**3GPP TSG RAN WG1 #107-e R1-200xxxx**

**e-Meeting, November 11th – 19th, 2021**

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

**Title: Session Notes of AI 8.16.2**

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

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



#### 8.16.2 UE features for supporting NR from 52.6 GHz to 71 GHz

[107-e-R17-UE-features-52-71GHz-01] Email discussion UE features for supporting NR from 52.6 GHz to 71 GHz – Ralf (AT&T)

* 1st check point: November 15
* Final check point: November 19

**Agreement: Adopt the following changes highlighted in red and blue, including the definitions of new FGs**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 24. NR\_ext\_to\_71GHz | 24-1 | Basic FR2-2 ~~[~~DL~~]~~ support | ~~1. Support 120KHz SCS [transmission and] reception [for initial/non-initial access]~~  ~~[2. Support multi-RB PUCCH format 0/1/4 for 120 kHz]~~  ~~[3. PRACH with 120KHz SCS and length 139[/571/1151]]~~  ~~[~~4. Support reception of 120kHz subcarrier spacing for DL data and control channels, SSB, and reference signals in FR2-2~~]~~ for non-initial access  ~~[5. Support 120kHz subcarrier spacing for UL data and control channels and reference signals in FR2-2]~~  ~~[6. Support multi-PUSCH[/PDSCH] scheduling by single DCI for the operation with 120 kHz SCS]~~ |  |  |  | FR2-2 is not supported | [per UE][per band] |  |  |  |  | Optional with capability signalling  [A UE that supports FR2-2 must indicate this FG is supported] |
| 24. NR\_ext\_to\_71GHz | 24-1a | Basic FR2-2 UL support | ~~1. Support 120KHz SCS reception for non-initial access~~  ~~2. Support multi-RB PUCCH format 0/1 for 120 kHz~~  3. PRACH with 120KHz SCS and length 139  4. Support transmission of 120kHz subcarrier spacing for UL data and control channels and reference signals in FR2-2 | [24-1] |  |  |  |  |  |  |  |  | Optional with capability signalling  [A UE that supports FR2-2 must indicate this FG is supported] |
| 24. NR\_ext\_to\_71GHz | 24-1b | Wideband PRACH [with/without shared spectrum channel access] | Enhanced PRACH design for operation by adopting a single long ZC sequence, with ZC sequence equal to 1151 for 120kHz and ZC sequence equal to 571 for 120kHz ~~/480kHz~~. | [24-1a] |  |  |  |  |  |  |  | FFS: whether to split this FG for SA and DC | Optional [with/without]capability signalling  [A UE that supports FR2-2 must indicate this FG is supported] |
| 24. NR\_ext\_to\_71GHz | 24-1c | Multi-RB support  PUCCH format 0/1/4 for 120 kHz [with/without shared spectrum channel access] | 1. Support multi-RB PUCCH format 4 for 120 kHz  2. Support multi-RB PUCCH format 0/1 for 120 kHz | [24-1a] |  |  |  |  |  |  |  |  | Optional with capability signalling  [A UE that supports FR2-2 must indicate this FG is supported] |
| 24. NR\_ext\_to\_71GHz | 24-1d | Multiple PDSCH scheduling by single DCI for 120kHz | 1. Multi-PDSCH scheduling by single DCI for the operation with 120 kHz SCS  2. HARQ enhancements | [24-1] |  |  |  |  |  |  |  |  | Optional with capability signalling  [A UE that supports FR2-2 must indicate this FG is supported] |
| 24. NR\_ext\_to\_71GHz | 24-1e | Multiple PUSCH scheduling by single DCI for 120kHz | 1. Multi-PUSCH scheduling by single DCI for the operation with 120 kHz SCS | [24-1a] |  |  |  |  |  |  |  |  | Optional with capability signalling  [A UE that supports FR2-2 must indicate this FG is supported] |
| 24. NR\_ext\_to\_71GHz | 24-2 | 120KHz SSB ~~based stand-alone~~ support for SA/DC in FR2-2 | 1. Support 120KHz SSB for SA/DC ~~initial access~~ in FR2-2  ~~2. PRACH with 120KHz SCS and length 139~~ | [24-1, 24-1a] | N/A | N/A | 120KHz SSB based stand-alone in FR2-2 is not supported | N/A | N/A | N/A | N/A | per band  FFS: whether to split this FG for SA and DC | Optional [with/without] capability signalling  [A UE that supports FR2-2 must indicate this FG is supported] |

* Note: basic groups may be merged once they are determined

**Proposal: Adopt the following changes highlighted in chromatic fonts, including the definitions of new FGs, while keeping the yellow highlighting as shown**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 24. NR\_ext\_to\_71GHz | 24-3 | 480KHz SSB ~~for initial access~~ support for SA/DC in FR2-2 | 1. Support 480KHz SSB for SA/DC ~~initial access~~ in FR2-2 | 24-1[, 24-2, 24-4] | FFS |  |  | [per UE][per band] |  |  |  | ~~From WID:~~   * ~~In addition to 120kHz, support 480 kHz SSB for initial access with support of CORESET#0/Type0-PDCCH configuration in the MIB with following constraints:~~   + ~~Note: 480 kHz is an optional SSB numerology for initial access for the UE. A UE supporting a band in 52.6-71 GHz must at least support 120 kHz SCS (for initial access and after initial access)~~   + ~~[only 480kHz CORESET#0/Type0-PDCCH SCS supported for 480 kHz SSB SCS]~~   FFS: whether to split this FG for SA and DC | Optional [with/without] capability signalling |
| 24. NR\_ext\_to\_71GHz | 24-4 | 480KHz SCS support for DL | ~~1. 480KHz SCS for UL data and control channels and reference signal transmission in FR2-2~~  2. 480KH SCS for DL data and control channels, SSB, and reference signal reception in FR2-2 for non-initial access  ~~3. 480KHz for SSB monitoring [for non-initial access]~~  4. Multiple-slot PDCCH monitoring for 480KHz with X=~~[~~4/8~~]~~ slots ~~[FFS: Component description to be updated once further details of multi-slot monitoring capability are known, e.g., definition of Y]~~  ~~5. PRACH with 480KHz and length 139/[571]~~  ~~FFS: 6. Support multi-RB PUCCH format 0/1/4 for 480 kHz~~  ~~FFS: 7. Multi-PUSCH/PDSCH scheduling by single DCI for the operation with 480 kHz SCS~~  5. Multi- PDSCH scheduling by single DCI for the operation with 480 kHz SCS  6. HARQ enhancements | 24-1 | Yes |  |  | [Per UE/band] |  |  |  | ~~From WID:~~  ~~In addition to 120kHz SCS, specify new SCS, 480kHz and 960kHz, and define maximum bandwidth(s), for operation in this frequency range for data and control channels and reference signals, only NCP supported.~~  ~~[Agreement:~~  ~~A UE supporting 480 kHz SCS supports multi-slot PDCCH monitoring for 480 kHz SCS~~  ~~Agreement:~~  ~~Do not support PRACH length L=571, 1151 for 960kHz PRACH and at least L =1151 for 480kHz PRACH]~~  ~~Note:~~  ~~• Resolve the issues of wideband PRACH, multi-RB PUCCH format 0/1/4, and multi-PUSCH/PDSCH scheduling by single DCI, i.e., whether to have components of a single FG or separate FGs, for 120 kHz first, then use the same structure for 480 kHz~~  ~~• Resolve the issue of having separate capabilities for DL and UL (data and control channels as well as reference signals) for 120 kHz first, then use the same structure for 480 kHz~~ | Optional with capability signalling |
| 24. NR\_ext\_to\_71GHz | 24-4a | 480KHz SCS support for UL | 1. PRACH with 480KHz and length 139  2. 480KHz SCS for UL data and control channels and reference signal transmission in FR2-2  3. Multi-PUSCH scheduling by single DCI for the operation with 480 kHz SCS |  |  |  |  |  |  |  |  |  | Optional with capability signalling |
| 24. NR\_ext\_to\_71GHz | 24-4b | Wideband PRACH for 480 kHz [with/without shared spectrum channel access] | PRACH with 480KHz and length 571 |  |  |  |  |  |  |  |  | FFS: whether to split this FG for SA and DC  [Agreement:  Do not support PRACH length L=571, 1151 for 960kHz PRACH and at least L =1151 for 480kHz PRACH] | Optional with capability signalling |
| 24. NR\_ext\_to\_71GHz | 24-4c | Multi-RB PUCCH format 0/1/4 for 480 kHz [with/without shared spectrum channel access] | Support multi-RB PUCCH format 0/1/4 for 480 kHz |  |  |  |  |  |  |  |  |  | Optional with capability signalling |
| ~~24. NR\_ext\_to\_71GHz~~ | ~~24-4d~~ | ~~Multiple PDSCH scheduling by single DCI for 480 kHz~~ | ~~1. Multi- PDSCH scheduling by single DCI for the operation with 480 kHz SCS~~  ~~2. HARQ enhancements~~ |  |  |  |  |  |  |  |  |  | ~~Optional with capability signalling~~ |
| ~~24. NR\_ext\_to\_71GHz~~ | ~~24-4e~~ | ~~Multiple PUSCH scheduling by single DCI for 480 kHz~~ | ~~1. Multi-PUSCH scheduling by single DCI for the operation with 480 kHz SCS~~ |  |  |  |  |  |  |  |  |  | ~~Optional with capability signalling~~ |
| 24. NR\_ext\_to\_71GHz | 24-4f | Enhanced PDCCH monitoring for 480KHz | Multiple-slot PDCCH monitoring for 480KHz with X=2/4 slots |  |  |  |  |  |  |  |  |  | Optional with capability signalling |

* Note: basic groups may be merged once they are determined

**Proposal: Adopt the following changes highlighted in chromatic fonts, including the definitions of new FGs, while keeping the yellow highlighting as shown**

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| 24. NR\_ext\_to\_71GHz | 24-5 | 960KHz SCS support for DL | ~~1. 960KHz SCS for UL data and control channels and reference signal transmission in FR202~~  2. 960KHz SCS for DL data and control channels, SSB, and reference signal reception in FR2-2 for non-initial access  ~~3. 960KHz for SSB monitoring~~  4. Multiple-slot PDCCH monitoring for 960KHz with X=~~[~~4/8~~]~~ slots ~~[FFS: Component description to be updated once further details of multi-slot monitoring capability are known, e.g., definition of Y]~~  ~~5. PRACH with 960KHz and length 139~~  ~~FFS: 6. Support multi-RB PUCCH format 0/1/4 for 960 kHz~~  ~~FFS: 7. Multi-PUSCH/PDSCH scheduling by single DCI for the operation with 960 kHz SCS~~  5. Multi-PDSCH scheduling by single DCI for the operation with 960 kHz SCS  6. HARQ enhancements | 24-1 | Yes |  |  | [Per UE/band] |  |  |  | ~~From WID~~   * ~~In addition to 120kHz SCS, specify new SCS, 480kHz and 960kHz, and define maximum bandwidth(s), for operation in this frequency range for data and control channels and reference signals, only NCP supported.~~   ~~[Agreement:~~  ~~A UE supporting 960 kHz SCS supports multi-slot PDCCH monitoring for 960 kHz SCS~~  ~~Agreement:~~  ~~Do not support PRACH length L=571, 1151 for 960kHz PRACH and at least L =1151 for 480kHz PRACH]~~  ~~Note:~~  ~~• Resolve the issues of wideband PRACH, multi-RB PUCCH format 0/1/4, and multi-PUSCH/PDSCH scheduling by single DCI, i.e., whether to have components of a single FG or separate FGs, for 120 kHz first, then use the same structure for 480 kHz~~  ~~• Resolve the issue of having separate capabilities for DL and UL (data and control channels as well as reference signals) for 120 kHz first, then use the same structure for 480 kHz~~ | Optional with capability signalling |
| 24. NR\_ext\_to\_71GHz | 24-5a | 960KHz SCS support for UL | 1. PRACH with 960KHz and length 139  2. 960KHz SCS for UL data and control channels and reference signal transmission in FR2-2  3. Multi-PUSCH scheduling by single DCI for the operation with 960 kHz SCS |  |  |  |  |  |  |  |  |  | Optional with capability signalling |
| 24. NR\_ext\_to\_71GHz | 24-5c | Multi-RB PUCCH format 0/1/4 for 960 kHz [with/without shared spectrum channel access] | Support multi-RB PUCCH format 0/1/4 for 960 kHz |  |  |  |  |  |  |  |  |  | Optional with capability signalling |
| ~~24. NR\_ext\_to\_71GHz~~ | ~~24-5d~~ | ~~Multiple PDSCH scheduling by single DCI for 960 kHz~~ | ~~1. Multi-PDSCH scheduling by single DCI for the operation with 960 kHz SCS~~  ~~2. HARQ enhancements~~ |  |  |  |  |  |  |  |  |  | ~~Optional with capability signalling~~ |
| ~~24. NR\_ext\_to\_71GHz~~ | ~~24-5e~~ | ~~Multiple PUSCH scheduling by single DCI for 960 kHz~~ | ~~1. Multi-PUSCH scheduling by single DCI for the operation with 960 kHz SCS~~ |  |  |  |  |  |  |  |  |  | ~~Optional with capability signalling~~ |
| 24. NR\_ext\_to\_71GHz | 24-5f | Enhanced PDCCH monitoring for 960KHz | Multiple-slot PDCCH monitoring for 960KHz with X=2/4 slots |  |  |  |  |  |  |  |  |  | Optional with capability signalling |

* Note: basic groups may be merged once they are determined

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

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| 24. NR\_ext\_to\_71GHz | 24-6 | Support Type 1 channel access procedure in uplink ~~channel access procedure~~ for FR2-2 unlicensed operation | 1. ~~Cat 3 [or Cat 4] LBT~~ Support Type 1 channel access procedure ~~[(not agreed yet if CW is supported, so it can be either Cat 3 or Cat 4 LBT for now. Will update when we have agreement)]~~ 2. [Support LBT performed per carrier/BWP bandwidth] | 24-1 |  |  |  | ~~[~~per band~~]~~ |  |  |  |  | Optional with capability signalling  [A UE that supports FR2-2 must indicate this FG is supported when required by regulation] |
| 24. NR\_ext\_to\_71GHz | 24-7 | ~~Cat 2 LBT~~ Support Type 2 channel access procedure in ~~for~~ uplink ~~channel access procedure~~ for FR2-2 unlicensed operation | 1. Support Type 2 channel access procedure ~~Cat 2 LBT~~ | 24-1~~[~~, 24-6~~]~~ |  |  |  | ~~[~~per band~~]~~ |  |  |  |  | Optional with capability signalling  [A UE that supports FR2-2 must indicate this FG is supported when required by regulation] |

**Proposed Agreement:**

* **Confirm FGs 24-8 and 24-9 as separate rows**
* **Proposal: Adopt the following changes highlighted in chromatic fonts, while keeping the yellow highlighting as shown**
* **Discuss FR1 and FR2-1 support in NR NTN as part of FG 26-5**

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| 24. NR\_ext\_to\_71GHz | 24-8 | 32 DL HARQ processes ~~[~~for FR 2-2~~]~~ | Support 32 HARQ processes in DL ~~[~~for 480/960 kHz~~]~~ |  |  |  |  | [Per UE/per FSPC/per band] |  |  |  | FFS: 120 kHz | Optional with capability signalling |
| 24. NR\_ext\_to\_71GHz | 24-9 | 32 UL HARQ processes ~~[~~for FR 2-2~~]~~ | Support 32 HARQ processes in UL ~~[~~for 480/960 kHz~~]~~ |  |  |  |  | [Per UE/per FSPC/per band] |  |  |  | FFS: 120 kHz | Optional with capability signalling |

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

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| 24. NR\_ext\_to\_71GHz | 24-10 | Additional beam switching time delay | Supported additional beam switching time delay d for 480 kHz SCS |  |  |  |  |  |  |  |  | Candidate value set: 56 or 112 symbols | Optional with capability signalling |

[R1-2110833](file:///C:\Users\youns\OneDrive\Documents\3GPP\RAN1%20tdocs\TSGR1_107-e\Docs\R1-2110833.zip) Rel-17 UE features for extension to 71 GHz Huawei, HiSilicon

[R1-2111051](file:///C:\Users\youns\OneDrive\Documents\3GPP\RAN1%20tdocs\TSGR1_107-e\Docs\R1-2111051.zip) Discussions on UE features for NR operation from 52.6GHz to 71GHz vivo

[R1-2111081](file:///C:\Users\youns\OneDrive\Documents\3GPP\RAN1%20tdocs\TSGR1_107-e\Docs\R1-2111081.zip) Discussion on UE features for 52.6 to 71GHz ZTE, Sanechips

[R1-2111153](file:///C:\Users\youns\OneDrive\Documents\3GPP\RAN1%20tdocs\TSGR1_107-e\Docs\R1-2111153.zip) On UE features for supporting NR from 52.6 GHz to 71 GHz Nokia, Nokia Shanghai Bell

[R1-2111313](file:///C:\Users\youns\OneDrive\Documents\3GPP\RAN1%20tdocs\TSGR1_107-e\Docs\R1-2111313.zip) Discussion on UE features for FR2-2 OPPO

[R1-2111471](file:///C:\Users\youns\OneDrive\Documents\3GPP\RAN1%20tdocs\TSGR1_107-e\Docs\R1-2111471.zip) UE features for extending current NR operation to 71 GHz Ericsson

[R1-2111526](file:///C:\Users\youns\OneDrive\Documents\3GPP\RAN1%20tdocs\TSGR1_107-e\Docs\R1-2111526.zip) Discussion on UE capability for extending NR up to 71 GHz Intel Corporation

[R1-2111770](file:///C:\Users\youns\OneDrive\Documents\3GPP\RAN1%20tdocs\TSGR1_107-e\Docs\R1-2111770.zip) UE features for supporting NR from 52.6 GHz to 71 GHz Samsung

R1-2111808 Summary of UE features for supporting NR from 52.6 GHz to 71 GHz Moderator (AT&T)

[R1-2111907](file:///C:\Users\youns\OneDrive\Documents\3GPP\RAN1%20tdocs\TSGR1_107-e\Docs\R1-2111907.zip) Views on Rel-17 Above 52.6 GHz  UE features Apple

[R1-2112070](file:///C:\Users\youns\OneDrive\Documents\3GPP\RAN1%20tdocs\TSGR1_107-e\Docs\R1-2112070.zip) Discussion on UE features for NR above 52.6 GHz LG Electronics

[R1-2112133](file:///C:\Users\youns\OneDrive\Documents\3GPP\RAN1%20tdocs\TSGR1_107-e\Docs\R1-2112133.zip) Views on UE features for supporting NR from 52.6 GHz to 71 GHz NTT DOCOMO, INC.

R1-2112247 UE features for NR from 52.6 Ghz to 71 Ghz Qualcomm Incorporated

Withdrawn

[R1-2112304](file:///C:\Users\youns\OneDrive\Documents\3GPP\RAN1%20tdocs\TSGR1_107-e\Docs\R1-2112304.zip) Views on UE features for supporting NR from 52.6 GHz to 71 GHz MediaTek Inc.