**3GPP TSG-RAN WG4 Meeting # 99-e R4-21XXXX**

**Electronic Meeting, 19th – 27th May, 2021**

**Agenda item:** 9.15.1, 9.15.2, 9.15.3, 9.15.7

**Source:** Moderator (Intel Corporation)

**Title:** Email discussion summary for [99-e][145] NR\_ext\_to\_71GHz\_Part\_1

**Document for:** Information

# Introduction

*Briefly introduce background, the scope of this email discussion (e.g. list of treated agenda items) and provide some guidelines for email discussion if necessary.*

*List of candidate target of email discussion for 1st round and 2nd round*

* 1st round: RRM work plan, Max CBW, SU, FR definition
* 2nd round: TBA

# Topic #1: Work plan (AI 9.15.1)

*Main technical topic overview. The structure can be done based on sub-agenda basis.*

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2110950**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2110950.zip) | Intel | ***Proposal #1: RAN4 to agree on the RRM core part of the workplan as presented in the above in this contribution.*** |

## Open issues summary

*Before e-Meeting, moderators shall summarize list of open issues, candidate options and possible WF (if applicable) based on companies’ contributions.*

*Moderator: In last RAN4#98Bis-e meeting, RF work plan was approved. In this meeting, we aim to approve on RRM work plan in 60 GHz NR.*

## Companies views’ collection for 1st round

### Open issues

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX |  |

### CRs/TPs comments collection

*For close-to-finalize WIs and maintenance work, comments collections can be arranged for TPs and CRs. For ongoing WIs, suggest to focus on open issues discussion on 1st round.*

|  |  |
| --- | --- |
| **CR/TP number** | **Comments collection** |
| XXX | Company A |
| Company B |
|  |
| YYY | Company A |
| Company B |
|  |

## Summary for 1st round

### Open issues

*Moderator tries to summarize discussion status for 1st round, list all the identified open issues and tentative agreements or candidate options and suggestion for 2nd round i.e. WF assignment.*

|  |  |
| --- | --- |
|  | **Status summary**  |
| **Sub-topic #1** | *Tentative agreements:**Candidate options:**Recommendations for 2nd round:* |

### CRs/TPs

*Moderator tries to summarize discussion status for 1st round and provides recommendation on CRs/TPs Status update*

*Note: The tdoc decisions shall be provided in Section 3 and this table is optional in case moderators would like to provide additional information.*

|  |  |
| --- | --- |
| **CR/TP number** | **CRs/TPs Status update recommendation**  |
| XXX | *Based on 1st round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |

## Discussion on 2nd round (if applicable)

# Topic #2: Band plans and regulatory requirements (AI 9.15.2)

*Main technical topic overview. The structure can be done based on sub-agenda basis.*

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2109433**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2109433.zip) | Apple | Proposal: Consider presented regulatory parameters in further technical discussions for the 52.6-71GHz frequency range. |
| [**R4-2109696**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2109696.zip) | vivo | **Proposal 1:** At least for unlicensed band definition, no need to exclude ITS spectrum.**Proposal 2:** Need further study whether to exclude ITS spectrum from licensed band definition.**Observation 1:** Band number definition for frequency range 52.6 ~ 71 GHz depends on the frequency range designation.**Proposal 3:** Consider the following options for 60GHz band numbering:* Option 1: Reuse the reserved band numbers in FR2 for 60GHz band definition.
* Option 2: Allocate new band numbers from 513~1024 for 60GHz band definition.
 |
| [**R4-2110684**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2110684.zip) | Nokia, Nokia Shanghai Bell | **Proposal 1:** Introduce an unlicensed band in the 57 to 71 GHz range as given in the TP.**Proposal 2:** Use harmonized standard EN 303 753 with priority over EN 303 722 where applicable.**Proposal 3:** Postpone introducing a licensed band to specification until spectrum availability becomes clear enough. |
| [**R4-2111058**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2111058.zip) | Huawei | **Proposal 1**: introduce two new FR2 sub-ranges: FR2.1 (24250 MHz – 52600 MHz) and FR2.2 (52600 MHz – 71000 MHz) under the existing FR2 term.**Proposal 2**: adopt FR2.2 bands numbering scheme with separate numbering range (as compared to the existing FR2 bands numbers).**Proposal 3**: out of the options analysed, adopt option 3 with the n513 as the first FR2.2 band number, which allows easy identification of FR2.2 bands belonging to 52.6 – 71 GHz range. **Proposal 4**: adopt separate tables for FR2.1 and FR2.2 Transmission bandwidth configurations. **Proposal 5**: adopt separate tables for FR2.1 and FR2.2 minimum guardband configurations. **Proposal 6**: Reuse the “BS type 2-O” terminology for the NR operation in 52.6 – 71 GHz range.  |
| [**R4-2111059**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2111059.zip) | Huawei | Draft CR to TS 38.104 based on R4-2111058 |

## Open issues summary

*Before e-Meeting, moderators shall summarize list of open issues, candidate options and possible WF (if applicable) based on companies’ contributions.*

### Sub-topic 2.2.1 Band numbering

*Open issues and candidate options before e-meeting:*

**Issue 2.2.1: Band numbering**

* Proposals (vivo, Nokia)
	+ Option 1: Reuse the reserved band numbers in FR2 for 60 GHz band definition
	+ Option 2: Allocate new band numbers from 513 – 1024 for 60 GHz band definition
* Recommended WF
	+ TBA

### Sub-topic 2.2.2 Regulatory requirement

*Open issues and candidate options before e-meeting:*

**Issue 2.2.2-1: Regulatory for Unlicensed band**

* Proposals
	+ Option 1: Use harmonized standard EN 303 753 with priority over EN 303 722 where applicable (Nokia)
* Recommended WF
	+ TBA

**Issue 2.2.2-2: Regulatory for Licensed band**

* Proposals
	+ Option 1: Postpone introducing a licensed band to specification until spectrum availability becomes clear enough (Nokia)
* Recommended WF
	+ TBA

### Sub-topic 2.2.3 ITS band

*Open issues and candidate options before e-meeting:*

**Issue 2.2.3-1: ITS band for unlicensed band**

* Proposals
	+ Option 1: No need to exclude ITS band for unlicensed band (vivo)
* Recommended WF
	+ TBA

**Issue 2.2.3-2: ITS band for licensed band**

* Proposals
	+ Option 1: Further study is required for licensed band (vivo)
* Recommended WF
	+ TBA

## Companies views’ collection for 1st round

### Open issues

**Issue 2.2.1 (Band numbering)**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX |  |

**Issue 2.2.2-1: Regulatory for Unlicensed band**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX |  |

**Issue 2.2.2-2: Regulatory for Licensed band**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX |  |

**Issue 2.2.3-1: ITS band for unlicensed band**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX |  |

**Issue 2.2.3-2: ITS band for licensed band**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX |  |

### CRs/TPs comments collection

*Major close to finalize WIs and Rel-15 maintenance, comments collections can be arranged for TPs and CRs. For Rel-16 on-going WIs, suggest to focus on open issues discussion on 1st round.*

|  |  |
| --- | --- |
| **CR/TP number** | **Comments collection** |
| XXX | Company A |
| Company B |
|  |
| YYY | Company A |
| Company B |
|  |

## Summary for 1st round

### Open issues

*Moderator tries to summarize discussion status for 1st round, list all the identified open issues and tentative agreements or candidate options and suggestion for 2nd round i.e. WF assignment.*

|  |  |
| --- | --- |
|  | **Status summary**  |
| **Sub-topic#1** | *Tentative agreements:**Candidate options:**Recommendations for 2nd round:* |

### CRs/TPs

*Moderator tries to summarize discussion status for 1st round and provided recommendation on CRs/TPs Status update suggestion*

|  |  |
| --- | --- |
| **CR/TP number** | **CRs/TPs Status update recommendation**  |
| XXX | *Based on 1st round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |

## Discussion on 2nd round (if applicable)

*Moderator can provide summary of 2nd round here. Note that recommended decisions on tdocs should be provided in the section titled ”Recommendations for Tdocs”.*

# Topic #3: System Parameters (AI 9.15.3)

*Main technical topic overview. The structure can be done based on sub-agenda basis.*

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2109014**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2109014.zip) | CATT | **Proposal 1:** 264 RB is defined as the maximum RB number for 400 MHz/120 kHz and 1600 MHz/480 kHz.**Proposal 2:** 2000 MHz is defined as the maximum CBW for both licensed and unlicensed bands. 166 RB is the maximum RB number for 960 KHz SCS/2000 MHz CBW.**Proposal 3:** Current FR2 NR-ARFCN and global channel raster are reused by 52.6-71 GHz.**Proposal 4:** The channelization for unlicensed bands when LBT is not needed are designed using the following high level guidelines,* + - * The channelization is designed as fixed channelization.
			* The granularity of the base channelization entries for 120 KHz SCS is 50 MHz. The granularity for 480 kHz SCS and 960 kHz SCS is 200 MHz or 100 MHz.
			* Several shifts to the base channelization entries are used to support the possible carrier aggregations. The shifts exist in both left side and right side.
			* The number of the shifts depends on the number of carrier aggregation types. Each base entry and the shifts to that base position can be looked as a group of channel raster entries.
			* There’s one sync raster entry for each channel raster group. Which channel raster is used as sync raster entry FFS.

**Proposal 5:** Channel raster for licensed band can reuse the no LBT channelization for unlicensed bands with the corresponding frequency range.**Proposal 6:** When LBT is necessary and the maximum CBW is 2000 MHz for unlicensed bands, the channelization entries are designed as the overlap of no LBT channelization and the candidates in Table 3.**Proposal 7:** The channelization is designed to support all of the possible intra-band CA.**Proposal 8:** CA RF requirement discussion can be put in low priority or one carrier aggregation can be an example in R17. |
| [**R4-2109325**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2109325.zip) | Apple | **Proposal 1:** Option 1 “2000MHz for both licensed and unlicensed operations” or option 3 “2160MHz for unlicensed operation and 2000MHz for licensed operation” is preferred.**Proposal 2:** it is proposed that UE support of the following max. CBW for each SCS is optional:* 120kHz: 400MHz
* 480kHz: 1600MHz
* 960kHz: 2000MHz and/or 2160MHz

**Proposal 3:** For licensed band, there is no need to align with IEEE 802.11ad/ay channels. For channel placement flexibility, floating raster can be used.**Proposal 4:** For unlicensed band, align with IEEE 802.11ad/ay channels wherever applicable. In addition, no NR channel overlaps with two IEEE 802.11ad/ay channels. |
| [**R4-2109475**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2109475.zip) | Qualcomm Incorporated | **CBW/CA****Observation 1:** Intraband contiguous CA is required to support beyond 400 MHz for 120 kHz SCS.**Proposal 1:** RAN4 to develop uplink and downlink intraband contiguous CA for 120 kHz SCS in order to support > 400MHz aggregated bandwidth.**Proposal 2:** For 120kHz SCS flexibility use 100, 200, and 400 MHz channel bandwidths.**Proposal 3:** For 120kHz SCS support intraband contiguous CA with at least 1200 MHz aggregated bandwidth. The maximum number of CCs is FFS.**Proposal 4:** For 480kHz SCS flexibility use 200, 400, 800, and 1600 MHz channel bandwidths.**Proposal 5:** Specify intraband contiguous CA for 480kHz SCS for 200, 400, and 800 MHz channel bandwidths.**Proposal 6:** For 960kHz SCS flexibility use 400, 800, 1600, and 2160 MHz channel bandwidths.**Proposal 7:** Specify intraband contiguous CA for 960kHz SCS using 400 and 800 MHz channel bandwidths.**Channel raster**Figure 2-1 shows 2160 MHz split into channels. The channelization is as follows:* The center of the diagram is centered on one of the 802.11 ad/ay channels
* The diagram is 2160 MHz wide
* 30 MHz guard band on either edge
* NR channel assignments are aligned across all SCS values
* 480 and 960 SCS don’t use the higher 100 MHz
* Up 2100 MHz of the 2160 MHz channel can be used

Figure 2-2 shows channelization for a 2000 MHz NR channel MHz split into channels. The channelization is as follows:* The center of the diagram is centered on one of the 802.11 ad/ay channels
* The diagram is 2160 MHz wide, the NR channel is 2000 MHz wide
* 80 MHz guard band on either edge
* NR channel assignments are aligned across all SCS values
* Up 2000 MHz of the 2160 MHz channel can be used
 |
| [**R4-2109479**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2109479.zip) | CMCC | **CBW****Proposal 1:** For 960KHz SCS maximum channel bandwidth, there is no need to differentiate licensed and unlicensed operations.**Proposal 2:** For 960KHz SCS maximum channel bandwidth, 2000MHz for both licensed and unlicensed operations**CA****Proposal 3:** CA is supported for CBW<2000MHz to support 2000MHz or larger bandwidth for UE not supporting 960KHz SCS.**Proposal 4:** CA is supported for CBW>=2000MHz to support larger bandwidth for UE supporting 960KHz SCS |
| [**R4-2109698**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2109698.zip) | vivo | **Channelization****Proposal 1:** Do not consider to align with IEEE channels.**Proposal 2:** Define 100MHz as the granularity bandwidth with fixed channelization for both licensed bands and unlicensed bands for the frequency range from 52.6GHz to 71GHz.**Channel raster****Observation 1:** With 100MHz fixed channelization, the granularity of two adjacent channel raster should 99.96/100.02MHz considering multiple times of 60kHz.**Sync raster****Observation 2:** With the fixed channelization, the number of sync raster points are 81 for licensed band and 235 for unlicensed band, which is well under the restriction of sync raster number 400 for a band. |
| [**R4-2110001**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2110001.zip) | Samsung | **Proposal 1:** it is suggested to align maximum channel bandwidth design for unlicensed and unlicensed operation as much as possible.**Proposal 2:** Design commonality with exiting NR specification and implementation should be considered to determine the maximum channel bandwidth@960kHz SCS.**Observation 1:** No regulation body provide any definition on channel bandwidth or channelization.**Observation 2:** LBT is requested only mentioned in EU and Japan regulation.**Observation 3:** even according to IEEE recommendation, there is no need to align channelization for co-existence purpose.**Observation 4:** The conclusion is that no special co-existence needs to be considered for maximum channel bandwidth case**Observation 5:** SU@maximum channel bandwidth should be the key point to be considered for compatibility rather than bandwidth itself.**Proposal 3:** it’s suggested to agree 2GHz as maximum channel bandwidth supported by 960 kHz SCS.  |
| [**R4-2110023**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2110023.zip) | Xiaomi | **Observation 1:** Spectrum sharing mechanism is defined in EU regulation as beamforming instead of LBT mechanism.**Observation 2:** Contention based Access Period is used in IEEE 802.11ad technology.**Observation 3:** Sub-channelization as 1.08GHz is already defined by IEEE.**Proposal 1:** To better co-exist with IEEE 802.11ad, it is proposed to support sub-channelization for 2.16 GHz channels to facilitate smooth coexistence for narrowband operation in unlicensed spectrum.**Observation 4:** Min SCS as 120 kHz and min channel bandwidth as 100MHz which is the same as FR2 hence more flexible spectrum usage is assumed.**Proposal 2:** To define NR floating raster for licensed spectrum. |
| [**R4-2110171**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2110171.zip) | Intel Corporation | **Channel bandwidths****Observation #1:** Introducing too many channel bandwidths creates excessive channel bandwidths combinations.**Proposal #1:** 2000 MHz for both licensed and unlicensed operations for 960 kHz SCS. **Proposal #2:** Minimize number of supported channel bandwidths

|  |  |  |  |
| --- | --- | --- | --- |
| **Subcarrier spacing [kHz]** | **Minimum bandwidths [MHz]**  | **Other bandwidths between min. and max. CBW** | **Maximum bandwidths [MHz]**  |
| 120 | 100  | 200 | 400  |
| 480 | 400 | 800, 1200 | 1600 |
| 960 | 400 | 500, 800, 1000, 1600 | 2000 |

Table 1. Summary of proposed numerologies and channel bandwidths**Spectrum utilization****Proposal #3:** Target spectrum utilization is 90 % across all supported channel bandwidths

|  |  |  |
| --- | --- | --- |
|  |  | Channel Bandwidth (MHz)/PRBs |
|  |  | 100 | 200 | 400 | 500 | 800 | 1000 | 1200 | 1600 | 2000 |
| SCS (kHz) | 120 | 63 | 125 | 250 | - | - | - | - | - | - |
| 480 | - | - | 63 | - | 125 | - | 188 | 250 | - |
| 960 | - | - | 31 | 39 | 63 | 78 | - | 125 | 156 |

Table 2. Proposed number of PRBs which meet 90 % spectrum utilization**Operation scenario****Proposal #4:** RAN4 prioritizes on standalone mode operation. |
| [**R4-2110483**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2110483.zip) | Ericsson | **Channelization****Observation 1:** UE SSB search complexity using “floating” raster is no longer a challenge given only 120 kHz SCS is supported for initial access.**Observation 2:** Raster design currently extends up to 100 GHz and therefore already includes frequencies up to 71 GHz.**Observation 3:** Channel flexibility is beneficial for harmonizing licensed and unlicensed as well as any potential coexistence with other technologies.**Spectrum Utilization****Observation 4:** There are many factors influencing the spectrum utilization such as larger array size at lower physical size, ACS/ACLR and occupied bandwidth requirements, higher modulation spectra for higher SCS and coverage considerations to maintain high power efficiency due to coverage in particular for UE.**Observation 5:** The re-use of FR2 spectrum utilization level is not optimum for NR in 52.6-71 GHz and spectrum utilization ~85% given further analysis around feasibility and efficiency aspects should be considered.**Proposal 1:** RAN4 to adopt “floating” channelization design, as in Rel-15.**Proposal 2:** RAN4 should consider reducing UE SSB search complexity if possible, such as where every 2nd GSCN is valid (e.g. 17.28 MHz vs. 34.56 MHz sync raster granularity). |
| [**R4-2110600**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2110600.zip) | ZTE Corporation | **CBW****Proposal 1:** It is not necessary to align NR channelization with IEEE 802.11ad channelization from coexistence perspective;**Proposal 2:** for 960kHz SCS, propose maximum CBW supported as 2000MHz;**Channel raster****Proposal 3:** 120kHz channel raster should be applied for licensed operation of 52.6-71GHz;**Sync raster****Proposal 4:** postpone the sync raster discussion until mini BW, SU and SSB SCS has been agreed;**SU****Proposal 5:** postpone the discussion of SU for 60GHz until there are clear agreement on emission mask and in-band emission requirements. |
| [**R4-2110685**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2110685.zip) | Nokia, Nokia Shanghai Bell | **CBW****Proposal 1:** Support channelization according to 2.16 GHz CBW, which is preferred from coexistence point of view.**Proposal 2:** Support sub-channelization for 2.16 GHz channels to facilitate smooth coexistence for narrowband operation.**Proposal 3:** Define Max. CBW for 960 kHz SCS to 2160 MHz.**CA****Proposal 4:** Support CA within a 2.16 GHz channel, and between 2.16 GHz channels**Proposal 5:** Consider n x 400 MHz, n= [2, 3, 4, 5] as the supported channel BW options for​ CA operation within a 2.16 GHz channel**Observation 1:** From performance point of view wider channel bandwidths are more favorable compared to CA configurations of many CCs.**Proposal 6:** Enable n x 100 MHz CA operation. |
| [**R4-2110992**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2110992.zip) | LG Electronics Finland | **Proposal 1:** Maximum channel bandwidth and SU for 960kHz SCS

|  |  |  |
| --- | --- | --- |
|  | **Licensed operation in 52.6-71GHz range** | **Un-licensed operation in 57-71GHz range** |
| 960kHz SCS | 2000MHz (166RBs, SU 95.6%) | 2160MHz (170RBs, SU 90.7%) |

 |
| [**R4-2111170**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2111170.zip) | MediaTek Inc. | The following **observations** were made in this document for channelization in the unlicensed band:* **Observation 1:** Alignment to IEEE seems only directly relevant in case we agree to define 2.16GHz channels, and only applicable to the channel raster.
* **Observation 2:** It seems appropriate to minimum use ΔFRaster of 120 kHz in the 57-71GHz band, in alignment with existing FR2 specifications.
* **Observation 3:** The NR-U type of synchronization raster approach with approx. 100MHz granularity enables the best cell search performance in terms of search time and power consumption.
* **Observation 4:** For explicitly specified GSCNs (NR-U type of approach), reusing the current baseline synchronization raster to select GSCN locations does not lead to any reduction in system efficiency compared to a raster optimised for this band.
* **Observation 5:** Flexibility in terms of channel raster for initial access should only be introduced where it is really justified, as unnecessary flexibility may add unnecessary cost and effort for NR-U deployments for 57-71GHz.
* **Observation 6:** A synchronization raster with 100MHz approximate granularity and SSB of 120kHz SCS can still allow some “floating” of NR-ARFCN locations around the SSB, especially so for higher channel bandwidths. This could be useful to consider if different countries/regions assign different band plans/requirements.
* **Observation 7:** Specification of additional SSB with higher SCS for initial access would increase cell search time and power consumption for the UE. Also, in the case of a fully-floating channel raster, it would require more granular GSCN locations for a given level of required channel raster flexibility for 100MHz minimum channel bandwidth.

Based on those observations, the following **proposals** are made:1. For unlicensed band operation, specify a Synchronisation Raster with method based on NR-U bands, with explicitly defined GCSN locations spaced approximately 100MHz apart across the band. The exact locations should be further discussed, but are proposed to be a subset of the existing 17.28MHz-spaced GCSN locations for FR2.
2. For unlicensed band operation, specify a Channel Raster with a fixed channelization for all channel bandwidths (similar to NR-U).
	1. If a 2.16GHz channel bandwidth is defined, then the selected NR-ARFCNs for those channels shall align closely to the IEEE 802.11ad channelization.

If identified as needed for unlicensed band operation in specific regions/countries, consider further the approach of adding some more flexibility in the channel raster, but limited by the proposed approx. 100MHz-spaced synchronisation raster. This type of approach could also be useful to consider for licensed bands at a later stage. |
| [**R4-2109697**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2109697.zip) | vivo | **Max CBW****Proposal 1:** To define 2000MHz for both licensed and unlicensed operations.**Intermediate CBWs****Proposal 2:** It is proposed to support these intermediate channel bandwidths for each SCS.* For 120kHz SCS, introduce 200MHz as the intermediate channel bandwidth;
* For 480kHz SCS, introduce 800MHz, 1200MHz as the intermediate channel bandwidth;
* For 960kHz SCS, introduce 800MHz, 1200MHz, 1600MHz as the intermediate channel bandwidths.

**SU****Proposal 3：**To reuse 95% Spectrum utilization as a starting point for 60GHz band.**CA****Proposal 4:** To enable intra-band CA for supporting aggregated channel bandwidths larger than 2000MHz. |
| [**R4-2110484**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2110484.zip) | Ericsson | **Max CBW****Proposal:** For the maximum bandwidth for 960 kHz SCS, support 2160 MHz. |

## Open issues summary

*Before e-Meeting, moderators shall summarize list of open issues, candidate options and possible WF (if applicable) based on companies’ contributions.*

### Sub-topic 3.2.1 Channel BWs

*Open issues and candidate options before e-meeting:*

**Issue 3.2.1-1: Max CBW for 960 kHz**

* Proposals
	+ Option 1: 2000 MHz for both licensed and unlicensed bands (CATT, Apple, QC, CMCC, vivo, Samsung, Intel, ZTE)
	+ Option 2: 2160 MHz for both licensed and unlicensed bands (Ericsson)
	+ Option 3: 2160 MHz and 2000 MHz for both licensed and unlicensed (QC, Xiaomi, Nokia)
	+ Option 4: 2160 MHz for unlicensed and 2000 MHz for licensed (Apple, LGE)
	+ Option 5: Make a decision for unlicensed operation and FFS for licensed operation
* Recommended WF
	+ TBA

*Sub-topic description:*

*Open issues and candidate options before e-meeting:*

**Issue 3.2.1-2: Intermediate CBWs between Max and Min CBWs**

* Proposals

|  |  |  |
| --- | --- | --- |
|  |  | Channel Bandwidth (MHz) |
|  |  | 100 | 200 | 400 | 500 | 800 | 1000 | 1200 | 1600 | 2000/2160 |
| SCS (kHz) | 120 | MIN | QCVivoIntelZTE | MAX | - | - | - | - | - | - |
| 480 | - | - | MIN |  | QCvivo |  | VivoIntelZTE | MAX | - |
| 960 | - | - | MIN | Intel | QCVivoZTEIntel | Intel | VivoZTE | QCIntel | MAX |

* Recommended WF
	+ TBA

### Sub-topic 3.2.2 Channelization related

*Sub-topic description:*

*Open issues and candidate options before e-meeting:*

**Issue 3.2.2-1: Channelization**

* Proposals
	+ Option 1: Harmonize channelization between licensed and unlicensed bands:
		- Option 1A: Align with IEEE with fixed channelization (QC)
		- Option 1B: Do not align with IEEE with fixed channelization (vivo)
		- Option 1C: Do not align with IEEE and floating channelization (Ericsson)
	+ Option 2: Separate channelization
		- For licensed:
			* Option 2A: NR based floating raster (No 802.11ad/ay alignment) (Apple, Xiaomi)
		- For unlicensed:
			* Option 2B: Align with 802.11ad/ay and no NR channel overlaps with two IEEE channels (Apple, Xiaomi)
* Recommended WF
	+ TBA

**Issue 3.2.2-2: Channel raster**

* Proposals
	+ Option 1: Reuse FR2 NR NR-ARFCN for 57 – 71 GHz (CATT)
	+ Option 2: 120 kHz channel raster (ZTE, MTK)
* Recommended WF
	+ TBA

**Issue 3.2.2-3: Sync raster**

* Proposals
	+ Option 1: Postpone until min BW, SU and SSB SCS are agreed (ZTE)
	+ Option 2: Explicitly define GSCN spaced approximately 100 MHz (MTK)
* Recommended WF
	+ TBA

### Sub-topic 3.2.3 Spectrum Utilization

*Sub-topic description:*

*Open issues and candidate options before e-meeting:*

**Issue 3.2.3-1: PRB (SU) for max CBW**

* Proposals
* PRB (SU) for max CBW
	+ 400MHz with 120 kHz SCS
		- 264: 95% (CATT, vivo)
		- 250: 90% (Intel)
	+ 1600MHz with 480 kHz SCS
		- 264: 95% (CATT, vivo)
		- 250: 90% (Intel)
	+ 2000 MHz with 960 kHz SCS
		- 166: 95% (CATT, vivo, LGE)
		- 156: 90% (Intel)
	+ 2160 MHz with 960 kHz SCS
		- 170: 90.7% (LGE)
* Other
	+ Postpone SU decision after sufficient discussion on RF requirements (Apple, ZTE)
	+ Consider a SU of ~87% such as other systems e.g. IEEE (Ericsson)
* Recommended WF
	+ TBA

### Sub-topic 3.2.4 Carrier Aggregation

*Sub-topic description:*

*Open issues and candidate options before e-meeting:*

**Issue 3.2.4-1: Intra-band contiguous CA within 2/2.16 GHz**

* Proposals
	+ Option 1: n x 400 MHz, n = [2, 3, 4, 5] (Nokia)
	+ Option 2: n x 100 MHz, n = ?? (Nokia)\*

*\*Moderator’s note: It’s not clear which one is Nokia’s position between option 1 and option 2. Nokia might want to clarify this.*

* Recommended WF
	+ TBA

**Issue 3.2.4-2: CA equal to or larger than 2/2.16 GHz**

* Proposals
	+ Option 1: Support CA ≥2/2.16 GHz (CMCC, vivo, Nokia)
* Recommended WF
	+ TBA

### Sub-topic 3.2.5 Operation Scenario

*Sub-topic description:*

*Open issues and candidate options before e-meeting:*

**Issue 3.2.5: Operation scenario in 60 GHz NR**

* Proposals
	+ Option 1: Prioritize on standalone mode operation (CATT, Intel)
* Recommended WF
	+ TBA

## Companies views’ collection for 1st round

### Open issues

**Issue 3.2.1-1: Max CBW for 960 kHz**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX |  |

**Issue 3.2.1-2: Intermediate CBWs between Max and Min CBWs**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX |  |

**Issue 3.2.2-1: Channelization**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX |  |

**Issue 3.2.2-2: Channel raster**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX |  |

**Issue 3.2.2-3: Sync raster**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX |  |

**Issue 3.2.3-1: SU for max CBW**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX |  |

**Issue 3.2.4-1: Intra-band contiguous CA within 2/2.16 GHz**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX |  |

**Issue 3.2.4-2: CA equal to or larger than 2/2.16 GHz**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX |  |

**Issue 3.2.5: Operation scenario in 60 GHz NR**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX |  |

### CRs/TPs comments collection

*Major close to finalize WIs and Rel-15 maintenance, comments collections can be arranged for TPs and CRs. For Rel-16 on-going WIs, suggest to focus on open issues discussion on 1st round.*

|  |  |
| --- | --- |
| **CR/TP number** | **Comments collection** |
| XXX | Company A |
| Company B |
|  |
| YYY | Company A |
| Company B |
|  |

## Summary for 1st round

### Open issues

*Moderator tries to summarize discussion status for 1st round, list all the identified open issues and tentative agreements or candidate options and suggestion for 2nd round i.e. WF assignment.*

|  |  |
| --- | --- |
|  | **Status summary**  |
| **Sub-topic#1** | *Tentative agreements:**Candidate options:**Recommendations for 2nd round:* |

### CRs/TPs

*Moderator tries to summarize discussion status for 1st round and provided recommendation on CRs/TPs Status update suggestion*

|  |  |
| --- | --- |
| **CR/TP number** | **CRs/TPs Status update recommendation**  |
| XXX | *Based on 1st round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |

## Discussion on 2nd round (if applicable)

*Moderator can provide summary of 2nd round here. Note that recommended decisions on tdocs should be provided in the section titled ”Recommendations for Tdocs”.*

# Topic #4: Others (AI 9.15.7)

*Main technical topic overview. The structure can be done based on sub-agenda basis.*

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2109375**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2109375.zip) | Apple | **Proposal:** Introduce new FR2-1 and FR2-2 notation for 24.25-52.6GHz and 52.6-71GHz, respectively |
| [**R4-2109835**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2109835.zip) | Nokia, Nokia Shanghai Bell | **Observation 1:** From RAN1 point of view there is a benefit in having a special designation for the 52.6-71GHz frequency range.**Observation 2:** Introducing a completely new FR, e.g. FR3, brings significant impact to RAN4 specification structure.**Proposal 1:** Do not introduce new RAN4 specifications to support the 52.6-71GHz frequency range.**Proposal 2**: RAN4 to further consider the recommendation to provide to RAN#92-e taking into account the pros and cons for the options listed above.* **Option 1:**
	+ Pros: works well in case majority of features, procedures, and requirements are expected to be the same for current FR2 and FR2x.
	+ Cons: it will require significant work on noting the exceptions for FR2x if significant differences arise.
* **Option 2:**
	+ Pros: clean separation of the existing FR2 and FR2x, still maintaining the possibility of using the FR2 label to address the common aspects.
	+ Cons: it requires modification of all current specifications to replace FR2 with FR2-part1 before it can be implemented. It can create conflict with non-3GPP product documentation that refers to FR2 already.
* **Option 3:**
	+ Pros: clean separation of the existing FR2 and FR2x.
	+ Cons: no label to identify the full range available, hence specification may contain several references as “(…) for FR2 and FR2x (…)”.
* **Option 4:**
	+ Pros: clean separation of the existing FR2 and FR2x, still maintaining the possibility of using a single label to address the common aspects. Requires special handling only to existing FR2 features that are applicable to the whole frequency range from 24250 MHz – 71000 MHz.
	+ Cons: requires definition of two new labels to identify FR2x and the whole FR2+FR2x frequency range, respectively.
 |
| [**R4-2110173**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2110173.zip) | Intel Corporation | ***Proposal #1:*** *RAN4 to recommend RANP to introduce a new notation for the 52.6 – 71 GHz frequency range** ***Option 1:*** *Use FR2 notation to designate the full 24.25 – 71 GHz range*
	+ *Use a new FR2-1 notation for 24.25 – 52.6 GHz range*
	+ *Use a new FR2-2 notation for 52.6 – 71 GHz range*
* ***Option 2:*** *Use FR2 notation for 24.25 – 52.6 GHz range and a new FR2-2 notation for 52.6 – 71 GHz range*

***Proposal #2:*** *Send LS to RANP to inform on the frequency range definition impact on the RAN4 specification structure and requirements and provide recommendations on the FR notation definition.* |
| [**R4-2110603**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2110603.zip) | ZTE Corporation | **Observation 1:** minimum and maximum SCS and BW, channel raster, channel spacing and sync raster of 52.6-71GHz would be different from that of legacy FR2.**Observation 2:** lot of BS RF requirements in legacy FR2 would be different from that for 52.6-71GHz.**Observation 3:** BS demod requirements for 52.6-71GHz would be different from that of legacy FR2.**Observation 4:** lot of UERF requirements in legacy FR2 would be different from that for 52.6-71GHz.**Observation 6:** UE demod requirements for 52.6-71GHz would be different from that of legacy FR2.**Proposal 1:** to define FR3 for 52.6-71GHz; |
| [**R4-2111060**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2111060.zip) | Huawei | **Draft LS to RAN** |
| [**R4-2111057**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2111057.zip) | Huawei | **Proposal 1**: RAN4 to exclude FR3 from considerations and extend the FR2 frequency range up to 71 GHz (i.e. FR2 to become 24 – 71 GHz range). Related naming conventions (e.g. FR2.1 + FR2.2) can be further studied. **Proposal 2**: send an LS to RAN to provide RAN4 recommendations, capturing the following: * RAN4 recommends to exclude FR3 from further considerations.
* RAN4 recommendation is that 52.6-71 GHz remains part of FR2, either as a sub-range of FR2 or as an extension of FR2.
 |
| [**R4-2111152**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2111152.zip) | Ericsson | **Proposal 1:** Agree not to introduce FR3 as a name for the 52.6 – 71GHz spectrum range.**Observation 1:** UE RF/demod requirements are based on band, BW, Power Class (PC) or band combinations.**Proposal 2:** All UE RF/demod requirements defined (if needed) as function of band, BW, PC or band combo within FR2 without adding new FR.**Proposal 3:** BS requirements can be updated to cater for an extension of FR2 to include 52.6 – 71GHz without adding new FR.**Observation 2:** Some RRM requirements are defined as function of SCS and/or slot lengths.**Observation 3:** Some RRM requirements are defined for FR2.**Proposal 3:** All RRM requirements for higher SCS (e.g. 480 kHz and 960 kHz) applicable for 52.6 – 71 GHz can be defined (if needed) as function of SCS within FR2 without adding new FR. |
| [**R4-2111058**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2111058.zip) | Huawei | **Proposal 1**: introduce two new FR2 sub-ranges: FR2.1 (24250 MHz – 52600 MHz) and FR2.2 (52600 MHz – 71000 MHz) under the existing FR2 term.**Proposal 2**: adopt FR2.2 bands numbering scheme with separate numbering range (as compared to the existing FR2 bands numbers).**Proposal 3**: out of the options analysed, adopt option 3 with the n513 as the first FR2.2 band number, which allows easy identification of FR2.2 bands belonging to 52.6 – 71 GHz range.  |
| [**R4-2111510**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2111510.zip) | Intel Corporation | **Observation 1:** In RAN4 #98Bis-e, many companies acknowledged the need to study the UE OTA test methods for the 52.6 to 71 GHz frequency range.**Observation 2:** Postponing testability discussions increases the likelihood of having issues with the defined requirements or their testing.**Proposal 1:** RAN4 agrees to communicate to RAN the need and urgency of studying the UE OTA test methods for the 52.6 to 71 GHz frequency range. |
| [**R4-2109445**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2109445.zip) | Apple | **Observation 1:** Preliminary RF core agreements on regulatory, RF performance, and CA aspects related to NR operation in the 52.6 – 71 GHz frequency range are needed in order to define the scope of test methodology development for this frequency range.**Observation 2:** The task of defining the test methodology for the 52.6 – 71 GHz frequency range can leverage existing RAN4 experience with FR2 test methodology extension from 43.5 to 48.2 GHz as well as enhancements related to low PSD test cases, polarization mismatch, and CA aspects.**Proposal 1:** RAN4 should recommend to RAN that a study into topics related to 60 GHz testability is needed**Proposal 2:** RAN4 should recommend to RAN to include NR 52.6-71GHz UE OTA test methods objectives in the scope of Rel-17 NR FR2 Test Methods Enhancements SI (FS\_FR2\_enhTestMethods).**Proposal 3:** RAN4 should further recommend to RAN that the potential study scope captured in the RAN #90 discusson on OTA topics in RP-210881 is stable and sufficient to implement Proposal 2. |

## Open issues summary

*Before e-Meeting, moderators shall summarize list of open issues, candidate options and possible WF (if applicable) based on companies’ contributions.*

### Sub-topic 4.2.1 FR definition in 52.6 – 71 GHz

*Sub-topic description:*

*Open issues and candidate options before e-meeting:*

**Issue 4.2.1: FR definition in 60 GHz**

* Proposals
	+ Option 1: Introduce FR2-1 (24.25 – 52.6 GHz) and FR2-2 (52.6 – 71 GHz) (Apple, Intel, HW)
		- Within option 1, indicate on the preferred approach:
			* “FR2-1 and FR2-2” (Apple, Intel), or
			* “FR2.1 and FR2.2” (Huawei)
	+ Option 2: Introduce FR2-2 (52.6 – 71 GHz) in addition to FR2 (24.25 – 52.6 GHz) (Intel)
	+ Option 3: Define FR3 (ZTE)
	+ Option 4: Not to introduce FR3 (Ericsson, Huawei R4-2111057)
	+ Option 5: Ericsson
		- All UE RF/demod requirements defined as function of band, BW, PC or band combo within FR2;
		- BS requirements can be updated to cater for an extension of FR2 to include 52.6 – 71 GHz;
		- All RRM requirements for higher SCS applicable for 52.6 – 71 GHz can be defined as function of SCS within FR2;
* Recommended WF
	+ TBA

**Issue 4.2.2: BS terminology**

* Proposals (subject to issue 4.2.1)
	+ Option 1 (Huawei, R4-2111058): Reuse the “BS type 2-O” terminology for the NR operation in 52.6 – 71 GHz range.
	+ Option 2: Other
* Recommended WF
	+ TBA

**Issue 4.2.3: Draft CR to TS 38.104**

* Proposals
	+ Option 1 (Huawei, R4-2111059): consider this Draft CR as running baseline capturing implementation of agreements on the 60 GHz range designations and system parameters (before we proceed to CRs in this WI).
	+ Option 2: Other
* Recommended WF
	+ TBA

**Issue 4.2.4: LS to RAN**

* Proposals (subject to issue 4.2.1)
	+ Option 1 (Huawei, R4-2111057): send an LS (draft LS in R4-2111059 as baseline) to RAN to provide RAN4 recommendations, capturing the following:
		- RAN4 recommends to exclude FR3 from further considerations
		- RAN4 recommendation is that 52.6-71 GHz remains part of FR2, either as a sub-range of FR2 or as an extension of FR2.
	+ Option 2: Send LS to RAN – details TBD (Intel, Nokia, Huawei)
* Recommended WF

TBA

### Sub-topic 4.2.2 OTA aspect in 60 GHz

*Sub-topic description:*

*Open issues and candidate options before e-meeting:*

**Issue 4.2.1: OTA aspect in 60 GHz**

* Proposals
	+ Option 1: Recommend to RAN the need and urgency of studying the UE OTA test methods for 52.6 – 71 GHz (Intel, Apple)
* Recommended WF
	+ TBA

## Companies views’ collection for 1st round

### Open issues

**Issue 4.2.1: FR definition in 60 GHz**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX |  |

**Issue 4.2.1: OTA aspect in 60 GHz**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX |  |

### CRs/TPs comments collection

*Major close to finalize WIs and Rel-15 maintenance, comments collections can be arranged for TPs and CRs. For Rel-16 on-going WIs, suggest to focus on open issues discussion on 1st round.*

|  |  |
| --- | --- |
| **CR/TP number** | **Comments collection** |
| XXX | Company A |
| Company B |
|  |
| YYY | Company A |
| Company B |
|  |

## Summary for 1st round

### Open issues

*Moderator tries to summarize discussion status for 1st round, list all the identified open issues and tentative agreements or candidate options and suggestion for 2nd round i.e. WF assignment.*

|  |  |
| --- | --- |
|  | **Status summary**  |
| **Sub-topic#1** | *Tentative agreements:**Candidate options:**Recommendations for 2nd round:* |

### CRs/TPs

*Moderator tries to summarize discussion status for 1st round and provided recommendation on CRs/TPs Status update suggestion*

|  |  |
| --- | --- |
| **CR/TP number** | **CRs/TPs Status update recommendation**  |
| XXX | *Based on 1st round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |

## Discussion on 2nd round (if applicable)

*Moderator can provide summary of 2nd round here. Note that recommended decisions on tdocs should be provided in the section titled ”Recommendations for Tdocs”.*

# Recommendations for Tdocs

## 1st round

**New tdocs**

|  |  |  |
| --- | --- | --- |
| **Title** | **Source** | **Comments** |
| WF on … | YYY |  |
| LS on … | ZZZ | To: RAN\_X; Cc: RAN\_Y |
|  |  |  |

**Existing tdocs**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Tdoc number** | **Title** | **Source** | **Recommendation**  | **Comments** |
| R4-210xxxx | CR on … | XXX | Agreeable, Revised, Merged, Postponed, Not Pursued |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |

Notes:

1. Please include the summary of recommendations for all tdocs across all sub-topics incl. existing and new tdocs.
2. For the Recommendation column please include one of the following:
	1. CRs/TPs: Agreeable, Revised, Merged, Postponed, Not Pursued
	2. Other documents: Agreeable, Revised, Noted
3. For new LS documents, please include information on To/Cc WGs in the comments column
4. Do not include hyper-links in the documents

## 2nd round

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Tdoc number** | **Title** | **Source** | **Recommendation**  | **Comments** |
| R4-210xxxx | CR on … | XXX | Agreeable, Revised, Merged, Postponed, Not Pursued |  |
| R4-210xxxx | WF on … | YYY | Agreeable, Revised, Noted |  |
| R4-210xxxx | LS on … | ZZZ | Agreeable, Revised, Noted |  |
|  |  |  |  |  |

Notes:

1. Please include the summary of recommendations for all tdocs across all sub-topics.
2. For the Recommendation column please include one of the following:
	1. CRs/TPs: Agreeable, Revised, Merged, Postponed, Not Pursued
	2. Other documents: Agreeable, Revised, Noted
3. Do not include hyper-links in the documents