**3GPP TSG RAN WG1 #111 R1-2211937**

**Toulouse, France, November 14th – 18th, 2022**

**Source: Ad-Hoc Chair (AT&T)**

**Title: Session Notes of AI 8.16.2 (NR\_FeMIMO, NR\_ext\_to\_71GHz, NR\_NTN\_solutions, IoT over NTN, NR\_IAB\_enh, NR\_DSS, LTE\_NR\_DC\_enh2, NR\_pos\_enh, and NR\_DL1024QAM\_FR1)**

**Agenda Item:** **8.16.2**

**Document for:** **Endorsement**

1.

###  UE features topics 2

*For discussions on Rel-17 UE features for NR-MIMO, NR from 52.6GHz to 71 GHz, NR-NTN, positioning, eIAB, DSS, IoT over NTN, 1024QAM.*

[111-R17-UE\_features\_2] To be used for sharing updates on online/offline schedule, details on what is to be discussed in online/offline sessions, tdoc number of the moderator summary for online session, etc – Ralf (AT&T)

**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 PCI2. 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 |

**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 |

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

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|  34. NR\_DSS | 34-2 | Cross-carrier scheduling from SCell to PCell/PSCell (Type B) | Support of Cross-carrier scheduling (CCS) from sSCell to PCell/PSCell (Type B)1. Cross-carrier scheduling from sSCell to PCell/PSCell with CIF
2. sSCell USS set(s) (for CCS from sSCell to PCell/PSCell) and search space sets on PCell/PSCell can be configured so that the UE monitors them in overlapping slot of PCell/PSCell and sSCell
3. Configuration of scaling factor α for BD and CCE limit handling and PDCCH overbooking handling on P(S)Cell
4. The number of unicast DCI limits for PCell/PSCell scheduling
* Processing K1 unicast DCI scheduling DL on PCell/PSCell per PCell/PSCell slot and its aligned N consecutive sSCell slot(s)
* Processing K2 unicast DCI scheduling UL on PCell/PSCell per PCell/PSCell slot and its aligned N consecutive sSCell slot(s)
* N is based on pair of (PCell/PSCell SCS, sSCell SCS): N=1 for(15,15), (30,30), (60,60) and N=2 for (15,30), (30,60) and N=4 for (15, 60)
1. Same numerology between sSCell and P(S)Cell or sSCell SCS is larger than P(S)Cell SCS
2. USS set(s) for DCI format 0\_1,1\_1 configured on sSCell for CCS from sSCell to PCell/PSCell and USS set(s) for DCI format 0\_2,1\_2 configured on sSCell for CCS from sSCell to PCell/PSCell if UE supports FG 11-1 (*dci-Format1-2And0-2-r16*)
3. PDCCH monitoring occasion(s) on sSCell for cross-carrier scheduling to Pcell/PSCell
4. frame boundary alignment between PCell/PSCell and sSCell
 | 6-5  | Yes | N/A | Cross-carrier scheduling from SCell to PCell/PSCell (Type B) is not supported | Per BC | No | Applicable to FR1 only | No | Candidate value set: One or more of supported SCS combinations ({P(S)Cell SCS in kHz, sSCell SCS in kHz}) from following set are indicated by the UE: {15,15}, {15,30}, (15, 60), {30,30}, {30,60},{60,60})Candidate value set 2: frequency band pair(s) for {PCell/PSCell, sSCell}Component 4 candidate values: (K1, K2) = {(1,1) for FDD P(S)Cell; (K1, K2) = (1,2) for TDD P(S)Cell}Component 7 candidate values:Value 1: within the first 3 OFDM symbols of sSCell slot overlapping with the first 3 OFDM symbols of PCell/PSCell slot. Value 2: within the first 3 OFDM symbols of any sSCell slot overlapping with PCell/PSCell slotNote: The CCS from sSCell to Pcell is applicable to FR1 only but there can be other Scells in FR2 configured for the UENote: The SCell configured with Cross-carrier scheduling to PCell/PSCell is referred to as ‘sSCell’Note: Candidate value set 2 only applies for the following value sets of components 1: {30,30}, {30,60},{60,60}Note: A UE supporting this FG does not imply that the UE can be configured with sSCell in shared spectrumNote: parameters in CSI-MeasConfig of P(S)Cell and sSCell are configured such that joint set of these parameters across P(S)Cell and sSCell does not result in exceeding any of the UE’s capabilities for A-/SP-CSI reporting on PUSCH on P(S)Cell | Optional with capability signalling |
|  34. NR\_DSS | 34-1 | Cross-carrier scheduling from SCell to PCell/PSCell with search space restrictions (Type A) | Support of Cross-carrier scheduling from sSCell to PCell/PSCell with search space restrictions (Type A)1. Cross-carrier scheduling from sSCell to PCell/PSCell with CIF
2. Search space restrictions: sSCell USS set(s) (for CCS from sSCell to PCell/PSCell) and following search space sets on PCell/PSCell can only be configured such that UE does not monitor them in overlapping slot of PCell/PSCell and sSCell
	* USS sets for DCI formats 0\_1,1\_1,0\_2,1\_2
	* USS sets for DCI formats 0\_0,1\_0
	* Type3-CSS set(s) for DCI formats 1\_0/0\_0 with C-RNTI/CS-RNTI/MCS-C-RNTI
3. Configuration of scaling factor α for BD and CCE limit handling and PDCCH overbooking handling on P(S)Cell
4. The number of unicast DCI limits for PCell/PSCell scheduling
* Processing K1 unicast DCI scheduling DL on PCell/PSCell per PCell/PSCell slot and its aligned N consecutive sSCell slot(s)
* Processing K2 unicast DCI scheduling UL on PCell/PSCell per PCell/PSCell slot and its aligned N consecutive sSCell slot(s)
* N is based on pair of (PCell/PSCell SCS, sSCell SCS): N=1 for(15,15), (30,30), (60,60) and N=2 for (15,30), (30,60) and N=4 for (15, 60)
1. Same numerology between sSCell and P(S)Cell or sSCell SCS is larger than P(S)Cell SCS
2. USS set(s) for DCI format 0\_1,1\_1 configured on sSCell for CCS from sSCell to Pcell/PSCell and USS set(s) for DCI format 0\_2,1\_2 configured on sSCell for CCS from sSCell to PCell/PSCell if UE supports FG 11-1 (*dci-Format1-2And0-2-r16*)
3. sSCell USS set(s) (for CCS from sSCell to Pcell/PSCell) and Type0/0A/1/2 CSS sets on Pcell/PSCell can be configured so that the UE monitors them in overlapping slot of Pcell/PSCell and sSCell
	* no simultaneous monitoring between ‘USS sets (for P(S)Cell scheduling) on sSCell’ and ‘Type 0/0A/1/2/CSS sets on P(S)Cell for DCI formats with CRC scrambled by C-RNTI/MCS-C-RNTI/CS-RNTI’
	* simultaneous monitoring of ‘USS sets (for P(S)Cell scheduling) on sSCell’ and ‘Type 0/0A/1/2/CSS sets on P(S)Cell for DCI formats with CRC not scrambled by C-RNTI/MCS-C-RNTI/CS-RNTI’
4. PDCCH monitoring occasion(s) on sSCell for cross-carrier scheduling to PCell/PSCell
5. frame boundary alignment between PCell/PSCell and sSCell
 | 6-5 | Yes | N/A | Cross-carrier scheduling from SCell to PCell/PSCell with search space restrictions (Type A) is not supported | Per BC | No | Applicable to FR1 only | No | Candidate value set: One or more of supported SCS combinations ({P(S)Cell SCS in kHz, sSCell SCS in kHz}) from following set are indicated by the UE: {15,15}, {15,30}, {15, 60}, {30,30}, {30,60},{60,60})Candidate value set 2: frequency band pair(s) for {PCell/PSCell, sSCell}Component 4 candidate values: (K1, K2) = {(1,1) for FDD P(S)Cell; (K1, K2) = (1,2) for TDD P(S)Cell}Component 8 candidate values:Value 1: within the first 3 OFDM symbols of sSCell slot overlapping with the first 3 OFDM symbols of PCell/PSCell slot. Value 2: within the first 3 OFDM symbols of any sSCell slot overlapping with PCell/PSCell slotNote: The CCS from sSCell to PCell is applicable to FR1 only but there can be other SCells in FR2 configured for the UENote: The SCell configured with Cross-carrier scheduling to PCell/PSCell is referred to as ‘sSCell’Note: Candidate value set 2 only applies for the following value sets of components 1: {30,30}, {30,60},{60,60}Note: A UE supporting this FG does not imply that the UE can be configured with sSCell in shared spectrumNote: parameters in CSI-MeasConfig of P(S)Cell and sSCell are configured such that joint set of these parameters across P(S)Cell and sSCell does not result in exceeding any of the UE’s capabilities for A-/SP-CSI reporting on PUSCH on P(S)Cell | Optional with capability signalling |

**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 | 27-15b | Positioning SRS transmission in RRC\_INACTIVE state configured outside initial UL BWP  | 1. Maximum SRS bandwidth supported for each SCS that UE supports within a single CC
2. Max number of SRS Resource Sets for positioning supported by UE
3. Max number of periodic SRS Resources for positioning
4. Max number of periodic SRS Resources for positioning per slot
5. Support of different numerology between the SRS and the initial UL BWP
6. Support of SRS operation without restriction on the BW: BW of the SRS may not include BW of the CORESET#0 and SSB
7. Max number of P/SP SRS Resources for positioning
8. Max number of P/SP SRS Resources for positioning per slot
9. Support a different center frequenecy between the SRS for positioning and the initial UL BWP
10. Switching time between SRS Tx and other Tx in initial UL BWP or Rx in initial DL BWP
 | 27-15 | Yes |  | Positioning SRS transmission in RRC\_INACTIVE state configured outside initial UL BWP is not supported | Per band | n/a | n/a | n/a | Component 1 candidate values: 1. FR1 bands: {5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 60, 70, 80, 90, 100}
2. FR2 bands: {50, 100, 200, 400}

Component 2 candidate values: {1, 2, 4, 8, 12, 16}Component 3 candidate values: {1,2,4,8,16,32,64}Component 4 candidate values: {1, 2, 3, 4, 5, 6, 8, 10, 12, 14}Component 7 candidate values: {1,2,4,8,16,32,64}Component 8 candidate values: {1, 2, 3, 4, 5, 6, 8, 10, 12, 14}Component 10 candidate values: {100us, 140us, 200us, 300us, 500us}Note 1: The SRS should have a locationAndBandwidth, SCS, CP, defined the same way as a legacy BWP. Note 2: If component 9 is not signaled, the UE only supports same center frequency between the SRS for positioning and initial UL BWP Note 3: If component 5 is not signaled, the UE only supports same numerology between the SRS and the initial UL BWPNote 4: If component 6 is not signaled, the UE supports only SRS BW that include the BW of the CORESET #0 and SSB.Note 5: Component 6 is not applicable to FDD or SUL bands.Need for location server to know if the feature is supported | Optional with capability signaling |

[R1-2211796](../Docs/R1-2211796.zip) View on Rel-17 UE features Apple

R1-2211936 Summary of UE features topics 2 Moderator (AT&T)

R1-2211937 Session Notes of AI 8.16.2 (NR\_FeMIMO, NR\_ext\_to\_71GHz, NR\_NTN\_solutions, IoT over NTN, NR\_IAB\_enh, NR\_DSS, LTE\_NR\_DC\_enh2, NR\_pos\_enh, and NR\_DL1024QAM\_FR1) Ad-Hoc Chair (AT&T)

[R1-2212163](../Docs/R1-2212163.zip) UE features topics 2 Ericsson

[R1-2212493](../Docs/R1-2212493.zip) Remaining issues for UE features topics 2 Huawei, HiSilicon