**3GPP TSG-RAN WG4 Meeting # 100-e R4-210XXXX**

**Electronic Meeting, 16th – 27th August, 2021**

**Agenda item:** 9.16.1, 9.16.2, 9.16.3, 9.16.8

**Source:** Moderator (Intel Corporation)

**Title:** Email discussion summary for [100-e][137] 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: High priority should be channelization, CBW related discussion, and CA aspect.
* 2nd round: TBA

# Topic #1: General (9.16.1), Band plan (9.16.2) and Others (9.16.8)

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

## Companies’ contributions summary

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| **T-doc number** | **Company** | **Proposals / Observations** |
| [R4-2113652](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113652.zip) | Ericsson | FR2 range needs to be updated based on the latest plenary decision  TP included for TS 38.101-1 |
| [R4-2113653](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113653.zip) | Ericsson | FR2 range needs to be updated based on the latest plenary decision  TP included for TS 38.101-2 |
| [R4-2113654](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113654.zip) | Ericsson | FR2 range needs to be updated based on the latest plenary decision  TP included for TS 38.104 |
| [R4-2114411](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2114411.zip) | Huawei | Proposal 1: agree on the implementation of the Updated implementation of the new FR2 frequency sub-range designations, as in Table 1.  Proposal 2: Consider triggering discussion on the worksplit in the preparation of the initial draft CRs.  TP included for TS 38.104 and 101-1 |
| [R4-2113686](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113686.zip) | Nokia | Proposal 1: Introduce an unlicensed band in the 57 to 71 GHz range as given in the TP.  Observation 1: We are not aware of any surely available licensed spectrum nor associated rules for licensed spectrum usage in any country/region in the 66 - 71 GHz range.  \* TP included for TS 38.101-2 |
| [R4-2114413](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2114413.zip) | Huawei | Proposal 1: agree on the approach to address the release-independence aspects of NR FR2 extension up to 71 GHz, by adding a clarification sentence to the scope in TS 38.307.  \* TP included for TS 38.307 |

## 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 1-1

*Sub-topic description:*

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

**Issue 1-1: Revise FR2 range in RF specs**

* Recommended WF
  + There are several similar TP proposals. Moderator suggests companies to comment directly in 1.3.2 CRs/TPs comment collection

### Sub-topic 1-2

*Sub-topic description*

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

**Issue 1-2: Capture release-independent aspect**

* Recommended WF
  + Moderator suggests companies to comment directly in 1.3.2 CRs/TPs comment collection

## Companies views’ collection for 1st round

### Open issues

*One of the two formats, i.e. either example 1 or 2 can be used by moderators.*

### 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.*

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| **CR/TP number** | **Comments collection** |
| [R4-2113652](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113652.zip) | Nokia, Nokia Shanghai Bell: These CRs should be implemented only when FR2-2 requirements are introduced, and the change should be implemented in all relevant specs - for example 38.101-3 is missing. Otherwise we end up with misalignment with FR2 definitions in specifications and having requirements applying to higher frequencies also when not intended. |
| Ericsson: Suggest noting this paper (authors request), see comment on R4-2114411. |
| Apple: For this tdoc and the ones below, as we started to make agreements on RF requirement, perhaps we can wait a bit to implement the RAN agreement on FR until all the RF requirements are clear. In this way, all the possible implications that may require further updates can be addressed. |
| ZTE: its better to postpone such CR approved, it’s better to introduce with other RF requirements as Big CR; |
| LGE: We agree with comments above aiming to capture the definition into all needed specs at the same time and in same way. However, it would be good to capture a definition that RAN4 companies can agree somewhere now that this topics is discussed – way forward etc. |
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| [R4-2113653](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113653.zip) | Nokia, Nokia Shanghai Bell: These CRs should be implemented only when FR2-2 requirements are introduced, and the change should be implemented in all relevant specs - for example 38.101-3 is missing. Otherwise we end up with misalignment with FR2 definitions in specifications and having requirements applying to higher frequencies also when not intended. |
| Ericsson: Suggest noting this paper (authors request), see comment on R4-2114411. |
| ZTE: its better to postpone such CR approved, it’s better to introduce with other RF requirements as Big CR; |
| LGE: We agree with comments above aiming to capture the definition into all needed specs at the same time and in same way. However, it would be good to capture a definition that RAN4 companies can agree somewhere now that this topics is discussed – way forward etc. |
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| [R4-2113654](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113654.zip) | Nokia, Nokia Shanghai Bell: These CRs should be implemented only when FR2-2 requirements are introduced, and the change should be implemented in all relevant specs - for example 38.101-3 is missing. Otherwise we end up with misalignment with FR2 definitions in specifications and having requirements applying to higher frequencies also when not intended. |
| Ericsson: Suggest noting this paper (authors request), see comment on R4-2114411. |
| ZTE: its better to postpone such CR approved, it’s better to introduce with other RF requirements as Big CR; |
| LGE: We agree with comments above aiming to capture the definition into all needed specs at the same time and in same way. However, it would be good to capture a definition that RAN4 companies can agree somewhere now that this topics is discussed – way forward etc. |
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| [R4-2114411](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2114411.zip) | Nokia, Nokia Shanghai Bell: It is not necessary to include the note that FR2-1 and FR2-2 should be used only when necessary. Further discussion is needed on in which tables FR2-1 and FR2-2 need to be differentiated. |
| Ericsson:  Proposal 1: Support this proposal of table structure change and note re-wording, might fine tune the wording a bit in future meeting  Proposal 2: Support of worksplit for CRs in coming meetings, we assume/suggests this will be managed by rapporteur during this meeting. |
| Apple: The note “NOTE: The frequency range designations FR2-1 and FR2-2 should only be used when needed.”, in our understanding, is a guidance for writing the specification and does not need to be captured in the specification. |
| ZTE: its better to postpone such CR approved, it’s better to introduce with other RF requirements as Big CR; |
| LGE: We agree with comments above aiming to capture the definition into all needed specs at the same time and in same way. However, it would be good to capture a definition that RAN4 companies can agree somewhere now that this topics is discussed – way forward etc. |
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| [R4-2113686](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113686.zip) | Ericsson: We can support introduction of unlicensed band in 57 to 71 GHz range, but it doesn’t preclude introduction of licensed bands in the whole or part of this range. |
| LGE: Introduction of unlicensed band in 57-71GHz is supported. |
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| [R4-2114413](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2114413.zip) | Nokia, Nokia Shanghai Bell: The statement could be avoided altogether by stating the release independency of FR2-2 bands clearly in table 5.1-1, which would be our preference. **Table 5.1-1: NR operating bands**   |  |  |  |  | | --- | --- | --- | --- | | **Feature** | **Duplex-mode** | **Release**  **independent from** | **Requirements to be fulfilled**  **(see TS 38.307 of the release in which the band was introduced)** | | Operating bands | FDD, TDD, SDL, SUL | Rel-15 | Table B.4.1-1, Table B.4.3-1 | | Operating bands for FR2-2 sub-range (i.e. 52.6 – 71 GHz) | TDD | Rel-17 |  |   In addition the statement does not reach the intention of clarifying if it says “may be”. It needs to be updated to say “are”. Also instead of clause 2 the statement should go to clause 4. |
| MediaTek: Okay with Nokia proposal, but suggest to modify to the following:  Table 5.1-1: NR operating bands   |  |  |  |  | | --- | --- | --- | --- | | Feature | Duplex-mode | Release  independent from | Requirements to be fulfilled  (see TS 38.307 of the release in which the band was introduced) | | Operating bands for FR2-1 frequency range | FDD, TDD, SDL, SUL | Rel-15 | Table B.4.1-1, Table B.4.3-1 | | Operating bands for FR2-2 frequency range | TDD | Rel-17 | Table x.y | |
| It may also be useful for some specs of other groups (e.g. 38.300) to be updated once the applicability of overall FR2 functionality is further defined by them, as 38.307 may not be the most visible. |
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|  | Samsung: in general, we believe it’s premature to endorse draft CRs for FR2-2 in this meeting with only update on frequency range agreement.  And the minor comment to Nokia and MTK’s comment to release independent spec is that the table to be updated is Table 6.1-1: NR operating bands. And it is believed that there may be other potential impact due to introduction of FR2-2 which should be addressed together in later phase.  ZTE: Okay with Nokia and MTK proposal; |

## 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.*

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|  | **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.*

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| **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: System Parameters (9.16.3)

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

## Companies’ contributions summary

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| **T-doc number** | **Company** | **Proposals / Observations** |
| [R4-2111913](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2111913.zip) | CATT | **Channelization**  Observation 1: The total number of sync raster entries for SCS based channel raster is up to 355 for 120 kHz SS SCS.  Observation 2: The granularity of fixed channel raster for 120kHz SCS is 50 MHz.  Observation 3: The total sync raster entries for the three data SCS is 210 when 120 kHz SCS is used for SSB.  Observation 4: FR2 GSCN can be reused by 57-71 GHz when fixed channel raster is used.  Observation 5: When unlicensed bands channelization needs to consider co-existence with IEEE channels, the adaption of 100 MHz granularity is better than 200 MHz granularity channelization.  Proposal 1: Current FR2 NR-ARFCN is reused by 52.6-71 GHz.  Proposal 2: For unlicensed bands when co-existence with IEEE channels doesn’t need to be considered, the channelization are designed as the followings   * + - * The high level guidelines are         + The channelization is designed as fixed channelization.         + The granularity of the channelization entries for 120 KHz SCS is 50 MHz. The granularity for 480 kHz SCS and 960 kHz SCS is 100 MHz.       * The channel raster entries for 120 kHz SCS is defined using the following equation.   2563333 + n\*834 - FLOOR ((n+1)/3)\*2, n=0:278   * The channel raster entries for 480 kHz SCS and 960 kHz SCS is defined using the following equation.   2564165 +n\*1668 - FLOOR((n+1)/3)\*4, n=0:137  Proposal 3: For unlicensed bands when co-existence with IEEE channels needs to be considered, the channelization is a subset of the whole channel entries of unlicensed bands.  Proposal 4: Channel raster for licensed band can reuse the channel raster entries of the unlicensed bands with the corresponding frequency range.  **Sync raster**  Proposal 5: Fixed sync raster corresponding to fixed channel raster is used for the unlicensed bands when co-existence with IEEE channels is not needed.  Proposal 6: The sync raster entries for channels considering the co-existence with IEEE channels can be a subset of the sync raster entries without IEEE channel co-existence issues.  Proposal 7: The sync raster entries of licensed band are a subset of the sync raster entries of unlicensed bands.  **CBW**  Observation 6: The motivation to support 1200 MHz single carrier CBW needs to be clarified.  Proposal 8: Agree the 2GHz maximum CBW for 960kHz SCS for both licensed and unlicensed bands.  Proposal 9: 1GHz single carrier CBW is supported for 480kHz and 960kHz SCS to accommodate the current spectrum status.  Proposal 9: 1GHz single carrier CBW is supported for 480kHz and 960kHz SCS to accommodate the current spectrum status.  **SU**  Observation 7: [165] RB which is 1900.8 MHz can be used as a starting point for 2GHz CBW SU analysis.  Observation 8: 1900.8 MHz is much larger than the 802.11 ad TBW of 1830.47 MHz which means no problem for LBT. |
| [R4-2112134](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112134.zip) | Apple | **CBW**  Proposal 1: it is proposed that UE support of the following max. CBW for each SCS is optional:  120kHz: 400MHz  480kHz: 1600MHz  960kHz: 2000MHz  **Channelization**  Proposal 2: For licensed band, there is no need to align with IEEE 802.11ad/ay channels in order to allow channel placement flexibility.  Proposal 3: For unlicensed band, align with IEEE 802.11ad/ay channels and avoid one NR channel overlapping with two IEEE 802.11ad/ay channels. A possible NR channelization shown in Fig. 1 can be used as a starting point for further discussion. |
| [R4-2112186](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112186.zip) | CMCC | Proposal 1: For 960KHz SCS maximum channel bandwidth, 2000MHz for both licensed and unlicensed operations  Proposal 2: Considering the available spectrum for 52.6-71GHz is much more than below 52.6GHz, it is proposed that the maximum channel bandwidth for each SCS is mandatory.   * + 120kHz: 400MHz   + 480kHz: 1600MHz   + 960kHz: 2000MHz   Proposal 3: CA is supported for intra-band contiguous within 2/2.16 GHz. N x 400 MHz, n = [2, 3, 4, 5].  Proposal 4: CA is supported for larger than 2000MHz. |
| R4-2112606 | Xiaomi | Proposal: It is proposed to have harmonized channelization for both licensed and un-licensed spectrum as:  -For Channel raster, still use current FR2 design as:  FREF = FREF-Offs + ΔFGlobal (NREF – NREF-Offs)  ΔFRaster = *I* ×ΔFGlobal , where *I* ϵ *{2,8,16} with* . ΔFGlobal = 60kHz.  -For Sync raster design, modify current FR2 design as double the sync raster with:   |  |  |  | | --- | --- | --- | | NR Operating Band | SS Block SCS | Range of GSCN  (First – <Step size> – Last) | | 52.6—71GHz | 120 kHz | 23899 - <2> - 24994 | | 480 kHz | 23905 - <8> - 24988 | |
| [R4-2112865](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112865.zip) | Samsung | Proposal 1: it’s suggested to confirm 2GHz as maximum channel bandwidth for 960 kHz SCS.  Proposal 2: it's suggested to agree the channel bandwidth for FR2-2 as table 1. |
| [R4-2112994](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112994.zip) | vivo | Proposal 1: To harmonize channelization for both licensed and unlicensed bands in 52.6~71GHz.  Proposal 2: No need to align with IEEE a.d./a.y. channels.  Observation 1: The number of sync raster entries based on fixed channelization is half of that based on the floating channelization.  Observation 2: No matter which way to define sync raster, fixed or floating, the total number of sync raster entries is no larger than 665.  Proposal 3: To define the channel raster and sync raster based on the fixed channelization for both licensed and unlicensed bands in B52.6G. |
| [R4-2113159](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113159.zip) | Intel Corporation | **Intermediate Channel bandwidths**  Observation 1.1-1: Relative bandwidths of 1200 MHz for 480 and 960 kHz SCS are significantly low, i.e., 61 %, compared to other channel bandwidths, i.e., > 81 %.  Observation 1.1-2: From UE implementation perspective, it is strongly preferrable to support 1200 MHz CBW as a carrier aggregation rather than a single carrier channel bandwidth.  Proposal 1.1-1: Channel bandwidths between minimum and maximum CBWs are integer multiples of each minimum channel bandwidth for each subcarrier spacing, except 1200 MHz for both 480 and 960 kHz SCS. Table 1-2 summarizes the proposal.  **Spectrum Utilization**  Proposal 1.2-1: RAN4 agrees on a general principle of the same max SU for all supported SCS.  **Carrier Aggregation**  Proposal 1.3-1: Intra-band contiguous CA is supported with normal CA operation.  **Channelization**  Fixed Channelization without align with IEEE 802.11ad/ay  Observation 1.4-1: Channel raster entries are not on the same FFT grid which prevents a single FFT implementation.  Observation 1.4-2: The channelization in [1] provides maximum spectrum utilization.  Observation 1.4-3: NR channel boundaries are not aligned with IEEE 802.11ad/ay channels which causes coexistence issues.  Channelization for Better Coexistence  Observation 1.4-4: NR channels are aligned with IEEE 802.11ad/ay channels.  Observation 1.4-5: Channel raster entries are on the same grid, i.e., 960 kHz, and a single FFT implementation is possible.  Compromised Channelization Proposal  Observation 1.4-6: The proposed channelization provides flexible choice between spectrum utilization and coexistence.  Observation 1.4-7: The proposed channelization provides sub-optimum spectrum utilization compared to the fixed channelization without align with IEEE 802.11ad/ay channels.  Observation 1.4-8: Smaller BWs such as 100 MHz and 200 MHz can be added outside the 802.11ad/ay channels that are underutilized but available from regulation perspective, which would further increase the amount of spectrum usage.  Observation 1.4-9: Channel raster entries of the proposed channelization are on the same grid, i.e., 960 kHz, and a single FFT operation is possible.  Observation 1.4-10: It is important to support a single FFT operation for efficient UE implantation.  Proposal 1.4-1: RAN4 agrees on future channelization discussion is based on the 960 kHz grid. |
| [R4-2113528](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113528.zip) | LG Electronics Finland | SSB raster for 52.6-71GHz frequency range is discussed and a proposal for SS raster entries as in Table 1 is made. |
| [R4-2113550](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113550.zip) | MediaTek (Chengdu) Inc. | Observation 1: For unlicensed band operation, a “fully floating” channel raster has impact on UE energy consumption due to increased GSCN raster instances, as well as testing complexity for certification of 3GPP technology compared to other technologies. It is also unclear how such raster flexibility would be useful for unlicensed band operation, considering that the spectrum is free for use.  Observation 2: The NR-U type of synchronization raster (Approach 2) with approx. 100MHz/400MHz granularity enables the best cell search performance in terms of search time and UE energy consumption. A similar approach with 0.85 x minCBW spacing would give slightly worse performance but a bit more flexibility.  Observation 3: If a fully-floating channel raster were required for minimum channel bandwidth ARFCNs, quite a large number of GSCN instances are required unless there is increased flexibility in CORESET#0 offset.  Observation 4: For licensed bands, a GSCN raster with approx. 100MHz/400MHz spacing could be sufficient to allow (with some CORESET#0 configuration flexibility):   * a fully-floating channelization for channel bandwidths ≥200MHz for 120kHz SCS SSB and ≥800MHz for 480kHz SCS SSB * a partially-floating channelization even for minimum channel bandwidths   More flexibility could be introduced in future as needed.  Observation 5: We don’t believe that defining a full ARFCN flexibility (120kHz, 480kHz ARFCN granularity) for 100MHz/400MHz bandwidths (worst case scenario) is really justified across the full 57-71GHz range at this stage, considering that this flexibility seems to be more relevant (if at all) for licensed spectrum once we have more regional insights on frequency ranges.  Proposal 1: For the 57-71GHz unlicensed band, agree on a fixed channelization raster and set the GSCN raster accordingly (similar method as used for bands n46 and n96) with approx. 100MHz and 400MHz spacing for 120kHz and 480kHz SCS SSB respectively.  Proposal 2: For any licensed band defined in the future, consider reuse of the same GCSN raster (as in Proposal 1) as a starting point with e.g. a more flexible channel raster around each GSCN. Additional GSCN locations could be enabled at that stage if more flexibility is deemed required. |
| [R4-2113680](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113680.zip) | Nokia, Nokia Shanghai Bell | **CBW**  Observation 1: Current ETSI (303 753, 303 722) and FCC (FCC 47 CFR § 15.255) rules do not mandate usage of specific channel bandwidths or channel rasters, therefore there is no issue in using 2000 MHz maximum channel bandwidth together with floating channel raster which is not tied to IEEE channel positions.  Proposal 1: 2000 MHz maximum channel bandwidth is defined for 960 kHz SCS and can be used for both licensed and unlicensed operation.  Proposal 2: Channel raster for unlicensed operation is defined as a floating raster not limited to IEEE channel positions, however attention needs to be put on number of raster points.  Proposal 3: Support 200 MHz, 400 MHz, 800 MHz and 1600 MHz intermediate channel bandwidths  **CA**  Proposal 4: Support CA within a 2 GHz channel, and between 2 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 GHz channel.  Observation 2: From performance point of view wider channel bandwidths are more favorable compared to CA configurations of many CCs.  Proposal 6: Enable m x 100 MHz CA operation, with a reasonable limit on m. |
| [R4-2113921](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113921.zip) | ZTE Corporation | **CBW**  Observation 1: It is not necessary to align NR channelization with IEEE 802.11ad channelization from coexistence perspective;  Proposal 1: for 960kHz SCS, propose maximum CBW supported as 2000MHz;  Proposal 2: for intermediate CBWs between min and max CBW:  120kHz: 200 MHz  480kHz: 800, 1200 MHz  960kHz: 800, 1200, 1600 MHz  **Channel raster**  Proposal 3: 120kHz channel raster should be applied for licensed operation of 52.6-71GHz.  **SU**  Proposal 4: postpone the discussion of spectral utilization for 60GHz until there are clear agreement on emission mask and in-band emission requirements;  **Sync raster**  Proposal 5: to define new sync raster step size for 52.6-71GHz instead reusing the existing FR2 17.28MHz step size.  Proposal 6: to postpone the sync raster discussion until mini BW, SU and SSB SCS has been agreed; |
| [R4-2113953](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113953.zip) | Ericsson | **Channelization**  Observation 1: UE SSB search complexity using “floating” raster is practical option given 120 kHz and 480 kHz SCS is supported for initial access.  Proposal 1: RAN4 to adopt “floating” channelization design, as in Rel-15.  **SU**  Observation 2: Given the minimum required spectral utilization for RAN1 design needed is 85%, and UE output power should be constrained within 70% of the declared nominal channel bandwidth; together with BS/UE RF design considerations initial spectral utilization should be considered as a range between 85-95%.  Proposal 2: Spectral utilization initial consideration of a range between 85-95%.  Example of Floating Channelization  Observation 3: With the exemplary floating channelization design, the UE SSB search complexity is less (505 GSCN points) than the search complexity for a Rel-15 UE supporting Band n257 and Band n259 (599 GSCN points).  Observation 4: none of the draft European standards for range c1-c3 specify a nominal channel raster, the nominal channel bandwidth used for RF requirements is declared. Hence raster alignment is not essential for coexistence.  Observation 5: 3GPP can specify a channel raster that allows flexible use of the 57-71 GHz in different geographical regions.  Observation 6: Adopting a floating channelization scheme as in Rel-15 FR2 results in flexible and forward compatible design that can be used for any band that is introduced in Rel-17 and later release. Such a design allows for configuration of any channel center frequency (with granularity equal to the SCS). This is beneficial to support both licensed and unlicensed band definitions and naturally supports alignment with channels of other technologies if coexistence is deemed to be important for a given deployment. |
| [R4-2114479](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2114479.zip) | Qualcomm Incorporated | Proposal 1: Specify intraband contiguous CA in 120 kHz SCS using 100, 200, and 400 MHz CCBWs.  Proposal 2: Re-use the CA bandwidth class concept from FR2-1.  Proposal 3: Further discuss channel bandwidths for intraband contiguous CA in 480 and 960 SCS.  Proposal 4: RAN4 to prioritize CA specifications for CA bandwidths less than or equal to 2000/2160 MHz. |
| [R4-2112993](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112993.zip) | vivo | **Max CBW for 960 kHz**  Observation 1: From the perspective of regulation, the option defining 200MHz for both licensed and unlicensed bands is allowed.  Observation 2: The channels defined in IEEE 802.11 ad/ay are not aligned and overlapping with each other.  Proposal 1: Channel bandwidth of 2000MHz should be defined for both licensed and unlicensed bands.  **Intermediate CBWs**  Proposal 2: The intermediate channel bandwidths can be chosen based on the principle multiple times of minimum channel bandwidth.    **Optionality of max CBW**  Proposal 3: The optionality of UE channel bandwidth should be discussed independent of SCS. |
| [R4-2113954](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113954.zip) | Ericsson | Proposal: For the maximum bandwidth for 960 kHz SCS, support Option 1 considering “floating” channelization can naturally support alignment with channels of other technologies if coexistence is deemed necessary for a given deployment |

## 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 2-1

*Sub-topic description:*

*Open issues and candidate options before e-meeting: Whether maximum CBW with 960 kHz SCS is 2 GHz or 2.16 GHz.*

**Issue 2-1: Max CBW with 960 kHz SCS**

* Proposals
  + Option 1: 2 GHz
* Recommended WF
  + Confirm 2 GHz as the maximum CBW with 960 kHz SCS

### Sub-topic 2-2

*Sub-topic description*

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

**Issue 2-2: Intermediate CBWs between min and max CBW**

* Proposals
  + Option 1: Integer multiples of the min CBW for each SCS
    - 120 kHz: 100 MHz (min), **200 MHz**, 400 MHz (max)
    - 480 kHz: 400 MHz (min), **800 MHz, 1200 MHz**, 1600 MHz (max)
    - 960 kHz: 400 MHz (min), **800 MHz, 1200 MHz, 1600 MHz**, 2000 MHz (max)
  + Option 2: Remove 1200 MHz from the Option 1
    - 120 kHz: 100 MHz (min), **200 MHz**, 400 MHz (max)
    - 480 kHz: 400 MHz (min), **800 MHz**, 1600 MHz (max)
    - 960 kHz: 400 MHz (min), **800 MHz**, **1600 MHz**, 2000 MHz (max)
  + Option 3: Replace 1200 MHz with 1000 MHz from the Option 1
    - 120 kHz: 100 MHz (min), **200 MHz**, 400 MHz (max)
    - 480 kHz: 400 MHz (min), **800 MHz**, **1000 MHz**, 1600 MHz (max)
    - 960 kHz: 400 MHz (min), **800 MHz, 1000 MHz, 1600 MHz**, 2000 MHz (max)
* Recommended WF
  + TBA

### Sub-topic 2-3

*Sub-topic description*

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

**Issue 2-3: Optionality of the max CBWs**

* Proposals: Optional support for the max CBWs. The following channels are optional:
  + 120 kHz: 400 MHz
  + 480 kHz: 1600 MHz
  + 960 kHz: 2000 MHz
* Recommended WF
  + TBA

### Sub-topic 2-4

*Sub-topic description*

*Open issues and candidate options before e-meeting: Since FR2 NR-ARFCN covers up to 100 GHz, NR-ARFCN for 52.6 – 71 GHz should be a part of this.*

**Issue 2-4: Channelization**

* Proposals:
  + Option 1: Harmonize channelisation between licensed and unlicensed bands
    - Option 1A: Align with IEEE 802.11ad/ay with fixed channelization
    - Option 1B: No IEEE 802.11ad/ay alignment with fixed channelization (vivo, MTK)
    - Option 1C: No IEEE 802.11ad/ay alignment and floating channelization (Nokia, Ericsson, ZTE, Xiaomi)
    - Option 1D: Hybrid between IEEE and no IEEE alignment with fixed channelization depending on max spectrum utilization and better coexistence (Intel)
    - Option 1E: Fixed channelization with proper channel raster granularity to consider the co-existence with IEEE 802.11ad/ay alignment if needed. (CATT)
  + Option 2: Separate channelization
    - For Licensed:
      * Option 2A: No IEEE 802.11ad/ay alignment (Apple)
    - For Unlicensed:
      * Option 2B: Align with IEEE 802.11ad/ay (Apple)
* Recommended WF
  + TBA

### Sub-topic 2-5

*Sub-topic description*

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

**Issue 2-5: Channel raster grid**

* Proposals:
  + Option 1: 120 kHz
  + Option 2: 960 kHz
* Recommended WF
  + TBA

### Sub-topic 2-6

*Sub-topic description*

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

**Issue 2-6: Reply LS on channelization**

* Recommended WF
  + This can be further discussed once the issues 2-4 and 2-5 are concluded.

### Sub-topic 2-7

*Sub-topic description*

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

**Issue 2-7: Spectrum Utilization**

**Moderator Note: This issue will be discussed in [138]**

* Proposals:
  + Option 1: Separate max SU target
    - For 120 kHz SCS: Keep the same max SU from FR2, i.e., 95%
    - For 480/960 kHz SCS: Consider relaxed max SU, i.e., [85 – 95]%
  + Option 2: The same max SU target for all SCS, i.e., [85 – 95]%
* Recommended WF
  + TBA

### Sub-topic 2-8

*Sub-topic description*

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

**Issue 2-8: Intra-band Contiguous Carrier Aggregation within 2 GHz**

* Proposals:
  + Option 1: Fixed combination
    - n x 400 MHz, n = [2, 3, 4, 5]
    - m x 100 MHz for 120 kHz SCS, m is FFS
  + Option 2: Normal CA operation
* Recommended WF
  + TBA

### Sub-topic 2-9

*Sub-topic description*

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

**Issue 2-9: Intra-band Contiguous Carrier Aggregation beyond 2 GHz**

* Proposals:
  + Option 1: Enable CA > 2 GHz
  + Option 2: Deprioritize CA > 2 GHz
* Recommended WF
  + TBA

## Companies views’ collection for 1st round

### Open issues

**Issue 2-1: Max CBW with 960 kHz SCS**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Nokia, Nokia Shanghai Bell | We agree with the WF. |
| MediaTek | Agree with WF |
| Ericsson | It appears that RAN4 is able to reach consensus on the maximum channel bandwidth of 2 GHz for 960 kHz SCS. Ericsson has a draft LS to RAN1 and can volunteer to draft the response on the remaining question, in order to conclude the discussion from the incoming LS R4-2102128, “LS on the maximum/minimum channel bandwidth and channelization for NR operation in 52.6 to 71 GHz”, RAN1. |
| Intel | Agree with the WF |
| Apple | Agree with WF |
| Samsung | We support the WF |
| Xiaomi | Agree with the WF. |
| ZTE | Agree with WF |
| Charter Comm Inc | Agree with WF |
| LGE | Agree with WF |
| CATT | Agree with WF |

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| Sony | We agree with the recommended WF |

**Issue 2-2: Intermediate CBWs between min and max CBW**

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| **Company** | **Comments** |
| Nokia, Nokia Shanghai Bell | Option 2, it is better to limit the number of ChBW to limit complexity and as discussed in our Tdoc implementation efficiency is poor for 1200 MHz. |
| MediaTek | Option 2 seems preferable. |
| Ericsson | We can support option 1, if 200 MHz for 120 kHz is removed. We can’t really see a need related to spectrum allocation to have 200 MHz carrier bandwidth. It will just drive test complexity. |
| Intel | Option 2. It is important to consider implementation efficiency. 1200 MHz can be supported by CA instead. |
| Apple | Option 2, with the understanding that CA can be used too |
| Samsung | Ok to option2 |
| Xiaomi | Option 2. |
| ZTE | We support option 1,since 1200MHz+800MHz or 400+1600MHz would be easier to support 2GHz. |
| Charter Communications Inc | Option 2 |
| LGE | Option 2 is OK |
| CATT | We see 1000 MHz is needed considering the spectrum status. But we’re also ok with option 2. |

**Issue 2-3: Optionality of the max CBWs**

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| **Company** | **Comments** |
| Nokia, Nokia Shanghai Bell | Both 480 and 960 kHz SCS are optional. Given that 2000 MHz is the only ChBW for 960 kHz SCS that is wider than 1600 MHz, it should be mandatory to be supported. For 120 kHz SCS 400 MHz should be mandatory to enable taking advantage of the wide available spectrum. |
| Ericsson | We don’t really see a need for optional max CBW support for this spectrum range. Even if we have it for FR2-1. |
| Intel | 480 and 960 kHz SCS are already optional. As Nokia commented above, 2000 MHz CBW is the only difference between 480 and 960 kHz SCS. Thus making 2000 MHz CBW to be optional seems not reasonable proposal. |
| Apple | Optionality is preferred in order to allow implementation flexibility and fast time to market, especially similar consideration was given in FR2-1. |
| Xiaomi | Since 480 and 960kHz SCS are already optional, we see it is feasible to have 2000MHz optional, too. |
| ZTE | We also prefer max CBW is mandatory if supported SCS has been reported, otherwise it will make UE capability a bit loosen to support 52.6-71GHz. |
| Charter Communications Inc | We agree with Nokia’s and Intel’s comments  480 and 960 kHz SCS are already optional. Given that 2000 MHz is the only ChBW for 960 kHz SCS, it should be mandatory to be supported. |
| LGE | No strong views on this, but optional on top of optional is not necessary. |

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| Sony | We support the comments from Nokia and Intel. |

**Issue 2-4: Channelization**

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| **Company** | **Comments** |
| Nokia, Nokia Shanghai Bell | Option 1C. No regulations mandate specific channel raster and floating channelization enables sufficient channel alignment in case needed in some specific case and this can be achieved by gNB implementation. |
| MediaTek | Option 1B is preferable. Our main rationale for fixed channelization is to minimize cell search complexity, and because the smallest channel bandwidth being quite small versus the spectrum range is already offering granularity in channel locations to avoid wasted spectrum.  To Nokia:  If really required to align with IEEE in some region, a GSCN raster based on a fixed channelization for minimum channel bandwidth (i.e. 100/400MHz granularity) would still be granular enough to allow wider bandwidth channel locations to be shifted around the SSB location, and in a fully-floating manner if really necessary (due to channel BW size relative to the SSB bandwidth, and the fact that SSB does not need to centred in the channel BW).  To Ericsson (below):  A GSCN raster using every 2nd point would not address our UE initial access searching concerns, because we could go much less and still offer reasonable flexibility in our view (see the analysis in our contribution). Minimizing energy consumption in UE is important, so introducing additional searching and further energy consumption for initial access should be avoided without clear justification. We have not seen any clear justification for that (and even less so for unlicensed operation where networks can be very dynamic). |
| Ericsson | Option 1C. To keep with RAN agreement, our proposal is to keep Rel-15 floating raster but using every second GSCN point a part of the sync raster definition. This would then consider UE search complexity concerns. |
| Intel | Option 1D. In our proposal, we came up with a compromise between maximum spectrum usage (Option 1C) and better coexistence (Option 1E/2A). In our paper, there is comparison table among those proposals. |
| Apple | Our main concern is alignment with IEEE channels with fixed channelization is needed for unlicensed operation. Furthermore, fixed channelization as proposed in R4-2112134 will also ensure the coexistence between two NR channels of the same CBW in the unlicensed bands. |
| Samsung | In general we support harmonize between licensed and unlicensed operation. No strong opinion on each solutions but from the angle of deployment flexibility point of view option 1C is slightly preferred. |
| Xiaomi | Option 1C. We have similar understanding as Ericsson as using every 2nd GSCN for sync raster which fulfills the newest WID requirement on sync raster points and meanwhile keep the flexibility of spectrum usage with much more channel raster points comparing to fixed channelization. |
| ZTE | We support Option 1C for channel raster for 52.6-71GHz since in regulation, therefore are no mandate to align with IEEE channels; Regarding the sync raster for 52.6-71GHz, 17.28MHz is not multiple of 480kHz and 960kHz PRBs, therefore we cannot directly use that approach, we could understand that it was used for n79 with minimum channel bandwidth as 40MHz, however here we might have slightly different stories since new SCSs are supported for 52.6-71GHz. |
| Charter Communications Inc. | We agree with Intel’s proposal. Option 1D: Hybrid between IEEE and no IEEE alignment with fixed channelization depending on max spectrum utilization and better coexistence (Intel) |
| LGE | We can agree to floating channel raster, but prefer fixed and limited set of SSB frequencies. |
| CATT | It seems option 1D and option 1E are similar, option 1E provides the method to achieve option 1D. So we think first we can agree fixed channelization then discuss the granularity to have some flexibility. We see 100 MHz granularity should be ok for all of the CBW and the sync raster entries are not increased. So with some flexibility for the channelization can solve all of the concerns and no increase of the implementation complexity. |

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**Issue 2-5: Channel raster grid**

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| **Company** | **Comments** |
| MediaTek | At least Option 1. Option 2 would need further evaluation of gain vs pain before being agreed. |
| Ericsson | It’s unclear about the reference of this proposal, since 120 kHz is supported in initial access and 960 kHz is optional, it doesn’t seem necessary to discuss this issue. |
| Intel | To Ericsson and MTK:  This is nothing to do with initial access. Our proposal is the difference between two channel raster entries to be integer multiple of 960 kHz. We defined 5 GHz NR-U channel raster grid based on 60 kHz which is least common multiple of all supported SCS, i.e., 60 kHz = LCM (15kHz, 30 kHz, 60 kHz). 960 kHz is the LCM of 120 kHz, 480 kHz, and 960 kHz.  In case of 120 kHz raster grid, there is no guarantee that two CCs are not on the same FFT grid in CA operation, i.e., 200 MHz with 120 kHz SCS + 400 MHz with 480 kHz SCS. This increases implementation complexity. |
| Apple | Option 2 seems reasonable as it allows single FFT implementation for each SCS. Furthermore, given the large CBW (and guard band), it should not cause problems for UEs to meet SU. |
| ZTE | At least Option 1 since this is minimum SCS supported for this frequency range; for higher channel raster, this might reduce channel positions for lower SCS. |
| Charter Communications Inc | Option 2 |
| LGE | Within this frequency range with wide channels (Min CBW) we think that raster can be less dense and selecting this in a way that enables single FFT is supported. |
| CATT | It seems 960 kHz is more reasonable, but prefer to see the details of the channel raster solution and also how to solve the problem of channel raster potions are not multiples of 100MHz. |

**Issue 2-6: Reply LS on channelization**

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| **Company** | **Comments** |
| Nokia, Nokia Shanghai Bell | We agree to return to this once more agreements are in place. |
| ZTE | Agree with Recommended WF |
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**Issue 2-7: Spectrum Utilization**

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| **Company** | **Comments** |
| Nokia, Nokia Shanghai Bell | Option 1. At least for 120 kHz same SU than in FR2-1 should be maintained as simulations do not show any UE power gain from lower SU. Using narrower RB allocation is always possible to boost the PSD. For other SCS we not see a reason to relax SU below 90 %. |
| MediaTek | Option 2: But we think it is useful to consider further something like 85% SU for all bandwidths, and not yet convinced that there is no power gain. But in general a further understanding on all related requirements should be progressed in parallel before confirming a decision. |
| Ericsson | Option 2. The SU has impact on other issues such as channelization and to not restrict other options it would be good to keep all available options open until other issues are finalized. For companies proposing to consider different Sus for different SCS it would be useful to understand the motivation since that approach has not been applied in the past. |

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| **Moderator** | **This issue will be discussed in [138] and no more discussion in [137]. Sorry for any convenient.** |

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| **Charter Communications Inc** | * Option 1: Separate max SU target   + For 120 kHz SCS: Keep the same max SU from FR2, i.e., 95%   + For 480/960 kHz SCS: Consider relaxed max SU, i.e., [85 – 95]%   **We will add our comment to [138] as well.** |
|  |  |

**Issue 2-8: Intra-band Contiguous Carrier Aggregation within 2 GHz**

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| **Company** | **Comments** |
| Nokia, Nokia Shanghai Bell | At least for unlicensed bands where spectrum licensing does not set strict side conditions option 1 can be applied to limit implementation complexity. |
| MediaTek | Option 1 at least with n x 400MHz should be considered. Does not seem that Option 2 is mutually exclusive to that though, so should be clear that Option 1 is a subset of Option 2. |
| Ericsson | Option 2. |
| Apple | Option 2, especially considering the limited intermediate CBW |
| Samsung | With the goal to enable both licensed and unlicensed operation in FR2-2, option 2 is preferred. |
| Xiaomi | Option 2. |
| ZTE | Option 2. |
| Charter Communications Inc. | Option 1: Fixed combination   * n x 400 MHz, n = [2, 3, 4, 5] * m x 100 MHz for 120 kHz SCS, m is FFS |
| CATT | Option 2. |

**Issue 2-9: Intra-band Contiguous Carrier Aggregation beyond 2 GHz**

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| --- | --- |
| **Company** | **Comments** |
| Nokia, Nokia Shanghai Bell | Our understanding of RAN1 progress is that CA beyond 2 GHz can be release independent from rel-17 even though core requirements in RAN4 would be defined only in later release. We do not see a reason to deprioritize CA work in this release. |
| MediaTek | From RAN4 perspective, treating this as lower priority seems reasonable e,g. added in Release independent manner assuming protocol spec is there. |
| Ericsson | We should not at this stage exclude the possibility to support CA with 2GHz carriers. Maybe the prio now should be on lower CA bandwidth combination. |
| Apple | No strong view, perhaps we can defer the decision |
| ZTE | Similar view as apple, no strong motivation on this issue. |
| Charter Communications Inc | Option 1: Enable CA > 2 GHz |
| CATT | Prefer to focus on single carrier in RAN4 at current stage. |

### 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 |  |
|  |  |  |  |  |
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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

# Annex

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Note:

1. Please add your contact information in above table once you make comments on this email thread.
2. If multiple delegates from the same company make comments on single email thread, please add you name as suffix after company name when make comments i.e. Company A (XX, XX)