**3GPP TSG-RAN WG4 Meeting # 99-e R4-2107671**

**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: Max CBW, SU, FR definition
* 2nd round: TBA

# Topic #1: RRM work plan

RRM work plan will be discussed in RRM thread [233]

# 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** |
| [**R4-2109696**](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.
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| [**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)
	+ Moderator’s note: GTW decision in RAN4#98Bis-e was the work except system parameters on licensed band will start when regulations become clear. Can Nokia further clarify the proposal addresses any additional aspect?
* 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** |
| Charter Communications Inc. | * + We prefer Option 1: Reuse the reserved band numbers in FR2 for 60 GHz band definition as long as US 54-71 GHz can be allocated a band number
 |
| Skyworks | Regardless whether the 52.6-71GHz range is part of FR2, allocating the whole 513-1024 range to such a small frequency range it an overkill and leaves RAN4 without any spare for future frequency rnages between FR1 and FR2 or above 71GHz. Note that there is still “only 99 FR1 bands and less than 10 FR2 bands. It would seem that allocating 128 or even 64 bands for 24.25-52.6GHz and the same for 52.6-71GHz should be plenty and leaves enough room for new ranges. If 52.6-71GHz range is part of FR2, band number should be allocated following the FR2 bands. If a separate range or sub-range is created, FR2 range should use 64 or 128 band and the new frequency range the next 64 or 128 bands |
| CATT | Support option 1 and agree with Skyworks that there’s enough room for FR2 bands. If reserving 128 is not sufficient, 256 can be considered. |
| CMCC | Support option 1. The reserved band numbers for FR2 is enough. We prefer to follow existing FR2 band numbers instead of allocating separate band number range for 52.6-71GHz |
| ZTE | Support the option 1 |
| Apple | On the frequency range (FR2 vs. FR3) discussion, there seems to be a majority view that this band should be covered by some sort of FR2 extension. Therefore, perhaps the easiest way is to continue using the existing FR2 band numbers. |
| Nokia, Nokia Shanghai Bell | We prefer option 1 and do not see a need for a new number range. |
| QCOM | We prefer option 1. We don’t have any regulatory or carrier holding basis for a licensed band definition. Until that happens we should not spend time discussing licensed bands. |
| Ericsson | Option 1. |
| Intel | It might be depending on FR definition. In case 52.6 – 71 GHz can be considered as part of FR2 range, then band number should also align with FR2. |
| Vivo | Option 1 is OK for us. |
| Samsung | Option 1 is preferred  |
| LGE | We support the option 1 |
| CableLabs | Support Option 1. We agree with Skyworks that there are plenty of band numbers to use. |
| Xiaomi | Option 1. |
| AT&T | Option 1. |
| Huawei | There is one issue that is not considered in this discussion, which is impact on the specification. As we indicated in our paper R4-2111058/59, a separate band numbering range for 52-71 was motivated by spec readability. When new bands will be added for “FR.2.1” and “FR2.2” in future, they will be mixed. As both sub-bands support different SCS/CHBW this would reduce readability of certain tables in the specs. There is solution: we can use single FR2 bands numbering, but in some cases bands will be simply not ordered by their numbers (to keep them grouped per “FR2.1” and “FR2.2” due to different SCS/CHBW supported in those two subranges). e.g. cells highlighted below may no longer be ordered by the band number:If the group is fine with the above editorial imperfections, Option 1 is OK.  |

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

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Charter Communications Inc. | We prefer option 1 as long as this standard is in oine with FCC regulatory rules |
| MediaTek | EN 303 722 is for fixed outdoor deployments, so probably EN 302 567 and 303 753 would need to be considered for mobile application. |
| Apple | Firstly, the regulatory parameters are slightly different for different countries/regions (e.g. max power, max EIRP, max EIRP density) and thus all the regional restrictions should be taken into account. As for EU/CEPT, ETSI EN 303 753 is an early draft document so more input is needed to understand whether it can be used as a stable reference for the normative work. |
| Nokia, Nokia Shanghai Bell | Option 1 |
| QCOM | We agree EN 303 753 should be a reference.. We can’t wait to follow 753, as we expect 753 to develop in parallel with 3GPP spec. IN some aspects we can follow it. |
| Ericsson | Not Option 1: the FR2 specification above 52.6 GHz should follow the regulations and be open for both mobile/portable (c2) and fixed applications (c3). For operations in Europe in the 57-71 GHz NR-U band in the range c2 the EN 303 753 will have to be followed to show compliance with the EC Decision, for c3 the 302 722 will have to be followed unless notified bodies are used. We remark that these are still in draft form or reviewed (the c2 early draft) and will not be available in the OJEU before March 2023 at the very earliest. |
| Intel | Don’t agree with option 1 and echo with MTK comment. EN 303 567 is for mobile and EN 303 722 is for fixed application. Also EN 303 722 and EN 303 753 are still in draft stage, while EN 302 567 is official version. FCC (Title 47, Part 1, 1.1310) also needs to be considered for US unlicensed operation. |
| Xiaomi | Option 1. We have similar observation in our RF requirement paper. |
| Huawei | Option 1 |

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

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Charter Communications Inc. | We prefer option 1: Postpone introducing a licensed band to specification until spectrum availability becomes clear enough (Nokia) |
| MediaTek | Unclear what is intended here, as we already agreed on this at the last RAN4 meeting. |
| CMCC | Last meeting GTW decision is already clear enough. We don’t think any further agreements is needed on this particular point. |
| ZTE | Similar view as CMCC |
| Nokia, Nokia Shanghai Bell | Apologies for missing this updated between the meetings. We shall follow the last meeting GTW outcome. |
| QCOM | Option 1. No further discussion on licensed. |
| Ericsson | Not Option 1. It has been agreed that the licensing schemes (not general authorization) or any blocks should not be discussed in relation to the specification of system parameters. Moreover, technology feasibility in the range does not depend on the licensing scheme. 3GPP should not specify any channel plans or arrangements constraining any deployment based on alignment with other standards not needed from a coexistence perspective.The 66-71 GHz has been allocated for IMT-2020. What is unclear? At least for operations in Europe that is commonly cited, the technical conditions for compliance with the EC Decision for SRD in Europe are far from ready. Is it any clearer? |
| Intel | Option 1. No need further discussion on licensed band at the moment. |
| vivo | Same view as Intel. |
| LGE | Option 1 |
| Xiaomi | Follow the GTW agreement last meeting. |
| Huawei | Agree with moderators note observation.  |

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

|  |  |
| --- | --- |
| **Company** | **Comments** |
| MediaTek | Option 1 |
| ZTE | Option 1 |
| Apple | From the EU/CEPT perspective, ITS band is part of the unlicensed 52-71GHz frequency range. |
| Nokia, Nokia Shanghai Bell | Option 1- as also commented last meeting |
| QCOM | Option 1 |
| Ericsson | There is no need to exclude ITS band independent of if the band is licensed or unlicensed, as ITS operates under non-protection non-interference basis in Europe in this range. |
| Intel | Option 1 |
| vivo | Option 1. If RAN4 agrees not to exclude the ITS spectrum from 60GHz band, do we need to revisit the objective of this WI? |
| LGE | Option 1 |
| Xiaomi | We have slightly concern here as ITS spectrum might be treated in Rel-17 Sidelink enhancement WID. Can proponent clarify the intension with not excluding the ITS band?  |

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

|  |  |
| --- | --- |
| **Company** | **Comments** |
| MediaTek  | Unclear what we would study in 3GPP on this until regulations allow such an operating scenario. Normally compatibility studies would be done by regional/national bodies once requested by regulators. 66-71GHz does not seem to overlap with ITS band – at least in Europe? |
| Nokia, Nokia Shanghai Bell | This discussion can be postponed as no licensed band requirements are being discussed no overlap with any potential future licensed band has been identified. |
| QCOM | We have no licensed band to work on now. No discussion needed. |
| Ericsson | There is no need to exclude ITS band independent of if the band is licensed or unlicensed, as ITS operates under non-protection non-interference basis in Europe in this range. |
| Intel | Discussion should be postponed until regulation becomes clear in licensed band. |
| vivo | The same view as Intel. |
| LGE | No need to discuss at the moment |

### 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 2.2.1**(Band numbering) | **Issue 2.2.1: Band numbering***Majority companies support option 1 (Reuse the reserved band numbers in FR2 for 60 GHz band) and no concern was shared.**Tentative agreements: Option 1 (Reuse the reserved band numbers in FR2 for 60 GHz band)* *Candidate options:**Recommendations for 2nd round:* |
| **Sub-topic 2.2.2****(Regulatory requirement)** | **Issue 2.2.2-1: Regulatory for Unlicensed band***While (4) companies supported option 1 (prioritize on EN 303 753), (4) companies didn’t fully agree with the option 1. Especially, there was comment that EN 302 567 is also for mobile application and has to be considered along with EN 303 753. Also it was commented EN 303 722 will not be available before March 2023. FCC also needs to be considered for US operation.**Tentative agreements: Consider EN 302 567, EN 303 753, and FCC 47 CFR 15.255 for mobile application in unlicensed band**Candidate options:* *Recommendations for 2nd round:*  |
|  | **Issue 2.2.2-2: Regulatory for Licensed band***Follow GTW decision in RAN4#98Bis-e: The work except system parameters on licensed band will start when regulations become clear.**Tentative agreements:* *Candidate options:**Recommendations for 2nd round: No further discussion.* |
| **Sub-topic 2.2.3****(ITS band)** | **Issue 2.2.3-1: ITS band for unlicensed band***Majority companies support option 1 (no need to exclude ITS band for unlicensed band). Moderator understand 60 GHz follow the same principle from 5 GHz NR-U where ITS band is also part of the unlicensed spectrum.**Tentative agreements: Option 1 (No need to exclude ITS band for unlicensed band)**Candidate options:**Recommendations for 2nd round:* |
|  | **Issue 2.2.3-2: ITS band for licensed band***Majority companies confirmed no discussion is needed at the moment.**Tentative agreements:* *Candidate options:**Recommendations for 2nd round: No further discussion.* |

### 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 and 2000 MHz for both licensed and unlicensed (QC, Xiaomi, Nokia)
	+ Option 3: 2160 MHz for unlicensed and 2000 MHz for licensed (Apple, LGE)
	+ Option : Make a decision for unlicensed operation and FFS for licensed operation
	+ Option 5: 2160 MHz for both licensed and unlicensed bands (Ericsson)
* 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,ZTE)
		- Option 1D: CATT
			* Option 1B for licensed and no LBT unlicensed bands.
			* Option 1A for LBT unlicensed bands. Try to harmonize option 1A with option 1B as much as possible.
	+ 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 ~85% 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)
		- Nokia’s comment: This option is for narrowband operation within 2.16 GHz channels.
	+ Option 2: n x 100 MHz, n = TBD (Nokia)

Nokia’s comment: This option is for CA for 120 kHz SCS

* 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** |
| Charter Communications Inc. | We prefer either option 2 or option 3. Either option is acceptable to us |
| MediaTek | Option 1 is slightly preferred, assuming 2000MHz will have less RBs than 2160MHz, unless companies can better justify why 2160MHz is specifically required. We would also propose to make maximum bandwidths optional for the UE. For 2160MHz we would require to limit the number of RBs to 170 RBs or less. We would prefer to elaborate more on the likely SU before making a final decision on Max Bandwidth though. |
| CATT | Option 1. We didn’t see much benefit for 2160 MHz but see much sacrifice for the implementation with only a small number extra RBs. |
| CMCC | We prefer option 1, 2000MHz makes more sense for us considering the band plan is 57-71GHz. The other point is that there is no need to distinguish maximum bandwidth for licensed and unlicensed, since the channel bandwidths anyway will be specified in a per band manner. |
| ZTE | 2000MHz is more preferred based on the legacy BW design principle, in addition, it’s also not necessary to align with IEEE 802.11ad channel bandwidth based on our initial simulation results. |
| Sony | Option 5 is preferred, but option 3 is also acceptable.  |
| Apple | Option 1 or option 3. Specifying both 2000MHz and 2160MHz for both licensed and unlicensed bands seem unnecessary. |
| Nokia, Nokia Shanghai Bell | Our preference is still to enable 2160 MHz channel bandwidth to avoid waste of spectrum in case single channel cannot overlap two 2160 MHz blocks. For situations where this is not a concern, 2000 MHz is sufficient. |
| QCOM | Option 4 makes sense. In addition we are ok with either 2000 or 2160 for unlicensed. |
| Ericsson | Option 5. Most importantly is to consider the motivations from RAN4#98bis-e, harmonizing licensed and unlicensed should be the goal. |
| Intel | Support option 1. The current RAN4 CBW design philosophy is having the same channel bandwidths for licensed and unlicensed bands.  |
| vivo | Support Option 1. The same maximum channel bandwidth for licensed and unlicensed can work and simplify the UE implementation. |
| Samsung  | We support option 1 which’s the same as our contribution to allow design commonality among 60G unlicensed, licensed operation and legacy NR operation as much as possible. And there is no need to stick to IEEE channelization from co-existence point of view.  |
| LGE | Option 3 with focus on 2160 for unlicensed operation, which we are discussing at the moment. We think that 2000 is more suitable for un-licensed, but that will naturally also depend on the regulatory decisions. |
| Xiaomi | With CATT’s analysis, we believe option 1 can be our choice. |
| Huawei | Option 1 as first priority. The argument of benchmarking with IEEE 802.11ad is not a sufficient justification for adding 2160MHz.  |

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

|  |  |
| --- | --- |
| **Company** | **Comments** |
| MediaTek | Not clear why we need 1000MHz or 1200MHz bandwidths. |
| CATT | Are the 1000MHz and 1200MHz CBW talking about CA CBW? For single carrier CBW, we think 2^n\*min\_CBW is the correct approach and there’s an exception that 960 KHz needs to support 2000MHz. So the reasonable CBW is 100, 200, 400, 800, 1600 and 2000. |
| CMCC | We support intermediate CBWs: 200MHz, 800MHz. 1600MHz. And we think the intermediate CBWs are not urgent to be decided. |
| ZTE | We also the intermediate CBW summarized in the table. |
| Apple | Specifying some intermediate CBWs as integer multiples of min. CBW for 480/960kHz seems straightforward and reasonable. |
| Nokia, Nokia Shanghai Bell | Number of additional channel bandwidth should be limited, considering system complexity. We do not see a need for 500 MHz and 1000 MHz, and 1200 MHz would leave to poor FFT utilization for 480 kHz. At the moment we could specify 100, 200, 400, 800, 1600 and 2160 MHz, and later add 2000 MHz if it is needed for licensed operation. |
| QCOM | We prefer our proposal |
| vivo | The same view with Apple.The channel bandwidths 500M and 1000M, they are not even the integer times of 400MHz minimum channel bandwidth. |
| LGE | Nokia proposal above seems reasonable. |
| Huawei | Looking at the FR1 and evolution of the list of CHBW, additional values were added mostly due to spectrum limitations for certain bands, and MNO’s desire to improve SU for those bands. Discussion on the additional intermediate CHBW values does not seem to be urgent at this stage.Multiples of the min CHBW seems to be the baseline approach.  |

**Issue 3.2.2-1: Channelization**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Charter Communications Inc. | We prefer option 1* Option 1: Harmonize channelization between licensed and unlicensed bands:
	+ Option 1A: Align with IEEE with fixed channelization (QC)
 |
| MediaTek | Option 1B seems the best starting point, as otherwise we waste spectrum. In MediaTek paper we show that some flexibility to do 1D could also be possible without increasing GCSN locations. |
| CATT | Option 1D. Our understanding is that if LBT is needed, aligning IEEE channels should be considered. Not sure if we missed anything. Agree with MTK Option 1D may be possible without increasing GSCN locations but that doesn’t mean IEEE channel alignment can be ignored for the channelization. The 2000MHz channelization may need some flexibility for example the granularity may need some detail consideration to align with IEEE channels. If 2160 MHz CBW is chosen, it’ll be more complicated. |
| CMCC | Harmonization between licensed and unlicensed bands is important. Designing different schemes is not preferable. Option 1D seems an approach we can further study in order to get theharmonization.The current agreed band 57-71GHz is not 100% aligned with IEEE.  |
| ZTE | We support the option 1c and there are also no need to align with IEEE channel. |
| Apple | Option 2 |
| Nokia, Nokia Shanghai Bell | Overall, we support option 1 to harmonize channelization to simplify implementations. Alignment with IEEE channel does not need to be perfect, but channelization should enable placing 2160 MHz NR carrier rather close to the IEEE channel point to make sure usable PRBs do not overlap two IEEE channels. Additional raster points need to be also available for efficient narrowband operation.  |
| QCOM | We prefer option 1 and specifically Option1AThis approach can help simplify the clear channel searching for unlicensed bands that require it. For licensed bands we have not spectrum, the work would progress better if we tabled any licensed band discussion until the is some spectrum. |
| Ericsson | As RAN1 has agreed to only support 120 kHz SCS for initial access choosing the “floating” raster as we have in FR2 would provide the flexibility to harmonize both unlicensed and licensed. Additionally, in order to help with SSB search complexity RAN4 should consider adopting every 2nd GSCN is valid (e.g. 34.56 MHz instead of 17.28 MHz sync raster granularityWe note that the alignment of the nominal channel raster with Wi-Fi for the 5 GHz range was due to an essential requirement on LBT in the European harmonised standard EN 301 893 that necessitated grid alignment between different technologies across the 20 MHz nominal bandwidth. However, LBT is neither needed nor an essential requirement for coexistence in the 60 GHz range with its beamforming (for c1 but for legacy reasons as the earlier standard was based on IEEE standards) and the nominal channel bandwidth is declared (also for c1). Hence the channel raster should be flexible and not based on artificial constraints on coexistence. |
| Vivo | First, we can agree on Option 1. The licensed band for 60GHz is [66-71] GHz with 5GHz spectrum, which is not even the multiple times of 2.16GHz chunk. For unlicensed band 57-71 GHz with 14GHz spectrum, which is not the multiple times of 2.16GHz chunk. So we support not to align with IEEE channel.With fixed channelization, it can reduce the raster entries to an extent.So, we support option 1B. |
| LGE | Option 1A for unlicensed operation. |
| Xiaomi | We prefer our option 2. Since the 120kHz SCS and 100MHz minCBW have been agreed, the flexible channel definition is assumed. If fixed channelization for licensed band is defined, then what is the meaning that we define similar SCS and MinCBW as FR2? For unlicensed band, we see the contention based access period is defined for IEEE 802.11ad hence we believe similar manner will be needed and with that, the alignment of channelization is better choice. |
| Huawei | Option 1C: Do not align with IEEE and floating channelization |

**Issue 3.2.2-2: Channel raster**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Charter Communications Inc. | We prefer Option 1: Reuse FR2 NR NR-ARFCN for 57 – 71 GHz (CATT) |
| MediaTek | Option 2 seems to align with existing specifications when 120kHz SCS is used, so depends what Option 1 means. |
| CATT | Option 1 and option 2 may talk different issues. We’re talking about Range of NREF and the exact channel raster entries can be discussed further. Agree option 1 doesn’t exclude option 2. For option 2, how to use it for 480 kHz and 960 kHz SCS should be clarified. |
| CMCC | Option 1. For option 2, if we follow the SCS based channel raster approach, 480 and 960KHz also need to be considered.  |
| ZTE | Option 2 is more preferred since 120kHz is the minimum supported scs for 60GHz. |
| QCOM | The proposals seem to be in conflict with the channelization item above. Maybe we don’t understand some aspect of the proposals .. but we do not agree with either one. |
| Nokia, Nokia Shanghai Bell | We prefer to reuse the FR2 NR NR-ARFCN scheme for the 57-71 GHz range. As 120kHz SCS is the smallest granularity, this can be the guideline as long as they allow the channelization discussed in Issue 3.2.2-1  |
| Intel | We need to consider 480 and 960 kHz SCS along with 120 kHz SCS. Therefore, 960 kHz (common multiple) should be considered. We can choose channel raster entries from the NR-ARFCN which is based on 60 kHz step. |
| Xiaomi | Similar understanding with QC, need to have conclusion of issue 3.2.2-1 first. |
| vivo | In CATT’s paper, it says to reuse the global channel raster which defines for the frequency range from 24.25MHz to 100 GHz. We can agree on reusing the global channel raster for 60GHz. |
| Huawei | Option 1: Reuse FR2 NR NR-ARFCN for 57 – 71 GHz |

**Issue 3.2.2-3: Sync raster**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Charter Communications Inc. | * + We prefer Option 2: Explicitly define GSCN spaced approximately 100 MHz (MTK)
 |
| MediaTek | Option 2.  |
| CATT | Currently may be option 1 although we think option 2 may be correct. But we still need to wait the conclusion to verify the idea. |
| CMCC | This is related to the channelization and also other issues. We prefer to postpone the discussion. |
| ZTE | Similar view as CMCC and more foundenmental issue might be fixed sync raster or floating raster. |
| Nokia, Nokia Shanghai Bell | Option 1 – we do think channelization needs to be resolved before we firmly define sync. raster. |
| QCOM | Option 1. This would be better discussed once the parameters are agreed. |
| Intel | Option 1. We can come back once other key parameters are finalized. |
| vivo | Option 2. We can also accept Option 1. |
| LGE | Should be postponed to agree first on channelization  |
| Xiaomi | Option 1. |
| Huawei | Option 1 |

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

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Charter Communications Inc | * We prefer postponing SU decision after sufficient discussion on RF requirements (Apple, ZTE)
 |
| MediaTek | We should at least agree that we definitely do not go above 95% SU. Postponing is reasonable. But then we should also postpone the agreement on maximum channel bandwidth for 960kHz SCS until we see the full picture in terms of potential number of RBs, as it is all related. |
| CATT | We think for 120 KHz and 480 KHz SCS, following current FR2 95% could be ok for the digital domain implementation. For 2000 MHz, we did preliminary analysis with some assumptions to compare the TBW with IEEE. We’re ok to see more analysis when the requirement is clear. |
| CMCC | In our view, at least SU should go above 90%. We are OK to postpone SU decision after discussion on RF requirements. |
| ZTE | Postpone the discussion until there are enough progress on RF requirements. |
| Sony | In general, we are positive to study lower SU, considering the benefit on the UE Tx/Rx performance, but okay to postpone once we have clearer picture of RF requirement. It may also benefit to discuss the SU together with RF requirement.  |
| Apple | As analyzed in our contribution, complying with the regulatory mask provides a good argument for not having the same SU as for existing FR2 bands. However, normally SU discussion is tied to the RF requirement discussions and as such RAN4 may benefit from having a better understanding of how the RF requirements may shape up. |
| Nokia, Nokia Shanghai Bell | Detailed agreements for SU can be postponed. For 120 kHz SCS current FR2 SU should be re-used. |
| QCOM | Postpone SU decision after sufficient discussion on RF requirements (Apple, ZTE). SU will likely be limited by emissions, EVM, and the guard required to comply with those; and should be decided in conjunction with those requirements. |
| Ericsson | Considering other systems such as IEEE have 85% SU a starting point for our studies can adopt this minimum SU. Considering also to postpone the discussion on SU where other aspects can also be considered together such as spectrum mask.The power capability should also be considered when discussing overall spectrum efficiency. For FR2 the UL power is constrained by EVM and occupied bandwidth requirements (and a high SU) that necessitate very large MPR -- in some cases so large that higher order MCS cannot even be tested. |
| Intel | Support 90 %. RAN4 need to conclude SU discussion as soon as possible as RAN1 is waiting for the input. |
| Vivo | In FR2, RAN4 considers 95% SU for 100M~400M. Do we really need to revisit the SU numbers for 100~400M for 60GHz?  |
| LGE | Agreement can be made later, but we see that similar SU as in FR2 today can be achieved at least for the two narrower SCS. |
| Huawei | Postpone the discussion until there are enough progress on RF requirements. |

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

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Charter Communications Inc | * + We prefer Option 1: n x 400 MHz, n = [2, 3, 4, 5] (Nokia)
 |
| MediaTek | Option 1 should at least be targeted and evaluated. |
| CATT | Option 1. Not sure the solution that 20 100MHz carriers is aggregated but not using larger CBW single carrier. |
| CMCC | Option 1 for UEs only support 120KHz  |
| Apple | In general, we support CA within the 2/2.16GHz channel. However, a decision on which channel bandwidth we can aggregate depends on the outcome of which channel bandwidth we will have.  |
| Nokia, Nokia Shanghai Bell | We support both option 1 and option 2 but option 2 definitely needs a reasonable upper limit for n. |
| QCOM | The proposals are a good start but not comprehensive, Our preference is that intraband CA combinations should be made from 100, 200, and 400 MHz CC BWs. The number of CCs is FFS but the CA bandwidth class method should be re-used from FR2. We may have different numbers of BW classes as FR2, or perhaps we use some of the same ones as FR2. This is FFS. This approach will provide better utilization and in some cases some commonality with FR2 implementation.  |
| Ericsson | We support normal CA operation. No need for sub-channelization. |
| Huawei | Follow 100/200/400 MHz CC baseline. |

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

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Charter Communications Inc | * + We prefer Option 1: Support CA ≥2/2.16 GHz (CMCC, vivo, Nokia)
 |
| CATT | At least the system parameters analysis need to consider it but think the requirements can be defined later based on request. |
| CMCC | Option 1 |
| Sony | We support option 1: Support CA ≥2/2.16 GHz |
| Nokia, Nokia Shanghai Bell | Option 1 |
| QCOM | We don’t agree with these wide CA values for a handheld UE. For a CPE UE we have not yet concluded whether the wider CCBWs are attractive. For CPE UE we would like to discuss further .  |
| Ericsson | We support normal CA operation. No need for sub-channelization. |
| vivo | Option 1. |
| Huawei  | Option 1 |

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

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Charter Communications Inc. | * + We prefer Option 1: Prioritize on standalone mode operation (CATT, Intel)
 |
| MediaTek | Naturally 3GPP would define the operating band first, and then later on define band combinations if desired by 3GPP members. But we should wait for RAN1/2 outcome on the architectural support. |
| CATT | Option 1. |
| CMCC | Normally RAN4 works on single band first, then the band combination. The proposed prioritization does not impact RAN4 work. Whether to prioritize standalone operation also depends on RAN1/2 design, RAN4 should not make such decision. |
| ZTE | Whether it’s standalone or NSA, this is not decided by RAN4. |
| Apple | It is not clear why we need to prioritise a particular mode of operation. |
| Nokia, Nokia Shanghai Bell | First priority should be to complete single band requirements. |
| QCOM | Option 1: We agree that standalone operation should be prioritized to give RAN4 the best chance of finishing the WI. |
| Intel | Option 1.  |
| vivo | Option 1. |
| LGE | First priority should be to complete single band requirements. |

### 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 3.2.1 Channel BWs** | **Issue 3.2.1-1: Max CBW for 960 kHz***While the Option 1 was supported by majority companies (11 companies), there were some other preferences. The moderator suggests to discuss during GTW on Wednesday (5/26).** Option 1: 2000 MHz for both licensed and unlicensed bands (CATT, Apple, QCOM, CMCC, vivo, Samsung, Intel, ZTE, MTK, Xiaomi, Huawei)
* Option 2: 2160 MHz and 2000 MHz for both licensed and unlicensed (QCOM, Xiaomi, Nokia, Charter)
* Option 3: 2160 MHz for unlicensed and 2000 MHz for licensed (Apple, LGE, Charter, Sony)
* Option 4: Make a decision for unlicensed operation and FFS for licensed operation (QCOM)
* Option 5: 2160 MHz for both licensed and unlicensed bands (Ericsson, Sony)

*Tentative agreements:**Candidate options:* *Recommendations for 2nd round: Discuss during GTW on Wednesday (5/26)* |
|  | **Issue 3.2.1-2: Intermediate CBWs between Max and Min CBWs***It seems most of companies are ok with the integer multiples of the minimum CBW for each SCS, i.e.** 120 kHz SCS: 200 MHz
* 480 kHz SCS: 800 MHz
* 960 kHz SCS: 800 MHz, 1600 MHz

*Tentative agreements:* *Candidate options:**Recommendations for 2nd round: Interested companies are encouraged to check the moderator proposal above and share views if it is agreeable.*  |
| **Sub-topic 3.2.2 Channelization related** | **Issue 3.2.2-1: Channelization**Views were diverged and can be further discussed in GTW on Wednesday (5/26) * + Option 1: Harmonize channelization between licensed and unlicensed bands (Nokia):
		- Option 1A: Align with IEEE with fixed channelization (QCOM, Charter)
		- Option 1B: Do not align with IEEE with fixed channelization (vivo, MTK)
		- Option 1C: Do not align with IEEE and floating channelization (Ericsson, ZTE, Huawei)
		- Option 1D: CATT, CMCC
			* Option 1D-1 for licensed and no LBT unlicensed bands.
			* Option 1D-2 for LBT unlicensed bands. Try to harmonize option 1A with option 1B as much as possible.
	+ Option 2: Separate channelization (Apple, Xiaomi)
		- 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)

*Tentative agreements:**Candidate options:**Recommendations for 2nd round: D*iscussed in GTW on Wednesday (5/26) |
|  | **Issue 3.2.2-2: Channel raster**It seems that there was a confusion on the issue. Moderator understanding and motivation was to define raster grid whether 60 GHz will use the same raster grid from NR-ARFCN or it can be further down sampled. Considering channelization discussion is still ongoing, the moderator think this issue can be postponed.*Tentative agreements:**Candidate options:**Recommendations for 2nd round: No further discussion.* |
|  | **Issue 3.2.2-3: Sync raster**This issue also seems to be related to channelization and channel raster. The moderator suggests postponing the discussion at least until channelization concluded. * Option 1: Postpone until min BW, SU and SSB SCS are agreed (ZTE, CATT, CMCC, Nokia, QC, Intel, LGE, Xiaomi, Huawei)
* Option 2: Explicitly define GSCN spaced approximately 100 MHz (MTK, Charter, vivo)

*Tentative agreements:**Candidate options:**Recommendations for 2nd round: No further discussion*  |
| **Sub-topic 3.2.3 Spectrum Utilization** | **Issue 3.2.3-1: PRB (SU) for max CBW***Majority companies wanted to postpone the decision after sufficient RF requirements discussion. However, RAN4 needs to reply to RAN1 LS as soon as possible.**Moderator suggest the following option:** For 120 kHz SCS: Keep the same max SU from FR2, i.e., 95%
* For 480/960 kHz SCS: provide the SU in range, i.e., [85 – 95] %

Detail SU decision on 480/960 kHz SCS can be discussed further.*Tentative agreements:* *Candidate options:**Recommendations for 2nd round: Interested companies are encouraged to check and share their view if the moderator proposal can be acceptable.* |
| **Sub-topic 3.2.4****Carrier Aggregation** | **Issue 3.2.4-1: Intra-band contiguous CA within 2/2.16 GHz** *While (5) companies support option 1 (n x 400 MHz, n = [2, 3, 4, 5]), other companies had different views, i.e., normal CA operation, 100/200/400 MHz CC baseline, etc. We can discuss during GTW with lower priority and during 2nd round.* *Tentative agreements:**Candidate options:**Recommendations for 2nd round:Continue discussion in GTW and 2nd round discussion* |
|  | **Issue 3.2.4-2: CA equal to or larger than 2/2.16 GHz** *Supporting CA larger than 2/2.16 GHz seems to be majority view. One company claimed that such wide CA is not needed for a handheld UE. Can we discuss further on this aspect during the 2nd round discussion?**Tentative agreements:**Candidate options:**Recommendations for 2nd round: Continue discussion whether CA > 2/2.16 is necessary for a handheld UE* |
| **Sub-topic 3.2.5 Operation Scenario** | **Issue 3.2.5: Operation scenario in 60 GHz NR** Given the unlicensed band in 60 GHz is newly defined, it is natural to define and finish a single band requirement first.*Tentative agreements: RAN4 aims to finish a single band requirement first.**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”.*

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

*While the Option 1 was supported by majority companies (11 companies), there were some other preferences. The moderator suggests to discuss during GTW on Wednesday (5/26).*

* Option 1: 2000 MHz for both licensed and unlicensed bands (CATT, Apple, QCOM, CMCC, vivo, Samsung, Intel, ZTE, MTK, Xiaomi, Huawei)
* Option 2: 2160 MHz and 2000 MHz for both licensed and unlicensed (QCOM, Xiaomi, Nokia, Charter)
* Option 3: 2160 MHz for unlicensed and 2000 MHz for licensed (Apple, LGE, Charter, Sony)
* Option 4: Make a decision for unlicensed operation and FFS for licensed operation (QCOM)
* Option 5: 2160 MHz for both licensed and unlicensed bands (Ericsson, Sony)

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

*It seems most of companies are ok with the integer multiples of the minimum CBW for each SCS, i.e.*

* 120 kHz SCS: 200 MHz
* 480 kHz SCS: 800 MHz
* 960 kHz SCS: 800 MHz, 1600 MHz

One company requested time for internal check. We are looking forward the confirmation and consensus during the 2nd round.

**Issue 3.2.2-1: Channelization**

Views were diverged and can be further discussed in GTW on Wednesday (5/26)

* + Option 1: Harmonize channelization between licensed and unlicensed bands (Nokia):
		- Option 1A: Align with IEEE with fixed channelization (QCOM, Charter)
		- Option 1B: Do not align with IEEE with fixed channelization (vivo, MTK)
		- Option 1C: Do not align with IEEE and floating channelization (Ericsson, ZTE, Huawei)
		- Option 1D: CATT, CMCC
			* Option 1D-1 for licensed and no LBT unlicensed bands.
			* Option 1D-2 for LBT unlicensed bands. Try to harmonize option 1A with option 1B as much as possible.
	+ Option 2: Separate channelization (Apple, Xiaomi)
		- 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)

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

*Majority companies wanted to postpone the decision after sufficient RF requirements discussion. However, RAN4 needs to reply to RAN1 LS as soon as possible. Moderator suggested the following option:*

* For 120 kHz SCS: Keep the same max SU from FR2, i.e., 95%
* For 480/960 kHz SCS: provide the SU in range, i.e., [85 – 95] %

Detail SU decision on 480/960 kHz SCS can be discussed further.

One company requested time for internal check and we are looking for consensus during the 2nd round.

## Companies views’ collection for 2nd round

|  |  |
| --- | --- |
| **Company** | **Comments** |
|  | **Issue 3.2.1-1: Max CBW for 960 kHz****Issue 3.2.1-2: Intermediate CBWs between Max and Min CBWs****Issue 3.2.2-1: Channelization****Issue 3.2.3-1: PRB (SU) for max CBW** |
|  |  |
|  |  |

# 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. |
| [**R4-2111510**](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 4.2.1-1: 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, Huawei, Charter, LG)
		- 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: Ericsson, Charter, CMCC, Samsung, AT&T
		- 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;
	+ Option 5: Nokia, ZTE, QCOM, R&S
		- Keep FR2 definition as it is
		- Introduce FR2x (52.6 – 71 GHz) and FR2-comb (24.25 – 71 GHz)
	+ Except option 3, all above proposals intend not to introduce FR3.
* Recommended WF
	+ TBA

**Issue 4.2.1-2: LS to RAN**

* Proposals (subject to issue 4.2.1)
	+ Option 1: [R4-2110173](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2110173.zip) (Intel)
	+ Option 2: R4-2111060 (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 4.2.2: 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 4.2.1-1: FR definition in 60 GHz**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Charter Communications Inc | * + We like either option1 and 4 with a slight preference with option 4 but if there is consensus with option 1, we can also agree with this direction
	+ Option 1: Introduce FR2-1 (24.25 – 52.6 GHz) and FR2-2 (52.6 – 71 GHz) (Apple, Intel, HW)

***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 4: Ericsson
		- Not to introduce FR3;
		- 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;
 |
| MediaTek | It looks like “Nokia option 1” has not been covered by the moderator, and should be considered too.Table 1: Option 1 for definition of frequency ranges

|  |  |
| --- | --- |
| Frequency range designation | Corresponding frequency range  |
| FR1 | 410 MHz – 7125 MHz |
| FR2 | 24250 MHz – 71000 MHz |
| FR2x | 52600 MHz – 71000MHz |
| [Or NOTE: FR2x is defined as 52600 MHz – 71000MHz as sub-frequency range of FR2.] |

Option 2 very similar to Option 5 from a spec impact perspective, so not sure there is much need to consider them totally separately. Only difference is whether you write in common functional parts of spec “FR2 and FR2x” or instead “FR2-combined”.We agree with Nokia on (moderator’s) Option 1 having backwards compatibility issues. As a minimum any approach we agree needs to be backwards compatible with Release 15. |
| CMCC | For option1, it is better to not touch existing FR1, otherwise there will be many spec changes needed. We prefer option4.  |
| ZTE | Fine to have FR2.x for 52.6-71GHz and not touch the existing FR2 definition. |
| Apple | As analyzed in our paper, option 1 looks good after comparing the pros and cons of different options. We slightly prefer the notation of “FR2-1 and FR2-2”. |
| Nokia, Nokia Shanghai Bell | We prefer option 5:

|  |  |
| --- | --- |
| Frequency range designation | Corresponding frequency range  |
| FR1 | 410 MHz – 7125 MHz |
| FR2 | 24250 MHz – 52600 MHz |
| FR2x | 52600 MHz – 71000 MHz |
| FR2-comb | 24250 MHz – 71000MHz |
| NOTE: 38.101-2 covers both FR2 and FR2x |

This solution keeps term FR2 compatible with rel-15 definition,and provides the needed flexibility to refer to legacy FR2, 60 GHz range, or to the combined range.All the other options have downsides of either changing rel-15 terminology or not having a single term for the combined frequency range. |
| QCOM | Partially option 5: It does not make sense to rename the existing FR2 band. That could cause unnecessary re-work. Option 5 calling it FR2x is ok. The FR2-comb part of Option 5 is not necessary. If someone wanted to refer to both bands they could write “Fr2 and FR2x”. |
| Ericsson | Support Option 4See no reason to introduce sub frequency ranges since requirements can be handled by extending FR2 as shown in input paper.This is business as usual adding new bands even if CHBW, SCS etc are extended and updated.Introducing sub ranges can cause more confusion than clarity. The initial thinking with introducing FR1 and FR2 in rel-15 was more related to OTA etc differentiating conducted and not conducted requirements and testing. |
| Intel | Option 1 |
| Samsung  | We support not to introduce FR3. Among other options, option 4 slightly preferred to simply extend FR2 and update related requirement for each band and/or specific frequency range as we did before for FR1 which is updated as 450—7000MHz from original 450-6000MHz. But we are also open to discuss further for final recommendation to June RAN-P.  |
| Rohde & Schwarz | Some way to distinguish the new range and existing FR2 is needed. No strong view on which other option to use. MTK proposed table looks ok. Maybe use FR2+ instead of FR2x, since “x” is often used as placeholder and can be misinterpreted. |
| LGE | We should first agree to drop the FR3 and then select the best way forward with RF2 / RF2.x. We think that Ericsson proposal to tie the requirements with band, PC, … etc. could also work as already today many requirements are band-specific, however it may be more straightforward to go with FR2-1 and FR2-2.  |
| CableLabs | We support not to introduce FR3. |
| AT&T | Option 4. We think that it is important to utilize the generic FR2 term to refer to the entire 24.25 – 71 GHz range to minimize impact to RAN4 specifications outside of 38.101-2.We would support Option 1 if the generic FR2 nomenclature is utilized when referring to any operating bands in the entire 24.25 – 71 GHz range and the sub-band designations of FR2-1 and FR2-2 are utilized on an as needed basis and completely contained in 38.101-2. |
| Huawei | @Mediatek, CMCC: as presented in the Draft CR in R4-2111059, there is no backward compatibility issue for Option 1. What was FR2 in Rel-15, stays as FR2 also in Rel-17. There is no need to change any FR acronyms across the specs:Option 5 would fail if we consider future extensions above 71 GHz. Following Option 1 is future-proof: We prefer option 1. For the notation: there is slight preference to follow 2.1/2.2, as the other notation may confuse with the minus sign.  |

**Issue 4.2.1-2: LS to RAN**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| MediaTek | None of them until we have discussed all the options. We are not sure that just polling companies is really the best way to do this though. We should first identify key showstoppers with certain options. |
| Apple | If RAN4 reaches an agreement, there are two ways to inform RAN: either by an LS or RAN4 chair can capture it in the RAN4 status report to RAN. If the LS approach is adopted, we suggest using the same LS to capture the agreement on OTA testing aspects. |
| Nokia, Nokia Shanghai Bell | We should first conclude the previous issue.  |
| QCOM | Decisions on the naming need to be made first.  |
| Ericsson | Agree with MediaTek that we need to settle Issue 4.2.1-1 |
| Intel | Wait until the decision on the issue 4.2.1-2 first.  |
| LGE | Need to agree first and then we can discuss the LS |
| Huawei | RAN was interested to know if FR3 is needed, or not. This becomes clear now in RAN4 so feedback can be shared. For the details on the FR2 extension, we can: 1. capture the conclusion on FR2 extension terminology (if agreed this meeting in Issue 4.2.1-1), or2. inform RAN on the options considered (if not agreed this meeting) |

**Issue 4.2.2: OTA aspect in 60 GHz**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Charter Communications Inc. | We prefer Option 1: Recommend to RAN the need and urgency of studying the UE OTA test methods for 52.6 – 71 GHz (Intel, Apple) |
| MediaTek | Disagree with Option 1. This discussion should be left for RAN plenary, as this is their job. Intel/Apple are free to highlight the urgency directly via RAN plenary input contributions. |
| ZTE | Leave this up to RAN discussion. |
| Apple | We prefer 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) and inform RAN accordingly. |
| Nokia, Nokia Shanghai Bell | In this meeting it would be necessary to also officially capture the discussion outcome from previous meeting that open testability issues shall not prevent defining core requirements and concluding the WI. |
| QCOM | We are OK with informing RAN the test method should be addressed or if nothing is sent we are fine with that too. How that is addressed could come into RAN as either a separate WI or a modification of existing WI. Different companies may have different ideas or proposals into RAN.  |
| Intel | Option 1 |
| AT&T | Option 1. We also prefer 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) and to have RAN4 provide a recommendation to RAN to expand the scope of the Rel-17 SI to minimize unnecessary debate in RAN. It is important to complete the NR 52.6-71GHz UE OTA test methods within the Rel-17 timeframe to ensure that RAN5 has the necessary information to complete the conformance test cases. |
| Huawei | This work needs to be done anyway. How this is formulated and under which WI, it is RAN decision. This was discussed in previous RAN meetings, together with other OTA testing concepts for umbrella WID.  |

### 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 4.2.1-1****FR definition in 60 GHz**  | **Issue 4.2.1-1: FR definition in 60 GHz** *There was clear view not to introduce FR3. However, for the rest of options, views were diverged. Moderator suggest to agree only on “Not introducing FR3” in this stage and continue discussion during GTW and 2nd round for the below option:** + Option 1: Introduce FR2-1 (24.25 – 52.6 GHz) and FR2-2 (52.6 – 71 GHz) (Apple, Intel, HW, Charter, LG)
		- 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 4: Ericsson, Charter, CMCC, Samsung, AT&T
		- 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;
	+ Option 5: Nokia, ZTE, QCOM, R&S
		- Keep FR2 definition as it is
		- Introduce FR2x (52.6 – 71 GHz) and FR2-comb (24.25 – 71 GHz)

*Huawei pointed out the option 5 would not work if frequency extends to above 71 GHz. Considering option 1 and option 5 are similar, moderator is wondering if the proponents of option 5 can support option 1?**Tentative agreements: Agree not to introduce FR3.**Candidate options:**Recommendations for 2nd round: Continue discussion during GTW and 2nd round on the remained option above.* |
|  | **Issue 4.2.1-2: LS to RAN***RAN4 need to conclude the issue 4.2.1-1 FR definition.**Tentative agreements:* *Candidate options:**Recommendations for 2nd round: Wait the decision on the issue 4.2.1-1 FR definition* |
| **Sub-topic 4.2.2 OTA aspect in 60 GHz** | **Issue 4.2.2: OTA aspect in 60 GHz** Seven companies support option 1, while two companies claimed this is RAN decision. Moderator think these are not conflict as final decision will be made by plenary.*Tentative agreements: Agree on option 1 (Recommend to RAN the need and urgency of studying the UE OTA test methods for 52.6 – 71 GHz)**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”.*

**Issue 4.2.1-1: FR definition in 60 GHz**

*There was clear view not to introduce FR3. However, for the rest of options, views were diverged. Moderator suggest to agree only on “Not introducing FR3” in this stage and continue discussion during GTW and 2nd round for the below option:*

* + Option 1: Introduce FR2-1 (24.25 – 52.6 GHz) and FR2-2 (52.6 – 71 GHz) (Apple, Intel, HW, Charter, LG)
		- 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 4: Ericsson, Charter, CMCC, Samsung, AT&T
		- 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;
	+ Option 5: Nokia, ZTE, QCOM, R&S
		- Keep FR2 definition as it is
		- Introduce FR2x (52.6 – 71 GHz) and FR2-comb (24.25 – 71 GHz)

*\*\* Huawei pointed out the option 5 would not work if frequency extends to above 71 GHz. Considering option 1 and option 5 are similar, moderator is wondering if the proponents of option 5 can support option 1?*

## Companies views’ collection for 2nd round

|  |  |
| --- | --- |
| **Company** | **Comments** |
|  | **Issue 4.2.1-1: FR definition in 60 GHz**  |
| QCOM | We feel the LS on OTA testing is not necessary. Deciding on a WID modification is a routine part of working in RANP. It is not a technical issue for RAN4. We are not objecting to the LS being sent if other companies agree to it, we are recording our position and rationale here. |
| AT&T | Concerning Issue 4.2.1-1, our position is the same and support Option 4. In addition as mentioned in the first round, we can support Option 1 if the generic FR2 nomenclature is utilized when referring to any operating bands in the entire 24.25 – 71 GHz range and the sub-band designations of FR2-1 and FR2-2 are utilized on an as needed basis and completely contained in 38.101-2.We are OK with the existing draft of the LS on OTA testing and support providing a clear RAN4 recommendation. We would also be OK if the RAN4 recommendation was communicated to RAN Plenary by the RAN4 chair in the RAN4 status report as an alternative to an LS. |
| Ericsson | On Issue 4.2.1-1:We agree with AT&T, as also verbally stated at the GTW, on supporting Option 4. If needed sub-band could be added if some RAN4 requirement needs that (or per request from e.g. RAN2) but at the same time referring to only FR2 should include the whole extended range up to 10GHz (as described by Huaweis table). |

# Recommendations for Tdocs

## 1st round

**New tdocs**

|  |  |  |
| --- | --- | --- |
| **Title** | **Source** | **Comments** |
| WF on [145] NR\_ext\_to\_71GHz\_Part1 | Intel | Capturing the outcomes during email and GTW discussions |
| Reply LS on the maximum channel bandwidth and channelization for NR operation in 52.6 to 71 GHz  | Intel | To: RAN\_1 |
| LS on UE OTA test method in 52.6 – 71 GHz | Apple | To: RAN\_P |
| LS on FR definition on 52.6 – 71 GHz | Huawei | To: RAN\_P |

**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 | WF on [145] NR\_ext\_to\_71GHz\_Part1 | Intel |  | Capturing the outcomes during email and GTW discussions |
| R4-210xxxx | Reply LS on the maximum channel bandwidth and channelization for NR operation in 52.6 to 71 GHz  | Intel |  | To: RAN\_1 |
| R4-210xxxx | LS on UE OTA test method in 52.6 – 71 GHz | Apple |  | To: RAN\_P |
|  | LS on FR definition on 52.6 – 71 GHz | Huawei |  | To: RAN\_P |

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