**3GPP TSG-RAN WG4 Meeting # 101Bis-e R4-2202227**

**Electronic Meeting, January 17 – 25, 2022**

**Agenda item:** 6.16.1, 6.16.2, 6.16.6, 6.16.8

**Source:** Moderator (Intel Corporation)

**Title:** Email discussion summary for [101-bis-e][127] NR\_ext\_to\_71GHz\_Part\_1

**Document for:** Information

# Introduction

*This document captures RAN4 discussions for the NR extension to 71GHz work item, including general aspects, band planning, and system parameters.* *The covered agenda items are: 6.16.1, 6.16.2, 6.16.6 and 6.16.8*

# Topic #1: General (AI 6.16.1)

## Companies’ contributions summary

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| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2200469**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-bis-e/Docs/R4-2200469.zip)  Views on sensing beam selection on the UE side | Sony | Observation 1: the existing beam correspondence test can not verify if the UE uses the same beam for sensing and transmission, regardless of the beam correspondence capability.  Observation 2: it is hard to define and adopt the X dB beamwidth method in practical UE RF requirements and tests.  Observation 3: the common spherical coverage concept may potentially be used as a starting point to define the relation between sensing beam and transmission beam |
| [**R4-2200847**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-bis-e/Docs/R4-2200847.zip)  Draft LS on sensing beam characteristics to RAN1 | Ericsson | For an adaptive array antenna system to be used for both BS and UE operating within the frequency range 52600 to 71000 MHz the following issues have been identified if requirements related to gain or beamwidth on the receive side is defined:  1. The parameter antenna gain by definition will require access to a conducted RF interface.  2. There are no beam quality requirement limits (such as antenna gain or beamwidth) defined in NR RF specifications.  3. Defining parameters such antenna gain (directivity) and beamwidth looks simple at first glance but finding relevant conditions and test cases it is much more difficult.  4. Testing beamwidth or antenna gain will significantly add to the conformance test specification complexity.  Based on the information provided in this contribution we propose not to define new requirements for beam quality for traffic and sensing beam. Based on questions given in LS we strongly support to not defining beam quality parameter-based requirements on specific beams during reception. We also suggest keeping beamforming aspect for different signals to be implementation specific not captured by the specification. **Hence, we support only alternative lF**.  Draft LS reply states:  RAN4 propose not to define new requirements for beam quality for traffic and sensing beam. RAN4 suggest RAN1 to adopt **alternative 1F** finalizing the remaining work related to extension of NR to support the frequency range 52600 to 71000 MHz. |
| **[R4-2200948](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-bis-e/Docs/R4-2200948.zip)**  Draft CR for TS 38.101-2: Introduction of system parameters for FR2-2 | vivo | Introduces subranges FR2-1/FR2-2, band n263 and UE channel bandwidths for FR2-2 to TS 38.101-2 |
| [**R4-2201533**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-bis-e/Docs/R4-2201533.zip)  Discussion and draft reply LS on sensing beam selection from RAN1 | Huawei, HiSilicon | **Observation 1:** Alt-1A and Alt-1D would lead to performance degradation of sensing accuracy.  **Observation 2:** Alt-1B and Alt-1C are not testable due to unmeasurable conducted connector  **Observation 3:** For UEs satisfying beam correspondence tolerance requirements and gNBs, 3dB sensing beamwidth could contain the beam peak direction of the transmission beam.  **Observation 4:** Alt-1F is acceptable if sensing performance could be ensured by UE/gNB implementation.  **Proposal 1:** Alt-1E is considered as the baseline.  Draft LS reply:  RAN4 discussed on all the potential methods provided by RAN1. Considering the sensing performance, implementation complexity and testability issues, it was agreed **Alt-1E** is the best compromise from RAN4 point of view. |
| [**R4-2201923**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-bis-e/Docs/R4-2201923.zip)  CR work split and UE feature list for NR ext. to 71GHz | Intel Corporation | *CR work split for TS 38.101-2*  **Proposal 1:** RAN4 should finalize the work split for TS 38.101-2 by having one more company volunteer for the remaining part highlighted below.   * System parameters – vivo * Tx or Rx – Apple * Tx or Rx – TBA * Big CR – Intel   *UE feature list*  **Proposal 2:** Adopt the UE feature list for NR\_ext\_to\_71GHz WI in Table 1. |

## Open issues summary

### Sub-topic 1-1: CR work split for TS 38.101-2

*The work split agreement for TS 38.101-2, along with the companies overseeing each part, is listed below. A volunteer is needed for the Tx or Rx part.*

* *System parameters - vivo*
* *Tx or Rx – Apple*
* *Big CR - Intel*
* *Tx or Rx - TBA*

**Issue 1-1: CR work split volunteer**

* Recommended WF
  + Provide feedback if interested in overseeing the Tx or Rx part of TS 38.101-2

### Sub-topic 1-2: Specification updates

**Issue 1-2: TS 38.101-2 update**

*Draft CR R4-2200948 introduces subranges FR2-1/FR2-2, band n263 and FR2-2 UE channel bandwidths to TS 38.101-2.*

* Recommended WF
  + Moderator suggests companies provide any feedback on draft CR R4-2200948 directly into Section **1.3.2 CRs/TPs** **comments collection**.

### Sub-topic 1-3: UE feature list for NR ext. to 71 GHz

*The three UE features to support FR2-2 operation proposed in R4-2201923 are listed below, along with the corresponding NR\_ext\_to\_71GHz feature list table.*

* *Channel bandwidth for a single CC*
* *Modulations - 64QAM for PUSCH for FR2-2*
* *Improved ON/ON transient period capability*

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Index | Feature group | Components | Prerequisite feature groups | Need for the gNB to know if the feature is supported | Applicable to the capability signalling exchange between UEs (V2X WI only)”. | Consequence if the feature is not supported by the UE | Type | Need of FDD/TDD differentiation | Need of FR1/FR2 differentiation | Capability interpretation for mixture of FDD/TDD and/or FR1/FR2 | Note | Mandatory/Optional |
| x-1 | FR2-2 channel bandwidths for each SCS in each band for DL and UL for a single CC | Support of FR2-2 channel bandwidths  1) 120 kHz SCS: {100, 400} MHz CBW  2) 480 kHz SCS: {400, 800, 1600} MHz CBW  3) 960 kHz SCS: {400, 800, 1600, 2000} MHz CBW | FFS | Yes | No | UE cannot support some UE channel bandwidths | Per band | N/A | Applicable to FR2-2 only | N/A | UE indicating the support of specific SCS per band (RAN1 features X-Y) is required to support all CBWs corresponding to this SCS  No additional capability signalling is needed. | NA |
| x-2 | 64QAM for PUSCH for FR2-2 | 1) Support of 64QAM modulation for FR2-2 PUSCH | FFS | Yes | No | UE cannot support PUSCH 64QAM transmission | Per band | N/A | Applicable to FR2-2 only | N/A |  | Optional with capability signalling |
| x-3 | [Improved ON/ON transient period] | 1) Support of improved ON/ON transient period of X < 5us (X is FFS) | FFS | Yes | No | UE does not support improved ON/ON transient period and support 5us transient period | Per UE | N/A | Applicable to FR2-2 only | N/A | Further RAN4 discussion is required on whether to support improved ON/ON transient period and X value | Optional with capability signalling |

**Issue 1-3: UE feature list**

* Recommended WF
  + Moderator suggests companies provide their feedback on the three UE features listed above.

## Companies’ views - collection for 1st round

### Open issues

Issue 1-1: CR work split volunteer

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| --- | --- |
| **Company** | **Comments** |
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Issue 1-3: UE feature list

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| **Company** | **Comments** |
| vivo | For now, RAN4 don’t have agreement on whether to introduce ‘Improved ON/ON transient period capability’. It may not be needed for x-3. |
| Nokia, Nokia Shanghai Bell | For UE supported FR2-2 channel bandwidths we support the proposal. As each SCS is optional to support, further optionality for channel bandwidth support is not required.  It is ok to have UL 64QAM as optional.  For support of improved transient further discussion on transient requirement is needed in UE RF thread before finalizing the capability. |
| LGE | On UE-supported FR2-2 channel bandwidth. Are the proposed alternatives 1,2 and 3 incremental or independent ? |
| Apple | As proposed in R4-2200286, we would like to make it optional for UE to support max. CBW for supported SCS, i.e.,  1. 400MHz for 120kHz SCS  2. 1600MHz for 480kHz SCS  3. 2000MHz for 960kHz SCS  The benefit of this optional capability is to allow implementation flexibility and fast time to market. This is similar to the consideration that in R15 and R16, 400MHz CBW is optionally supported by UE for FR2 to accommodate different UE implementation choices. |
| Intel | UE supported FR2-2 channel bandwidths  In RAN1 UE feature list (R1-2112902), 480/960 kHz are already defined as optional UE features for FR2-2, so there is no benefit in defining support of maximum CBW as additional optional capabilities.  To LGE, if the alternatives refer to the listed SCSs in the Components column, these are independent. |

### CRs/TPs comments collection

*Moderator suggests companies comment directly for feedback on the CRs below*

|  |  |
| --- | --- |
| **CR/TP number** | **Comments collection** |
| R4-2200948 | Nokia: Clauses 5.1 and 5.2 have been already covered in endorsed draft CR R4-2119993. The new proposal is misaligned with the endorsed draft CR and we prefer R4-2119993.  In clauses 5.3.2 new table is not needed as SU is the same for 120 kHz SCS and 480 and 960 kHz is applied only in FR2-2, i.e. there is no confusion if these are in one table. Note 1 should read “This SCS is optional in this release of the specification” to align the wording with table 5.3.5-1. Same reasoning for table structure applies for clause 5.3.5  Adding FR2-2 bands and band combinations and therefore whether there is need to separate FR2-1 and FR2-2 is addressed more generally in issue 3-1a. It would make sense to discuss issue 3-1a before going too deep into draftCR specific comments. |
|  |

## 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 #1-1:**  **CR work split for TS 38.101-2** | **Issue 1-1: CR work split volunteer**  *Split agreement we have so far for TS 38.101-2:*   * *System parameters - vivo* * *Tx – Apple* * *Big CR - Intel* * *Tx or Rx - TBA*   *No comments were received in the first round, and one volunteer is still needed to cover the Rx portion of TS 38.101-2.*  ***Recommended WF:*** *Discuss in GTW session to finalize the work split* |
| **Sub-topic #1-3:**  **UE feature list** | *The three UE features listed below were discussed to support FR2-2:*   * *UE supported channel bandwidths for a single CC* * *Modulations - 64QAM for PUSCH for FR2-2* * *Improved ON/ON transient period capability*   *Modulation feature was agreed in GTW session. For ON/ON transient period, we will wait on the outcome of UE RF discussions in thread [128].*  ***Recommended WF:*** *Continue discussing UE supported channel bandwidths and wait for ON/ON transient period discussion outcome* |

### 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 5 and this table is optional in case moderators would like to provide additional information.*

|  |  |
| --- | --- |
| **CR/TP number** | **CRs/TPs Status update recommendation** |
| R4-2200948 | *To be revised* |
|  |  |

## Discussion on 2nd round

**TBA**

## Companies’ views - collection for 2nd round

### Open issues

**TBA**

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| --- | --- |
| **Company** | **Comments** |
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# Topic #2: Operation bands and system parameters (channelization, raster, CBW) – AI 6.16.2

## Companies’ contributions summary

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| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2200080**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-bis-e/Docs/R4-2200080.zip)  Discussion of channelization for up to 71 GHz | CATT | **Observation 1:** The total number of sync raster entries for fixed channelization is 210.  **Observation 2:** There’s no need to add new SSB-CORESET0 offset for (120,120). One configuration for each CORESET0 is needed, (480,480) can use the same offset as (120,120).  **Observation 3:** There’s flexibility for CA support and new CBW addition for fixed channelization.  **Observation 4:** Both 100 MHz and 200 MHz granularity fixed channelization can achieve channel alignment with WIFI channels if the alignment is needed.  **Observation 5:** The number of sync raster entries for floating channelization is 337.  **Observation 6:** New SSB CORESET0 offset is needed for (120,120) {SS/PBCH block, PDCCH} SCS for floating channelization.  **Proposal:** Define harmonized channelization for licensed and unlicensed bands. Fixed channelization with proper granularity is agreed for 71GHz channelization. |
| R4-2200081  Draft LS for the channelization for up to 71 GHz | CATT | Reserved |
| [**R4-2200282**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-bis-e/Docs/R4-2200282.zip)  Channel and Sync rasters for NR operation in 52.6GHz - 71GHz | Apple | **Observation 1:** It is unclear how option 1D would work to ensure coexistence for unlicensed band if operators have the freedom to choose either Alt. A or Alt. B for deployments.  **Proposal 1:** For unlicensed band, Option 1D has clear benefits over Option 1C.  **Proposal 2:** For unlicensed band, align with IEEE 802.11ad/ay channels and avoid one NR channel overlapping with two IEEE 802.11ad/ay channels. |
| [**R4-2200321**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-bis-e/Docs/R4-2200321.zip)  draft CR to 38.101-2 60 GHz UE general clauses | Qualcomm | Introduces n263 CA, maximum transmission bandwidth, and channel bandwidths content to Operating bands and channel arrangement clause of TS 38.101-2 |
| [**R4-2200863**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-bis-e/Docs/R4-2200863.zip)  Channel arrangement and channel bandwidths for n263 | Ericsson | Introduces band and channel arrangement of band n263: band definition, channel bandwidth, channel raster and synchronization raster to Clause 5 of TS 38.1010-2 |
| [**R4-2200949**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-bis-e/Docs/R4-2200949.zip)  Further discussion on channel raster and sync raster for 52.6~71 GHz | vivo | **Observation 1:** The sync raster granularity is no less than 3 times of 17.28MHz GSCN and the cell searching complexity is acceptable for both Option 1C and 1D.  **Observation 2:** CA support can be much more flexible for Option 1C than for 1D, without not being fully utilized spectrum resources.  **Observation 3:** The flexibility of minimum channel bandwidth should be considered in the sync raster design due to different SSB SCS based on Option 1C and 1D.  **Proposal 1:** Option 1C is preferred as a starting point for both licensed and unlicensed bands in FR2-2. |
| [**R4-2201490**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-bis-e/Docs/R4-2201490.zip)  Draft CR to TS 38.104: Section 5.4 Channel arrangement | Ericsson | Adds conclusion from RAN4 #101-e meeting as guidance towards RAN4 #101Bis-e-meeting for reference |
| [**R4-2201491**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-bis-e/Docs/R4-2201491.zip)  52.6-71 GHz System Parameters | Ericsson | *Floating channelization features*   * The set of allowed ARFCNs enables a high degree of flexibility in configuring the center frequency of a channel or set of channels since the ARFCN step size is equal to the SCS configured for those channel(s) (i.e., 120, 480, or 960 kHz SCS)   + This high degree of flexibility allows for alignment of those channel(s) with any arbitrary spectrum allocation including     - Alignment with IEEE 802.11 ad/ay channels if required     - Alignment with any regional unlicensed spectrum allocation     - Alignment with any future licensed spectrum allocation   + Additionally this allows for single FFT operation since the channel spacing between multiple channels is always an integer number of subcarriers * The center frequency (ARFCN) for a channel of a given SCS for any of the supported bandwidths (100, 400, 800, 1600, 2000 MHz) is configured using the same set of defined ARFCNs   + In other words, it is not necessary do design a separate set of ARFCNs and corresponding GSCNs for each supported channel bandwidth (as required for the Option 1-D design) * The CA channel arrangement for FR2-1 can be reused (with appropriate modifications due to the different SCS for FR2-2).   *Observations and proposals*  **Observation 1:** With the proposed floating channelization design in Table 1, a complete simple design is available [1][2]. No requirement for further analysis on placement of each raster point as would be required (tabular format) as in Option 1D where each numerology and channel bandwidth combination would need to be further studied.  **Observation 2:** With the proposed floating channelization design, the UE SSB search complexity is less (337 GSCN points) than the search complexity for Rel-15 Band n259 (344 GSCN points).  **Observation 3:** a floating raster allows reuse of the CA channel arrangement for FR2-2 without constraints compared to unclarity of fixed raster operator of CA channel arrangement  **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 operating band that is introduced in Rel-17 and later release. Such a design allows for configuration of any channel centre 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.  **Observation 7:** Alt B design provides a channelization design where the maximum number of channels of each nominal bandwidth is centered on the IEEE channels. E.g. 2 \* 800 MHz, 1 \* 1600 MHz, 5 \* 400 MHz, 136 \* 100 MHz.  What are the aligning GSCN points between Alt A and Alt B (if any)?  **Observation 8:** If Option 1D is understood as aligning as many Alt A and Alt B GSCN points to reduce search complexity the method would be understood as simply removing the channels which cross the boundary  **Observation 9:** There is a need to specify 66 – 71 GHz band for licensed usage |
| [**R4-2201592**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-bis-e/Docs/R4-2201592.zip)  60GHz channel and synchronization raster | LG Electronics Finland | **Proposal#1:** Channel raster for 57-71GHz as explained in Section 2, Channel raster for 57-71GHz frequency range.   1. As minimum supported channel bandwidth is 100MHz, the ARFCN is defined in a way that there is a raster location with about 50MHz steps between ~57 050MHz and ~70 950MHz. This enables supporting all channel bandwidths in a way that results in maximal band utilization, which is also illustrated in Figure 1.     Figure 1. ~50MHz channel raster to support all bandwidths with maximal band utilization   1. Channel raster starting point is selected in a way that starting frequency is as close to 57 050MHz as possible.    1. Proposed first NREF= 2 563 339 corresponds to frequency of 57 050.40MHz, which is 40kHz above the target of 57 050.00MHz. 2. As 50MHz is not divisible with 960kHz the raster is based on combination of 49.92 and 50.88MHz steps. These can also be expressed as multiples of 60kHz, which is the basis for the global raster in existing specifications. 49.92MHz= 52\*960kHz= 832\*60kHz and 50.88MHz= 53\*960kHz= 848\*60kHz. 3. In order to minimize the delta between 50MHz mathematical raster and 49.92 and 50.88MHz steps there is a need to take 11x 49.92 and 1x 50.88MHz, which adds up to 600MHz and is divisible with 50MHz and then repeat this through the band. With proposed step size vector of < 832 832 832 832 832 832 832 832 832 832 832 ***848*** > the delta between the 50MHz mathematical raster and the actual channel raster varies between -480kHz and 400kHz. The “100MHz” steps with this kind of raster are either 49.92+49.92= 99.84MHz or 49.92+50.88= 100.8MHz. Although 99.84MHz is slightly smaller than the minimum channel bandwidth of 100MHz this is not expected to cause problems with performance requirements, emissions, guards bands etc. for two adjacent channels as delta is small (only about 1 SC with 120kHz SCS) and for FR2-2 SU smaller than what is currently used (~95%) has also been discussed. 4. Channel raster end-point becomes 70 950.24MHz, which is 240kHz higher than the target of 70 950.00MHz. This means that there will be 240kHz narrower guard band (-10% vs. 2.42MHz, which is the GB used for 120k SCS in RF2-1) on the highest 100MHz channel. 5. Number of channel raster entries is 279. 6. With selected first NREF= 2 563 339 the difference between the ARFCN and GSCN center locations is multiple of 960kHz, which is the highest supported SCS, and hence the proposed scheme supports use of wide-band carriers as in NRU.   **Proposal#2:** Sync raster for 57-71GHz as explained in Section 4, SSB raster for 57-71GHz frequency range.   1. One SSB location is defined for each 100MHz channel 2. Two SSB locations are defined for 480kHz SCS and 400MHz channel. SSB locations for 400MHz reuse the down selected center frequencies from 120kHz SSB. Two SSB locations is selected as it increased the flexibility with Coreset#0.   Total number of synchronization channels is 140 (120k SCS) + 2 x 35 (480k SCS) = 210  **Observation#1:** Proposed channel raster and SCS raster are aligned on 960kHz grid and hence the NRU type wide-band operation can be supported.  **Observation#2:** The proposed channel raster scheme supports also co-existence with 802.11ad and 802.11ay and therefore there is no need to define additional ARFCN to avoid cases where NR channel would overlap with two 802.11ad channels.  Detailed numerology and frequencies for the proposal are shown in excel that is attached in ANNEX 1 (ARFCN, GSCN and Coreset#0). |
| **[R4-2201598](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-bis-e/Docs/R4-2201598.zip)**  System parameters for a NR band in the range 52.6GHz – 71GHz | Nokia, Nokia Shanghai Bell | **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 a floating channel raster which is not tied to IEEE channel positions.  **Observation 2:** Fixed channel raster should be able to guarantee same level of future proofness, CA compatibility and spectrum utilization as floating channelization to be considered to be adopted.1  **Proposal 1:** Adopt the synchronization raster entries for FR2-2 as shown in Table 1:  Table 1: Proposed floating channelization design for the 57 – 71 GHz band   |  |  |  | | --- | --- | --- | | **SSB SCS** | **GSCN Range and**  **<Step Size>** | **Number of Sync Raster Points** | | 120 kHz | 24153 <3> 24960  (57030.24 – 70975.20 MHz) | 270 | | 480 kHz | 24157 <12> 24949  (57099.36 – 70785.12 MHz) | 67 | | 960 kHz | 24157 <12> 24949  (57099.36 – 70785.12 MHz) | 67 |   **Proposal 2:** Confirm the agreement as starting point from previous meeting:   * Consider n x 400 MHz, n= [2, 3, 4, 5] and m x 100 MHz, m=[ 2..8] as the supported channel BW options for​ CA operation in unlicensed band for total bandwidths up to 2000 MHz.   **Proposal 3:** Apply same spectrum utilization for 120 kHz SCS in FR2-2 as in FR2-1  **Proposal 4:** Consider similar spectrum utilization for scenarios with 800MHz and 1600MHz as 120 kHz SCS in FR2-1  **Proposal 5:** Support reduced spectrum utilization for 960 kHz SCS & 2 GHz CBW |
| **[R4-2201924](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-bis-e/Docs/R4-2201924.zip)**  Views on channelization for 52.6 to 71 GHz | Intel Corporation | **Observation 1**: There was no agreement to seek a unified raster design for both licensed and unlicensed bands.  **Observation 2**: It is unclear if future licensed bands will require entirely different channel bandwidth sizes, e.g., 250 MHz, and in such case, it is unclear if potential optimizations conducted for 100/200/400/800/1600/2000 MHz aimed for licensed operation will actually be optimal or even functional.  **Observation 3**: The potential possibility for licensed operation only exists between 66 to 71 GHz, and there is no need to apply licensed operation optimization on the entire band between 57 to 71 GHz.  **Proposal 1**: RAN4 to consider supporting separate raster design for licensed and unlicensed bands.  **Proposal 2:** Consider separate GSCN usage between unlicensed and licensed band operation. |
| [**R4-2201985**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-bis-e/Docs/R4-2201985.zip)  Channelization and synchronization raster for 60GHz | MediaTek (Chengdu) Inc. | **Proposal**   * At least for unlicensed operation, the GSCN raster shall use no more than 175 GSCN locations as a subset of the baseline 3 x 17.28MHz GSCN raster points (similar to NR-U approach). * Agree either of the following for the channel raster:   + Hybrid approach (fixed for minCBW/SCS and floating for larger CBWs) for both licensed and unlicensed operation   + Separate2: Fixed or hybrid for unlicensed, floating for licensed, with unlicensed GSCNs a subset of licensed GSCN raster (3 x 17.28MHz for 120kHz SCS SSB) * If the Hybrid approach is used for the channel raster, then the licensed design for GSCN raster shall follow the proposed unlicensed design. |
| [**R4-2202023**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-bis-e/Docs/R4-2202023.zip)  Discussion on the channel raster and sync raster in FR2-2 | Huawei | **Proposal 1:** For licensed band, support floating channelization with 120/480/960 kHz step gap for 120/480/960kHz SCS respectively. The corresponding ARFCN are given in Table 1.  **Proposal 2:** For the unlicensed band n263, support fixed channelization. For 100MHz or 200MHz channel bandwidth, the gap between two adjacent channels is about 100MHz or 200 MHz respectively. For channel bandwidth not smaller than 400MHz, the gap between two channel rasters is about 400MHz. the corresponding ARFCN are given in Table 2.  **Proposal 3:** For 66~71 GHz licensed band, support candidate SS raster in Table 3 for 120 kHz and 480 kHz SCS. For n263 unlicensed band, support candidate SS raster in Table 4 and Table 5 for 120 kHz and 480 kHz SCS, respectively. |

## Open issues summary

### Sub-topic 2-1: Channelization

*In RAN4 #101e, it was agreed that we would consider the aspects listed below to decide the channelization during this meeting (R4-2120061).*

**Agreement:**

* **Keep both Option 1C and Option 1D and have further discussion to compare two options and make decision on channelization in the next RAN4 meeting** 
  + **Considering the following aspects**
    - **Number of sync raster entries and cell searching complexity**
    - **Support of CA in this frequency range**
    - **Whether flexibility is needed for minimum channel bandwidth in particular, and how much benefit for the system performance**
    - **Co-existence with IEEE channels (find out whether there is similar activity in IEEE)**
    - **Whether to consider and how to ensure future proof for adding new frequency bands or channel bandwidth**
    - **Other aspects are not precluded**
* **If there is no agreement in the next RAN4 meeting, then consider different channelization for licensed band(s) and unlicensed band(s)**
* **Sync raster granularity should be no less than 3 times of GSFN (17.28)**
* **NOTE: it is encouraged for proponents for Option 1D and Option 1C to provide concrete proposals in the format of draft CRs for the purpose of comparison**

**Issue 2-1a: Channelization solution**

* Option 1C: No IEEE 802.11ad/ay alignment and floating channelization
* Option 1D: Hybrid between IEEE and no IEEE alignment with fixed channelization depending on max spectrum utilization and better coexistence
* Option 2: Hybrid approach (fixed for min CBW/SCS and floating for larger CBWs) for both licensed and unlicensed operation (MediaTek, R4-2201985)
* Recommended WF
  + Moderator suggests companies share their views on Option 1C, Option 1D and Option 2 (new option detailing a method to implement Option 1D) by focusing on the aspects listed above in a concise way. Also, please include in your feedback whether the option can be supported. As captured in the WF, if consensus cannot be reached in this meeting, we will consider different channelizations for licensed and unlicensed bands.

**Issue 2-1b: New channelization option**

* New Option 1: Fixed or hybrid for unlicensed, floating for licensed, with unlicensed GSCNs a subset of licensed GSCN raster (3 x 17.28MHz for 120kHz SCS SSB). (MediaTek, R4-2201985)
* Recommended WF
  + Companies to provide their views on the option above for separate channelizations.

### Sub-topic 2-2: Carrier aggregation

**Issue 2-2: CA support**

*A tentative agreement was captured in RAN4 #101-e (R4-2120061).*

* Proposal: Confirm the agreement as starting point from previous meeting: (Nokia)
  + Consider n x 400 MHz, n= [2, 3, 4, 5] and m x 100 MHz, m=[ 2..8] as the supported channel BW options for CA operation in unlicensed band for total bandwidths up to 2000 MHz.
* Recommended WF
  + Companies should share their views on confirming the above agreement.

### Sub-topic 2-3: Specification updates

*Draft CR R4-2201490 adds the conclusion from RAN4 #101-e meeting to TS 38.104 as guidance towards RAN4 #101Bis-e-meeting for reference (R4-2120061).*

**Issue 2-3: TS 38.104 update**

* Recommended WF
  + Moderator suggests companies provide any feedback on draft CR R4-2201490 directly into Section **2.3.2 CRs/TPs** **comments collection**.

## Companies’ views - collection for 1st round

### Open issues

Sub-topic 2-1: Channelization

Issue 2-1a: Channelization solution (Option 1C, Option 1D and Option 2)

Issue 2-1b: New channelization option

|  |  |
| --- | --- |
| **Company** | **Comments** |
| CATT | We would like to see a harmonized solution for unlicensed and licensed bands. |
| vivo | Issue 2-1a: Channelization solution (Option 1C, Option 1D and Option 2)  For Issue 2-1a, we are aiming at defining harmonized channelization for both licensed and unlicensed bands. We prefer Option 1C as a starting point for its flexibility and compatibility.  Issue 2-1b: New channelization option  This new option i.e., separate channelization can be considered if we still cannot decide between Option 1C and 1D. If we adopt the separate channelization, we don’t need the hybrid for unlicensed band. |
| Nokia, Nokia Shanghai Bell | **Issue 2-1a:** We prefer option 1C as floating channelization:   * It enables smoother support for CA and potential additions in channel bandwidths in the future * Difference in number of sync raster is small, both options are well below the limit set by RAN * Generally channel alignment is not required and it has been shown not to impact co-existence e.g. in ETSI BRAN * If required by some administration, gNB implementation can handle channel alignment   **Issue 2-1b:**  We prefer fully floating design compared to the hybrid approach. Using a floating design for wider channel bandwidths acknowledges that channel alignment with IEEE is not required while keeping the minimum channel bandwidth fixed still reduces the flexibility to place channels. |
| LGE | Issue 2-1a: We do not see the need for full flexibility of the floating solution for the case of unlicensed band and support 1D. |
| Huawei | **Issue 2-1a:**  Based on above comments the views are still varying, so it is not clear if we can reach same channelization for both licensed and unlicensed. For licensed band of 66.0~71.0 GHz, floating channel raster similar as FR2-1 is preferred.  **Issue 2-1b:**  As per our proposal in R4-2202023, we were proposing floating channelization for licensed, and fixed channelization for unlicensed n263. We consider it to be good compromise considering past discussions on this topic. Channel/sync raster details can be further detailed. |
| QCOM | **2-1a:** We prefer 1D which has sufficient flexibility and can be aligned for ad/ay coex |
| Sony | Issue 2-1a:  1D is preferred but open for other fixed or hybrid methods for the unlicensed bands. For the licensed bands, we support going with the same solution as unlicensed but can also accept floating one instead. |
| CMCC | **Issue 2-1a: Channelization solution**  We prefer option 1C considering the harmonization between unlicensed and licensed. And floating raster provides better forward capability when the spectrum is available in future. |
| Apple | **Issue 2-1a:**  Based on our analysis, for unlicensed band, Option 1D has clear benefits over Option 1C. So we prefer 1D over 1C. Meanwhile, we wonder how option 1D would work to ensure coexistence for unlicensed band if operators have the freedom to choose either Alt. A or Alt. B for deployments. |
| Ericsson | We would like to stick to previous RAN Plenary agreement to have harmonized solution in this band.  Option 1-C is providing a harmonization between licensed and unlicensed and even with reduced search complexity compared to existing FR2-1 design to help accommodate concerns expressed in previous meetings by companies. It offers the future proof aspects which is desirable for this allocation. It can also be beneficial to adopt continuous CA which cannot be supported with Option 1-D.  Hybrid solutions consider independent GSCN raster, which cause even larger search points than currently Option 1-C has presented.  For Option 1D: a fix design should not be aligned with IEEE channels since LBT is not essential for coexistence. There is no corresponding activity within the IEEE. This arrangement only introduced unnecessary gaps in the spectrum and complicates channel assignment and CA support. |
| China Telecom | **Issue 2-1a: Channelization solution**  We support option 1C to define harmonized channelization for both licensed and unlicensed bands |
| MediaTek | Issue 2-1a: @Ericsson: The hybrid proposal was very specific in document [**R4-2201985**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-bis-e/Docs/R4-2201985.zip), the same GSCN points are intended to be used for all bandwidth sizes. We also did some analysis of the number of GSCNs comparing different options. Please indicate specifically why you believe that that proposal means more GSCNs than a floating raster.  We would support the Hybrid Proposal here as a compromise for a common solution.  Issue 2-1b: Might be best to come on that in Round 2. |
| Xiaomi | **Issue 2-1a: Channelization solution**  As stated in previous meeting, we support different channelization for licensed and un-licensed band. Most of the argument is the flexibility of un-licensed spectrum is not needed to be as large as the licensed spectrum. From this point of view, it is hard to compromise to a harmonized channelization. |
| China Unicom | Issue 2-1a: Option 1C is preferred considering the harmonization between unlicensed and licensed operation. |
| Intel | Issue 2-1a:  It is unclear if future licensed bands will require entirely different channel bandwidth sizes, e.g., 250 MHz, and in such case, it is unclear if potential optimizations conducted for 100/200/400/800/1600/2000 MHz aimed for licensed operation will actually be optimal or even functional if we choose Option 1C.  The possibility of licensed operation only exists between 66 to 71 GHz, and there is no need to apply licensed operation optimization on the entire 57 to 71 GHz range.  Our preference would be to go with Option 1D approach, first optimizing for unlicensed operation (given the lack of information for licensed operation).  It is unclear to us what kind of gains are expected by supporting granular forms of CBW shifting (e.g., floating) for unlicensed operation.  We provide one example of 1D implementation to specification in R4-2201924.  Issue 2-1b:  We support the principle of this option (a separate approach) but need to further discuss and align on the specifics of the option as a solution. |

Sub-topic 2-2: Carrier aggregation

|  |  |
| --- | --- |
| **Company** | **Comments** |
| CATT | We don’t have an issue for this topic but would like to know the action after it’s agreed. Is the intention that the introduction CR will include the CA? |
| vivo | We prefer not to have this restriction since the supported channel bandwidth options are not restricted to 100M and 400M. |
| Nokia, Nokia Shanghai Bell | We support the proposal. |
| Huawei | While we understand the motivation behind the R4-2201598, that opens broad set of CA cases. In our view, this should be complemented with the CA permutation limitation restrictions – some proposed solutions were proposed last meeting, but not concluded.  Based on the above, we would prefer to keep the tentative agreement as is, possibly with a disclaimer saying e.g. in case of no further inputs it will be confirmed by next meeting.  CA band combinations interest for future deployments is not clear at that moment (despite related CA text in the WID). |
| QCOM | We support the proposal |
| Apple | The proposal is OK. |
| Samsung | Fine to confirm the previous starting point. But it’s also preferred to see associated proposal on specification impact to TS38.101-1. |
| Ericsson | Is there any desire for companies to have different CBWs for CA? For example 100 MHz with 400 MHz combination?  We remark that the floating raster would accommodate a smaller CA carrier spacing that would allow larger internal guard bands for the aggregated channels similar to FR2-1. This is also the case for aggregation of carriers of unequal bandwidths. |

### 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 focusing on open issues discussion on 1st round.*

|  |  |
| --- | --- |
| **CR/TP number** | **Comments collection** |
| R4-2201490 | vivo: Only one comment:  SSB SCS 960kHz is not considered for initial access, then why do we need to consider it in the sync raster table? |
| Nokia: We think table 5.3.5-3 is not needed, the information can be added to the previous table as done in other tables. Specification baseline is erroneous as n262 is not included in the baseline. For channel rasters discussion is still on-going. |
| Ericsson: @Vivo yes you are correct there is no initial access for 960 kHz but still there is SSB patterns for 960 kHz (along with 120 kHz and 480 kHz) since UE still need to preform measurements on 960 kHz cells (Scell) |
| MediaTek: It needs to at least be clarified in RAN4 spec that there is no support for 960kHz SSB for initial access if we keep this in the table. Otherwise it is very confusing. |

## 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 #2-1:**  **Channelization** | **Issue 2-1a: Channelization solution**  *Companies provided feedback on the following options:*   * *Option 1C: No IEEE 802.11ad/ay alignment and floating channelization* * *Option 1D: Hybrid between IEEE and no IEEE alignment with fixed channelization depending on max spectrum utilization and better coexistence* * *Option 2: Hybrid approach (fixed for min CBW/SCS and floating for larger CBWs) for both licensed and unlicensed operation (MediaTek, R4-2201985)*   *Overall, views did not deviate from previous meeting and preference between Option 1C and Option 1C is still split.*  ***Recommended WF:*** *Further discuss in GTW session*  **Issue 2-1b: New channelization option**  *Initial feedback for an option based on a separate approach was provided.*   * *New Option 1: Fixed or hybrid for unlicensed, floating for licensed, with unlicensed GSCNs a subset of licensed GSCN raster (3 x 17.28MHz for 120kHz SCS SSB). (MediaTek, R4-2201985)*   ***Recommended WF:*** *Depending on the outcome of the GTW session, further discuss separate channelizations and this option in the 2nd round* |
| **Sub-topic #2-2:**  **Carrier aggregation** | **Issue 2-2: CA support**  *The tentative agreement below was captured in RAN4 #101-e and a proposal aimed to confirm the agreement as a starting point for future discussions.*   * *Consider n x 400 MHz, n= [2, 3, 4, 5] and m x 100 MHz, m=[ 2..8] as the supported channel BW options for CA operation in unlicensed band for total bandwidths up to 2000 MHz.*   ***Recommended WF:*** *Confirm above agreement as a starting point for future discussions. Additional wording can be included in final agreement* |

### 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 5 and this table is optional in case moderators would like to provide additional information.*

|  |  |
| --- | --- |
| **CR/TP number** | **CRs/TPs Status update recommendation** |
| R4-2201490 | *Current content needs to be revised* |
| R4-2200321 | *Content may be agreeable, need to confirm in 2nd round* |

## Discussion on 2nd round

**TBA**

# Topic #3: FR1 + FR2-2 DC/CA band combinations (AI 6.16.6)

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2201599**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-bis-e/Docs/R4-2201599.zip)  How to introduce FR2-2 bands into 38.101-2 and combinations into 38.101-3 | Nokia, Nokia Shanghai Bell | **Observation 1:** Operating band number is enough to find out whether band belongs to FR2-1 or FR2-2.  **Proposal 1:** When FR2-2 bands and band combinations involving FR2-2 are introduced, existing tables and table formatting should be re-used as much as possible. |
| [**R4-2201916**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-bis-e/Docs/R4-2201916.zip)  Discussion on FR2-2 DC/CA with FR1 anchor | Ericsson | **Proposal:** CA/DC combinations with FR2-2 and with an anchor in FR1 can be added directly by draft CR’s just like it is done for CA/DC FR2-1 combinations with an anchor in FR1 |
| [**R4-2201917**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-bis-e/Docs/R4-2201917.zip)  draft CR 38.101-3 on FR2-2 DC/CA with FR1 anchor | Ericsson | Adds new tables to introduce FR1+FR2-2 DC/CA combinations to different clauses of TS 38.101-3 |

## Open issues summary

### Sub-topic 3-1: Introducing FR1 + FR2-2 DC/CA band combinations into specs

**Issue 3-1a: Adding FR2-2 bands and band combinations**

* Proposal: When FR2-2 bands and band combinations involving FR2-2 are introduced, existing tables and table formatting should be re-used as much as possible. (Nokia)
* Recommended WF
  + Companies should provide their views on the above proposal.

**Issue 3-1b: FR2-2 DC/CA with FR1 anchor**

* Proposal: CA/DC combinations with FR2-2 and with an anchor in FR1 can be added directly by draft CR’s just like it is done for CA/DC FR2-1 combinations with an anchor in FR1
* Recommended WF
  + Moderator suggests companies share their view on the above proposal.

**Issue 3-1c: TS 38.101-3 update**

*Draft CR R4-2201917 adds new tables to introduce FR1+FR2-2 DC/CA combinations to different clauses of TS 38.101-3.*

* Recommended WF
  + Moderator suggests companies provide any feedback on draft CR R4-2201917 directly into Section **3.3.2 CRs/TPs** **comments collection**.

## Companies’ views – collection for 1st round

### Open issues

Sub-topic 3-1: Introducing FR1 + FR2-2 DC/CA band combinations into specs

Issue 3-1a: Adding FR2-2 bands and band combinations

Issue 3-1b: FR2-2 DC/CA with FR1 anchor

|  |  |
| --- | --- |
| **Company** | **Comments** |
| CATT | We support Nokia’s proposal. We didn’t see any confusions if FR2-1 and FR2-2 are not separated. It’s similar with the operating bands. Our understanding is that n263 is defined in the table of FR2 bands, not in a separate table of FR2-2 bands. |
| vivo | Issue 3-1a: Adding FR2-2 bands and band combinations The proposal is OK.  Issue 3-1b: FR2-2 DC/CA with FR1 anchor  The proposal is OK. |
| Nokia, Nokia Shanghai Bell | **Issue 3-1a:** We support the proposal.  **Issue 3-1b:** We support the proposal. |
| LGE | We agree proposals 3-1a and 3-1b. |
| QCOM | 3-1a agree with WF |
| Samsung | Issue 3-1a/b: fine to both proposal |
| Intel | For Issue 3-1a and 3-1b, both proposals are ok |

### CRs/TPs comments collection

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

|  |  |
| --- | --- |
| **CR/TP number** | **Comments collection** |
| [**R4-2201917**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-bis-e/Docs/R4-2201917.zip) | vivo: We had an agreement in the last meeting that：   * *Limit Rel-17 consideration of FR2-2 inter-band scenarios to two bands, before studying higher order configurations, i.e., one FR1 band + one FR2-2 band.*   So we suggest to remove the band combinations tables exceeding two bands. |
| Nokia: This is related to issue 3-1a. We do not see the benefit in creating new tables. |
| Huawei: same as vivo: there was 2 bands limitation agreed for Rel-17.  Last meeting we were also proposing to separate FR1+FR2-1 combos from FR1+FR2-2 for readability purposes, covering multiple other aligned modifications – it was not concluded. Whichever approach is agreed, probably it would be good to keep alignment across the spec: if we keep separating FR2-1 from FR2-2 CA combos, let’s do such separation also in the list of bands, etc. |
| QCOM | New tables are not needed. Also in the drafting we don’t believe you can renumber tables. |

## 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 #3-1:**  **Introducing FR1 + F2-2 DC/CA band combinations** | **Issue 3-1a: Adding FR2-2 bands and band combinations**   * Proposal: When FR2-2 bands and band combinations involving FR2-2 are introduced, existing tables and table formatting should be re-used as much as possible. (Nokia)   **Issue 3-1b: FR2-2 DC/CA with FR1 anchor**   * Proposal: CA/DC combinations with FR2-2 and with an anchor in FR1 can be added directly by draft CR’s just like it is done for CA/DC FR2-1 combinations with an anchor in FR1 (Ericsson)   *Majority view on both issues was that the proposals are agreeable.*  *Tentative agreement: Approve the proposals above* |

### 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 5 and this table is optional in case moderators would like to provide additional information.*

|  |  |
| --- | --- |
| **CR/TP number** | **CRs/TPs Status update recommendation** |
| R4-2201917 | *Needs to be revised* |

## Discussion on 2nd round

**TBA**

## Companies’ views - collection for 2nd round

### Open issues

**TBA**

# Topic #4: Others (AI 6.16.8)

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2200469**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-bis-e/Docs/R4-2200469.zip)  Views on sensing beam selection on the UE side | Sony | Observation 1: the existing beam correspondence test can not verify if the UE uses the same beam for sensing and transmission, regardless of the beam correspondence capability.  Observation 2: it is hard to define and adopt the X dB beamwidth method in practical UE RF requirements and tests.  Observation 3: the common spherical coverage concept may potentially be used as a starting point to define the relation between sensing beam and transmission beam |
| [**R4-2200847**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-bis-e/Docs/R4-2200847.zip)  Draft LS on sensing beam characteristics to RAN1 | Ericsson | For an adaptive array antenna system to be used for both BS and UE operating within the frequency range 52600 to 71000 MHz the following issues have been identified if requirements related to gain or beamwidth on the receive side is defined:  1. The parameter antenna gain by definition will require access to a conducted RF interface.  2. There are no beam quality requirement limits (such as antenna gain or beamwidth) defined in NR RF specifications.  3. Defining parameters such antenna gain (directivity) and beamwidth looks simple at first glance but finding relevant conditions and test cases it is much more difficult.  4. Testing beamwidth or antenna gain will significantly add to the conformance test specification complexity.  Based on the information provided in this contribution we propose not to define new requirements for beam quality for traffic and sensing beam. Based on questions given in LS we strongly support to not defining beam quality parameter-based requirements on specific beams during reception. We also suggest keeping beamforming aspect for different signals to be implementation specific not captured by the specification. **Hence, we support only alternative lF**.  Draft LS reply states:  RAN4 propose not to define new requirements for beam quality for traffic and sensing beam. RAN4 suggest RAN1 to adopt **alternative 1F** finalizing the remaining work related to extension of NR to support the frequency range 52600 to 71000 MHz. |
| [**R4-2201533**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-bis-e/Docs/R4-2201533.zip)  Discussion and draft reply LS on sensing beam selection from RAN1 | Huawei, HiSilicon | **Observation 1:** Alt-1A and Alt-1D would lead to performance degradation of sensing accuracy.  **Observation 2:** Alt-1B and Alt-1C are not testable due to unmeasurable conducted connector  **Observation 3:** For UEs satisfying beam correspondence tolerance requirements and gNBs, 3dB sensing beamwidth could contain the beam peak direction of the transmission beam.  **Observation 4:** Alt-1F is acceptable if sensing performance could be ensured by UE/gNB implementation.  **Proposal 1:** Alt-1E is considered as the baseline.  Draft LS reply:  RAN4 discussed on all the potential methods provided by RAN1. Considering the sensing performance, implementation complexity and testability issues, it was agreed **Alt-1E** is the best compromise from RAN4 point of view. |
| [**R4-2200083**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-bis-e/Docs/R4-2200083.zip)  Discussion on the LBT requirement and the reply LS for sensing beam selection | CATT | **Proposal 1:** Selecting sensing beam at the gNB is up to gNB’s implementation.  **Proposal 2:** Selecting sensing beam at UE is up to UE’s implementation.  **Observation 1:** RAN4 should define LBT requirement and test procedure to guarantee the sensing beam covers transmission beam.  **Proposal 3:** The channel access parameters use Table 1 and Table 2 to define BS/UE LBT requirements.  Table 1: Channel access parameters for PDSCH   |  |  |  | | --- | --- | --- | | **Parameter** | **Unit** | **Value** | | LBT measurement bandwidth | MHz | [400] | | Energy detection threshold | [dBm/400 MHz] | [] or X | | Maximum channel occupancy time | ms | 5 | | NOTE: The specific value X is declared by the vendor. | | |   Table 2: Channel access parameters for PUSCH   |  |  |  | | --- | --- | --- | | Parameter | Unit | Value | | LBT measurement bandwidth (BW) | MHz | [400] | | Energy detection threshold | dBm/BW | [-54] | | Detection timing | microseconds | 5 |   **Proposal 4:** The following information can be captured in the reply LS to RAN1.   1. Selecting sensing beam at the gNB is up to gNB’s implementation. 2. Selecting sensing beam at UE is up to UE’s implementation. 3. RAN4 will define LBT requirements and test procedures for both gNB (in TS 37.107) and UE (in TS 37.106) to guarantee the sensing beam covers transmission beam. |
| **[R4-2200084](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-bis-e/Docs/R4-2200084.zip)**  Draft CR for TS 37.107: introduction of LBT requirements for FR2-2 | CATT | A new clause for “Downlink channel access procedure for FR2-2” is added to TS 37.107 to define the LBT requirements of band n263. |
| [**R4-2200085**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-bis-e/Docs/R4-2200085.zip)  Draft CR for TS 37.106: introduction of LBT requirements for FR2-2 | CATT | A new clause for “Downlink channel access procedure for FR2-2” is added to TS 37.106 to define the LBT requirements of band n263. |
| [**R4-2200953**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-bis-e/Docs/R4-2200953.zip)  Discussion and draft reply LS on sensing beam selection | vivo | **Proposal 1:** It is suggested that no RF requirement/test procedure is needed to guarantee sensing beam(s) “covers” the transmission beam(s).  **Proposal 2:** Leave it to UE’s or gNB’s implementation to guarantee sensing beam(s) “covers” the transmission beam(s). |
| [**R4-2201600**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-bis-e/Docs/R4-2201600.zip)  Sensing beam for LBT in FR2-2 | Nokia, Nokia Shanghai Bell | **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 and therefore also channel alignment is optional.  **Observation 2:** Shared spectrum channel access requirements are not specified in TS 38.104.  **Observation 3:** Specification impact to requirements and conformance tests for shared spectrum channel access is not part of the WID and therefore LBT requirements cannot be specified.  **Proposal 1:** Leave sensing beam and its relationship to transmission beam to gNB implementation. |

## Open issues summary

### Sub-topic 4-1: LS reply to RAN1 on sensing beam characteristics

*RAN4 received an LS from RAN1 (R1-2112806) with a set of questions on how to specify requirements and test procedure to guarantee a sensing beam(s) “covers” the transmission beam(s) for the situations listed below:*

* *Selecting sensing beam at the gNB*
* *Selecting sensing beam at the UE when UE does not indicate a capability for beam correspondence with beamCorrespondenceWithoutUL-BeamSweeping ={1}*
* *Selecting sensing beam at the UE when UE uses a different beam for sensing than the beam used for transmission,*

*Additionally, the following method options to define “cover” were discussed in RAN1 were included:*

* *Alt-1A: the angle included in the [3] dB beamwidth of the transmission beam is included in the [X, FFS] dB beamwidth of the sensing beam.*
* *Alt-1B: the sensing beam gain measured along the direction of peak transmission direction is at least X [FFS] dB of the transmission beam gain*
* *Alt-1C: The sensing beam gain is measured in one or more directions where the transmission beam EIRP is within A [FFS] dB of the peak EIRP. The sensing beam gain measured along the chosen directions is at least X [FFS] dB of the transmission beam gain in those directions.*
* *Alt-1D: The sensing beam gain is measured in one or more directions where the transmission beam EIRP is within A [FFS] dB of the peak EIRP and the sensing beam gain measured along the chosen directions is at least X [FFS] dB of the peak sensing beam gain*
* *Alt-1E: Sensing beam has the minimum [3] dB beamwidth which at least contains all beam peak directions of transmission beams.*
* *Alt-1F:*
  + *Selecting sensing beam at the gNB is up to gNB’s implementation*
  + *Sensing beam at the UE may use a wider beam for sensing than the beam used for transmission, when the UE does not indicate a capability for beam correspondence with beamCorrespondenceWithoutUL-BeamSweeping ={1}*

*Additionally, RAN1 further notes:*

* + *RAN4 choice may not be limited by the list above*
  + *RAN4 can further decide for gNB or UE separately if such test or requirement is not needed or not practical and leave it to gNB or UE implementation*

**Issue 4-1a: Whether a requirement or test is needed for gNB or UE**

* Option 1: Yes (include preferred method if any)
* Option 2: No
* Option 3: Other
* Recommended WF
  + Moderator suggests companies answer whether defining requirements/tests is needed. Companies may also share their views on the listed methods.

**Issue 4-1b: LS reply**

* Option 1: Adopt Alt-1F - Ericsson (R4-2200847)
  + RAN4 propose not to define new requirements for beam quality for traffic and sensing beam. RAN4 suggest RAN1 to adopt alternative 1F finalizing the remaining work related to extension of NR to support the frequency range 52600 to 71000 MHz.
* Option 2: Alt-1E – Huawei (R4-2201533)
  + RAN4 discussed on all the potential methods provided by RAN1. Considering the sensing performance, implementation complexity and testability issues, it was agreed Alt-1E is the best compromise from RAN4 point of view.
* Option 3: CATT (R4-2200083)
  + Selecting sensing beam at the gNB is up to gNB’s implementation.
  + Selecting sensing beam at UE is up to UE’s implementation.
  + RAN4 will define LBT requirements and test procedures for both gNB (in TS 37.107) and UE (in TS 37.106) to guarantee the sensing beam covers transmission beam.
* Option 4: vivo (R4-2200953)
  + RAN4 decides not to define any RF requirement/test procedure to guarantee sensing beam(s) “covers” the transmission beam(s) and leaves it to UE’s or gNB’s implementation to guarantee sensing beam(s) “covers” the transmission beam(s).
* Option 5: Other
* Recommended WF
  + Moderator suggests companies provide their views on the preferred LS reply. Companies may also share any feedback on the draft LS replies.

### Sub-topic 4-2: Specification updates

**Issue 4-2a: TS 38.107 and TS 38.106 update**

*Draft CR R4-2200084 and CR R4-2200085 add a new clause for “Downlink channel access procedure for FR2-2” to TS 37.107 and TS 37.106, respectively, to define the LBT requirements of band n263.*

* Recommended WF
  + Please provide any feedback for draft CR R4-2200084 and draft CR R4-2200085 directly into Section **4.3.2 CRs/TPs** **comments collection**. Current draft CR should be agreeable.

## Companies’ views - collection for 1st round

### Open issues

Sub-topic 4-1: LS reply to RAN1 on sensing beam characteristics

Issue 4-1a: Whether a requirement or test is needed for gNB or UE

Issue 4-1b: LS reply

|  |  |
| --- | --- |
| **Company** | **Comments** |
| CATT | First of all, we think we can agree the followings,   * + Selecting sensing beam at the gNB is up to gNB’s implementation.   + Selecting sensing beam at UE is up to UE’s implementation.   All of the alternatives in RAN1 LS may not be very perfect for RAN4 understanding, so we think RAN4 should have new wording for this.  Second, for the LBT requirement, our understanding is that it should be a requirement in the core part like LAA and NR-U. RAN1 concerns the relationship of sensing beam and transmission beam which are used in the LBT procedure. RAN1 can be informed that RAN4 will define the LBT requirement to solve RAN1’s concerns. RAN1 running CR is waiting for RAN4 decision as the following notes in the RAN1 running CR for TS 37.213:  *Editor’s note: Definition of “cover” pending RAN4 LS response.* |
| Vivo | Issue 4-1a: Whether a requirement or test is needed for gNB or UE  • Option 2: No  Issue 4-1b: LS reply  From our perspective, Option 1 and Option 4 are quite aligned. Either of these two options is OK.  For Option 2, how to interpret Alt 1E into feasible RF requirements/test?  For Option 3, We prefer not to define RF requirements/tests related to transmission beam and sensing beam. Furthermore, the impacted specs for both gNB (in TS 37.107) and UE (in TS 37.106) are not included in the WID for B52.6G. |
| MediaTek | **Issue 4-1a: Whether a requirement or test is needed for gNB or UE**  For UE: Option 2 (No). Because FR2 UEs in network already pass certain beam corresponding requirement, no matter with or w/o beam sweep; there are corresponding requirements. Hence, we can assume UEs have capability to create similar radiation pattern of UE Rx beam (for sensing) and UE Tx beam (for transmission) for the LBT behavior. Hence, we think there is no need to have additional requirement on this.  **Issue 4-1b: LS reply**  We think use ”Option 4: vivo (R4-2200953)” as starting to further discuss the content would be fine. |
| Sony | Issue 4-1a:  In our view, the current metric proposed in RAN1 LS all have difficulty in the practical test, at least from the UE aspect. For example, we think the beamwidth may not be a good concept to measure the UE beam coverage. Also, even for UE support beam correspondence without ul beam sweeping, it does not actually ensure the relation between DL and UL beams. However, we are open to having a further technical discussion on the possible test method, but if RAN4 can not agree on a proper metric and test method, we may have to go without the requirement in Rel-17. |
| Nokia, Nokia Shanghai Bell | **Issue 4-1a:** gNB requirement is not needed, and this seems to be the view also in RAN given the relevant specification is not part of the WI. This aligns with LBT not being a mandatory feature.  **Issue 4-1b:** RAN1 did not ask for reply and as such reply is not necessary. However, we would be ok to reply that RAN4 has agreed to leave this to gNB implementation. |
| LGE | Issue 4-1a: For UE Option 2: No. Our understanding is aligned with comments from Sony above. As long as effective and practical methods to test a requirement does not exist we should not define requirement.  Issue 4-1b: We do not see the need to respond, but if RAN4 decides to send one we support reply where RAN4 has agreed to leave this to UE implementation to take care of. |
| QCOM | 4-1 a  We think RAN4 should require FR2-2 UEs to support and declare beam correspondence. This can both eliminate UL beam sweeping and also in this case obviate the need for this concept of ‘cover’.  4-1b  Per above send LS to RAN1 that FR2-2 UEs are required to support beam correspondence |
| Apple | Issue 4-1a: our current thinking is option 2, i.e., no requirements will be specified given the difficulty of specifying both core requirements and testing.  Issue 4-1b: it is OK to reply to RAN1 with the decision made in RAN4. |
| HW | 4-1 a.  Option 1. Requirement could be specified with Alt-1E.  The sensing accuracy is critical with regard to the communication efficiency and co-existence requirement. It’s important that RAN1 and RAN4 make effort on specifying relevant requirements.  Regarding the test method, some initial thinking is:  Step 1: Detect the beam peak direction of Sensing beam and Transmission beam  Step 2: Measure the EIS performance on Sensing beam on the detected Tx/Rx beam peak directions.  Step 3: Compare the EIS difference between Tx peak direction and Rx peak direction. If the delta is less than 3dB, it could be decided that Tx peak is within the 3dB Rx beamwidth.  C:\Users\g00334960\AppData\Roaming\eSpace_Desktop\UserData\g00334960\imagefiles\5553314E-8594-4DAE-A06A-309DA68E9113.png  4-1b  Option 2. LS to RAN1 informing that Alt-1E would be considered. |
| Ericsson | Issue 4-1a: Based on background presented in R4-2200847 we see only one solution and that is to follow alternative 1F. This would mean that gain and beamwidth characteristics is not specified and tested. Instead gain and beamwidth is implementation specific for both UE and BS. We have drafted a LS response to capture RAN4 conclusion.  Issue 4-1b: It seems that some companies suggest keeping sensing beam characteristics to be implementation specific. That information could be included in an LS to RAN1. Based on information given in R4-2200847, an introduction of beam quality requirement would be a quite significant addition to the specifications. Currently, no test requirements for beam quality exists in specifications. That could also be sent to RAN1.  Issue 4-2a: Regarding the CRs to 37.106 and 37.107 we think its too early to approve and also information is not complete. For FR2-2, conducted levels in dBm needs to be converted into proper OTA parameters including power level and spatial properties. |
| Intel | Issue 4-1a: Given how involved it would be to define a requirement and test, our preference is Option 2 (No).  Issue 4-1b: No strong preference; we can use content from several options (i.e., Option 1 and Option 4) and refine the content/wording until it is agreeable |

### CRs/TPs comments collection

*Moderator suggests companies comment directly for feedback on the CRs below*

|  |  |
| --- | --- |
| **CR/TP number** | **Comments collection** |
| R4-2200084 | Nokia. This is not OK. We do not agree to introduce the requirement and further this specification is not even part of the WI. |
| QCOM: Agree with Nokia |
| Ericsson: Subclause 5.2 does not reflect OTA aspects related to FR2-2. We suggest postponing this CR until all technical details are resolved. |
| R4-2200085 | Nokia: Same as above, this specification is not part of the WI. |
| QCOM: Again, agree with Nokia. |
| Ericsson: Subclause 5.2 does not reflect OTA aspects related to FR2-2. We suggest postponing this CR until all technical details are resolved. |

## 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 #4-1:**  **LS reply to RAN1 on sensing beam characteristics** | **Issue 4-1a: Whether a requirement or test is needed for gNB or UE**  *Majority view is that they are not needed (No - 7 companies, Yes - 2 companies, open to further discussion if needed - 1)*  **Issue 4-1b: LS reply**  *Most companies are open to send an LS. Specific wording is TBD.*  ***Recommended WF:*** *Work on the LS reply focusing the “no” answer. Also, discuss in GTW session and 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 5 and this table is optional in case moderators would like to provide additional information.*

|  |  |
| --- | --- |
| **CR/TP number** | **CRs/TPs Status update recommendation** |
| R4-2200084 | *Content is not agreeable* |
| R4-2200085 | *Content is not agreeable* |

## Discussion on 2nd round

**TBA**

## Companies’ views - collection for 2nd round

### Open issues

**TBA**

# Recommendations for Tdocs

## 1st round

**New tdocs**

|  |  |  |
| --- | --- | --- |
| **Title** | **Source** | **Comments** |
| WF on general aspects and system parameters of FR2-2 | Intel |  |
| Draft CR for TS 38.101-2: Introduction of system parameters for FR2-2 | vivo | Revision of R4-2200948 |

**Existing tdocs**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Tdoc number** | **Title** | **Source** | **Recommendation** | **Comments** |
| [R4-2200469](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-bis-e/Docs/R4-2200469.zip) | Views on sensing beam selection on the UE side | Sony | Noted |  |
| [R4-2200847](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-bis-e/Docs/R4-2200847.zip) | Draft LS on sensing beam characteristics to RAN1 | Ericsson | Return to | Need to further discuss LS content |
| [R4-2200948](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-bis-e/Docs/R4-2200948.zip) | Draft CR for TS 38.101-2: Introduction of system parameters for FR2-2 | vivo | To be revised |  |
| [R4-2201533](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-bis-e/Docs/R4-2201533.zip) | Discussion and draft reply LS on sensing beam selection from RAN1 | Huawei, HiSilicon | Noted |  |
| [R4-2201923](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-bis-e/Docs/R4-2201923.zip) | CR work split and UE feature list for NR ext. to 71GHz | Intel Corporation | Noted |  |
| [R4-2200080](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-bis-e/Docs/R4-2200080.zip) | Discussion of channelization for up to 71 GHz | CATT | Noted |  |
| R4-2200081 | Draft LS for the channelization for up to 71 GHz | CATT | Noted | This is a reserved draft LS |
| [R4-2200282](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-bis-e/Docs/R4-2200282.zip) | Channel and Sync rasters for NR operation in 52.6GHz - 71GHz | Apple | Noted |  |
| [R4-2200321](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-bis-e/Docs/R4-2200321.zip) | draft CR to 38.101-2 60 GHz UE general clauses | Qualcomm Incorporated | Return to | Content should be agreeable, but may need discussion in 2nd round |
| [R4-2200863](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-bis-e/Docs/R4-2200863.zip) | Channel arrangement and channel bandwidths for n263 | Ericsson | Return to | Part of the content depends on channelization discussion |
| [R4-2200949](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-bis-e/Docs/R4-2200949.zip) | Further discussion on channel raster and sync raster for 52.6~71 GHz | vivo | Noted |  |
| [R4-2201490](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-bis-e/Docs/R4-2201490.zip) | Draft CR to TS 38.104: Section 5.4 Channel arrangement | Ericsson | Return to | If revised in this meeting, the content will depend on the outcome of channelization discussion |
| [R4-2201491](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-bis-e/Docs/R4-2201491.zip) | 52.6-71 GHz System Parameters | Ericsson | Noted |  |
| [R4-2201592](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-bis-e/Docs/R4-2201592.zip) | 60GHz channel and synchronization raster | LG Electronics Finland | Noted |  |
| [R4-2201598](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-bis-e/Docs/R4-2201598.zip) | System parameters for a NR band in the range 52.6GHz – 71GHz | Nokia, Nokia Shanghai Bell | Noted |  |
| [R4-2201924](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-bis-e/Docs/R4-2201924.zip) | Views on channelization for 52.6 to 71 GHz | Intel Corporation | Noted |  |
| [R4-2201985](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-bis-e/Docs/R4-2201985.zip) | Channelization and synchronization raster for 60GHz | MediaTek (Chengdu) Inc. | Noted |  |
| [R4-2202023](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-bis-e/Docs/R4-2202023.zip) | Discussion on the channel raster and sync raster in FR2-2 | Huawei | Noted |  |
| [R4-2201599](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-bis-e/Docs/R4-2201599.zip) | How to introduce FR2-2 bands into 38.101-2 and combinations into 38.101-3 | Nokia, Nokia Shanghai Bell | Approved | Confirm in GTW session or 2nd round |
| [R4-2201916](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-bis-e/Docs/R4-2201916.zip) | Discussion on FR2-2 DC/CA with FR1 anchor | Ericsson | Noted |  |
| [R4-2201917](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-bis-e/Docs/R4-2201917.zip) | draft CR 38.101-3 on FR2-2 DC/CA with FR1 anchor | Ericsson | Return to | Current content may be revised to capture our agreements |
| [R4-2200083](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-bis-e/Docs/R4-2200083.zip) | Discussion on the LBT requirement and the reply LS for sensing beam selection | CATT | Noted |  |
| [R4-2200084](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-bis-e/Docs/R4-2200084.zip) | Draft CR for TS 37.107: introduction of LBT requirements for FR2-2 | CATT | Not agreeable |  |
| [R4-2200085](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-bis-e/Docs/R4-2200085.zip) | Draft CR for TS 37.106: introduction of LBT requirements for FR2-2 | CATT | Not agreeable |  |
| [R4-2200953](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-bis-e/Docs/R4-2200953.zip) | Discussion and draft reply LS on sensing beam selection | vivo | Noted |  |
| [R4-2201600](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-bis-e/Docs/R4-2201600.zip) | Sensing beam for LBT in FR2-2 | Nokia, Nokia Shanghai Bell | Noted |  |

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

**TBA**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Tdoc number** | **Title** | **Source** | **Recommendation** | **Comments** |
|  |  |  |  |  |
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|  |  |  |  |  |

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