**3GPP TSG-RAN WG4 Meeting # 98-bis-e R4-210XXXX**

**Electronic Meeting, 12th – 20th April, 2021**

**Agenda item:** 8.12.4, 8.12.6

**Source:** Moderator (Qualcomm)

**Title:** Email discussion summary for [98-bis-e][138] NR\_ext\_to\_71GHz\_Part\_2

**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: TBA
* 2nd round: TBA

# Topic #1: Timing and switching

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

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2107271 | HiSilicon Technologies Co. Ltd | ***Observation 1: for in-panel case, 5us is required for Tx beam switching and on-on power change. For cross panel case, RAN4 may need further discussion on current FR2 Band, and also FFS for new 60GHz Band.***  ***Proposal 1: For in panel case, Tx beam switching time is 5us on 60GHz Band. For cross panel case, FFS.***  ***Proposal 2: U/D and D/U switching time for 60GHz stay with 7us as current FR2 Band.*** |
| R4-2106909 | Apple | ***Observation 4****: In terms of RF hardware control timelines, leveraging of FR2 based implementations implies reusing FR2 requirements on switching between DL and UL as well as Tx/Rx beam switching delays.*  ***Proposal 2****: For NR operation in the 52.6 – 71 GHz range, the Rx-Tx and Tx-Rx transition time shall reuse the FR2 value of 13792 Tc.*  ***Proposal 3****: For NR operation in the 52.6 – 71 GHz range, the Tx and Rx beam switch delay shall reuse the FR2 assumption.*  ***Proposal 4****: RAN4 should inform RAN1 that as a baseline the FR2 assumptions on Tx beam switching time, Rx beam switching time, Rx-Tx transition time, and Tx-Rx transition time shall be reused for NR operating in the 52.6 – 71 GHz frequency range. RAN4 should further ask RAN1 whether from the physical layer design perspective it is feasible to support an optionally shorter Rx-Tx/Tx-Rx transition time.* |
| R4-2104805 | CATT | **Proposal 1: 100 ns is the worst-case beam switching time for 52.6-71 GHz.**  **Proposal 2: 7us is the switching time assumption from DL-to-UL or UL-to-DL for 52.6-71 GHz.** |
| R4-2105138 | Ericsson | The switching from DL to UL and from UL to DL as specified in 38.211 Section 4.3.2, i.e. and depends on RAN4 cell Phase sync (**TSync**) and UE and BS transient requirements:  **≥ TSync + max(TBS on🡺 off, TUE off🡺 on)**  **≥ TSync + max(TBS off🡺 on, TUE on🡺 off )**  This means that the final and requirements in TS 28.211 depends on the final values of RAN4 cell Phase sync in TS 38.133, BS transients in TS 38.104 and UE transients in TS 38.101.  For electronics operating at 52 to 71 GHz, the maximum beam switching time of 50 ns can be assumed.  A draft reply LS can be found in appendix A. The original LS can be found in appendix B. |
| R4-2106591 | ZTE Corporation | **Observation 1: switching delay for Tx and Rx beams should be the same.**  **Proposal 1: the feasible beam switching delay for 60GHz should be around 20ns from manufacturing’s variations.**  Proposal 2: for ON-OFF/OFF-ON transition time for 60GHz, settling time for PLL, transceiver and PA setup time and PA ramp up time should be considered for 60GHz from hardware implementation perspective.  Proposal 3: for cell synchronization error for 60GHz WID, 3us should be reused.  **Observation 2: to reduce the GP overhead for 480kHz and 960kHz of 60GHz, alternatives could be either extend the TDD periodicity or reduce ON-OFF transition time from BS and UE side.** |
| R4-2107191 | Nokia, Nokia Shanghai Bell | **Proposal 8: RAN4 to reply to RAN1 aligned with study item conclusions that gNB beam switching can take place in less than 59 us.**  **Observation 5: UE beam switching times should not be longer than gNB beam switching times**  **Proposal 9: Further discussion on transient periods in >52.6 GHz is needed before responding to RAN1 on UL-to-DL and DL-to-UL switching times**. |
| R4-2107210 | Qualcomm Incorporated | **Switching UE from downlink to uplink or from uplink to downlink:**  For frequencies between 52.6 ~ 71 GHz, UE switching time DL-to-UL or UL-to-DL requires up to 13792 Tc (=7.015 µsec). This time includes any necessary beam switches.  **Switching UE beams (applicable for both TX and RX beams):**  For frequencies between 52.6 ~ 71 GHz UE, the time to switch beams is 200 nsec and the minimum duration between the start of any two consecutive beam switches is 4.5 µsec. |
| R4-2107342 | Intel Corporation | **Transient period**  **Proposal 3**: RAN4 agrees on 1 uS transient period for both ON/OFF and ON/ON transient period for 52.6 – 71 GHz range.  **Proposal 4**: RAN4 agrees on 3 uS for switching time for both DL-to-UL and UL-to-DL.  **Observation 2**: ON/OFF transient period has impact on the DL/UL switching time and determines the cell coverage distance as well as DL/UL switching overhead.  **Observation 3**: 1uS ON-OFF and OFF-ON switching time are feasible from implementation perspective.  **Observation 4:**   * Single slot scheduling case:   + The existing 5 uS transient period cannot provide reliable performance for 16QAM MCS 16 with 480 kHz and 960 kHz SCS (note that ∞ means that there is scenario with certain TP cannot reach 1 % BLER).   + 3uS transient period shows 13.6 dB performance loss compared to the ideal transient period (0 uS) for the MCS 16 with 960 kHz SCS   + 2us transient period provides up to 3.5 dB performance loss for MCS 16 with 960 kHz SCS   + 1us transient period allows < 2 dB performance loss for all considered scenarios * Multiple PUSCH/PUCCH slot transmissions   + Comparing the same evaluation condition with the multiple PUSCH/PUCCH slot transmission, the performance get improved with larger number of bundling. For example, for 3 uS transient period for MCS 16 with 960 kHz SCS the performance is 13.6 dB (without bundling) 🡪 11.3 dB (with 2 slot bundling) 🡪 9.2 dB (with 4 slot bundling) 🡪 7.6 dB (with 8 slot bundling).   + While there could be 6 dB throughput improvement with multiple-slot transmission, we would like to point out that the evaluation is based on optimistic assumption, i.e., there is no transient period between the multiple slots illustrated in figure 4, which may or may not hold true based on the final design. Furthermore, the 7.6 dB loss from the 3 uS transient period with MCS 16 with 960 kHz SCS is still quite large compared to the ideal transient period (0 uS TP). |

## 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: UE Switching from DL to UL and UL to DL**

* Proposals
  + Option 1: 7us, 13792 Tc
  + Option 2: depends on cell phase sync and transients
  + Option 3: 3 us
* Recommended WF
  + Discuss during round 1

### Sub-topic 1-2

*Sub-topic description*

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

**Issue 1-2: UE Switching TX and RX beams**

* Proposals
  + Option 1: Re-use FR 2 assumption (200 ns)
  + Option 2: 100 ns
  + Option 3: 50 ns
  + Option 4: 20 ns
* Recommended WF
  + Discuss during round 1

### Sub-topic 1-3

*Sub-topic description*

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

**Issue 1-3: Minimum duration between beam switches**

* Proposals
  + Option 1: 4.5us
* Recommended WF
  + Discuss during round 1

### Sub-topic 1-4

*Sub-topic description*

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

**Issue 1-4: gNB beam switching**

* Proposals
  + 59 us max (typo?)
  + 100 ns
  + 20ns
* Recommended WF
  + Discuss during round 1

### Sub-topic 1-5

*Sub-topic description*

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

**Issue 1-5: Reply LS out to RAN1**

* Proposals
  + Option 1: from R4-2105138
  + Option 2: from R4-2107210
  + Option 3: from R4-2106909
  + Option 4: from R4-2104805
  + Option 5: from R4-2107342
* Recommended WF
  + Dependent on conclusion on sub-topics 1-1 through 1-4. Revisit this during round 2.

## Companies views’ collection for 1st round

### Open issues

Sub topic 1-1 **UE Switching from DL to UL and UL to DL**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| MediaTek | Support Option 1.  We do not see a problem to keep 7us. |
| CATT | We support option1 to reuse FR2 assumption. |
| ZTE | Support option 2 and we agree to revisit on-ff mask for 60GHz in SID phase. |

Sub topic 1-2 **UE Switching TX and RX beams**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| MediaTek | Support Option 1.  We understand the beam switch time 200ns may be insufficient in SCS 480KHz and 960KHz. However, since only SCS 120KHz is mandatory in this WI. We suggest RAN4 to consider the UE minimum requirement based on the mandatory SCS.  For SCS 480KHz and 960KHz, RAN4 can further discuss whether a shorter switching time is needed. But we would like this shorter switch time to be optional, aligning with 3GPP’s decision on SCS 480KHz and 960KHz. UE should not be mandated to support a switching time short than 200ns in order to support 71GHz. |
| ZTE | It’s better to futher check its capability, switched based phase shifter might provide much better performance. |

Sub topic 1-3 **Minimum duration between beam switches**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| MediaTek | More discussions are needed.  Clarification on the proposal is needed. Is this the time gap between 2 beam switches, e.g., between 2 TCI-state switch commands from network or between 2 autonomous Rx beam switch? We also wonder what the spec impact is, if we conclude this value. |

Sub topic 1-4 **gNB beam switching**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| CATT | We prefer 100 ns from FR2 assumption. And if UE can’t be improved, we’re not sure if there’s benefit to improve gNB only. |
| ZTE | 20ns is feasible from our product feedback. |

Sub topic 1-5 **Reply LS out to RAN1**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| MediaTek | Suggest to work on the technical part first. |

### CRs/TPs comments collection

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

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

## Summary for 1st round

### Open issues

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

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

### CRs/TPs

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

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

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

## Discussion on 2nd round (if applicable)

# Topic #2: UE TX requirements

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

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2105090 | Ericsson | **Proposal 1: consider a UE ACLR range of 15-20 dB feasible for the 52.6-71 GHz frequency range.**  **Observation 1: the order of magnitude of the UE power capability is estimated at EIRP = 23 dBm in the beam peak with a TRP = 7 dBm.**  **Observation 2: in practice it is the OBW and EVM requirements that determine the achievable UE output power, the ACLR is not dimensioning.**  **Proposal 2: limit the modulation order for NR in 52.6-71 GHz to 64QAM due to EVM and the corresponding PAE.**  **Proposal 3: consider SU < 90% SU for improved UE power capability.**  **Observation 3: no need to use interlaced transmissions for meeting the occupied bandwidth requirements for SRD bands c1 and c3 as such, only if the PSD limit requires an output power EIRP > 23 dBm.**  **Observation 4: power control for UEs is part of a regulatory requirement for c3 despite the use of beam forming.** |
| R4-2106909 | Apple | ***Observation 1****: UE at 60 GHz and above ranges may always operate at PCMAX in order to achieve the desired SNR at gNB receiver.*  ***Observation 2****: The +12dB absolute power tolerance for open loop power control would imply that UE will be operating at PCMAX.*  ***Observation 3****: The -12dB absolute power tolerance may for open loop power control cause UE to be out of UL coverage range and prolong the initial access process.*  ***Proposal 1****: For NR operation in 60GHz and above ranges, UE output power is always set at Pmax during the initial access.* |
| R4-2107342 | Intel Corporation | **Observation 1:** As the requirements for the 52.6 to 71GHz frequency range will be radiated, we can use the requirements in TS38.101-2 as reference in our discussion.  **Tx requirement scope**  **Proposal 1:** RAN4 should discuss and approve the Tx requirement scope for the 52.6 to 71GHz range. Table 1 can facilitate the discussion.  **Power classes beyond 52.6GHz**  **Proposal 2:** Based on targeted use cases and new frequency range, discuss if power class framework needs to be modified and choose which power classes will be included in the work item’s scope. |
| R4-2107191 | Nokia, Nokia Shanghai Bell | **Observation 1: Implementation losses need special attention to guarantee high EIRP output and therefore good UL link budget.**  **Proposal 1: RAN4 strives to keep UE implementation loss budget reasonably small for NR operation above 52.6 GHz to ensure good UL link budget.**  **Proposal 2: For an unlicensed NR band adopt the power limits given in Table 2 as a baseline**  **Proposal 3: Further discuss which, if any, of the existing power classes in 38.101-2 can be reused for an unlicensed NR band or a new power class is needed. As basis for power class definition, it is beneficial to discuss what are representative antenna array sizes in this frequency range.**  **Proposal 4: Postpone discussing RF output limits for a licensed band until spectrum and regulations becomes available.**  **Observation 2: Co-existence study for this frequency range has already been documented in TR 38.803**  **Proposal 5: Extract the ACLR and ACS requirements from TR 38.803 for licensed operation**  **Observation 4: Emissions due to non-linearities are typically much wider than the common 1 MHz measurement bandwidth and increasing MBW appears practical especially for wide subcarrier spacings, like 960 kHz.**  **Proposal 7: Consider specifying wider measurement bandwidth than 1 MHz at least for 960 kHz SCS in case regulatory requirements allow it.** |
| R4-2107211 | Qualcomm Incorporated | **Observation : Typical UE EIRP at boresight is approximately 18.5 dBm, assuming 16 antenna elements.** |
| R4- 2105172 | Qualcomm CMDA Technologies | **Proposal 1: We would like to invite other companies to provide their views on the different parameters for downlink and uplink cases as well as the deployment scenarios to be investigated.** |
| R4-2105173 | Qualcomm CMDA Technologies | **Proposal 1: We would like to invite other companies to provide their views on the different parameters for downlink and uplink cases as well as the deployment scenarios to be investigated.** |

## 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:*

**Issue 2-1: Parameters to be considered for specification**

* Proposals
  + Table for parameters to be considered as an organizational guide to spec development. List of parameters is a guide. It may change.

|  |  |  |
| --- | --- | --- |
|  | **Parameter** | **Notes** |
| 2-1.1 | UE maximum output power   * Minimum peak EIRP * Spherical coverage | FFS |
| 2-1.2 | UE max power Multi-band relaxation | FFS |
| 2-1.3 | UE maximum output power reduction | FFS |
| 2-1.4 | UE maximum output power with additional requirements | FFS |
| 2-1.5 | Transient period | Being discussed in topic 1 |
| 2.1-6 | Carrier leakage | FFS |
| 2.1-7 | In-band emissions (IBE) | FFS |
| 2.1-8 | Adjacent channel leakage ratio (ACLR) | FFS |
| 2.1-9 | Spurious emission band UE co-existence | FFS |
| 2.1-10 | Additional spurious emissions | FFS |
| 2.1-11 | Beam correspondence | FFS |
| 2.1-12 | Highest modulation order | FFS |

* Recommended WF
  + Discuss during round 1

**Issue 2-1.1: UE maximum output power and power class**

* Proposals
  + Consider typical (not minimum performance) UE at 18.5 dBm at 16QAM EVM limit from FR2
  + Max power unlicensed use r4-2107191 Table 2 as baseline
  + Discuss 38.101-2 power classes for re-used in 60GHz
  + Approximately 23 dBm EIRP beam peak
* Recommended WF
  + Discuss during round 1

**Issue 2-1.8: UE ACLR**

* Proposals
  + 15-20 dB is feasible
  + From TR 38.803
  + Perform system sims to help determine ACLR
* Recommended WF
  + Postpone ACLR value discussion until system simulation (Topic 5) discussion concludes. topic 5.

**Issue 2-1.12: UE TX modulation order**

* Proposals
  + Highest modulation 64 QAM
* Recommended WF
  + Discuss during round 1

### Sub-topic 2-2

*Sub-topic description*

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

**Issue 2-2: Spectral utilization**

* Proposals
  + Option 1: Consider < 90% for improved UE power capability
* Recommended WF
  + Discuss during round 1

### Sub-topic 2-3

*Sub-topic description*

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

**Issue 2-3: 960 kHz measurement BW**

* Proposals
  + Option 1: Consider > 1MHz if regulatory allows
* Recommended WF
  + Consider this in future meetings

### Sub-topic 2-4

*Sub-topic description*

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

**Issue 2-4: Power classes and array sizes**

* Proposals
  + Option 1: Discuss power class framework and re-use of FR2 classes and antenna array sizes
* Recommended WF
  + Discuss during round 1

### Sub-topic 2-5

*6909 (Apple) describes the behavior of power control given the UL power tolerance. This seems like a RAN1 topic however some discussion of this may give us better understanding to align with RAN1.*

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

**Issue 2-5: Power control tolerance and initial access power level**

* Proposals
  + For NR operation in 60GHz and above ranges, UE output power is always set at Pmax during the initial access.
* Recommended WF
  + Discuss during round 1

## Companies views’ collection for 1st round

### Open issues

Issue 2-1 table for specification guidance

|  |  |
| --- | --- |
| **Company** | **Comments** |
| MediaTek | “Multi-band relaxation requirement” shall be added & FFS |

Issue 2-1.1 UE MOP and power class

|  |  |
| --- | --- |
| **Company** | **Comments** |
| MediaTek | Band plan shall be specified firstly. |

Issue 2-1.8 UE ACLR

|  |  |
| --- | --- |
| **Company** | **Comments** |
| MediaTek | Fine with moderator recommendation on ACLR |

Issue 2-1.12 mod order

|  |  |
| --- | --- |
| **Company** | **Comments** |
| MediaTek | More analysis is required, so prefer to keep highest Tx modulation order FFS |

Sub topic 2-2 spectral utilization

|  |  |
| --- | --- |
| **Company** | **Comments** |
| MediaTek | Needs further study, and also discussed in the Part1 email thread. |

Sub topic 2-3 960 SCS MBW

|  |  |
| --- | --- |
| **Company** | **Comments** |
| MediaTek | Agree with moderator recommendation. |

Sub topic 2-4 power class and array sizes

|  |  |
| --- | --- |
| **Company** | **Comments** |
| MediaTek | Use FR2 power class discussion framework is a good starting point, however, for exact antenna array size assumption shall be FFS. |

Sub topic 2-5 power control tolerance and initial access power level

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

### CRs/TPs comments collection

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

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

## Summary for 1st round

### Open issues

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

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

### CRs/TPs

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

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

## Discussion on 2nd round (if applicable)

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

# Topic #3: UE RX requirements

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

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2107343 | Intel Corporation | **Proposal 1:** RAN4 should discuss and approve the specific Rx requirement scope for the 52.6 to 71GHz range. Table 1 can facilitate the discussion. |
| R4-2107192 | Nokia, Nokia Shanghai Bell | **Observation 1: For licensed operation in the 52.6 – 71 GHz range NR FR2 Rx requirements can be reused as baseline.**  **Observation 2: UE antenna array sizes for NR operation up to 71 GHz should be discussed.**  **Observation 3: It is possible to extract some requirements, like ACS, also from the co-existence study in 38.803.**  **Proposal 1: Postpone further discussion of UE Rx requirements for licensed operation until available spectrum becomes clear.**  **Proposal 2: Align UE Rx requirements to the ETSI EN 303 753 harmonized standard where possible for unlicensed operation in the 57 – 71 GHz range.**  **Proposal 3: Where no Rx requirements is given by the ETSI EN 303 753 harmonized standard use current FR2 NR requirements as a baseline for unlicensed operation in the 57 – 71 GHz range.**  **Proposal 4: RAN4 to further discuss relaxation, if needed, of Rx requirements as compared to current FR2 NR requirements for unlicensed operation in the 57 – 71 GHz range.** |

## Open issues summary

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

### Sub-topic 3-1

*Sub-topic description:*

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

**Issue 3-1: Parameter table to guide specification development**

* Proposals
  + Use this table as a starting point to guide specification discussion.

|  |
| --- |
| **Parameter** |
| Reference sensitivity power level  Minimum peak EIS |
| EIS spherical coverage |
| Adjacent channel selectivity (ACS) |
| In-band blocking (IBB) |

* Recommended WF
  + Discuss during round 1

### Sub-topic 3-2

*Sub-topic description:*

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

**Issue 3-2: Postpone licensed RX requirement discussion**

* Proposals
  + Postpone further discussion of UE Rx requirements for licensed operation until available spectrum becomes clear.
* Recommended WF
  + Discuss during round 1

### Sub-topic 3-3

*Sub-topic description:*

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

**Issue 3-3: Align RX requirements with ETSI**

* Proposals
  + Align UE Rx requirements to the ETSI EN 303 753 harmonized standard where possible for unlicensed operation in the 57 – 71 GHz range.
  + Where no Rx requirements is given by the ETSI EN 303 753 harmonized standard use current FR2 NR requirements as a baseline for unlicensed operation in the 57 – 71 GHz range.
* Recommended WF
  + Discuss during round 1

## Companies views’ collection for 1st round

### Open issues

Sub topic 3-1 **Parameter table to guide specification development**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| MediaTek | “Multi-band relaxation requirement” and “Maximum Input level“ shall be added & FFS |

Sub topic 3-2 **Postpone licensed RX requirement discussion**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| MediaTek | Postpone further Rx requirements discussion until band-plan has been agreed. |

Sub topic 3-3 **Align RX requirements with ETSI**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| MediaTek | EN 303 753 is still draft with no Rx requirements in place. However it is expected that 3GPP Rx requirements for unlicensed operation would allow UEs to fulfil regulatory requirements.  Using FR2 as starting point for analysis also seems reasonable for other requirements. |

### CRs/TPs comments collection

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

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

## Summary for 1st round

### Open issues

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

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

### CRs/TPs

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

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

## Discussion on 2nd round (if applicable)

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

# Topic #4: 60 GHz frequency range designation

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

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2104835 | Apple | **Proposal 1: discuss FR2 or FR2a+FR2b designations**  **Proposal 2: the following principles should be considered to define the frequency range of 52.6 GHz to 71 GHz**   * **No new spec should be introduced** * **Ensure flexibility to either reuse FR2 or introduce 60GHz-specific features and requirements** * **Strive to reduce the impact on existing spec** |
| R4-2104803 | CATT | **Observation 1: Some of RF requirements may be different with FR2 but they’re not discussed in detail yet in RAN4.**  **Observation 2: Treating the bands as FR2 extension can be done for BS RF and UE RF spec.**  **Observation 3: Treating the bands as FR3 may need a new UE RF spec to be created.**  **Observation 4: RRM spec impact needs more discussion when the requirements are clearer.**  **Observation 5: Reusing FR2 name for above 52.6 GHz in DEMOD spec may be feasible.**  **Proposal 1: Treat 52.6-71 GHz as FR2 extension.**  **Proposal 2: Keep FR2 notation for 24.25-52.6 GHz and use a new FR2a notation for 52.6-71 GHz range when it’s necessary. By default, FR2 descriptions automatically apply to FR2a, only exception requirements are defined.** |
| R4-2104595 | CMCC | ***Observation: From RF, demodulation, RRM perspective, we do not see the necessity to introduce new terminology, i.e. FR3 or FRx.***  ***Proposal 1: No new specifications should be created for 52.6GHz~71GHz.***  ***Proposal 2: It is proposed to extend FR2 up to 71GHz.*** |
| R4-2104588 | Ericsson France S.A.S | In this paper, a preliminary analysis on how an introduction of NR in 52.6 – 71 GHz could be implemented is done, using either an extension of FR2 or a newly introduced Frequency Range (FR3).  In general terms for RAN4 specifications, differentiation of requirement level approach can be adopted for BS and UE RF specifications per e.g. band. For RRM, the differentiation should be made on a basis of supported SCS (which would anyhow be needed even with introduction of new Frequency Range). And can be adopted since generic and agnostic requirements are difficult to define due to large difference between new specified SCS:s.  The analysis show that the extension of FR2 is a viable solution while it seems that introduction of new frequency range is not motivated. |
| R4-2106467 | Intel Corporation | In this paper we present our views on the frequency range definition on NR 52.6 – 71 GHz. In summary, we make the following proposals.  ***Proposal #1: No new RAN4 technical specifications shall be introduced to capture the NR 52.6 – 71 GHz and the existing specifications shall be reused.***  ***Proposal #2: RAN4 to recommend RANP to introduce a new notation for the 52.6 – 71 GHz frequency range***   * + ***Option 1: Use FR2 notation to designate the full 24.25 – 71 GHz range***      - ***Use a new FR2a notation for 24.25 – 52.6 GHz range***     - ***Use a new FR2b notation for 52.6 – 71 GHz range***     - ***By default, any existing references to FR2 will automatically apply to the new FR2b bands.***   + ***Option 2: Keep FR2 notation for 24.25 – 52.6 GHz and use a new FR2a notation for 52.6 – 71 GHz range***     - ***By default, any existing references to FR2 will not automatically apply to the new FR2a bands.*** |
| R4-2106666 | Nokia, Nokia Shanghai Bell | In this contribution, we provided our views on how to introduce the 52.6-71GHz frequency range, taking into account RAN1, 2, and 4 aspects. The following observation and proposals were made:  **Observation 1: From RAN1 and RAN2 point of view there is a benefit in having a special designation for the 52.6-71GHz frequency range.**  **Observation 2: Introducing a completely new FR, e.g. FR3, brings significant impact to RAN4 specification structure.**  **Proposal 1: Do not introduce new RAN4 specifications to support the 52.6-71GHz frequency range.**  **Proposal 2**: **RAN4 to further consider the recommendation to provide to RAN#92-e taking into account the pros and cons for the options listed above.** |
| R4-2107316 | Skyworks Solutions Inc. | In this contribution, we shortly discuss the potential for new coexistence issues at the UE or network level between FR2 and the new 52.6-71GHz range and we make the following observation.  **Observation: Whether or not the new NR 52.6-71GHz range is consolidated with FR2, RAN4 should determine if coexistence issues at the UE or network level should be analyzed in relation to potential harmonic 2 or 3 interference.** |
| R4-2106294 | Xiaomi | **Observation 1：There is no frequency gap between FR2 and the new 52.6 to 71GHz frequency range.**  **Observation 2: Similar RF architecture for FRx range comparing to FR2.**  **Observation 3: RF requirements are defined band specific with different value and measurement bandwidth.**  **Proposal 1: To extend FR2 to cover 52.6—71GHz.** |
| R4-2106592 | ZTE Corporation | **Observation 1: minimum and maximum SCS and BW, channel raster, channel spacing and sync raster of 52.6-71GHz would be different from that of legacy FR2.**  **Observation 2: lot of BS RF requirements in legacy FR2 would be different from that for 52.6-71GHz.**  **Observation 3: BS demod requirements for 52.6-71GHz would be different from that of legacy FR2.**  **Observation 4: lot of UERF requirements in legacy FR2 would be different from that for 52.6-71GHz.**  **Observation 6: UE demod requirements for 52.6-71GHz would be different from that of legacy FR2.**  **Proposal 1: to define FR3 for 52.6-71GHz;** |

## Open issues summary

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

### Sub-topic 4-1

*Sub-topic description:*

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

**Issue 4-1: 60 GHz range designator**

* Proposals
  + Option 1: FR2
  + Option 2: FR2a
  + Option 3: rename FR2 🡺FR2a and 60 GHz 🡺 FR2b
  + Option 4: defer pending 2nd 3rd harmonic interference analysis
  + Option 4: FR3
* Recommended WF
  + Discuss during round 1

### Sub-topic 2-2

*Sub-topic description*

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

**Issue 2-2: Same or different minimum performance TS**

* Proposals
  + Option 1: No new spec (include 60 GHz in UE and BS existing specs)
* Recommended WF
  + Option 1. Same TS for UE and BS.

## Companies views’ collection for 1st round

### Open issues

Sub topic 4-1 **60 GHz range designator**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| MediaTek | Whichever causes less impact and confusion in defining & maintaining specs. |
| CATT | Keep FR2 and further discuss how to treat the different requirements for RF, RRM and DEMOD part. |
| Rohde & Schwarz | RAN5 is already using designations FR2a, FR2b, FR2c to subdivide current FR2 range, so we should not use such names. Prefer to have a separate name for the new frequency range e.g. Option 4. FR2 is meanwhile well established, increasing to 71 GHz is no minor change and will lead to confusion. Also RF parameters may be fundamentally different (SCS, bandwidth, etc.) so having a new frequency range makes sense. |
| Skyworks | As we observed in our paper, regardless of the frequency range designation, RAN4 should determine if coexistence aspects between the current FR2 range and the 52-71GHz extension is needed to account for harmonic interference. |
| ZTE | We prefer to have new frequency range naming for 60GHz due to lot of difference could be foreseen in future. |

Sub topic 4-2 **Same or different minimum performance TS**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| MediaTek | Option 1 - Prefer same minimum performance TS as FR2. |
| CATT | Support the recommended WF. |
| Skyworks | Option 1, even more needed if coexistence needs to be addressed in the TS as per our observation |
| ZTE | Option 1 |

### CRs/TPs comments collection

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

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

## Summary for 1st round

### Open issues

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

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

### CRs/TPs

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

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

## Discussion on 2nd round (if applicable)

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

# Topic #5: System simulations

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

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2104806 | CATT | **Proposal 1: Take Scenario indoor-A (for two operator case) from TS 38.808 as RAN4 co-exist simulation scenario for 52.6-71 GHz.**  **Proposal 2: 70GHz is used as the carrier frequency assumption for 52.6-71 GHz co-existence simulation, 60 GHz can also be considered as an extra choice.**  **Proposal 3: 1.6GHz CBW and 480KHz SCS/264 RB are the assumption for the configuration.**  **Proposal 4: For the BS and UE antenna model, use TR 38.808 assumption with the update of BS antenna size (1,1,16,16,2).**  **Proposal 5: EIRP is used as the BS/UE Tx power metric. BS Tx power is assumed as 61.8 dBm EIRP, UE Tx power is assumed as 25 dBm EIRP.**  **Proposal 6: Noise figure assumption in TR 38.803 can be reused for co-existence simulation for 52.6-71GHz.**  **Proposal 7: No LBT is used for co-exit simulation.**  **Proposal 8: Remaining assumptions can reuse the assumptions in TR 38.803 if there’re no conflicts with the above assumptions.** |
| R4- 2105172 | Qualcomm CDMA Technologies | **Observation 1: For DL case, an ACIR of 15 dB would be enough to keep degradation due to ACI within 5% loss region.**  In addition, RAN 4 should start discussing simulation parameters for 52.6-71GHz.  **Proposal 1: We would like to invite other companies to provide their views on the different parameters for downlink and uplink cases as well as the deployment scenarios to be investigated.** |
| R4-2105173 | Qualcomm CDMA Technologies | **Observation 1: For DL case, an ACIR higher than 15 dB and 17 dB would provide enough margin against adjacent channel interference for the 2GHz and 400MHz channel bandwidth, respectively, for the coordinated deployment case. On the other hand, for the un-coordinated case, ACIR higher than 5 dB and 8 dB for the two bandwidth configurations would suffice.**  In addition, RAN 4 should start discussing simulation parameters for 52.6-71GHz.  **Proposal 1: We would like to invite other companies to provide their views on the different parameters for downlink and uplink cases as well as the deployment scenarios to be investigated.** |

## 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 5-1

*Sub-topic description:*

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

**Issue 5-1: System simulation**

* Proposals
  + Option 1: Discuss and align system simulation parameters
  + Option 2: Rely on system simulation results from 38.803
* Recommended WF
  + Discuss during round 1

## Companies views’ collection for 1st round

### Open issues

Sub topic 5-1 **System simulation**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| MediaTek  XXX | Option 1 - Parameters need more analysis |
| CATT | Option 1, and we welcome the comments on our simulation assumption proposals. |

### CRs/TPs comments collection

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

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

## Summary for 1st round

### Open issues

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

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

### CRs/TPs

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

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

## Discussion on 2nd round (if applicable)

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

# Recommendations for Tdocs

## 1st round

**New tdocs**

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

**Existing tdocs**

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

Notes:

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

## 2nd round

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

Notes:

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