” * We assume that even if UE signals support this feature (FG 24-1i, 24-1k) for 15/30/60KHz SCS, but if UE does not support SCS 60KHz on FR1 (which is also an optional UE feature), then the joint capability is that UE only supports multiple PDSCH/PUSCH for 15/30KHz SCS on FR1. |
| LG Electronics | We share the view with Ericsson and Apple. No spec changes are expected and this feature is band-agnostic and beneficial at least in terms of DCI overhead reduction.  We also agree with 3 bullets in Apple’s comments. |
| ZTE, Sanechips | We support introducing the above mentioned new FGs and share the same reason with Ericsson, Apple and LGE. |
| Nokia, NSB | Do not support. This has been discussed for several meetings, always with the same outcome, i.e. no consensus. It is way too late to introduce such new features for Rel-17 as they are not corrections neither essential. Moreover these are already under discussion for Rel-18 XR, and that is a better place for such discussions. |
| Huawei, HiSilicon | We support the for FGs and have a similar view as Ericsson, Apple, LGE, and ZTE.  Further, we think that the third bullet mentioned by Apple is better to be added as a Note to 24-1i and 24-1k.  Unlike Nokia, we don’t see any reason to not to discuss these FGs here given that the same 4 FGs are agreed in this AI for FR2-2 as well as FR2-1 with 120 kHz SCS. Further, for multiple PUSCH scheduled by single DCI, it has already been supported for all FRs since Rel-16. The only enhancement in Rel-17 is allowing discontinues resource allocation which will not have any specification impact. Finally, it is correct that there are also discussions in Rel-18 XR on the multiple PDSCH/PUSCH scheduled by single DCI. However, in fact, agreeing in above 4 FGs will simplify their work and avoid potential harmonization in the future. |
| Intel | Ok |
| MediaTek | We share the same view with Nokia and don’t support the features. In addition, our concern is there is no clear technical motivation to enable the feature to smaller SCSs and there are many scheduling restriction (e.g., no out-of-order among any DCI-PDSCH pairs) will make the scheduling more difficult. |
| Samsung | We don’t support the proposal. This has been discussed for many meeting, and our position doesn’t change. The supporting of multiple PDSCH/PUSCH is SCS specific. The discussion on the maximum number of PDSCH/PUSCH needs careful justification for each SCS, and we don’t think it’s simply to reuse such number from 480/960 to other SCSs. |

## NR\_NTN\_solutions

Void

## IoT over NTN

Void

## NR\_IAB\_enh

Void

## NR\_DSS

Void

## LTE\_NR\_DC\_enh2

Void

## NR\_pos\_enh

### FG 27-3-2

After review of contributions submitted to RAN1 #110bis-e in this agenda item, the following is proposed by the moderator. Companies submitted the following views on the moderator’s proposals.

**Proposal: Adopt the following changes highlighted in chromatic fonts, while keeping the yellow highlighting, if any, as shown**

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| 27. NR\_pos\_enh | 27-3-2 | DL PRS measurement outside MG and in a PRS processing window | 1. Supported PRS processing types subject to the UE determining that DL PRS to be higher priority for PRS measurement outside MG and in a PRS processing window  2. Support of priority handing options of PRS: Option1, Option2 or Option3   * 1. Option 1: Support of “st1” and “st3” defined in clause 5.1.6.5 of TS 38.214 ~~UE may indicates support of two priority states.~~      1. ~~State 1: PRS is higher priority than all PDCCH/PDSCH/CSI-RS~~      2. ~~State 2: PRS is lower priority than all PDCCH/PDSCH/CSI-RS~~   2. Option 2: Support of “st1”, “st2”, and “st3” defined in clause 5.1.6.5 of TS 38.214 ~~UE may indicate support of three priority states~~      1. ~~State 1: PRS is higher priority than all PDCCH/PDSCH/CSI-RS~~      2. ~~State 2: PRS is lower priority than PDCCH and URLLC PDSCH and higher priority than other PDSCH/CSI-RS~~         1. ~~Note: The URLLC channel corresponds a dynamically scheduled PDSCH whose PUCCH resource for carrying ACK/NAK is marked as high-priority.~~      3. ~~State 3: PRS is lower priority than all PDCCH/PDSCH/CSI-RS~~   3. Option 3: Support of “st1” only defined in clause 5.1.6.5 of TS 38.214 ~~UE may indicate support of single priority state~~      1. ~~State 1: PRS is higher priority than all PDCCH/PDSCH/CSI-RS~~ | 13-1 | Yes |  | DL PRS measurement outside MG and in a PRS processing window is not supported | per band | n/a | n/a | n/a | Component 1 candidate values: One or more of {Type 1A, Type 1B, Type 2}  Component 2 candidate values: {option1, option2, option3}  Need for location server to know if the feature is supported  Note: Component 2 can be reported per supported band for each type supported by the UE, details left to RAN2  Note:   * Type 1A refers to the determination of prioritization between DL PRS and other DL signals/channels in all OFDM symbols within the PRS processing window. The DL signals/channels from all DL CCs (per UE) are affected across LTE and NR * Type 1B refers to the determination of prioritization between DL PRS and other DL signals/channels in all OFDM symbols within the PRS processing window. The DL signals/channels from a certain band are affected * Type 2 refers to the determination of prioritization between DL PRS and other DL signals/channels only in DL PRS symbols within the PRS processing window   Note: When the UE determines higher priority for other DL signals/channels over the PRS measurement/processing, the UE is not expected to measure/process DL PRS which is applicable to all of the above capability options  Note: Within a PRS processing window, UE measurement is inside the active DL BWP with PRS having the same numerology as the active DL BWP  Note: Support of configuration of PRS processing window in RRC and support of using DL MAC CE to activate/deactivate the PRS processing window for PRS measurements is part of the FG , but no dedicated signaling is required.  A UE that supports FG 27-3-3 must indicate this FG is supported | Optional with capability signaling |

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| Company | Comments/Questions/Suggestions |
| Huawei, HiSilicon | Yes. This fixed the unalignment between 38.214 and TS 38.306. |
| Qualcomm | Not strong view; we are OK with the change is majority prefers it. |
| ZTE | Not support. It is more easier to update 38.214 according to this UE feature. We have submitted one CR in maintenance session, we can discuss this issue there. |
| Nokia, NSB | OK. We do not agree with ZTE, UE FGs are supposed to follow the main RAN1 specs, not the other way around. |
| CATT | We think the alignment between 38.214 and 38.306 is needed. We can accept either change the UE FG or change the 38.214. |

### FG 27-3-3/27-6

After review of contributions submitted to RAN1 #110bis-e in this agenda item, the following is proposed by the moderator. Companies submitted the following views on the moderator’s proposals.

**Proposal: On the support of FG27-3-3 and FG27-6 in FR2-2 band with 480/960 kHz SCS, either of the following ways forward can be considered:**

* **Alt-1: No change for support of larger SCS (i.e., FG27-3-3/27-6 is not supported for the operation in FR2-2 with 480 or 960 kHz SCS**
* **Alt-2: Update FG27-3-3 and/or FG27-6 so that they can report component 3 even for 480 and/or 960 kHz SCS**
* **Alt-3: Define new FG to report DL-PRS processing capability per 480 kHz SCS slot and/or 960 kHz SCS slot**

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| Company | Comments/Questions/Suggestions |
| Huawei, HiSilicon | Alt.1 |
| Qualcomm | Alt-1. There is also a related email thread:  [110bis-e-R17-Pos-02] Email discussion on incoming RAN2 LS in [R1-2208325](file:///D:\20.RAN1%20Tdocs\TSGR1_110bis-e_202210_E\Inbox\drafts\8.16(NR_R17_UE_feat)\Docs\R1-2208325.zip) on the support of positioning in FR2-2 – Qi (Samsung)  <https://nwm-trial.etsi.org/#/documents/8155> |
| ZTE | Same view as Qualcomm |
| Intel | We support Alt-2. Given that component 3 is indicating the numbers of PRS resources within a slot, for the larger SCS values, the smaller values are already included, and thus, the candidates for 480/960 kHz can be simply defined as same as those for 60/120 kHz for FR2:  FR2 bands: {1, 2, 4, 6, 8, 12, 16, 24, 32, 48, 64} for each SCS: 60kHz, 120kHz, 480kHz, 960kHz |
| Nokia, NSB | Alt-1. |
| CATT | Alt-1. This issue is discussing in the [110bis-e-R17-Pos-02] as mentioned by Qualcomm. No change is needed before the outcome is available of that email thread. |

### New FG: M-sample measurements in RRC\_CONNECTED within the PRS processing window

After review of contributions submitted to RAN1 #110bis-e in this agenda item, the following is proposed by the moderator. Companies submitted the following views on the moderator’s proposals.

**Proposal: Introduce the following new row/FG**

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| 27. NR\_pos\_enh | 27-3-1a | M-sample measurements in RRC\_CONNECTED within the PRS processing window | The capability to support reporting a measurement based on measuring M=1 or 2 samples (instances) of a DL PRS resource set within the PRS processing window.  Note: UE may indicate support of the feature only if UE does not support FG 27-3-1. | 13-1, 27-3-3 | No |  | If the UE does not provide the capability, support of M-sample PRS measurement in the PPW is according to the FG 27-3-1. | Per band | n/a | n/a | n/a | Need for location server to know if the feature is supported  Note: this feature is supported for both UE-assisted and UE based positioning | Optional with capability signaling |

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| Company | Comments/Questions/Suggestions |
| Huawei, HiSilicon | Support. |
| Qualcomm | We could accept of a new FD, if there is majority support, but we don’t consider it essential overall. |
| ZTE | Don’t support. We don’t think the new FG should be added at such late stage. Further, there is no much reason to support different M within or outside PPW. |
| CATT | We can live with this proposal, since it is useful for capacity indication of M-sample PRS measurement in the PPW. |
| Huawei, HiSilicon | Reply to ZTE:  From Huawei perspective, we consider reduced sample in PPW higher priority than in the MG for the UE implementation. Reasons are   * PPW measurement has more stringent synchronization requirement that facilitates UE using advanced architecture to process. * PPW measurement can enable N2/T2 processing with optimized processing delay that can benefit most from 1-sample processing. |
| ZTE | Reply to Huawei, we are still non convinced.  First, UE supporting PPW should also support measurement gap.  Second, support of M samples just implies UE can do shorter filter based 1 or two PRS occasions. The issue is unclear why UE can do the shorter filter in PPW but cannot do it in MG. |

## NR\_DL1024QAM\_FR1

Void

# Discussion Items during RAN1 #110bis-e — Second Checkpoint

Based on the comments/questions/suggestions received by the first checkpoint, the following are the revised proposals and/or proposed agreements by the moderator. Companies submitted the following views on the moderator’s proposals.

***[Please submit all comments/questions/suggestions here, late comments/questions/suggestions submitted in Section 3 will not be considered]***

**General comments**

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| Company | Comments/Questions/Suggestions |
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## NR\_FeMIMO

### New FG: Support of CSI-IM for CSI enhancement for multi-TRP

After review of contributions submitted to RAN1 #110bis-e in this agenda item, the following is proposed by the moderator. Companies submitted the following views on the moderator’s proposals.

**Proposal: Introduce the following new row/FG**

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| 23. NR\_FeMIMO | 23-7-6 | Support of CSI-IM for CSI enhancement for multi-TRP | Support CSI-IM for CSI enhancement for Multi-TRP | 23-7-1 | Yes |  |  | Per UE | n/a | Yes | n/a |  | Optional with capability signalling |

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| Company | Comments/Questions/Suggestions |
| Samsung | Support in principle as there is no UE capability which explicitly mentioned on supporting CSI-IM for NCJT CSI. |
| Apple | We support the proposed FG23-7-6 |
| Nokia, NSB | OK |
| DOCOMO | Not support.  Without support of CSI-IM, we could not understand how UE could derive CSI? CSI-IM is needed for CSI. No need to introduce UE capability for it. |
| ZTE | Not support. If our understanding is correct, for CSI/CQI report, CSI-IM should be mandatorily support for CQI determination. That means that the UE should support CSI-IM if supporting mTRP-CSI. |
| Intel | In our view there is no need to support additional UE capability on CSI-IM for MTRP CSI. |
| Huawei, HiSilicon | We have no clear understanding about what new FG will really enable or disable, and the importance. We disagree with further new FG in such a late stage |
| Ericsson | We do not support this proposal. If CSI-IM for NC-JT is an optional capability, how does the UE perform interference measurement for the baseline capability 23-7-1 (e.g., for a UE that doesn’t support this proposed capability). |
| Samsung | @Docomo, ZTE, Intel, Huawei, Ericsson  Thanks for your view. Just want to ask and clarify.  Our understanding is that CSI-IM can be supported by Rel-15 UE capability, FG 2-33, which is mandatory with capability signaling, so CSI-IM itself can be supported as mandatory.  However, for the case of CSI-IM for NCJT (which a single CSI-IM can be associated with CMR pair for NCJT), if the above new FG 23-7-6 is not supported, then is it correct understanding that CSI-IM for NCJT can be supported by a UE if the UE reports FG 23-7-1? |

### New FG: Support DCI format 1\_0 scheduling PDSCH with single or two TCI states based on the scheduling CORESET when time offset is larger than the threshold

After review of contributions submitted to RAN1 #110bis-e in this agenda item, the following is proposed by the moderator. Companies submitted the following views on the moderator’s proposals.

**Proposal: Introduce the following new row/FG**

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| 23. NR\_FeMIMO | 23-6-7 | Support DCI format 1\_0 scheduling PDSCH with single or two TCI states based on the scheduling CORESET when time offset is larger than the threshold | Support determining single TCI state or two TCI states for PDSCH scheduled by DCI format 1\_0 based on the scheduling CORESET when time offset is larger than the threshold |  | Yes | N/A |  | Per band | n/a | n/a |  |  | Optional with capability signalling |

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| Company | Comments/Questions/Suggestions |
| Samsung | Our view is that this is already supported by component 2 in FG 23-6-4 as follows:  FG 23-6-4: Default DL beam setup for SFN  2. Support PDSCH reception using default beam for Rel-17 enhanced SFN scheme when TCI field is not present in DCI when PDSCH is scheduled with offset equal or larger than the threshold, if applicable |
| Apple | We think explanation from Samsung is valid |
| Nokia, NSB | Agree with Samsung and Apple above, this FG is not needed. |
| NTT DOCOMO | Not support. We believe UE should be able to receive PDSCH scheduled by DCI format 1\_0 without separate UE capability. |
| Ericsson | We don’t think this is included in FG23-6-4. Open for discussion. |
| ZTE | Share similar view with companies that this FG is not needed. |
| Intel | Okay |
| QC | If companies think that proposed FG for DCI format 1\_0 is part of FG 23-6-4, this then should be clarified as below. Our view is that that component 2 was mainly added for DCI format 1\_1 and 1\_2. But we are okay to clarify that if this is common understanding.   |  | | --- | | FG 23-6-4: Default DL beam setup for SFN  2. Support PDSCH reception using default beam for Rel-17 enhanced SFN scheme when TCI field is not present in any DCI format when PDSCH is scheduled with offset equal or larger than the threshold, if applicable |   Replying to DOCOMO with some clarification, UE will always be able to receive PDSCH by DCI format 1\_0 (this is mandatory feature). What we are saying if UE support this feature, then DCI 1\_0 can schedule SFN PDSCH (ie. with two TCI states) or single-TCI PDSCH. Otherwise, If UE doesn’t support this feature (as per RAN1 agreement), then DCI format 1\_0 is as legacy (single TCI PDSCH). |
| Samsung | If companies have aligned understanding that Component 2 in FG 23-6-4 already covers all DCI foramts (DCI format 1\_0/1\_1/1\_2), then we are fine to revise the wording of Component 2 in FG 23-6-4 as follows:   |  | | --- | | FG 23-6-4: Default DL beam setup for SFN  2. Support PDSCH reception using default beam for Rel-17 enhanced SFN scheme when TCI field is not present in DCI format 1\_0/1\_1/1\_2 when PDSCH is scheduled with offset equal or larger than the threshold, if applicable | |
| NTT DOCOMO | Thank Qualcomm for explanation. As long as it is clarified that DCI format 1\_0 can schedule single TCI PDSCH (legacy), regardless of the FG, we are fine. We prefer Samsung’s update. |
| Ericsson | If here we are discussing purely UE feature, it should be fine to add the DCI format 1\_0 to the FG23-6-4, but maybe we need to double check the current spec for possible impact with this change. I remember there’s some difference on the behavior of fallback DCI and dedicated DCI in HST discussion. |

## NR\_ext\_to\_71GHz

Void

## NR\_NTN\_solutions

Void

## IoT over NTN

Void

## NR\_IAB\_enh

Void

## NR\_DSS

Void

## LTE\_NR\_DC\_enh2

Void

## NR\_pos\_enh

### New FG: M-sample measurements in RRC\_CONNECTED within the PRS processing window

After review of contributions submitted to RAN1 #110bis-e in this agenda item, the following is proposed by the moderator. Companies submitted the following views on the moderator’s proposals.

**Proposal: Introduce the following new row/FG**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 27. NR\_pos\_enh | 27-3-1a | M-sample measurements in RRC\_CONNECTED within the PRS processing window | The capability to support reporting a measurement based on measuring M=1 or 2 samples (instances) of a DL PRS resource set within the PRS processing window.  Note: UE may indicate support of the feature only if UE does not support FG 27-3-1. | 13-1, 27-3-3 | No |  | If the UE does not provide the capability, support of M-sample PRS measurement in the PPW is according to the FG 27-3-1. | Per band | n/a | n/a | n/a | Need for location server to know if the feature is supported  Note: this feature is supported for both UE-assisted and UE based positioning | Optional with capability signaling |

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| Company | Comments/Questions/Suggestions |
| Huawei, HiSilicon | Support. |
| Qualcomm | We could accept of a new FD, if there is majority support, but we don’t consider it essential overall. |
| ZTE | Don’t support. We don’t think the new FG should be added at such late stage. Further, there is no much reason to support different M within or outside PPW. |
| CATT | We can live with this proposal, since it is useful for capacity indication of M-sample PRS measurement in the PPW. |
| Huawei, HiSilicon | Reply to ZTE:  From Huawei perspective, we consider reduced sample in PPW higher priority than in the MG for the UE implementation. Reasons are   * PPW measurement has more stringent synchronization requirement that facilitates UE using advanced architecture to process. * PPW measurement can enable N2/T2 processing with optimized processing delay that can benefit most from 1-sample processing. |
| ZTE | Reply to Huawei, we are still non convinced.  First, UE supporting PPW should also support measurement gap.  Second, support of M samples just implies UE can do shorter filter based 1 or two PRS occasions. The issue is unclear why UE can do the shorter filter in PPW but cannot do it in MG. |

## NR\_DL1024QAM\_FR1

Void

# Discussion Items during RAN1 #110bis-e — Third Checkpoint

Based on the comments/questions/suggestions received by the second checkpoint, the following are the revised proposals and/or proposed agreements by the moderator. Companies submitted the following views on the moderator’s proposals.

***[Please submit all comments/questions/suggestions here, late comments/questions/suggestions submitted in Section 4 will not be considered]***

**General comments**

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| Company | Comments/Questions/Suggestions |
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## NR\_FeMIMO

### FG

**Proposal: Adopt the following changes highlighted in chromatic fonts, while keeping the yellow highlighting, if any, as shown**

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## NR\_ext\_to\_71GHz

### FG

**Proposal: Adopt the following changes highlighted in chromatic fonts, while keeping the yellow highlighting, if any, as shown**

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## NR\_NTN\_solutions

### FG

**Proposal: Adopt the following changes highlighted in chromatic fonts, while keeping the yellow highlighting, if any, as shown**

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| Company | Comments/Questions/Suggestions |
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## IoT over NTN

### FG

**Proposal: Adopt the following changes highlighted in chromatic fonts, while keeping the yellow highlighting, if any, as shown**

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| Company | Comments/Questions/Suggestions |
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## NR\_IAB\_enh

### FG

**Proposal: Adopt the following changes highlighted in chromatic fonts, while keeping the yellow highlighting, if any, as shown**

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| Company | Comments/Questions/Suggestions |
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## NR\_DSS

### FG

**Proposal: Adopt the following changes highlighted in chromatic fonts, while keeping the yellow highlighting, if any, as shown**

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| Company | Comments/Questions/Suggestions |
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## LTE\_NR\_DC\_enh2

### FG

**Proposal: Adopt the following changes highlighted in chromatic fonts, while keeping the yellow highlighting, if any, as shown**

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| Company | Comments/Questions/Suggestions |
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## NR\_pos\_enh

### FG

**Proposal: Adopt the following changes highlighted in chromatic fonts, while keeping the yellow highlighting, if any, as shown**

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| Company | Comments/Questions/Suggestions |
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## NR\_DL1024QAM\_FR1

### FG

**Proposal: Adopt the following changes highlighted in chromatic fonts, while keeping the yellow highlighting, if any, as shown**

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| Company | Comments/Questions/Suggestions |
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# Summary of Agreements

This Section summarizes the final agreements in RAN1 #110bis-e in this agenda item.

# References

1. R1- 2207923, Updated RAN1 UE features list for Rel-17 NR after RAN1 #110 Thursday, Moderators (AT&T, NTT DOCOMO, INC.)
2. R1- 2207924, Updated RAN1 UE features list for Rel-17 LTE after RAN1 #110 Thursday, Moderators (AT&T, NTT DOCOMO, INC.)
3. R1-2208462, Remaining issues for UE features set 2 topics, Huawei/HiSilicon
4. R1-2209241, Discussion on some remaining issues of Rel-17 UE features, ZTE/Sanechips
5. R1-2209567, View on Rel-17 UE features, Apple
6. R1-2209887, Discussion on remaining issues regarding Rel-17 RAN1 UE features topics 2, NTT DOCOMO, INC.
7. R1-2209964, Discussion on Rel-17 UE features topic 2, Qualcomm Incorporated
8. R1-2210087, UE features topics 2, Ericsson