**3GPP TSG-RAN WG4 Meeting #104-bis-e R4-22xxxxx**

**Online Meeting, 10 – 21 October 2022**

**Source: RAN4 vice chair (Samsung)**

**Title:** **RAN4#104-e BS\_Demod\_Testing Session meeting minutes**

**Agenda Item:** **2**

**Document for:** **Information**

## 3 Incoming LS and meeting report

### 3.2 Session chair notes

BS RF Demod Test Session email thread list

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **#** | **Email title** | **WI** | **Topic areas** | **AI** | **Moderator** |
| 301 | [104-e][301] BSRF\_Maintenance | Rel-15/16 NR maintenance (BS RF) NR\_DL1024QAM\_FR1-Core/Perf NB\_IOTenh4\_LTE\_eMTC6-Core/Perf Rel-17 TEI (BS RF related) | Rel-15/16 LTE/NR BS RF maintenance Rel-17 DL 1024QAM BS/UE RF maintennace Rel-17 NB\_IoT/MTC BSRF, RF conformance Rel-17 TEI (BS RF only) | 4.2 5.2.2.1 9.24.2，9.24.3 5.2.4.5 (R4-2212311) | Johan Sköld  AI 4.8 |
| 302 | [104-e][302] BSConformance\_Maintenance | Rel-15/16 LTE/NR BS RF conformance | Rel-15/16 LTE/NR BS RF conformance | 4.3 | Liehai Liu AI 4.8 |
| 303 | [104-e][303] EMC | Rel-15/16 LTE/NR EMC maintenance NR\_repeaters-Core/Perf | Rel-15/16 BS/UE EMC maintenance Rel-17 NR repeater EMC maintenance | 4.4 9.5.4 | Wubin Zhou AI 4.8 |
| 304 | [104-e][304] NR\_Repeater\_RFMaintenance | NR\_repeaters-Core | Rel-17 NR repeater RF maintnenance | 9.5.1, 9.5.2, 9.5.3 | Chunxia Guo AI 9.5.6 |
| 305 | [104-e][305] NR\_Repeater\_RFConformance\_Part1 | NR\_repeaters-Perf | Rel-17 NR repeater RF conformance general part | 9.5.5.1 | Michal Szydelko AI 9.5.6 |
| 306 | [104-e][306] NR\_Repeater\_RFConformance\_Part2 | NR\_repeaters-Perf | Rel-17 NR repeater conformance test cases | 9.5.5.2, 9.5.5.3 | Huiping Shan AI 9.5.6 |
| 307 | [104-e][307] NTN\_Solutions\_SANRF\_Maintenance | NR\_NTN\_solutions-Core | Rel-17 NR NTN WI: SAN (Satellite Access Node) RF | 9.11.1, 9.11.2 | Dorin Panaitopol AI 9.11.8 |
| 308 | [104-e][308] NTN\_Solutions\_RFConformance | NR\_NTN\_solutions-Perf | Rel-17 NR NTN RF conformance | 9.11.3 | Dominique Everaere AI 9.11.8 |
| 309 | [104-e][309] NTN\_Solutions\_UERF\_Maintenance | NR\_NTN\_solutions-Core | Rel-17 NR NTN RF requirements: UE RF | 9.11.4 | Fei Xue AI 9.11.8 |
| 310 | [104-e][310] NR\_exto71GHz\_BSRF | NR\_ext\_to\_71GHz-Core/Perf | Rel-17 NR extending to 71GHz: BS RF requirements, BS RF conformance | 9.14.4 9.14.5 | Toni lahteensuo AI 9.14.9 |
| 311 | [104-e][311] NR\_eIAB\_RFMaintenance | NR\_IAB\_enh-Core/Perf | Rel-17 NR eIAB RF maintenance and RF conformance testing | 9.15.1 9.15.2 | Yankun Li AI 9.15.4 |
| 312 | [104-e][312] RAIL\_900MHz\_RF | NR\_RAIL\_EU\_900MHz-Core/Perf | Rel-17 5G NR applicable for Rail Mobile Radio on 900MHz | 8.2.1 | Michal Szydelko AI 8.2.3 |
| 313 | [104-e][313] LS\_Response\_ITU-R |  | LS response for ITU-R: LS RP-212699 ITU-R WP5D | 6.1 | Johan Sköld  AI 6.1 |
| 314 | [104-e][314] FS\_NR\_BS\_RF\_evo | FS\_NR\_BS\_RF\_evo | Rel-18 NR BS RF requirements evoluation | 11.4 | Liehai Liu AI 11.4.3 |
| 315 | [104-e][315] FS\_NR\_duplex\_evo | FS\_NR\_BS\_RF\_evo | Rel-18 NR Duplex evoluation SI | 11.13 | Yankun Li AI 11.13.4 |
| 316 | [104-e][316] LTE\_terr\_bcast\_bands\_BSRF | [LTE\_terr\_bcast\_bands\_part2-Core | New bands for 5G terrestrial broadcast: BS RF | 12.4.4  R4-2211555/ R4-2211981/ R4-2211982/ R4-2212099( Proposal3 only), R4-2111585 (proposal 3 only) | Susanne Rath AI 12.4.5 |
| 317 | [104-e][317] IoT\_NTN\_Co-existence\_SANRF | LTE\_NBIOT\_eMTC\_NTN\_req-Core | Rel-18 IoT NTN SAN RF, system parameters and co-existence | 12.5.2, 12.5.3, R4-2214019 (proposal 1 only) | Fei Xue AI 12.5.6 |
| 318 | [104-e][318] Demod\_Maintenance\_BS | Rel-15/16 Demod maintenance Rel-17 BS demod maintenance | Rel-15/16 BS demod maintenance Rel-17 BS demod maintenance | 4.6.3 ~~5.2.4.4 (BS part)~~ | Aijun Cao AI 4.8 |
| 319 | [104-e][319] Demod\_Maintenance\_UE | Rel-15/16 Demod maintenance NR\_DL1024QAM\_FR1-Perf NR\_HST\_FR1\_enh-Perf NR\_UE\_pow\_sav\_enh-Perf | Rel-15/16 Demod maintenance: UE part Rel-17 DL 1024QAM Demod maintenance Rel-17 FR1 HST demod Rel-17 Powersaving demod | 4.6.1,4.6.2 5.2.2.2 5.2.4.4 (UE part) 9.6.3 9.12.3 | Manasa Raghavan AI 4.8 |
| 320 | [104-e][320] NR\_HST\_FR2\_Demod | NR\_HST\_FR2-Perf | Rel-17 NR FR2 HST Demod requirements | 9.7.4 | Yunchuan Yang AI 9.7.5 |
| 321 | [104-e][321] NR\_perf\_enh2\_Demod | NR\_demod\_enh2-Perf | Rel-17 performance requirements enhancement: General, CRS-IM | 9.10 | Shan Yang AI 9.10.3 |
| 322 | [104-e][322] NR\_NTN\_Demod\_Part1 | NR\_NTN\_solutions-Perf | Rel-17 NTN demodulation part: General, UE part | 9.11.7.1 9.11.7.3 | Bin Han AI 9.11.8 |
| 323 | [104-e][323] NR\_NTN\_Demod\_Part2 | NR\_NTN\_solutions-Perf | Rel-17 NTN demodulation part:BS part | 9.11.7.1 (BS part only) 9.11.7.2 | Tricia Li AI 9.11.8 |
| 324 | [104-e][324] NR\_exto71GHz\_Demod\_Part1 | NR\_ext\_to\_71GHz-Perf | Rel-17 NR extending to 71GHz demodualtion:General, BS part | 9.14.8.1, R4-2213804 (proposal 3 and 4) 9.14.8.3 | Rafael Paiva AI 9.14.9 |
| 325 | [104-e][325] NR\_exto71GHz\_Demod\_Part2 | NR\_ext\_to\_71GHz-Perf | Rel-17 NR extending to 71GHz demodualtion:UE part | 9.14.8.2 R4-2212673, R4-2213967, R4-2213804 (proposal 1 and proposal 2), R4-2213803 (Proposal 1), R4-2212105 (Proposal 8 and proposal 9) | Pierpaolo Vallese  AI 9.14.9 |
| 326 | [104-e][326] NR\_cov\_enh\_Demod | NR\_cov\_enh-Perf | Rel-17 NR coverage enhancement WI: demodulation part | 9.16.2 | Jingzhou Wu AI 9.16.3 |
| 327 | [104-e][327] NR\_FeMIMO\_Demod | NR\_feMIMO-Perf | Rel-17 FeMIMO: demodulation part | 9.17.4 | Yunchuan Yang AI 9.17.5 |
| 328 | [104-e][328] NR\_RedCap\_Demod | NR\_redcap-Perf | Rel-17 Reduced capability NR device: demodulation part |  | Kazuyoshi Uesaka AI 9.18.6 |
| 329 | [104-e][329] NR\_IIOT\_URLLC\_enh\_Demod | NR\_IIOT\_URLLC\_enh-Perf | Rel-17 NR\_IIOT\_URLLC\_enh WI: Demodulation part | 9.21.3 | Axel Muller AI 9.21.4 |
| 330 | [104-e][330] NB-IOT\_MTC\_Demod | NB\_IOTenh4\_LTE\_eMTC6-Perf | Rel-17 Additional enhancements for NB-IoT and LTE-MTC: demodulation part | 9.24.6 | Tricia Li AI 9.24.7 |
| 331 | [104-e][331] NR\_MIMO\_OTA | FS\_NR\_MIMO\_OTA\_test NR\_MIMO\_OTA | Rel-16 MIMO OTA SI maintenance Rel-17 NR MIMO OTA Test | 4.7 9.1 | Xuan Yi AI 9.1.4 |
| 332 | [104-e][332] FR1\_TRP\_TRS\_Part1 | NR\_FR1\_TRP\_TRS | Rel-17 FR1 TRP, TRS: General, SA, EN-DC test methodology | 9.2.1, 9.2.2.1, 9.2.2.2, 9.2.3 | Ruixin Wang AI 9.2.4 |
| 333 | [104-e][333] FR1\_TRP\_TRS\_Part2 | NR\_FR1\_TRP\_TRS | Rel-17 FR1 TRP, TRS: Multi antenna, Others including test time reduction | 9.2.2.3, 9.2.2.4 | Qifei Liu AI 9.2.4 |
| 334 | [104-e][334] FS\_NR\_FR2\_OTA\_enh | FS\_NR\_FR2\_OTA\_enh | Rel-18 FR2 OTA test method enhancement | 11.5 11 (R4-2213179,2213180) | Bin Han AI 11.5.4 |

## 4 Up to Rel-16 maintenance for LTE and NR

### 4.8 Moderator summary and conclusions

**[104-e][301] BSRF\_Maintenance, AI 4.2, 5.2.2.1, 9.24.2, 9.24.3, 5.2.4.5 (R4-2212311)– Johan Sköld**

**R4-2214161 Email Discussion Summary for [104-e][301] BSRF\_Maintenance**

*Type: other For: Information  
 Source: Moderator (Ericsson)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Revised to R4-2214290**

**R4-2214290 Email Discussion Summary for [104-e][301] BSRF\_Maintenance**

*Type: other For: Information  
 Source: Moderator (Ericsson)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Return to.**

**Conclusions after 1st round**

**GTW discussion on August 24th**

Topic #3: Rel-17 TEI: Home gNB RF requirements

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Title** |
| R4-2212311 | CMCC | Home gNB RF requirements |

**Proposal 1: it’s suggested to regard home class as one type of LA with some note in the spec to emphasize all LA requirements are still applicable for BS with lower power declared by manufacturers. The detailed update of spec is listed as in Annex.**

|  |
| --- |
| For *BS type 1-C* and 1-H, BS classes are defined as indicated below:  - Wide Area Base Stations are characterised by requirements derived from Macro Cell scenarios with a BS to UE minimum coupling loss equal to 70 dB.  - Medium Range Base Stations are characterised by requirements derived from Micro Cell scenarios with a BS to UE minimum coupling loss equals to 53 dB.  - Local Area Base Stations are characterised by requirements derived from Pico Cell scenarios with a BS to UE minimum coupling loss equal to 45 dB or from Femto Cell scenarios with less power compared with the limit in Table 6.2.1-1.  All the RF requirements for LA BS apply for both Pico Cell scenarios and Femto Cell scenarios.  For BS *type 1-C, 1-H and 1-O,* HAPS BS class is defined as indicated below:  - HAPS Base Stations are characterised by requirements derived from High Altitude Platform scenarios with a BS to ground UE minimum distance of typically around 20km.  - Unless otherwise stated, HAPS BS class would refer to Wide Area BS class, which is specified in clause 4.4. |

* Discussion:
  + QC: Local Areas Base station already covered BS with lower power than the limit. No see the strong need on the “All the RF requirements for LA BS apply for both Pico Cell scenarios and Femto Cell scenarios.”
  + CMCC: Low power not same meaning as Home BS. BS type declared by manufacture, power limit still need to be declared when operators purchase BS.
  + Nokia: Local Areas with 24dBm power limit, does the intention to declare Home BS follow requirements as specified for Local areas BS into the specification?
  + CMCC: We provided some analysis in our t-docs; all the local area requirements can be applied for Home BS. We didn’t consider CSG and CAG feature.
  + ZTE: We think no harm to enable another type of BS into specifications.
  + Nokia: Does mean we assume same 45dB coupling loss for Home BS?
  + CMCC/ZTE: We assume the same coupling loss not applied for Home BS, and no definition on coupling loss in LTE for Femoto cell.
  + Nokia: If we use the same requirements for Home BS, then shall we assume same coupling loss as well?
  + Huawei: We support to clarify requirements for Local area BS also applied for Femto cells. Does “All the RF requirements for LA BS apply for both Pico Cell scenarios and Femto Cell scenarios. “ already enough to meet CMCC demand?
  + CMCC: We think in LTE specification, there is no relationship with coupling loss. We can refine the wording in next meeting.
* Agreement: it’s agreed to regard home class as one type of LA with some note in the spec to emphasize all LA requirements are still applicable for BS with lower power declared by manufacturers. Further discuss the text proposal to specification in future RAN4 meetings.

**Conclusions after 2nd round**

**[104-e][302] BSConformance\_Maintenance, AI 4.3– Liehai Liu**

**R4-2214162 Email Discussion Summary for [104-e][302] BSConformance\_Maintenance**

*Type: other For: Information  
 Source: Moderator (Huawei)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Revise to R4-2214291**

**R4-2214291 Email Discussion Summary for [104-e][302] BSConformance\_Maintenance**

*Type: other For: Information  
 Source: Moderator (Huawei)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Return to.**

**Conclusions after 1st round**

**Conclusions after 2nd round**

**[104-e][303] EMC, AI 4.4, 9.5.4 – Wubin Zhou**

**R4-2214163 Email Discussion Summary for [104-e][303] EMC**

*Type: other For: Information  
 Source: Moderator (ZTE)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Revise to R4-2214292**

**R4-2214292 Email Discussion Summary for [104-e][303] EMC**

*Type: other For: Information  
 Source: Moderator (ZTE)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Return to.**

**Conclusions after 1st round**

**R4-2214366 WF on NR Repeater EMC testing performance**

*Type: other For: Approval  
 Source: ZTE*

**Decision: Return to.**

**Conclusions after 2nd round**

**[104-e][318] Demod\_Maintenance\_BS, AI 4.6.3– Aijun Cao**

**R4-2214178 Email Discussion Summary for [104-e][318] Demod\_Maintenance\_BS**

*Type: other For: Information  
 Source: Moderator (ZTE)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Revise to R4-2214307**

**R4-2214307 Email Discussion Summary for [104-e][318] Demod\_Maintenance\_BS**

*Type: other For: Information  
 Source: Moderator (ZTE)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Return to.**

**Conclusions after 1st round**

**Conclusions after 2nd round**

**[104-e][319] Demod\_Maintenance\_UE, AI 4.6.1,4.6.2, 5.2.2.2, 5.2.4.4 (UE part), 9.6.3, 9.12.3– Manasa Raghavan**

**R4-2214179 Email Discussion Summary for [104-e][319] Demod\_Maintenance\_UE**

*Type: other For: Information  
 Source: Moderator (Apple)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Revise to R4-2214308**

**R4-2214308 Email Discussion Summary for [104-e][319] Demod\_Maintenance\_UE**

*Type: other For: Information  
 Source: Moderator (Apple)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Return to.**

**Conclusions after 1st round**

**Conclusions after 2nd round**

## 5 Rel-17 maintenance for LTE and NR

### 5.3 Moderator summary and conclusions

## 6 LS response to ITU

**[104-e][313] LS\_Response\_ITU-R, AI 6.1– Johan Sköld**

**R4-2214173 Email Discussion Summary for [104-e][313] LS\_Response\_ITU-R**

*Type: other For: Information  
 Source: Moderator (Ericsson)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Revise to R4-2214302**

**R4-2214302 Email Discussion Summary for [104-e][313] LS\_Response\_ITU-R**

*Type: other For: Information  
 Source: Moderator (Ericsson)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Return to.**

**Conclusions after 1st round**

**Conclusions after 2nd round**

## 7 Rel-17 feature list

## 8 Rel-17 spectrum related WIs for NR

### 8.2 Introduction of 900 MHz spectrum to 5G NR applicable for Rail Mobile Radio

#### 8.2.3 Moderator summary and conclusions

**[104-e][312] RAIL\_900MHz\_RF, AI 8.2.1, Michal Szydelko**

**R4-2214172 Email Discussion Summary for [104-e][312] RAIL\_900MHz\_RF**

*Type: other For: Information  
 Source: Moderator (Huawei)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Revise to R4-2214301**

**R4-2214301 Email Discussion Summary for [104-e][312] RAIL\_900MHz\_RF**

*Type: other For: Information  
 Source: Moderator (Huawei)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Return to.**

**Conclusions after 1st round**

**Conclusions after 2nd round**

## 9 Rel-17 non-spectrum related work items for NR and LTE

### 9.1 Multiple Input Multiple Output (MIMO) Over-the-Air (OTA) requirements for NR UEs

#### 9.1.4 Moderator summary and conclusions

**[104-e][331] NR\_MIMO\_OTA, AI 9.1– Yuan Yi**

**R4-2214191 Email Discussion Summary for [104-e][331] NR\_MIMO\_OTA**

*Type: other For: Information  
 Source: Moderator (CAICT)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Revise to R4-2214320**

**R4-2214320 Email Discussion Summary for [104-e][331] NR\_MIMO\_OTA**

*Type: other For: Information  
 Source: Moderator (CAICT)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Return to.**

**GTW discussion on August 18th**

List of open issues

* Sub-topic 2-2 FR1 MIMO OTA lab alignment
* Sub-topic 2-3 FR1 MIMO OTA performance test campaign
* Sub-topic 2-4 FR1 MIMO OTA performance requirements
* Sub-topic 2-5 Test Tolerance for FR1 MIMO OTA

**Issue 2-2-1: Pass/fail limit for FR1 MIMO OTA lab alignment**

* Proposals:
  + Proposal 1: keep the current lab alignment criteria unchanged at 0.75\*MU. (Huawei)
  + Proposal 2: Define +/- 0.6\*MU as the pass/fail limit for FR1 MIMO OTA lab alignment, i.e. +/- 1.8 dB for band <3GHz and +/- 2.0 dB for band >3GHz. (OPPO)
* Discussion:
  + Samsung: If proposal 1 agreed, then TT shall be considered larger.
  + OPPO: We have similar view with Samsung in addition that larger TT shall be considered.
  + Keysight: RAN4 can provide TT recommendation to RAN5, but final confirmation shall be RAN5 responsibility.
  + CAICT: Final TT value will be decided by RAN5 according to WID.
* Agreement: Proposal 1 agreed

**Issue 2-2-2: FR1 MIMO OTA lab alignment outcome**

* Proposals:
  + Proposal 1: Lab that submit PAD measurement results meeting the pass/fail limit in this meeting can be confirmed as FR1 MIMO OTA aligned lab. Close FR1 lab alignment activity in RAN4#104-e meeting. (CAICT)
  + Proposal 2: Discuss and make decision on whether the 6 labs can be confirmed as aligned labs in RAN4#104-e meeting. (Moderator)
* Agreement: Proposal 1 agreed.

**Issue 2-4-1: Framework for defining FR1 MIMO OTA performance requirements**

* Proposals:
  + Proposal 1: Discuss and decide the percentile of CDF to derive TRMS requirements. Consider the following options:
    - * Option 1: 80% pass rate (CAICT, OPPO)
      * Option 2: 95% pass rate (Xiaomi, Samsung, Huawei, vivo for n78)
      * Option 3: 90% (Apple, vivo for n41)
  + Proposal 2: The adjustments or relaxations with 80% percentile is needed based on the collected measurement data of commercial devices. (OPPO)
  + Proposal 3: Define a manufacturing tolerance, which is used to relax the population pass/fail limit, a similar passing rate as expected from the average TRMS statistics can be obtained. (Apple)
  + Proposal 4: UEs supporting multiple bands must pass the OTA requirements for all applicable bands in order to achieve certification and by introducing the evaluation of a joint band passing rate (JBPR) based on the comparison of the potential requirements against the measured OTA performances over a selected set of bands and evaluating the ratio of the number of passed UEs over the total number of UEs. (Apple)

**Issue 2-4-2: Final values of TRMS requirements**

* Proposals:
  + Proposal 1: Make decision on FR1 MIMO OTA performance requirements in this meeting. (CAICT)
  + Proposal 2: Approve the values in the following table as FR1 MIMO OTA TRMS requirements for n41 and n78 bands. (CAICT)

|  |  |  |
| --- | --- | --- |
| **Operating Band** |  | **TRMSaverage,70 [dBm/30kHz]** |
| n41 |  | -95 |
| n78 |  | -97 |

* + Proposa1 3: Adopt 80% percentile values in the CDF curves of the lasted TRMS data pool as presented under Issue 2-3. (Moderator)

|  |  |  |
| --- | --- | --- |
| **Operating Band** |  | **TRMSaverage,70 [dBm/30kHz]** |
| n41 |  | -94 |
| n78 |  | -96 |

* + Proposal 4: (Apple; OPPO with additional relaxations being considered)

|  |  |  |
| --- | --- | --- |
| **Operating Band** |  | **TRMSaverage,70 [dBm/30kHz]** |
| n41 |  | -93.8 |
| n78 |  | -95.5 |

* + Proposal 5: (Xiaomi with TT as 0.75MU)

|  |  |  |
| --- | --- | --- |
| **Operating Band** |  | **TRMSaverage,70 [dBm/30kHz]** |
| n41 |  | -93.5 |
| n78 |  | -95.5 |

* + Proposal 6:

|  |  |  |
| --- | --- | --- |
| **Operating Band** |  | **TRMSaverage,70 [dBm/30kHz]** |
| n41 |  | -93.5 |
| n78 |  | -95.2 |

* Recommended WF
  + Companies are invited to discuss the final values. The target is to reach agreements on TRMS requirements and conclude this issue in this meeting.
* Discussion:
  + Apple: Proposal 4 was proposed on the collected results, no extra margin considered. We would like to maintain 90% percentile.
  + Xiaomi: We think TT shall be decided together with performance requirements. We saw a LS from RAN5 for TRP/TRS WI. We are reusing same LTE approach to derive the values from proposal 5.
  + CAICT: In LTE, 85% adopted and CCSA 80% adopted. We prefer to take similar percentile for NR MIMO requirements.
  + Huawei: Relaxation shall be considered in RAN4, TT not considered in some regulatory bodies.
  + Samsung: We think 95% is reasonable for introducing NR MIMO OTA requirements.
  + OPPO: We can consider proposal 5 as starting point and further check whether additional relaxation needed.
  + Apple: We can accept proposal 5 without TT part.
  + Keysight: We shall decouple the discussion on requirements and TT.
  + CAICT: We can consider proposal 3 as starting point; proposal 5 only can be accepted without further relaxation.
  + vivo: We prefer to focus on the requirement introduction without starting point. For band n41, 90% value and n78 95% can be considered separate.
  + Apple: We can support proposal 6. For proposal 3, what’s the consideration on relaxation.
  + CAICT: -93.5 for n41 ok for us, for n78, we prefer -95.5.
  + Samsung: We have concern if these values are final values.
  + Apple: We can agree the proposal from CAICT considering TT not considered here.
  + OPPO: For band n78, there is limited samples and we propose to consider [0.5 -1] dB relaxation.
  + Samsung: Multi-band impact shall also be considered with [1~1.5] dB relaxation.
  + CAICT: We propose to consider [-95 ~-96] for band n78.
  + Apple: For proposal 3, what’s the relaxation? We have one paper JBTR for multi-band impact.
  + Xiaomi: We shall consider TT, the value -93.5 not acceptable at current stage without TT values agreed.
  + CAICT: -95.5 for n78 and -93.5 for n41 without relaxation.
  + Apple: We agree with CAICT.
* Agreement:
  + Further discuss TRMS requirements in Rel-17 MIMO OTA for n78 within below range:
    - n78: [-94.5 ~-95.5] dBm/30kHz
  + Further discuss TRMS requirements in Rel-17 MIMO OTA for n41 with below range:
    - n41: [-93.0 ~ -93.5] dBm/30kHz

**Issue 2-5-2: TT values for FR1 MIMO OTA**

*Moderator: For LTE MIMO OTA, TT was defined as 1dB, while MU is 2.65dB.*

* Options:
  + Option 1: Define TT=0.5\* MU budget, i.e. 1.5dB for ≤3GHz, and 1.7 dB for >3GHz. (CAICT, vivo)
  + Option 2: Define TT values as the same as lab alignment pass/fail limit [0.75\*MU], i.e. 2.3dB for ≤3GHz, and 2.5dB for >3GHz. (vivo, Samsung, Apple, Xiaomi, OPPO)
  + Option 3: TT values are not directly driven from assessed MU budget. Values between Option 1 and Option 2. (vivo, Samsung, Apple, CAICT, OPPO)
    - Option 3a: Define TT values as 1.6dB for n41 and 1.8dB for n78. (vivo)
    - Option 3b: Define TT values as 1.8dB for n41 and 2dB for n78. (CAICT)
* Agreement: RAN4 recommended TT values as:
  + Option 3b: Define TT values as 1.8dB for n41 and 2dB for n78.

**Conclusions after 1st round**

**WF/LS**

**R4-2214360 WF on MIMO OTA**

*Type: other For: Approval  
 Source: CAICT, vivo*

**Decision: Return to.**

**Conclusions after 2nd round**

### 9.2 Introduction of UE TRP (Total Radiated Power) and TRS (Total Radiated Sensitivity) requirements and test methodologies for FR1 (NR SA and EN-DC)

#### 9.2.4 Moderator summary and conclusions

**[104-e][332] FR1\_TRP\_TRS\_Part1, AI 9.2.1, 9.2.2.1, 9.2.2.2, 9.2.3– Ruixin Wang**

**R4-2214192 Email Discussion Summary for [104-e][332] FR1\_TRP\_TRS\_Part1**

*Type: other For: Information  
 Source: Moderator (vivo)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Revise to R4-2214321**

**R4-2214321 Email Discussion Summary for [104-e][332] FR1\_TRP\_TRS\_Part1**

*Type: other For: Information  
 Source: Moderator (vivo)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Return to.**

**GTW discussion on August 18th**

List of open issues

* Issue 3-1-1: Outcome of lab alignment activity
* Issue 3-1-2: Whether a new pass/fail limits is needed for lab alignment activity
* Issue 3-2-1: Recommended TT values for FR1 TRP TRS
* Issue 3-3-1: Requirements for FR1 TRP TRS

***Moderator****: the lab alignment analysis is summarized in R4-2212817:*

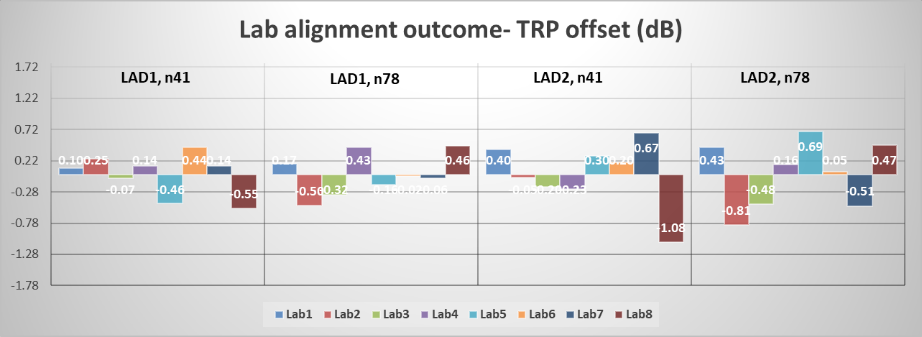


Figure 1: NR FR1 TRP lab alignment analysis, deviation between each test lab and reference value

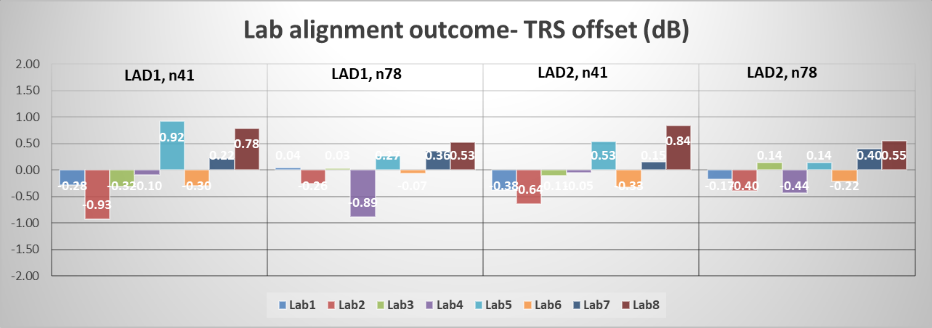


Figure 2: NR FR1 TRS lab alignment analysis, deviation between each test lab and reference value

**Issue 3-1-1: Outcome of lab alignment activity**

* Proposals
  + Proposal 1: 3GPP Rel-17 FR1 TRP TRS lab alignment activity can be successfully concluded and all the 8 labs (vivo, CAICT, CMCC, SRTC, OPPO, Sporton, Huawei, Element) with anechoic chamber system are well aligned.
* Discussion:
  + AT&T: We shall conclude 3-1-2 first and then comeback to this.
  + vivo: Lab alignment activity shall not be impacted by issue 3-1-2 pass/fail limit discussion.
  + AT&T: We would like to further discuss TT.
  + TIM: We share similar view as AT&T.
  + Apple: After updated pass/fail limit based on the collected results, we still maintain the lab alignment activity.
* Agreement: Proposal 1 agreed

**Issue 3-1-2: Whether a new pass/fail limits is needed for lab alignment activity**

* Proposals
  + Option 1: stick to previous agreements, i.e., lab alignment pass/fail limit [0.75\*MU], i.e. 1.34dB for TRP, and 1.65dB for TRS. [Huawei, CAICT]
  + Option 2: define a new stricter pass/fail limit for FR1 TRP TRS lab alignment, i.e. 1.2dB for both TRP and TRS [TIM, AT&T]
  + New Option 3: 1.2dB for TRP and 1.5dB for TRS (a new stricter pass/fail limit, but consider the MU difference of TRP and TRS) [vivo, Apple, Samsung?]
* Agreement: Option 3 agreed

**Issue 3-2-1: Recommended TT values for FR1 TRP TRS**

* Proposals
  + Proposal 1: Consider the following options to define TT values for TRP TRS:
    - Option 1: Define TT=0.5\* Preliminary MU budget, i.e. 0.9dB for TRP, and 1.1 dB for TRS.
    - Option 2: TT values are not directly driven from assessed MU budget. Propose TT= 1.1 dB for TRP, and 1.3 dB for TRS.
    - Option 3: Define TT values as the same as lab alignment pass/fail limit [0.75\*MU], i.e. 1.34dB for TRP, and 1.65dB for TRS.
    - Option 4: 0.62 \* MU as TT recommendation (1.1 dB TT for TRP and 1.36 dB TT for TRS) in line with actual RAN4 3GPP lab alignment framework and measurements
  + Proposal 2: Consider the following options related to future TT and MU work
    - Option 1: Optimization of the MU assessment can be done in the RAN5 but the TT value shall not be further impacted.
      * With the understanding that RAN5 to decide the MU only based on the test method and test equipment
    - Option 2: Propose recommended TT as a fraction/ration of MU for TT to adjust when MU is optimized/changed in future.
* Discussion:
  + TIM: We would like to decide TRP/TRS requirements before we conclude TT values.
  + AT&T: If MU further optimized , then we shall also consider the possibility of improvement on TT as well. We also would like to take full package with TT, and TRP/TRS requirements.
  + Apple: Regarding TT, it’s better to provide scalable value based on MU to RAN5. Can we choose option 4 for TT as starting point and then discuss TRP/TRS requirement to conclude as a package.
  + TIM: We agree scalable approach, but we prefer option 1.
  + vivo: The TT value from option 1 even tighten than conductive requirements which seems not reasonable.
* Agreement:
  + Option 4 as starting point for TT values and further decide final values together with TRP/TRS requirements

**Issue 3-3-1: Requirements for FR1 TRP TRS**

* Proposals
  + Proposal 1: Define requirements values for TRP and TRS based on the following options:
    - Option 1: 80%-tile, i.e., 13dBm for n41 and n78 TRP, -82dBm for n41 TRS, and -83.5dBm for n78 TRS. [CAICT]
    - Option 2: 85%-tile, i.e., 12.5dBm for n41 and n78 TRP, -81.5dBm for n41 TRS, and -83dBm for n78 TRS.
    - Option 3: 90%-tile, i.e., 12.5dBm for n41 and n78 TRP, -81.0dBm for n41 TRS, and -82.5dBm for n78 TRS.
    - Option 4: 95%-tile, i.e., 11dBm for n41, and 12dBm for n78 TRP; -80.5dBm for n41 TRS, and -82.0dBm for n78 TRS. [Huawei, Samsung (additional relaxation need to be considered) , Apple, Xiaomi]
* Discussion:
  + TIM: We don’t have chance to provide the preferred values on the requirements. Some important information missing due to the measurement campaign, we would like to know the set of samples be measured in a transparent way without linkage between the measured data and devices.
  + SoftBank: We support TIM, option 4 not acceptable for us. The difference among n41 and n78 is big compared to CDF curve.
  + AT&T: We share same concern as TIM. Option 4 seems conservative taking TT into account.
  + vivo: The intention is only to collect information for industry, but no impact on the framework we already agreed for deriving the requirements?
  + TIM: We don’t know what’s the impact till we can get the information.
  + vivo : Based on the CDF curve analysis, we think the collected data pool is stable enough. Volunteer Labs spent lots of effort to derive the requirements.
  + Apple: We appreciate the efforts from rapporteur and all the volunteer labs. As vivo explained, the CDF curves already prove the data pool quite stable. For disclose the device information, it’s not acceptable for us.
  + Samsung: We believe the test numbers already enough based on collected data. For disclose device information/sample list, we also think that’s not appropriate way.
  + Huawei: The raw data already available, if TIM can provide evidence based on the collected data where there is issue then we can reconsider the already agreed approach.
  + Samsung: ETSI test campaign, multi-band impact considered.
  + TIM: In ETSI, no TT considered, and no relaxation value on multi-band impact.
  + OPPO: We proposed to use different percentile for TRP and TRS.
* Agreement:
  + RAN4 further discuss the TRP/TRS requirements within below ranges
    - n41 TRP/TRS: 11~12.5; -82 ~-79.5
    - n78 TRP/TRS: 12~13; -83.5 ~ -80.5

**Conclusions after 1st round**

**WF/LS**

**R4-2214359 WF on FR1 TRP TRS**

*Type: other For: Approval  
 Source: vivo*

**Decision: Return to.**

**Conclusions after 2nd round**

**[104-e][333] FR1\_TRP\_TRS\_Part2, AI 9.2.2.3, 9.2.2.4– Qifei Liu**

**R4-2214193 Email Discussion Summary for [104-e][333] FR1\_TRP\_TRS\_Part2**

*Type: other For: Information  
 Source: Moderator (OPPO)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Revise to R4-2214322**

**R4-2214322 Email Discussion Summary for [104-e][333] FR1\_TRP\_TRS\_Part2**

*Type: other For: Information  
 Source: Moderator (OPPO)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Return to.**

**Conclusions after 1st round**

**WF/LS**

**R4-2214358 WF on FR1 TRP TRS for UE with multi-antenna and test time reduction**

*Type: other For: Approval  
 Source: OPPO*

**Decision: Return to.**

**Conclusions after 2nd round**

### 9.5 NR repeater

#### 9.5.6 Moderator summary and conclusions

**[104-e][304] NR\_Repeater\_RFMaintenance, AI 9.5.1, 9.5.2, 9.5.3– Chuaxia Guo**

**R4-2214164 Email Discussion Summary for [104-e][304] NR\_Repeater\_RFMaintenance**

*Type: other For: Information  
 Source: Moderator (CMCC)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Revise to R4-2214293**

**R4-2214293 Email Discussion Summary for [104-e][304] NR\_Repeater\_RFMaintenance**

*Type: other For: Information  
 Source: Moderator (CMCC)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Return to.**

**GTW discussion on August 19th**

**Issue 1-2: LA requirements applicability for downlink**

* Proposals
  + Option 1: all RF requirements for LA 1-C also applies for repeater with declared output power less than LA rated maximum power. And emphasize above agreements in the spec as in 2212309 (CMCC)
* Discussion:
  + NEC: We think Note is not needed.
  + ZTE: We support the proposal from CMCC.
  + CMCC: We prefer to keep the note to ensure the requirements applicable for Femoto cell Repeater with lower power.
  + Ericsson: We think the note still helpful.
  + Nokia: We are fine to change the repeater specification and shall we make clear understanding the changes to repeater specification has no linkage to BS TS 38.104 specification.
* Agreement: update the repeater spec as below

“Local Area repeaters are characterised by requirements derived from Pico Cell scenarios with a repeater to UE minimum distance along the ground equal to 2 m and/or from Femto Cell scenarios.

Note: The requirements in this specification for LA 1-C repeaters apply to repeaters with declared output power less than or equal to the LA rated output power limits as in table 6.2.1-1.”

**Conclusions after 1st round**

**Conclusions after 2nd round**

**[104-e][305] NR\_Repeater\_RFConformance\_Part1, AI 9.5.5.1– Michal Szydelko**

**R4-2214165 Email Discussion Summary for [104-e][305] NR\_Repeater\_RFConformance\_Part1**

*Type: other For: Information  
 Source: Moderator (Huawei)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Revised to R4-2214294**

**R4-2214294 Email Discussion Summary for [104-e][305] NR\_Repeater\_RFConformance\_Part1**

*Type: other For: Information  
 Source: Moderator (Huawei)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Return to.**

**GTW discussion on August 19th**

List of open issues:

* Issue 1-1-1: Input signal spectral purity
* Issue 2-1-1: Naming of test configurations
* Issue 2-1-2: Carrier allocation
* Issue 2-1-3: BW
* Issue 2-2-1: Clarification on NTC2 carrier allocation
* Issue 3-2-1: TDD Switching
* Issue 3-1-1: RF test channels

**Issue 1-1-1: Input signal spectral purity**

* Proposals
  + Option 1: E-UTRA repeater stimulus signal spectral purity requirements
  + Option 2: check with ETSI ERM/MSG TFES on FR1/FR2 NR based repeater stimulus signal spectral purity requirements
* Recommended WF
  + Proposal 1: No need to check repeater stimulus signal spectral purity requirements with ETSI ERM/MSG TFES,
  + Proposal 2: For FR1, reuse the repeater stimulus signal spectral purity requirements from E-UTRA repeater specification, as baseline.
  + Proposal 3: For FR2, further discuss whether the same stimulus signal spectral purity requirements can be used as for FR1.
* Discussion:
  + ZTE: Fine with proposal 2. Not sure how to proceed for FR2 since no reference from the past.
  + Nokia: We are fine proposals in principle. For FR2, further study required.
  + Ericsson: We agree all the proposals. We can further discuss FR2 in 2nd round.
  + Nokia: We would like to encourage TE vendors’ feedback.
* Agreement: Proposal 1, 2 & 3 agreed
  + Further discuss how to deal with FR2 in 2nd round and encourage TE vendors to provide feedback.

**Issue 2-1-1: Naming of test configurations**

* Proposals
  + Option 1: NTCx
  + Option 2: RTCx
* Recommended WF
  + Proposal 4: Use RTCx naming convention for NR repeater test configurations.
* Agreement: Proposal 4 agreed.

**Issue 2-1-2: Carrier allocation**

RAN4 to clarify what to assume for the maximum number of carriers when allocating carriers within the passband

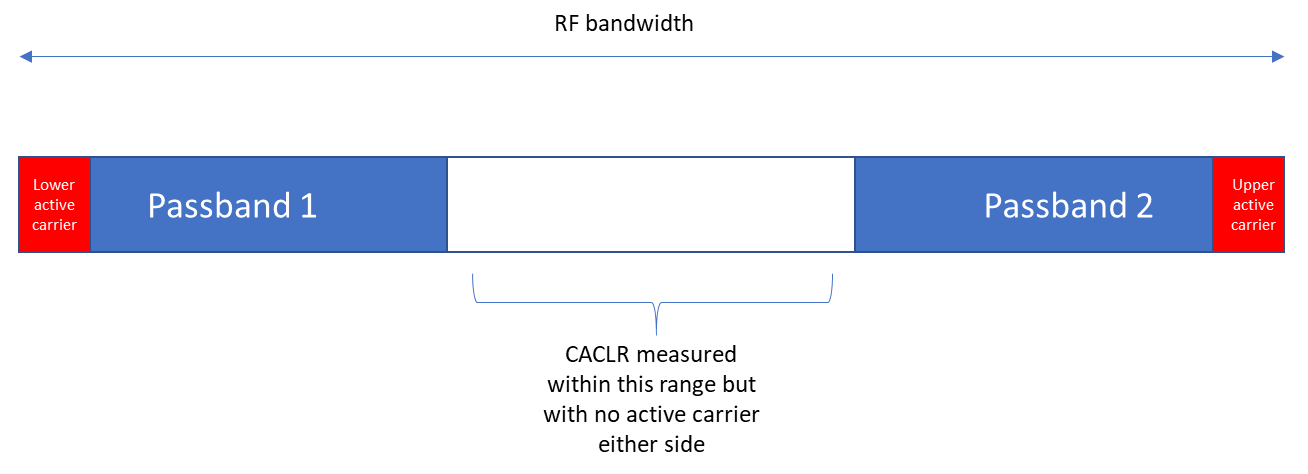
* Proposals
  + Option 1: no limit on the number of carriers
  + Option 2: a nominal maximum number of carriers
* Recommended WF
  + Based on the feedback, it was clarified that it is not possible to directly follow the BS approach, i.e. there is no concept of a maximum number of supported carriers and hence the BS TC method for allocating carriers cannot be directly applied. As Option 2 seems to be slightly preferred by companies, the following is proposed by the Moderator:
  + Proposal 5: further discuss pros and cons and verify whether option 2 is agreeable.
* Discussion:
  + Ericsson: We think option 2 aligned with previous agreement. We need to further discuss the number e.g. 2 times of number of passband and we have one carrier on each side of pass band edge.
  + ZTE: We need to clarify the definition “carrier” here.
  + Ericsson: We need to address this considering Test mode definition with signal.
* Agreement: “a nominal maximum number of carriers” agreed and further discuss the carrier definition and the details of number
  + Option 1: 2 times of number of passbands unless passband too small
  + Other options not precluded

**Issue 2-1-3: BW**

* Proposals
  + Propose to use the nominal channel bandwidth for the definition of NR repeater testing signal
* Recommended WF
  + Proposal 6: use the nominal channel bandwidth for the definition of NR repeater testing signal
* Agreement: Proposal 6 agreed

**Issue 2-2-1: Clarification on NTC2 carrier allocation**

* Proposals
  + RAN4 clarify NTC2 and CACLR TC



* Recommended WF
  + Proposal 7: Further discuss how to test the non-contiguous spectrum within the band, i.e. more than one passband.
* Discussion:
  + Ericsson: For CACLR TC, carrier shall be allocated on top and bottom of each passband.
  + CATT: This is related NC declaration. Need to clarify NCC supported in each of passband or across multiple passbands?
  + ZTE: We have similar comment as CATT. For CACLR test, with 2 100MHz passband, not possible to configure the gap between passbands.
  + Ericsson: We think passband should be always continuous, if it’s non-continuous than it shall mean multiple passbands. For ZTE comment, we can further work on test configuration later.
  + Nokia: Agree with Ericsson.
  + CATT: We have different understanding on passband, we think both contiguous and non-continues can be supported within one passband. What Ericsson mentioned seems different compared to BS.
  + Ericsson: Passband refer to the channel repeater can amplify the signal.
  + CATT: If that’s common understanding that non-continuous can be supported by multiple passbands.
  + Huawei: We agree with Ericsson. We can further discuss in 2nd round for details.
  + Nokia: We already have definition on the “passband” which aligned with the explanation from Ericsson.
* Agreement: For CACLR TC, carriers shall be allocated on top and bottom of each passband.

**Issue 3-1-1: RF test channels**

* Proposals
  + To adopt the RF channels in the following table for NR repeater conformance testing

|  |  |  |  |
| --- | --- | --- | --- |
|  | RF channel | | |
|  | Single carrier | Multi-carrier | Multi-carrier, Multi-band |
| Repeater output power | B,M,T | BRFBW, MRFBW, TRFBW | BRFBW\_T'RFBW, B'RFBW\_TRFBW |
| Frequency stability  Error Vector Magnitude | B,M,T | BRFBW, MRFBW, TRFBW | BRFBW\_T'RFBW, B'RFBW\_TRFBW |
| Out of band gain | B,M,T | BRFBW, MRFBW, TRFBW | BRFBW\_T'RFBW, B'RFBW\_TRFBW |
| Unwanted emissions,  ACLR, spurious emission | B,M,T | BRFBW, MRFBW, TRFBW | BRFBW\_T'RFBW, B'RFBW\_TRFBW |
| Input intermodulation | M | MRFBW | BRFBW\_T'RFBW, B'RFBW\_TRFBW |
| Output intermodulation | M | MRFBW | BRFBW\_T'RFBW, B'RFBW\_TRFBW |
| Adjacent Channel Rejection Ratio (ACRR) | B,M,T | BRFBW, MRFBW, TRFBW | BRFBW\_T'RFBW, B'RFBW\_TRFBW |
| Transmit ON/OFF power | M | MRFBW | BRFBW\_T'RFBW, B'RFBW\_TRFBW |
| Note: since there is no carrier related definition in repeater, carrier should be placed by nominal channel bandwidth of pass band. | | | |

* Recommended WF
  + Proposal 8: Consider the above table as baseline for RF test channels for single carrier.
  + Further discussion needed to clarify multi-carrier and multi-band cases.
* Discussion:
  + Ericsson: Not sure any relation to repeater conformance test?
  + ZTE: Similar as BS, single carrier also needs to be considered for conformance test.
* Agreement: Proposal 8 agreed

**Issue 3-2-1: TDD Switching**

* Proposals
  + Proposal 1: Long group delay should be declared when beginning of the output transient period is later than the beginning of the input transient period.
  + Proposal 2: The beginning of the output signal transient period should refer the output signal or group delay + beginning of the input transient period.
  + Proposal 3: The EVM test should refer output signal’s timing.
* Discussion:
  + CATT: There is overlapped discussion with [306]. “Ul/DL timing can be provided to repeater “ and leave the details out of specification.

**Conclusions after 1st round**

**WF/LS**

**R4-2214367 WF on [305] NR Repeater\_RF Conformance (Part1) agreements**

*Type: other For: Approval  
 Source: Huawei*

**Decision: Return to.**

**Conclusions after 2nd round**

**[104-e][306] NR\_Repeater\_RFConformance\_Part2, AI 9.5.5.2, 9.5.5.3– Huiping Shan**

**R4-2214166 Email Discussion Summary for [104-e][306] NR\_Repeater\_RFConformance\_Part2**

*Type: other For: Information  
 Source: Moderator (CATT)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Revise to R4-2214295**

**R4-2214295 Email Discussion Summary for [104-e][306] NR\_Repeater\_RFConformance\_Part2**

*Type: other For: Information  
 Source: Moderator (CATT)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Return to.**

**GTW discussion on August 19th**

List of open issues

* Topic #1 FR1 RF conformance test
* Topic#2 FR2 RF conformance test

**Issue 1-1: FR1 declaration open issues**

* Observation 1 in R4-2211706 :
  + Power declarations: No need to change.
  + Declarations for contiguous and non-contiguous spectrum operation: It needs to be added.
  + Table notes: No issues.
  + Group delay declaration: The understanding should be aligned and the wording may need some change.
  + Need and usage of D.8: Can keep it if no problem is seen.
* Proposals in R4-2212837
  + Proposal 1: There is no need for declaration for contiguous and non-contiguous spectrum operations.
    - Observation 2: If there are no parameters specifically relevant for the contiguous or non-contiguous operation of the repeaters, Note 2 can be removed from the declaration table.
  + Proposal 2: Note on declarations contiguous or non-contiguous spectrum is removed.
  + Proposal 3: Include length of repeater internal delay to long delay repeater declaration D.15
* Discussion:
  + Nokia: We are fine for the proposal NC CA. For group delay, it’s only needed when the time on/off requirements can’t meet.
  + ZTE: We think group delay declaration could be helpful for NW planning.
  + Ericsson: Declaration on long delay repeater or not? And then delay value need to be declared? Our understanding on the proposal from CATT: Proposed to only declare whether Long delay repeater and then leave to implementation for test. We think the value for test and for real deployment maybe different.
  + ZTE: We are ok to add note as Ericsson proposed “the value for test maybe different compared to real deployment”.
  + Nokia: We agree that the value for test maybe different compared to real deployment. For repeaters which can meet the time requirements, does such declaration needed since by default the group delay is small enough. Signal generator/test implementation can’t resolve the problem in real filed.
  + CATT: Long group delay in real deployment shall only related GP and for transient time test, two alternatives can be considered:
    - Alt1: Group delay declaration for all repeaters, leave transient time test to implementation basis
    - Alt2: NO declaration for all repeater with additional note into transient time test to allow flexibility on long group delay
  + ZTE: Response to Nokia, we think declaration still helpful even repeater can meet the transient time requirements.
* Agreement:
  + NC CA no needs to be declared.
  + Group delay:
    - Option 1: Declaration with values for all repeaters (CATT, Nokia, ZTE, Ericsson)
      * It’s not precluded that 0 can be declared if repeater can fulfil transient time requirements
      * Further work on the specification draft

**Issue 1-2: Rx spurious emission limits test set up**

* Proposal in R4-2212006: RAN4 adopt Figure 1 in R4-2208138 for system set-up description for the measurement of Rx spurious emission limits.



Figure 1: Measuring system set-up for *repeater type 1-C* output power, frequency stability, EVM, unwanted emissions, ACRR [2]

* Discussion:
  + Ericsson: Tx-> Output, Rx-> Input
  + DoCoMo: We proposed signal generator for TDD on state.
  + Nokia: We can understand the proposal from DoCoMo and we propose to signal generator is optional and during test for spurious emission, no transmitted signal.
  + CATT: We proposed to further discuss this issue.
* Agreement: Add “Optional” in signal generator box



**Issue 1-3: Repeater Tx/Rx spurious emissions MU and TT**

* Proposals in R4-2212006
  + Proposal 2: RAN4 consider MU values for BS Rx spurious emissions as baseline for repeater Rx spurious emissions.
* 30 MHz ≤ f ≤ 4 GHz: ±2.0 dB
* 4 GHz < f ≤ 19 GHz: ±4.0 dB
* 19 GHz < f ≤ 26 GHz: ±4.5 dB
  + Proposal 3: RAN4 adopt 0dB as TT values for Tx and Rx spurious emissions.
* Agreement: Proposal 2 and proposal 3 agreed

**Issue 1-4: ALCR BW in MU**

* Proposal in R4-2213717
  + BW should be replaced by the nominal repeater channel bandwidth for ACLR requirements.
* Agreement: BW should be replaced by the nominal repeater channel bandwidth for ACLR requirements.

**Issue 1-5: UL/DL timing for TDD FR1 (and FR2) repeater**

* Proposals
  + Observation 1 (in R4-2211707): UL/DL timing can be captured by the measurement equipment through the UL signal and DL signal separately. No need to specify the timing into specification
  + Observation 1(in R4-2213717): there might be two options to obtain the DL/UL timing information:
    - * Option 1: the DL information at the repeater output could be estimated by DL PSS/SSS/DMRS signals and UL timing information at the repeater output could be estimated by the PRACH or SRS signals.
      * Option 2: If the group delay of repeater is marginal, then DL and UL timing information could be also informed by the cable. Or if the group delay of repeater is relatively large, the vendor could declare the group delay, then DL and UL timing information could be informed by the cable and declared group delay.
  + As common proposal for both FR1 and FR2 (in R4-2213928)
    - For TDD setup (this is common for FR1 and FR2), add description like following to set up diagram

“UL/DL timing could be provided through DL signal or cable to repeater under test”

* Agreement: Add generic description into specification: “UL/DL timing can be provided to the repeater”

**Issue 2-1: FR2 declarations open issues**

* Observation 2 in R4-2211706
  + - Power declarations: Some modifications are needed.
    - Declarations for contiguous and non-contiguous spectrum operation: It needs to be added.
    - Table notes: Some modifications are needed, such as BS, declaration numbers.
    - Group delay declaration: The understanding should be aligned and the wording may need some change.
* Observations and proposals in R4-2212838
  + - Observation 1: Power declarations could be changed to be per passband instead of per carrier.
    - Proposal 1: As a starting point, change power declarations to be per passband instead of per carrier, but further review the consequences.
    - Proposal 2: Put fractional bandwidth related declarations to square brackets
    - Observation 2: Further review is needed on whether declarations should be done per operating band or per RIB.
    - Proposal 3: There is no need for declaration for contiguous and non-contiguous spectrum operations.
    - Proposal 4: Note 7 can be removed from the declaration table.
    - Proposal 5: Include length of repeater internal delay to long delay repeater declaration D.15
* Agreement: NC CA and long group delay follow FR1 agreement

**Issue 2-2: TRP measurement with input antenna rotating together with repeater**

* Proposals
  + Observation 2 in R4-2211707: Beam-based directions TRP measurements method can be considered for power, ACLR, SEM, OBUE. More discussion is needed for spurious emissions test.
  + Proposal 1 in R4-2212841: Keep the 3GPP description of providing input signal to the repeater generic and allow reasonable uncertainty for it, allowing test engineers to use appropriate solutions in various different test systems.
  + Proposal 2 in R4-2212841: RAN4 should look into possibilities to reduce the number of required TRP measurements.
  + Proposal in R4-2213928: For OTA TRP, measure half sphere by half sphere with changing feeding antenna position and re-calibrate test system. Although this adds more effort, this seems only possible method to avoid impact of feeding antenna itself during TRP measurement
* Discussion:
  + ZTE: We are fine to have general description and with some notes.
* Agreement:
  + Keep the 3GPP description of providing input signal to the repeater generic and allow reasonable uncertainty for it, allowing test engineers to use appropriate solutions in various different test systems.
    - Further work on the drafting TP

**Issue 2-3: TDD off power measurement;**

* Proposals
  + Observation 3 in R4-2211707: Input signal can be considered to be turned off for TDD off power measurement. The working state for the Tx path should be guaranteed the same with the state when input signal is on.
  + Proposal 3 R4-2212841: In TDD ON/OFF power measurement, input signal generator does not transmit towards repeater during the OFF-power measurement.
  + Proposal in R4-2213928: For OTA Tx off power for repeater, use signal generator for providing UL/DL timing only then turn off test signal. In this case, timing should be provided through other method like direct cable connection. For measuring emission during off period, under no test signal condition, turning on device with required condition (gain level etc.), measure emission level during off period.
* Discussion:
  + Keysight: We need to ensure the assumption that “Transmit antenna gain can be maintained during off period” still valid.
  + Ericsson: Not sure any impact to specifications.
  + Nokia: We can take similar approach as BS approach.
* Agreement:
  + Take same approach as BS for transmit antenna gain assumption during on/off period.
  + In TDD ON/OFF power measurement, input signal generator does not transmit towards repeater during the OFF-power measurement.

**Issue 2-4: OTA test procedure**

* Proposal in R4-2213928
  + For OTA test procedure, At calibration step, impact of feeding test signal should be measured with device under test being turned off. Measured result should be below requirement limit level.
    - Also for better uncertainty, measured level of test signal impact should correctly subtract from measured result. this should be described in test procedure.
* Agreement:
  + “Measurement impact from feeding test signal by generating a signal for repeater input with repeater to be turned off. Verify measured result is enough below requirement limit”
    - Further work on specification drafting

**Conclusions after 1st round**

**WF/LS**

**R4-2214369 WF on NR repeater conformance test remaining issues**

*Type: other For: Approval  
 Source: CATT*

**Decision: Return to.**

**Conclusions after 2nd round**

### 9.7 NR support for high speed train scenario in FR2

#### 9.7.5 Moderator summary and conclusions

**[104-e][320] NR\_HST\_FR2\_Demod, AI 9.7.4– Yunchuan Yang**

**R4-2214180 Email Discussion Summary for [104-e][320] NR\_HST\_FR2\_Demod**

*Type: other For: Information  
 Source: Moderator (Samsung)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Revise to R4-2214309**

**R4-2214309 Email Discussion Summary for [104-e][320] NR\_HST\_FR2\_Demod**

*Type: other For: Information  
 Source: Moderator (Samsung)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Return to.**

**Conclusions after 1st round**

**Conclusions after 2nd round**

### 9.10 Further enhancement on NR demodulation performance

#### 9.10.3 UE demodulation and CSI requirements

**[104-e][321] NR\_perf\_enh2\_Demod, AI 9.10– Shan Yang**

**R4-2214181 Email Discussion Summary for [104-e][321] NR\_perf\_enh2\_Demod**

*Type: other For: Information  
 Source: Moderator (China Telecom)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Revise to R4-2214310**

**R4-2214310 Email Discussion Summary for [104-e][321] NR\_perf\_enh2\_Demod**

*Type: other For: Information  
 Source: Moderator (China Telecom)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Return to.**

**GTW minutes on August 16th**

**List of open issues**

* Topic #1: MMSE-IRC receiver for inter-cell and intra-cell inter-user interference
  + Issue 1-1: Interference modelling in PDCCH region
  + Issue 1-2: T-put gain requirement for MMSE-IRC based CQI reporting
* Topic #2: CRS-IM in scenarios with overlapping spectrum for LTE and NR
  + Issue 2-1-1: Whether the same CRS-IM test requirements can be applied in the two sets of test setup in scenario 2
  + Issue 2-1-2: Extra time for CHBW information detection in the test with only inter-RAT MO configured in scenario 2
  + Issue 2-2-1: Test applicability for CRS-IM scenario 2
  + Issue 2-4-1: How to solve the problem that if default assumptions is invalid
  + Issue 2-4-2: Whether Cell ID should be mandatory to be signalled when network decides to indicate other parameters to the UE

**Topic #1: MMSE-IRC receiver for inter-cell and intra-cell inter-user interference**

**Issue 1-1: Interference modelling in PDCCH region**

* Proposals
  + Option A: Assume PDCCH is interfered by the neighbor cell interference (China Telecom, Apple, Nokia, CMCC, Ericsson, MTK, NTT DOCOMO)
    - Option A1: All the REs in control region filled with QPSK randomly modulated symbols with random precoding for the number of antenna ports (Nokia, CMCC slightly preferred, Ericsson, MTK, NTT DOCOMO)
      * Nokia, CMCC: option 1 is easiest, while option 2 will require companies to reach an agreement on defining the PDCCH parameters
    - Option A2: Assume PDCCH transmission from interference cells, and for each cell, OCNG signal is transmitted on each RE that is not occupied by the PDCCH of this cell (China Telecom, Apple - slightly preferred, MTK)
  + Option B: Assume PDCCH transmission from interference cells which is non-overlapping with serving cell. (Huawei)
* Discussion:
  + Apple: We prefer A2, we can reuse same configuration from serving cell for interference. We are fine with A1 as well since no difference from UE performance aspect.
  + Huawei: We can compromise to A1 to simplify the test.
  + CMCC: How to reflect option A1 into specification, similar way as LTE?
  + Nokia: We can reuse the same way as LTE.
* Agreement: Option A1 agreed. “All the REs in control region filled with QPSK randomly modulated symbols with random precoding for the number of antenna ports”

**Issue 1-2: T-put gain requirement for MMSE-IRC based CQI reporting**

* Proposals
  + For 2Rx:
    - Option 1: 2.0 (CTC, Nokia, Ericsson, Huawei, MTK, Qualcomm)
    - Option 2: 1.8 (Apple)
  + For 4Rx:
    - Option 1: 2.5 (CTC)
    - Option 2: 2.0 (Nokia, Ericsson, Huawei, MTK, Qualcomm)
    - Option 3: 1.9 (Apple)
  + CTC: the averaged T-put gain is at least 2.11 for 2Rx, and 2.53 for 4Rx.
  + Apple: From the simulation results setting the TP gain as requirement a 2.0 for 2RX and 2.2 for 4RX seems suitable. Taking into account impairment and implementation margin.
* Discussion:
  + Apple: Based on the simulation results and considering the extra implementation margin, we proposed option 2 (1.8) for 2Rx and option 3(1.9) for 4Rx.
  + Ericsson: We will provide the summary on results and we can further check based on the collected results

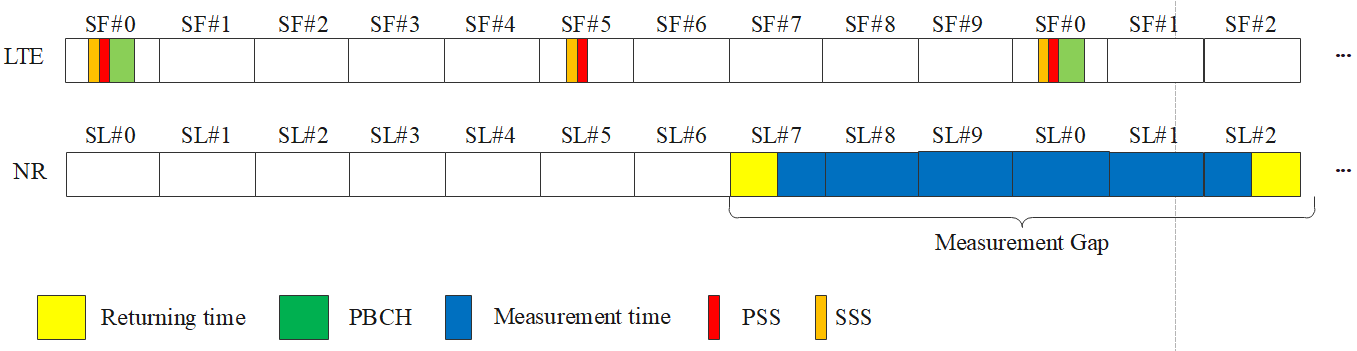
**Topic #2: CRS-IM in scenarios with overlapping spectrum for LTE and NR**

**Issue 2-1-1: Whether the same CRS-IM test requirements can be applied in the two sets of test setup in scenario 2**

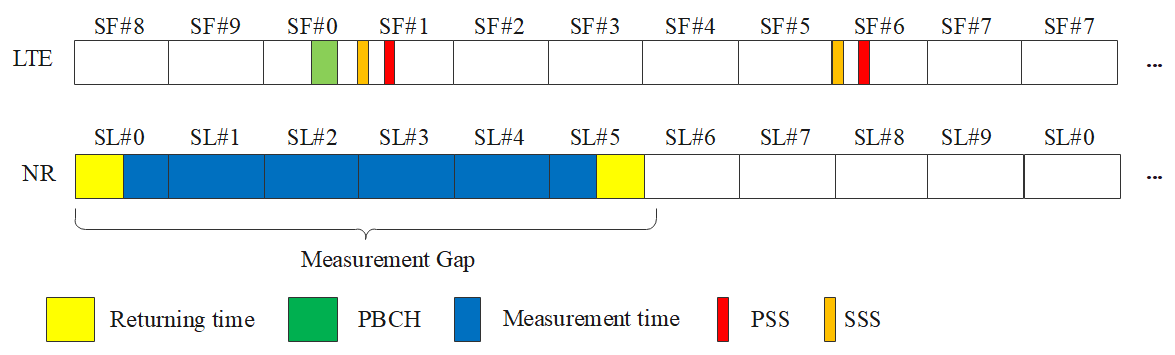
* Proposals:
  + Option 1: Same requirement applies for the two sets of test setup (i.e., with NWA and with only inter-RAT MO configured) in scenario 2. (China Telecom, CMCC, QC, E///, Nokia, ZTE, Apple)
* Agreement: Option 1 agreed

**Issue 2-1-2: Extra time for CHBW information detection in the test with only inter-RAT MO configured in scenario 2**

* Proposals on the Measurement Gap offset:
  + Option 1: For 15 kHz SCS, configure gap offset to 7 for FDD and 0 for TDD to make LTE’s PBCH in middle of measurement gap. (Huawei)



**Figure: Measurement gap pattern for 15 kHz FDD**



**Figure: Measurement gap pattern for 15 kHz TDD**

* + Option 2: No need to restrict the PBCH decoding to be in the middle of the gap. (E///, ZTE, Apple)
    - E///: There is a description in 38.133: 'When measurement gaps are needed, the UE is not expected to detect SSB which start earlier than the gap starting time + switching time, nor detect SSB which end later than the gap end – switching time. Switching time is 0.5ms for frequency range FR1 and 0.25ms for frequency range FR2'
* Proposals on the time period length before PDSCH scheduling
  + Proposals on Period 1 for cell identification
    - Option 1: 3840ms (CMCC, ZTE, Huawei, Apple, Qualcomm)
      * Apple: both LTE cells are on the same frequency layer
    - Option 2: 2 x 3840ms = 7680ms (Ericsson)
      * E///: Considering 2 interference cells, parameter CSSFinterRAT should be as 2
  + Proposals on Period 2 for PBCH decoding
    - Option 1: 500 ms (CMCC, ZTE, Huawei, Ericsson)
    - Option 2: 800 ms (Apple, E/// - fine, Qualcomm)
      * Apple: For the weaker LTE cell, in the presence of interference from other LTE cell, for 99.99% successful decoding 6 samples are needed for 2x2 and 5 samples are needed for 4x2. Considering implementation margin, we think 8 coherence times are necessary for successful PBCH decoding on both LTE cells.
* Discussion:

Measurement gap offset

* + Huawei: Option 1 with configured PBCH in the middle can ensure the best performance to avoid the overlapping with serving cell PBCH and CSI-RS signals.
  + Apple: CSI-RS can always be configured to avoid the overlapping with PBCH.
  + CMCC: Option 2 is the criteria we can follow; option 1 is detailed configured which also following the criteria. We are fine with option 1 or other configuration options.
  + MTK: We slightly prefer no limitation in RAN4 specification, we can leave the details of test set-up to RAN5.
  + Ericsson: We believe TS 38.133 already have clear definition; we should not introduce any additional restrictions.
  + Qualcomm: We would like to check with our RRM colleagues and come back later.
  + China Telecom: We agree with CMCC, the criteria in option 2 is the correct understanding. For detailed test set-up, option 1 also fine with us. We also need to consider NR carrier 30kHz SCS. We think this parameter need to be specified in RAN4.

Period 1 for cell identification/ Period 2 for PBCH decoding

* + Ericsson: We are fine with option 1 based on the clarifications from companies.
  + Qualcomm: For period 1, we support option 1; for period 2, we support option 2.
  + Apple: We proposed 800ms for PBCH decoding based on the evaluation results with implementation margin into account.
  + Huawei: Our results show 500ms feasible, but we are also fine with 800ms.
  + MTK: For period 1, we support option 1; and period 2 we support option 2.
  + ZTE: For period 1, option 1 fine; period 2, we think 500ms enough.
  + CMCC: For period 1, option 1 fine; period 2 we are fine with option 2 also we prefer shorter value.
  + China Telecom: For period 2, we think 500ms enough based on the analysis in previous RAN4 meeting; meanwhile considering the major purpose of this requirement is to verify CRS-IM processing we are also fine to have more margin on period 2.
* Agreement:
  + Measurement gap offset: The test set-up for measurement gap offset shall follow the criteria specified in TS 38.133; companies further check RRM specification.
  + Period 1 for cell identification/ Period 2 for PBCH decoding:
    - Period 1: 3840ms
    - Period 2: 800ms

**Issue 2-2-1: Test applicability for CRS-IM scenario 2**

* Proposed test applicability for UEs declare to support CRS-IM both with and without NWA on a certain each SCS
  + Option 1: UE is only required to pass performance requirements without NWA signalling based test setup, i.e. UE capability #2 and #4. (China Telecom, CMCC, Ericsson, ZTE, Nokia - compromise)
  + Option 2: The UE is only required to pass performance requirements with NWA signalling based test setup, i.e. UE capability #3 and #5. (Nokia, Huawei slightly preferred, Apple)
* Discussion:
  + Apple: Our preference is option 2 since the baseline assumption will be with NWA signaling.
  + China Telecom: We prefer option 1. We believe without NWA require more UE complexity with detection on BW required.
  + CMCC: We share same view as China Telecom, if UE can ensure performance without NWA, then UE can also support CRS-IM with NWA signaling.
  + Huawei: We slightly prefer option 2 since test case without NWA signaling require more complicated test set-up.
  + ZTE: We prefer option 1. We need to verify UE no mis-detection if UE declares to support CRS-IM without NWA.
  + Nokia: This is specific for the case UE support both cases with and without NWA signaling. We think the test cases already be there.
  + Ericsson: We support option 1, otherwise we can’t ensure UE shall detect parameters without NWA signaling.
* Agreement: Option 1: UE is only required to pass performance requirements without NWA signaling based test setup, i.e. UE capability #2 and #4.

**Issue 2-4-1: How to solve the problem that if default assumptions is invalid**

* Proposals:
  + Proposal 1: Invite companies to give some feedback how to solve the problem that if default assumption is invalid and UE doesn't know that, UE will perform CRS-IM with wrong assumptions and system performance degradation will be observed. (Huawei)
  + Proposal 2: Define a single bit network assistance signaling to indicate whether it is known that deployment is aligned with default network assumptions or not. (Qualcomm, Apple, Huawei, MTK)
  + Nokia: From RAN4-102e WF: “Note: It’s RAN4 common understanding it’s up to UE implementation to turn on/off CRS-IM with reasonable performance.”
* Discussion:
  + Huawei: We support proposal 2 since it can avoid the performance degradation and bring benefits for saving power assumption.
  + QC: We understand that there is agreement in previous meeting to leave it for UE implementation. We would like to avoid performance degradation.
  + Nokia: We brought up this issue 2 meetings ago, at that time we leave it to UE implementation with reasonable performance. We should be careful for the cross WG impact given Rel-17 ASN.1 already frozen.
  + CMCC: If the default assumption not valid, NWA signaling can be indicated to UE; not clear what’s the issue?
  + China Telecom: We think option2 can’t fully resolve the issue mentioned in option 1. For new bit on disable CRS-IM receiver, we are open for the discussion.
  + Apple: We are discussing if the default assumption not valid, and UE not aware of this, then performance will be degraded.
  + MTK: We support proposal 2.
  + Huawei: Inform UE that default assumption not valid, then it’s up to UE implementation turn on/off CRS-IM receiver.
  + QC: We have similar comment as Huawei.
  + Nokia: In previous agreement, UE need to ensure reasonable performance.
  + CMCC: It’s still not clear what’s the purpose of this 1bit signaling.
  + ZTE: We think this can leave to UE implementation.

**Issue 2-4-2: Whether Cell ID should be mandatory to be signalled when network decides to indicate other parameters to the UE**

* Proposals:
  + Proposal 1: if network decides to indicate other parameters in network assistance information, it should also indicate the Cell Id so that the UE can distinguish which cell that information belongs to. (Qualcomm, Apple)
  + Not support proposal 1 (E///, Nokia, ZTE, CMCC, Huawei)
    - Nokia, ZTE: v-shift information shall not be informed. So if Cell ID is mandatory to be signalled
* Discussion:
  + QC: NW can inform information with up to 8 cells, it’s better to inform Cell ID information otherwise it’s difficult for UE to use NWA information. V-shift can be acquired by cell ID information.
  + Huawei: We don’t think cell ID information is always necessary.
  + Nokia: We think existing NWA didn’t preclude to include cell ID information. If no cell ID information provided, then the parameters applied for cells. Currently NWA design quite flexible and we didn’t strong need to need to update.
  + ZTE: In previous meeting, we already agreed cell ID/v-shift can be informed.
  + CMCC: We share similar view as Huawei.
  + QC: Cell ID information still be optional, we are proposing if other NWA information except v-shift informed, then cell ID information shall be provided as well. I don’t it’s reasonable the parameters applied for all cells if cell ID not provided.
  + Nokia: We still see the possibility the information can be generic.
  + QC: How does UE know the parameters applied for all cells or single cell?
    - If no cell-D/v-shift informed, then parameters indicated by NWA are applied for cells from UE receiver baseline assumption.
    - If NW indicated NWA information except v-shift for multiple cells, then associated cell-ID shall be included.

**Conclusions after 1st round**

**GTW discussion on August 24th**

**Issue 1-2: T-put gain requirement for MMSE-IRC based CQI reporting**

*Candidate option for the second-round discussions:*

* For 2Rx:
  + - Option 1: 2.0 (CTC, Nokia, Ericsson, Huawei, MTK, Qualcomm)
    - Option 2: 1.8 (Apple, MTK)
    - Option 3: 1.9 (QC slightly prefer, Apple, Huawei, MTK, Nokia as compromise, CTC as compromise)
* For 4Rx:
  + - Option 1: 2.5 (CTC)
    - Option 2: 2.0 (Nokia, Ericsson, Huawei, MTK, Qualcomm, Apple, CTC as compromise)
    - Option 3: 1.9 (Apple, QC slightly prefer, Huawei, MTK, Nokia as compromise)
* Agreement: 1.9 for 2Rx and 2.0 for 4Rx

**Issue 2-1-2: Measurement Gap offset for 15 kHz FDD, 15 kHz TDD and 30 kHz TDD in the test with only inter-RAT MO configured in scenario 2**

* On the Measurement Gap offset for 15 kHz FDD, 15 kHz TDD and 30 kHz TDD:
  + Option 2: (Huawei, QC, Apple, CMCC, China Telecom)
    - * For 15kHz FDD: gap offset is 7 and TRS offset is 13,14
      * For 15 kHz TDD and 30kHz TDD: Gap offset is set to 1
  + Option 3: directly follow RRM test case configurations or not to specify a particular offset (E///)
* Agreement: Option 2 with [ ] on the value.

**WF/LS**

**R4-2214362 LS on CRS-IM network assistance signalling**

*Type: LS out For: Approval*

*To: RAN2  
 Source: Qualcomm*

**Decision: Approved**

**Conclusions after 2nd round**

### 9.11 Solutions for NR to support non-terrestrial networks (NTN)

#### 9.11.8 Moderator summary and conclusions

**[104-e][307] NTN\_Solutions\_SANRF\_Maintenance, AI 9.11.1, 9.11.2, Dorin Panaitopol**

**R4-2214167 Email Discussion Summary for [104-e][307] NTN\_Solutions\_SANRF\_Maintenance**

*Type: other For: Information  
 Source: Moderator (Thales)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Revise to R4-2214296**

**R4-2214296 Email Discussion Summary for [104-e][307] NTN\_Solutions\_SANRF\_Maintenance**

*Type: other For: Information  
 Source: Moderator (Thales)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Return to.**

**GTW Agenda on August 17th**

List of open issues

* Issue 1-2-1: SAN OTA Tx spurious requirements
* Issue 1-2-2: SAN requirements for the Extreme conditions testing

**Issue 1-2-1: SAN OTA Tx spurious requirements**

* Proposals
  + Option 1: Specify SAN OTA Tx spurious requirement based on the manufacturer declaration parameter Prated,c,EIRP
  + Option 2: TBA
* Discussion
  + Ericsson: We think current definition only applied for 1-H, which need to be updated for 1-O.
  + ZTE: Shall be TRP instead of EIRP for spurious emission requirements?

**Issue 1-2-2: SAN requirements for the Extreme conditions testing**

* Proposals
  + - Option 1: Remove SAN output power accuracy requirements for the extreme test conditions from TS 38.108.
    - Option 2: TBA
* Discussion:
  + - Ericsson: If no extreme condition specified in Rel-17, then core requirement can be removed for this.
    - ZTE: We have same view with Ericsson.
* Agreement: Remove SAN output power accuracy requirements for the extreme test conditions from TS 38.108 by assuming Rel-17 SAN conformance test only cover “normal test condition”

**Conclusions after 1st round**

**WF/LS**

**R4-2214370 WF on NTN Solutions SAN RF Maintenance**

*Type: other For: Approval  
 Source: Thales*

**Decision: Return to.**

**Conclusions after 2nd round**

**[104-e][308] NTN\_Solutions\_RFConformance, AI 9.11.3– Dominique Everaere**

**R4-2214170 Email Discussion Summary for [104-e][308] NTN\_Solutions\_RFConformance**

*Type: other For: Information  
 Source: Moderator (Ericsson)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Revise to R4-2214297**

**R4-2214297 Email Discussion Summary for [104-e][308] NTN\_Solutions\_RFConformance**

*Type: other For: Information  
 Source: Moderator (Ericsson)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Return to.**

**GTW Agenda on August 17th**

List of open issues

* Issue 1-4-1: Extreme conditions
* Issue 1-3-1: Rooms used for testing
* Issue 3-1-2: Measurement set-up (OTA)
* Issue 3-1-1: Measurement uncertainties for radiated requirements
* Issue 1-2-1: Conducted and radiated declarations
* Issue 2-1-3: Dynamic range and EVM conducted
* Issue 3-1-3: Dynamic range and EVM OTA

**Issue 1-2-1: Conducted and radiated declarations**

* Proposals: Independent declaration identifier for conducted testing and radiated testing, using declaration identifier D.x for conducted testing, and declaration identifier DE.x for radiated testing, where x=1, 2
  + Yes (CATT)
  + No. Please, make another proposal.
* Discussion:
  + Huawei: We have single specification covering both radiated and conductive for SAN conformance.
  + CATT: We are fine with single table or separate table but some update needed to discriminate conductive and radiated.
  + Thales: No strong preference.
* Agreement: further discuss offline

**Issue 1-3-1: Rooms used for testing**

* + Proposals: For testing purposes, the SAN components can be located in several rooms with different classes.
    - Yes, in clean room up to ISO class 8 (Thales)
    - No. Please, elaborate why.
  + Discussion:
    - Thales: We have different classes for clean room with different test conditions. The values seem close to existing TN BS specification.
    - Huawei: We would like to have more discussion for this proposal which seems not applicable for TN. Which document I can refer to? Can we consider only single class?
    - ZTE: Test set-up in RAN4 is informative and we shall the information generic and not sure such details in 3GPP.
    - CATT: There is overlapping for the definition in “clean room” and “normal test condition”. Clean room applied for both conductive and radiated test?
    - Thales: Such information is public from ISO. We can consider a note to refer to ISO.
    - Qualcomm: We consider some informative information in the Annex.
  + Agreement:
    - Further discuss whether some relevant informative information can be included in the conformance specification Annex.

Sub-topic description: This sub-topic is related to the test under extreme conditions.

**Issue 1-4-1: Extreme conditions**

* + Proposals: Based on ZTE observations, would you agree with the following Way Forward:
    - Evaluate NTN scenario to assess how to define extreme power supply and extreme temperatures for SAN – as the manufacturer declares those limits as operating limits.
    - Other extreme conditions as humidity, are not relevant.
    - Evaluate if and how the Normal test environment may be redefined
    - Investigate testing aspects for the vacuum conditions
  + Discussion:
    - Thales: We provide CR for TS 38.108, and explained the reason not considering “extreme test condition” since this pending on manufacture declaration.
    - ZTE: Extreme condition including several parameters besides temperature e.g., barometric pressure.
    - Huawei: I tend to agree that humidity not relevant to SAN, and temperature control system is out of 3GPP scope. We need more study for barometric.
    - Ericsson: Radio performance shall be verified considering real condition in realistic.
    - Thales: The comments from ZTE and Huawei make sense.
    - Ligado/Hughes: We agree with Thales, no need to consider “extreme test condition”.
  + Agreement:
    - Only consider “normal test condition” for Rel-17 SAN RF conformance testing
      * Current parameters from BS conformance specification 38.141 shall be considered as starting point
      * Further discuss the parameters including temperature/power supply and barometric pressure and refinement on the values not precluded
      * The definition of “normal test condition” shall not impact the agreed SAN RF core requirements.
    - It’s not precluded to consider “extreme test condition” in future release or Rel-17 conformance maintenance phase.

**Issue 3-1-1: Measurement uncertainties for radiated requirements**

* + Proposals: adopt measurement uncertainties in Table 4.1.2.2-2 for OTA transmitter tests and Table 4.1.2.3-2 for OTA receiver tests.

Table 4.1.2.2-2: Maximum OTA Test System uncertainty for FR1 OTA transmitter tests

| Clause | Maximum OTA Test System uncertainty |
| --- | --- |
| 9.2 Radiated transmit power | Normal condition:  ±1.1 dB, f ≤ 3 GHz |
|  | Extreme condition:  ±2.5 dB, f ≤ 3 GHz |
| 9.3 OTA base station output power | ±1.4 dB, f ≤ 3.0 GHz |
| 9.4.3 OTA total power dynamic range | ±0.4 dB |
| 9.6.2 OTA frequency error | ±12 Hz |
| 9.6.3 OTA modulation quality | ±1 % |
| 9.7.2 OTA occupied bandwidth | ±100 kHz, BWChannel 5 MHz, 10 MHz  ±300 kHz, BWChannel 15 MHz, 20 MHz, 25 MHz, 30 MHz, 40 MHz, 50 MHz  ±600 kHz, BWChannel 60 MHz, 70 MHz, 80 MHz, 90 MHz, 100 MHz |
| 9.7.3 OTA ACLR/CACLR | f ≤ 3.0 GHz  ±1 dB, BW ≤ 20MHz  ±1 dB, BW > 20MHz  Absolute power ±2.2 dB, f ≤ 3.0 GHz |
| 9.7.4 OTA operating band unwanted emissions | Absolute power ±1.8 dB, f ≤ 3.0 GHz |
| 9.7.5.2 OTA transmitter spurious emissions, mandatory requirements | ±2.3 dB, 30 MHz < f ≤ 6 GHz  ±4.2 dB, 6 GHz < f ≤ 19 GHz |
| 9.7.5.3 OTA transmitter spurious emissions, protection of SAN receiver | ±3.1 dB, f ≤ 3 GHz |
| NOTE 1: Fulfilling the criteria for CLTA selection and placement in clause 4.10 is deemed sufficient for the test purposes. When these criteria are met, the measurement uncertainty related to the selection of the co-location test antenna and its alignment as specified in the appropriate measurement uncertainty budget in TR 37.941 [29] shall be used for evaluating the test system uncertainty.  NOTE 2: Test system uncertainty values are applicable for normal condition unless otherwise stated. | |

Table 4.1.2.3-2: Maximum OTA Test System uncertainty for FR1 OTA receiver tests

|  |  |
| --- | --- |
| Clause | Maximum OTA Test System uncertainty |
| 10.2 OTA sensitivity | ±1.3 dB, f ≤ 3.0 GHz |
| 10.3 OTA reference sensitivity level | ±1.3 dB, f ≤ 3.0 GHz |
| 10.4 OTA dynamic range | ±0.3 dB |
| 10.5.1 OTA adjacent channel selectivity | ±1.7 dB, f ≤ 3.0 GHz |
| 10.6 OTA out-of-band blocking (General) | fwanted ≤ 3.0 GHz:  ±2.0 dB, finterferer ≤ 3.0 GHz  ±2.1 dB, 3.0 GHz < finterferer ≤ 6.0 GHz  ±3.5 dB, 6.0 GHz < finterferer ≤ 12.75 GHz |
| 10.7 OTA receiver spurious emissions | ±2.5 dB, 30 MHz ≤ f ≤ 6.0 GHz  ±4.2 dB, 6.0 GHz < f ≤ 19 GHz |
| 10.9 OTA in-channel selectivity | ±1.7 dB, f ≤ 3.0 GHz |
| NOTE 1: Fulfilling the criteria for CLTA selection and placement in clause 4.10 is deemed sufficient for the test purposes. When these criteria are met, the measurement uncertainty related to the selection of the co-location test antenna and its alignment as specified in the appropriate measurement uncertainty budget in TR 37.941 [29], shall be used for evaluating the test system uncertainty.  NOTE 2: Test system uncertainty values are applicable for normal condition unless otherwise stated. | |

* + - Yes (CATT)
    - No. Please describe your proposal.
  + Discussion:
    - Huawei: We can use above values as starting point based on the assumption of test set-up can be maintained.
    - Thales: Some refinement needed for spurious emission (5th harmonic and CHBW and frequency ranges).
    - CATT: We can harmonize the changes aligned with TS 38.108 and MU is critical for completing the conformance work.
  + Agreement: Endorsed the values with [ ] and further refinement not precluded;
    - The parameters need to be aligned with core specification TS 38.108 for spurious emission and CHBW

**Issue 3-1-2: Measurement set-up**

* + Proposals: to use the existing measurement set-up as following for SAN 1-O conformance testing:
    - Yes (ZTE)
    - No, explain why.
  + Discussion:
    - Huawei: We are ok taking existing measurement set-up as starting point. How to consider the applicable OTA chamber size? If larger chamber size needed, then MU need to be considered?
    - ZTE: Gateway can be connected by cable and out of chamber room and then existing chamber size can be maintained.
    - Thales: The assumption from ZTE is correct. We also can consider separate ISO classes for clean room for different SAN components.
  + Agreement: Use existing measurement set-up from 38.141 for SAN 1-O conformance testing as starting point with necessary refinement if identified

**Conclusions after 1st round**

The decision can be referred to latest t-doc list in the inbox:

**WF/LS**

**R4-2214371 WF for NTN SAN RF conformance**

*Type: other For: Approval  
 Source: Ericsson*

**Decision: Return to.**

**Conclusions after 2nd round**

**[104-e][309] NTN\_Solutions\_UERF\_Maintenance, AI 9.11.4 – Fei Xue**

**R4-2214169 Email Discussion Summary for [104-e][309] NTN\_Solutions\_UERF\_Maintenance**

*Type: other For: Information  
 Source: Moderator (ZTE)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Revise to R4-2214298**

**R4-2214298 Email Discussion Summary for [104-e][309] NTN\_Solutions\_UERF\_Maintenance**

*Type: other For: Information  
 Source: Moderator (ZTE)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Return to.**

**Conclusions after 1st round**

**WF/LS**

**R4-2214372 WF for NTN UE RF maintenance**

*Type: other For: Approval  
 Source: ZTE*

**GTW discussion on August 24th**

**Issue 1-1: Frequency error assumption for UE RF requirements other than frequency error testing**

* Agreement: option 1 agreed

**Issue 1-2: Frequency error assumption for non-zero doppler**

* Candidate options:
  + Option 1: Frequency error with non-zero doppler is required to be within +/- 0.1 ppm in constant doppler conditions. [Qualcomm]
  + Option 2: under varying doppler shift for the non-zero doppler shift case [MTK]
  + Option 3: UT1 and leap second
* Discussion:
* Huawei: We respect RAN1 agreement, just curious how to apply the test condition.
* Thales: We can have separate test conditions with GNSS assumption and ephemeris data information. From UE feature aspect, some UE may only support GSO case.
* MTK: We can further discuss in test cases for test conditions. For the core requirements, it’s hard to further update.
* Huawei: The 0.1 ppm is specified based on the assumption of the frequency error after pre-compensation is marginal. We prefer to leave test conditions to RAN5.
* ZTE: Not sure leap information included in RAN1/RAN2. What’s the assumption on constant doppler condition?
* QC: Frequency error 0.1 ppm requirements can be met with the assumption of constant doppler conditions.
* Thales: We need to separate the core requirements and test conditions. Does QC observe the problem with varied doppler shift to meet RAN4 core requirements?
* MTK: The accuracy of ephemeris data and location may impact on the pre-compensation.
* Huawei: UT1 and leap information is not included in RAN1/RAN2. We can send LS to RAN5 for what’s the information needed.

**Sub-topic 2-1 OOBB requirements for n256**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Operating Band | Parameter | Unit | Range 1 | Range 2 | Range 3 |
|  | Pinterferer | dBm | -44 | -30 | -15 |
| n255 | Finterferer (CW) | MHz | -60 < f – FDL\_low < -15  or  15 < f – FDL\_high < 60 | -85 < f – FDL\_low ≤ -60  or  60 ≤ f – FDL\_high < 85 | 1 ≤ f ≤ FDL\_low – 85  or  FDL\_high + 85 ≤ f  ≤ 12750 |
| n2561 | Finterferer (CW) | MHz | -100 < f – FDL\_low < -15  or  15 < f – FDL\_high < 60 | -145 < f – FDL\_low ≤ -100  or  60 ≤ f – FDL\_high < 85 | 1 ≤ f ≤ FDL\_low – 145  or  FDL\_high + 85 ≤ f ≤ 12750 |
| NOTE 1: Band n256 lower frequency ranges are modified to enable specific implementations  NOTE 2: Void  NOTE 3: Void  NOTE 4: Void | | | | | |

* Agreement: Option 1

**Decision: Return to.**

**Conclusions after 2nd round**

**[104-e][322] NR\_NTN\_Demod\_Part1, AI 9.11.7.1, 9.11.7.3 – Bin Han**

**R4-2214182 Email Discussion Summary for [104-e][322] NR\_NTN\_Demod\_Part1**

*Type: other For: Information  
 Source: Moderator (Qualcomm)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Revised to R4-2214311**

**R4-2214311 Email Discussion Summary for [104-e][322] NR\_NTN\_Demod\_Part1**

*Type: other For: Information  
 Source: Moderator (Qualcomm)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Return to.**

**Conclusions after 1st round**

The decision can be referred to latest t-doc list in the inbox:

**WF/LS**

**R4-2214386 WF for NTN demodulation requirements - general and PDSCH**

*Type: other For: Approval  
 Source: Qualcomm*

**GTW discussion on August 22th**

**Issue 1-1: Channel model for NTN-TDLA (NLOS)**

* Discussion:
  + QC: After UE compensation, residual doppler is due to UE mobility and doppler shift due to Satellite mobility was covered by RRM requirements.
  + Apple: 200Hz only reflect both UE mobility and residual doppler after pre-compensation
  + Thales: Doppler is relative frequency offset.
* Agreement:
  + DS =100ns, Doppler = 200Hz

**Issue 1-2: Channel model for NTN-TDLC (LOS)**

* Discussion:
  + Apple: This is related to another issue, K\_factor pending on elevation angle. Elevation angle also related to K\_offset and TE vendors’ feedback also needed for the feasibility of selected values.
  + Ericsson: In our simulation results, K-factor =3dB can be considered as worst case. K\_offset has no impact on the demodulation performance. Firstly, we decide elevation angle and then decide corresponding K\_offset and K\_factor.
  + QC(Moderator): Elevation angle 30degree proposed by many companies.
  + Huawei/QC/Nokia/Thales: We are fine with elevation degree 30 degree.
* Agreement:
  + Assuming elevation angle: 30 degree to decide K\_offset and K-factor
    - DS = [3.5ns], Doppler =200Hz, K\_factor= 8.05 dB , K\_offset = [8 slots]

**Issue 1-3: Channel model parameter combination**

* Agreement: Option 1 agreed

**Issue 1-4: Doppler shift due to satellite motion for DL in service link**

* Agreement: Option 1 agreed

**Issue 1-5: Timing drift and sampling frequency offset**

* Agreement: Option 1 agreed

**Issue 2-2: Applicability rules for LEO requirements**

* Discussion:
  + EchoStar: For GSO, all TS 38.101-4 requirements referred; and meanwhile RF requirements 38.101-5
  + QC: From demodulation requirements perspective, demodulation requirements is same as TN for GSO operation. We can clarify this only applied for demodulation requirements.
* Agreement:
  + From RAN4 UE demodulation requirement perspective, the applicability for GSO only is proposed to be the same as ‘nonTerrestrialNetwork-r17’: UE needs to pass TS38.101-4 requirements only

**Issue 2-3: K-offset value**

* Discussion:
  + QC: It’s better to align the assumption of K-offset for simulation assumption.
  + Apple: We have 1 test case with HARQ 32 cases, HARQ disable, less than 32 HARQ.
  + EchoStar: This applied for LEO case only?
* Agreement: K\_offfset = [8 slots] applied for all HARQ configurations

**Issue 2-4: AoA of the LOS Path for the NTN TDL-C Channel**

* Discussion:
  + Huawei: With TDL channel modelling, no AoA information into specification.
  + Apple: Any impact for the agreed parameters?
  + Ericsson: No AoA considered for TDL channel model. We prefer to follow the traditional way.
  + QC: This is captured in NTN SI.

**Issue 2-5: Modulation order**

* Discussion:
  + Huawei: RF session already considered 64QAM supported.
  + Thales: Supporting 64QAM is optional.
  + EchoStar: We prefer to include 64QAM for future proof.
  + QC: We prefer to exclude 64QAM considering link-budget limitation.
  + Huawei: We think it’s feasible and derive UE requirements as optional feature.
  + Apple: We share same view as QC. We can consider it in future once feasibility confirmed.

**Issue 2-6: SCS/CBW set**

* Discussion:
  + Huawei: We prefer to consider 30kHz SCS.
  + Apple: We already agreed only focused on 15kHz SCS.
  + QC: We agree with Apple.
* Agreement:
  + Further discuss whether 30kHz needed to introduced in additional to 15kHz SCS

**Decision: Return to.**

**Conclusions after 2nd round**

**[104-e][323] NR\_NTN\_Demod\_Part2, AI 9.11.7.1, 9.11.7.2 – Tricia Li**

**R4-2214183 Email Discussion Summary for [104-e][323] NR\_NTN\_Demod\_Part2**

*Type: other For: Information  
 Source: Moderator (Huawei)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Revised to R4-2214312**

**R4-2214312 Email Discussion Summary for [104-e][323] NR\_NTN\_Demod\_Part2**

*Type: other For: Information  
 Source: Moderator (Huawei)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Return to.**

**Conclusions after 1st round**

**GTW discussion on August 22th**

**List of open issues**

* Issue 1-5-1-1: Test applicability rule for SAN supporting different antenna configurations
* Issue 1-5-1-2: Transform precoding
* Issue 1-5-2-1: DM-RS configuration for PUCCH format 3/4
* Issue 1-5-2-2: Antennal configuration
* Issue 1-5-3-1: Preamble Format

**Sub-topic 1-5-1 Normal PUSCH requirement**

**Issue 1-5-1-1: Test applicability rule for SAN supporting different antenna configurations**

* Proposals
  + Option 1 (Huawei): Only the highest supported Rx number shall be tested based on manufacture declaration.
  + Option 2 (Ericsson, Nokia): Unless otherwise stated, for a SAN supporting different numbers of antenna connectors (for SAN type 1-C) or TAB connectors (for SAN type 1-H) (see D.xxx in table yyy) by same polarization type, the tests with low MIMO correlation level shall apply only for the lowest and highest numbers of supported connectors, and the specific connectors used for testing are based on manufacturer declaration.
  + Option 3 (Samsung): Unless otherwise stated, for a SAN supporting different numbers of antenna connectors (for SAN type 1-C) or TAB connectors (for SAN type 1-H) (see D.xxx in table yyy) by same polarization type, the tests with low MIMO correlation level shall apply only for either one connector or the second lowest number of supported connecters, in addition to the highest number of supported connectors, and the specific connectors used for testing are based on manufacturer declaration
  + Option 4 (THALES): Only 1Rx should be considered for SAN.
* Discussion:
  + Thales: For coverage enhancement objective in Rel-18 NTN WI, only 1 Rx assumed. It’s better to align with RAN1 assumption. In Rel-17, 1Rx also assumed in RAN1.
  + Huawei: This is manufacture declaration basis. We still prefer to include 1Rx and 2Rx cases.
  + Ericsson: in SI TR 38.821, 2Rx is optional. The performance is degraded under 1Rx case. If Satellite industry can confirm 1Rx is typical case then we are also fine to reduce our workload.
  + Thales: We confirm 1 Rx is typical case.

**Issue 1-5-1-2: Transform precoding**

* Proposals
  + Option 1 ((Huawei, Ericsson, Samsung, THALES): Both CP-OFDM and DFT-s-OFDM
  + Option 2 (Nokia): Only DFT-s-OFDM
* Discussion:
  + Nokia: We understand DFT-s-OFDM is most common for NTN transmission.
  + Thales: We think CP-OFDM can be applicable for some of use cases.
* Agreement: Option 1 agreed.

Sub-topic 1-5-2 PUCCH requirements

**Issue 1-5-2-1: DM-RS configuration for PUCCH format 3/4**

* Proposals
  + Option 1 (Huawei, Ericsson): Both DM-RS 1+0 and 1+1 with SAN manufacture declaration, i.e. supporting additional DM-RS for PUCCH format 3/4 or not.
  + Option 2 (Nokia): DMRS 1+0
* Discussion:
  + Nokia: We are ok with option 1.
* Agreement: Option 1 agreed

Sub-topic 1-5-3 PRACH requirements

**Issue 1-5-3-1: Preamble Format**

|  |
| --- |
| *1st round tentative agreements:*  ·         *Keep previous agreement: include format 0, B4 and C2*  ·         *Not include PRACH format A2, FFS format 2* |

* Proposals for PRACH format 2
  + Option 1 (Ericsson, Huawei, Samsung): Don’t consider format 2 for SAN PRACH demodulation requirements.
  + Option 2: Consider format 2 for SAN PRACH demodulation requirements
  + Option 3: Consider format 0, 2 and B4 for SAN PRACH demodulation requirements (Thales)
* Discussion:
  + Samsung: We support option 1, larger TA compensation the coverage can be similar as TN, option 1 already ensure test coverage.
  + Thales: In Rel-18 coverage objective of NTN, RAN1 consider format 0, 2 and B4. We think format 2 is best choice for NTN.
  + Huawei: We don’t need to couple Rel-18 discussion and Rel-17 NTN performance requirements. RAN1 and RAN4 may have different understanding.
* Agreement: include format 0, B4 and C2 and 2 for SAN PRACH demodulation requirements, further discuss the test applicable rules

**WF/LS**

**R4-2214387 WF for NTN SAN demodulation requirements**

*Type: other For: Approval  
 Source: Huawei*

**Decision: Return to.**

**Conclusions after 2nd round**

### 9.14 Extending current NR operation to 71GHz

#### 9.14.9 Moderator summary and conclusions

**[104-e][310] NR\_exto71GHz\_BSRF, AI 9.14.4, 9.14.5– Toni lahteensuo**

**R4-2214168 Email Discussion Summary for [104-e][310] NR\_exto71GHz\_BSRF**

*Type: other For: Information  
 Source: Moderator (Nokia)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Revise to R4-2214299**

**R4-2214299 Email Discussion Summary for [104-e][310] NR\_exto71GHz\_BSRF**

*Type: other For: Information  
 Source: Moderator (Nokia)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Return to.**

**GTW discussion on August 17th**

List of open issues

* Topic #2: Conformance testing
  + Sub-topic 2-2: Test models and TDD pattern
  + Sub-topic 2-3: General measurement environment/chamber
  + Sub-topic 2-4: Link budget inside chamber
  + Sub-topic 2-5: Measurement uncertainty and calibration
  + Sub-topic 2-6: Upper and lower frequency limits
  + Sub-topic 2-7: Measurement frequency step size
  + Sub-topic 2-8: Tx OFF measurement
  + Sub-topic 2-9: OOB blocking feasibility
* Topic #3: BS demod OTA test methodology

**Topic #2: Conformance testing**

Sub-topic 2-2: Test models and TDD pattern

**Issue 2-2-1: Applicable test models**

* Proposals
  + Proposal 1: only NR-FR2-TM1.1, NR-FR2-TM2 and NR-FR2-TM3.1 are applicable for FR2-2.71GHz.
  + Proposal 2: TBA
* Recommended WF
  + TBA
* Agreement: Proposal 1 agreed

**Issue 2-2-2: Test model data length**

* Proposals
  + Proposal 1: Adopt 5ms for test model data length for FR2-2
  + Proposal 2: Focus on using a fixed number of slots ([80 slots]) for EVM measurement time length and test model data length and select the number of slots to ensure a good trade-off between the test time and MU for BS type 2-O transmitter testing in the frequency range between 52.6GHz and 71GHz.
  + Proposal 3: There is no need to adjust the EVM measurement time length depending on TDD pattern used in the text model for BS type 2-O EVM test in the frequency range between 52.6GHz and 71GHz.
* Discussion:
  + Keysight: We proposed 80 slots to proceed the work.
  + ZTE: With fixed number of slots, the duration in general table need to be refined.
* Agreement: Proposal 2 agreed ([80 slot])

Sub-topic 2-3: General measurement environment/chamber

**Issue 2-3-1: General framework**

* Proposals
  + Proposal 1: The suitability of each OTA chamber (Far field anechoic chamber, CATR, Near field chamber, PWS, etc.) for each test in the frequency range between 52.6GHz and 71GHz should be studied and confirmed by TE vendors, or the list of OTA chamber should be updated for each BS type 2-O transmitter test in the frequency range between 52.6GHz and 71GHz.
  + Proposal 2: the existing measurement setup framework in TS 38.141-2 Annex D and Annex E could also been applicable for FR2-2. (*moderator: Already agreed in R4-2210638)*
* Discussion:
  + Moderator suggestion: No update on TS 38.141-2 Annex D and Annex E; and the suitability of OTA chambers analysis can be captured into TR 37.941.
  + Nokia: We encourage to provide some informative information on the suitable OTA chambers.
  + Ericsson: We believe some update still required in Annex D/E for FR2-2. The Annex D/E can be considered as baseline meanwhile additional component maybe required for FR2-2.
  + Huawei: We support the ideal from moderator.
  + ZTE: I tend to agree with Ericsson, some notes maybe required in TS 38.141-2 Annex.
* Agreement: Proposal 1 agreed; FFS any update needed or not in TS 38.141-2 Annex and/or TR 37.941

Sub-topic 2-4: Link budget inside chamber

**Issue 2-4-1: Path loss**

* Proposals
  + Proposal 1: For FR2-2 consider CATR pathloss values for a CATR suitable for FR2-2 testing. Pathloss values in Table 2.1-2 can be used as baseline for FR2-2 (*moderator: see R4-2212465 for the values)*

**Table 2.1-2: Coupling loss for CATR with area of 2 m2 with , (0 dB)**

|  |  |
| --- | --- |
| **Carrier frequency**  **(GHz)** | **(dB)** |
| 38.0 | 56.1 |
| 47.0 | 57.9 |
| 52.6 | 58.9 |
| 71.0 | 61.5 |

* + Proposal 2: TBA
* Discussion:
  + Keysight: We have concern on the proposal value in proposal 1 which seems not achievable.
  + Nokia: The feedback from TE vendors appreciated.
  + Ericsson: We only consider in-band related test here. Different test cases require separate test set-up.
* Agreement: Further discuss the suitable pathloss values for FR2-2 testing. TE vendors’ feedback is encouraged.

Sub-topic 2-5: Measurement uncertainty and calibration

**Issue 2-5-2: Additional components**

* Proposals
  + Proposal 1: Use of LNA should be in MU budget for FR2-2 except Tx off power measurement.
  + Proposal 2: For MU budget table for Rx testing. MU term of up converter (mixer) and additional power amplifier should be added.
  + Proposal 3: Introduce external mixer stage test setup and corresponding calibration procedures for receiver requirements and out-of-band requirements to improve measurement uncertainty. *(moderator: calibration is further discussed in next issue)*
  + Proposal 4: Consider two configurations for out of band spurious measurement system below 110 GHz and above up to 142 GHz
    - For out of band spurious measurement system, both use or not to use mixer case to consider and then pick larger MU case to use for calculating total test system MU. For above 110 GHz up to 142 GHz, mixer should be assumed and used for MU budget calculation like FR2-1 spurious emission.
* Discussion:
  + Ericsson: We would like to get reasonable MU with feasible test set-up.
  + Keysight: Additional components can be considered in test set-up. Mixer usually have large MU.
  + Ericsson: Additional calibration procedure/step can be considered to control MU.
* Agreement:
  + Use of LNA if applicable should be in MU budget for FR2-2 except Tx off power measurement.
  + FFS whether mixer can be considered for some of test cases if applicable

**Issue 2-5-3: Measurement system calibration**

* Proposals
  + Proposal 1: Add intermediate calibration stage of spectrum analyser absolute power accuracy for DL EIRP measurement, with the intension to break the trend with very large measurement uncertainties for high frequencies.
  + Proposal 2: For test system measurement uncertainty, extend measurement procedures to enable for test setups to break the trend where measurement uncertainty grows rapidly as function of frequency
  + Proposal 3: Introduce external mixer stage test setup and corresponding calibration procedures for receiver requirements and out-of-band requirements to improve measurement uncertainty. *(moderator: focus on calibration, need for components discussed in previous issue)*
  + Proposal 4: Use of power sensor/meter for signal leveling should not be mandated for test system setup because limited condition for use of sensor.
* Discussion:
  + Keysight: Not sure we can use system calibration to reduce MU.
  + Ericsson: MU specified in RAN4 is too relaxed, we would like to consider system calibration which industry already considered to get reasonable MU budget for FR2-2.

**Issue 2-5-4: Measurement uncertainty contributions**

* Proposals
  + Proposal 1: For equipment MU number up to 80 GHz, because these already exist as agreed number, use numbers used in budget for UE. These are;
    - Power measurement equipment for spurious, 1 sigma number from 40.8 GHz to 80 GHz is 2.00
    - Network analyzer, 1 sigma number from 40.8 GHz to 80 GHz is 0.85
* Discussion:
  + Keysight: This value comes from UE budget table; we should reuse for BS/
  + Ericsson: We also need to consider the discussion on the extension of AAS in FR2.
* Agreement:
  + For equipment MU number up to 80 GHz, use numbers used in budget for UE as starting point. These are;
    - Network analyzer, 1 sigma number from 40.8 GHz to 80 GHz is 0.85

Sub-topic 2-6: Upper and lower frequency limits

**Issue 2-6-1: Upper and lower frequency limits**

* Proposals
  + Proposal 1: Choose a frequency slightly larger than Fstep,6 (127GHz) as max limit frequency point, e.g., 130GHz.
  + Proposal 2: Align the maximum limit frequency point for RX with that for TX.
* Discussion:
  + Nokia: Can we check is that possible to consider 142 GHz (2nd harmonic)?
  + Keysight: We would like further check.
  + Ericsson: We follow the logic as FR2-1 with reasonable value for FR2-2 below 2nd harmonic.
  + CATT: We are also fine with 142 GHz if no difficulty observed by TE vendors.
  + Keysight: Beyond 110GHz, no much difference between 130 and 142GHz.
  + ZTE: We agree with CATT.
* Agreement:
  + Proposal 2 agreed
  + Max limit frequency point: [142] GHz

Sub-topic 2-7: Measurement frequency step size

**Issue 2-7-1: Interferer signal step size for OOB blocking**

* Proposals
  + Proposal 1: 120 MHz can be considered as measurement step size for interferer signal step size for 800MHz, 1600MHz, and 2000MHz CBW for OTA in-band blocking and OTA out-of-band blocking.
  + Proposal 2: Update Table 7.6.4.2.3-1 in TS 38.141-2 to include larger step size 120MHz or 240MHz for minimum supported BS channel bandwidth larger than 400MHz for NR operation in 52.6 – 71 GHz range.
* Agreement:
  + Update Table 7.6.4.2.3-1 in TS 38.141-2 to include larger step size 240MHz for minimum supported BS channel bandwidth larger than 400MHz for NR operation in 52.6 – 71 GHz range.

**Issue 2-9-1: OOB blocking feasibility**

* Proposals
  + Proposal 1: For out of band blocking, further consider feasibility.
  + Proposal 2: TBA
* Discussion:
  + Keysight: We think more consideration for OOB blocking feasibility.
  + Ericsson: We need to further work how to generate feasible test set-up.
* Agreement: Further consideration required for the OOB blocking test feasibility.

Topic #3: BS demod OTA test methodology

**Issue 3-1: AWGN offset**

New proposals in this meeting are provided below

* Proposals
  + Proposal 1: RAN4 to define demodulation requirements for FR2-2 including opportunity for AWGN\_offset reduction as specified for FR2-1
  + Proposal 2: For demod setup, consider using 15dB margin for lowering AWGN level. This reduces risk of not finding appropriate amplifier.
* Discussion:
  + Keysight: No difference between proposal 1 and proposal 2.
  + Nokia: We share the view as Keysight. Does Keysight analysis consider 2GHz CHBW and 20dB SNR?
  + Keysight: We can do more analysis for above worst case mentioned by Nokia.
* Agreement:
  + RAN4 to define demodulation requirements for FR2-2 including opportunity for AWGN\_offset reduction as specified for FR2-1
    - AWGN\_offset = [0-15] dB
  + Demodulation requirements can be proceeded based on the agreements from RF session.

**Conclusions after 1st round**

**WF/LS**

**R4-2214373 WF on FR2-2 BS test environments**

*Type: other For: Approval  
 Source: Ericsson*

**Decision: Return to.**

**R4-2214374 WF on FR2-2 BS conformance testing**

*Type: other For: Approval  
 Source: Nokia*

**Decision: Return to.**

**Conclusions after 2nd round**

**[104-e][324] NR\_exto71GHz\_Demod\_Part1, AI 9.14.8.1, 9.14.8.3 – Rafael Paiva**

**R4-2214184 Email Discussion Summary for [104-e][324] NR\_exto71GHz\_Demod\_Part1**

*Type: other For: Information  
 Source: Moderator (Nokia)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Revise to R4-2214313**

**R4-2214313 Email Discussion Summary for [104-e][324] NR\_exto71GHz\_Demod\_Part1**

*Type: other For: Information  
 Source: Moderator (Nokia)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Return to.**

**Conclusions after 1st round**

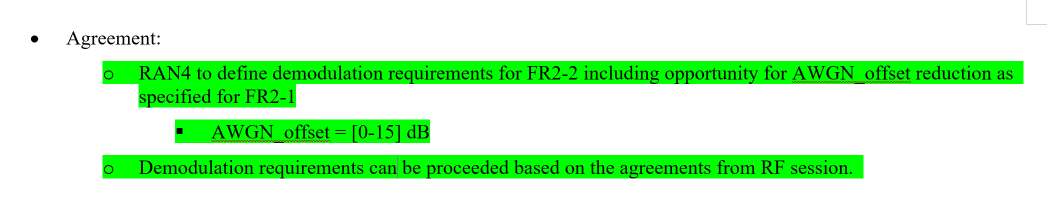
**GTW discussion on August 22th**

**List of open issues:**

* Issue 1-4-2: SNR limit
* Issue 1-3-1: SCS for demodulation requirements
* Issue 1-3-2a: Channel bandwidth for BS/UE demodulation requirements
* Issue 1-2-1: Channel model tap delay resolution
* Issue 1-2-2: Optionality of channel models
* Issue 1-4-1a: Use of ICI for BS demodulation requirements
* Issue 1-2-3: Doppler shift for demodulation requirements above 52.6 GHz
* Issue 2-4-5: Test cases for PUSCH requirements with transform precoding

**Issue 1-4-2: SNR limit**

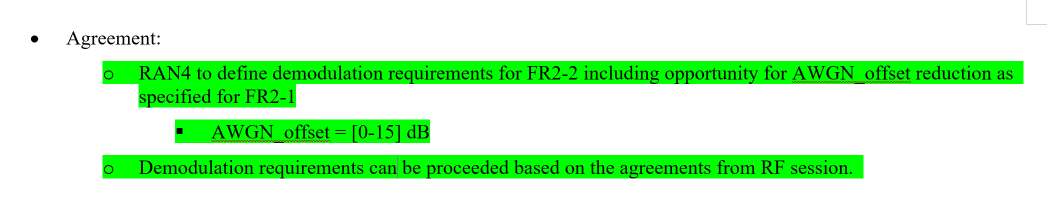
Please consider GTW agreement from 17th August for thread [104-e][310] NR\_exto71GHz\_BSRF, Issue 3-1: AWGN offset



* Proposals
  + Option 1: Keep the agreement in the previous meeting that using the minimum CBW and 20dB SNR limit for discussion at current stage. Pending the decision until RF have agreements on the link budget.
  + Option 2: Keep the agreement in the previous meeting that using the minimum CBW and 20dB SNR limit for discussion at current stage.
* Recommended WF
  + Given the BS RF agreements, can we agree on Option 2?
* Discussion:
  + Huawei: We doubt the feasibility for AWGN\_offset reduction.
  + Ericsson: We believe AWGN offset is last way to improve link budget and which potentially impact the performance.
  + Nokia: We think we need a WF how to proceed the work.
* Agreement: Encourage demod experts to join in the discussion in Thread [310] Topic #3 BS Demod OTA test methodology.

**Issue 1-3-2a: Channel bandwidth for BS demodulation requirements**

Please consider GTW agreement from 17th August for thread [104-e][310] NR\_exto71GHz\_BSRF, Issue 3-1: AWGN offset



* Proposals
* For BS demodulation requirements
  + Proposal 1: RAN4 to define demodulation requirements with 400 MHz and 1600 MHz CBW for 480kHz SCS.
  + Proposal 2: RAN4 to define demodulation requirements with 400MHz and 2000MHz CBW for 960kHz SCS.
  + Proposal 3: RAN4 to define demodulation requirements with 400 MHz CBW for 480kHz SCS.
  + Proposal 4: RAN4 to define demodulation requirements with 400MHz CBW for 960kHz SCS.
* Discussion:
  + Ericsson: We agreed to focus on minimum CHBW (option 3).
  + Huawei: We support option 3.
  + Nokia: Our preference is to define minimum and maximum CHBW for both BS and UE sides.
  + Samsung: We support option 3 to align with RF session.
* Agreement:

RAN4 agreed to introduce BS demodulation requirements at least:

* + 400MHz CBW for 480kHz SCS
  + FFS for other cases including
    - * 1600MHz for 480kHz
      * 400MHz and 2000MHz CBW for 960kHz SCS

**Issue 1-2-1: Channel model tap delay resolution**

* Proposals
  + RAN4 to specify TDLA10 and TDLD10 models for FR2-2 with
    - Option 1: 2 ns delay resolution and 16 taps
    - Option 2: 2 ns delay resolution and 12 taps
    - Option 3: 2.5 ns delay resolution and 16 taps
    - Option 4: 2.5 ns delay resolution and 12 taps
    - Option 5: 5 ns delay resolution and 16 taps
    - Option 6: 5 ns delay resolution and 12 taps
* Recommended WF
  + Please indicate which options are agreeable.
* Discussion:
  + R&S: We have different proposal in round 1. We prefer to use 5ns for up to 200MHz and use 2ns for above 200MHz considering test feasibility. Within 200MHz, this should not make any difference. Delay resolution this can be pending on CBW.
  + QC: For FR2-2, we prefer to keep single tap resolution.
  + Apple: What’s the drawback with 2ns combined with 200MHz?
  + Ericsson: We need to consider BW and delay spread for decide delay resolution.
  + Nokia: Another alternative is to use delay spread 30 instead of 10ns for 100MHz requirements. Then 5ns delay resolution can be used.
  + Apple: We are fine with R&S proposal based on the feedback. The maximum delay can go behind of 10ns.
  + Anritsu: We are fine to compromise with 2ns resolution.
  + R&S: Nokia’s proposal also fine for us.
* Agreement:
  + - For below or equal to 200MHz, 5ns delay resolution; for above 200MHz, 2ns delay resolution
      * TE vendors’ feedback are encouraged for the feasibility of supported number of taps

**Issue 1-2-2: Optionality of channel models**

* Proposals
  + Option 1: Channel models for 480 kHz and 960 kHz SCS shall be at least optional.
* Agreement: NO need further discussion on issue 1-2-2.

**Issue 1-4-1a: Use of ICI for BS demodulation requirements**

* Proposals
  + Option 1: Do not consider ICI
  + Option 2: Consider ICI
  + Option 3: It is up to the BS implementation
  + Option 4: Consider ICI in the following cases

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| SCS | MCS | 100 MHz | 400 MHz | 800 | 1600 | 2000 |
| 120 kHz | QPSK | No | No | - | - | - |
|  | 16 QAM | No | Yes | - | - | - |
|  | 64 QAM | Yes | No | - | - | - |
| 480 kHz | QPSK | - | No | No | No | - |
|  | 16 QAM | - | No | No | Yes | - |
|  | 64 QAM | - | No | Yes | Yes | - |
| 960 kHz | QPSK | - | No | No | No | No |
|  | 16 QAM | - | No | No | No | No |
|  | 64 QAM | - | No | No | No | No |

* Discussion:
  + - Ericsson: We only focused on minimum CHBW. We didn’t see the necessary ICI needed for minimum CHBW.
    - Huawei: We share same view as Ericsson. No performance gain observed for minimum CHBW.
    - Nokia: Our preference is option 2 and option 4.
* Agreement:
  + - For test cases with minimum CHBW, no need to consider ICI
    - For other test cases with larger CHBW if introduced, FFS whether ICI shall be considered or not

**Issue 1-2-3: Doppler shift for BS demodulation requirements above 52.6 GHz**

* Proposals
  + Option 1: Use 650Hz Doppler shift for FR2-2 NLOS channel model.
  + Option 2: RAN4 to define demodulation requirements using 650 Hz Doppler for QPSK and PRACH, PUCCH, PDCCH & PBCH. Doppler of 200Hz to be used for the remaining cases.
  + Option 3 (new): Adopt 650 Hz for TDLA and 200 Hz with TDLD.
* Discussion
  + Ericsson: This doppler shift is pending on deployment scenario not pending on physical channels, and we prefer option 3.
  + Nokia: We are fine option 2 or option 3.
  + Huawei: We are fine with option 3 considering test coverage.
  + Apple: 650Hz only applied for high speed and not sure realistic for FR2-2 deployment.
  + Ericsson: 650Hz is not high speed as 10 km/h, which same assumption as FR2-1 which is typical for Urban deployment and 200Hz is indoor deployment.
  + Nokia: We would see smaller doppler shift from UE side.
* Agreement:
  + - Adopt 650 Hz for TDLA and 200 Hz with TDLD for BS demodulation requirements.

**Issue 2-4-5: Test cases for PUSCH requirements with transform precoding**

Moderator notes: It was commented that there was an agreement indicating transform precoding was not included. From the WF R4-2210664 we can find the following agreement, which we should have in mind when replying to this issue:

|  |
| --- |
| **Issue 2-2-2: How to consider transform decoding?**  Specify requirements for FR2-2 PUSCH demodulation with transform precoding enabled. |

* Proposals
  + Option 1: Revise agreement from R4-2210664 and not include test cases with transform precoding.
  + Option 2: Define test cases with MCS 16, and minimum CBW for the agreed SCSs
  + Option 3: Define test cases with MCS 16 and same CBW as for PUSCH without transform precoding
* Agreement: Specify requirements for FR2-2 PUSCH demodulation with transform precoding enabled:
  + MCS 4 with minimum CHBW for the agreed SCSs

**WF/LS**

**R4-2214388 WF on PUSCH demodulation requirements for FR2-2**

*Type: other For: Approval  
 Source: Nokia*

**Decision: Return to.**

**R4-2214655 WF on general aspects for demodulation requirements for FR2-2**

*Type: other For: Approval  
 Source: Huawei*

**Decision: Return to.**

**R4-2214500 WF on PUCCH demodulation requirements for FR2-2**

*Type: other For: Approval  
 Source: Ericsson*

**Decision: Return to.**

**R4-2214389 WF on PRACH demodulation requirements for FR2-2**

*Type: other For: Approval  
 Source: Samsung*

**Decision: Return to.**

**Conclusions after 2nd round**

**[104-e][325] NR\_exto71GHz\_Demod\_Part2, AI 9.14.8.1, 9.14.8.2 – Pierpaolo Vallese**

**R4-2214185 Email Discussion Summary for [104-e][325] NR\_exto71GHz\_Demod\_Part2**

*Type: other For: Information  
 Source: Moderator (Qualcomm)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Revise to R4-2214314**

**R4-2214314 Email Discussion Summary for [104-e][325] NR\_exto71GHz\_Demod\_Part2**

*Type: other For: Information  
 Source: Moderator (Qualcomm)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Return to.**

**Conclusions after 1st round**

**GTW discussion on August 22th**

**List of open issues:**

* Issue 1-1-4: Whether to define UE Demodulation requirements for 960kHz SCS
* Issue 1-2-2: How to address low maximum DL Testable SNR
* Issue 1-2-4: Whether RAN4 should introduce requirements for 30% of peak throughput
* Issue 2-2-1: SSB index assumption
* Issue 3-1-1: Scope of the FR2-2 UE SDR Requirements:
* Issue 3-2-1: Scope of the FR2-2 CQI Requirements:

**Issue 1-1-4: Whether to define UE Demodulation requirements for 960kHz SCS**

* Proposals
  + Option 1: Yes (Nokia);
    - Option 1a: Define the following separate sets of requirements and agree on the capability rule below:
      * Set 1) for legacy TE capabilities (480kHz with not too large CBW, and 960 KHz with non-full FDRA).
      * Set 2) for future 71GHz capable test equipment (480 and 960 kHz with larger CBW).
      * Define capability rules to allow that one of the 2 sets of the requirements are passed depending on what test equipment is available.
  + Option 2: No (Apple, Ericsson, Huawei, Qualcomm, Anritsu);
* Discussion:
  + - Nokia: We still prefer to support 960kHz as optional feature. Question to TE vendors, whether is feasible to support 960kHz in some cases?
    - Anritsu: We need more time to check the test feasibility.
    - QC: We suggest to prioritize the other mandatory features.
    - Apple: We suggest to focus on other cases.
    - Huawei: We proposed not consider 960kHz which require much number of HARQ processes and not feasible from test aspect.
    - Nokia: We encourage other TE vendors’ feedback. 32 HARQ process still possible for 960kHz.
    - Ericsson: There are lots of parameters related to 960kHz e.g., CHBW if we go with small CHBW then we didn’t see the benefits to introduce 960kHz.
* Agreement:
  + - RAN4 focuses on others SCSs before test feasibility for supporting 960kHz SCS is confirmed.

**Issue 1-2-2a: Whether to introduce Demodulation requirements with partial bandwidth allocation**

* Proposals
  + Option 1: Yes;
  + Option 2: No;
* Discussion:
  + - Ericsson: we are fine with option 1 especially for 480kHz SCS.
    - Nokia: We agree with option 1 to achieve test feasibility.
    - QC: We support option 1.
    - Huawei: We are fine with option 1.
* Agreement: Option 1 agreed.

**Issue 1-2-4: Whether RAN4 should introduce requirements for 30% of peak throughput**

* Proposals
  + Option 1: No (Apple, Huawei, Qualcomm);
  + Option 2: Yes (Nokia, Ericsson);
  + Option 3: Keep FFS (Qualcomm);
* Discussion:
  + Huawei: 30% was specified for maximum number HARQ process and soft combination. And for Fr2-2, we didn’t see the motivation on this.
  + Ericsson: We think soft combining also need to be verified in FR2-2. This should be considered at least for one of test case.
  + Apple: We can deprioritize this test case.
  + QC: We share similar view as Apple and Huawei.
  + Nokia: We share similar view as Ericsson.
* Agreement: FFS whether introduce requirements for 30% of peak throughput

**Issue 2-2-1: SSB index assumption**

* Proposals:
  + Option 1: Only with not known SSB index (Qualcomm, Apple);
  + Option 2: Both known and not known SSB index (Nokia, Ericsson, Huawei);
* Discussion:
  + - QC: Unknown SSB index is most interesting case and we prefer option 1 given no test for PBCH.
    - Apple: Same view as QC. Unknown case can cover both scenarios.
    - Nokia: We can compromise to option 1.
    - Ericsson/Huawei: We can compromise to option 1.
* Agreement: Option 1 agreed.

**Issue 3-1-1: Scope of the FR2-2 UE SDR Requirements:**

* Proposals:
  + Option 1: Do not introduce SDR requirements for FR2-2 (Qualcomm, Apple, Huawei);
  + Option 1: Define SDR tests according to the table below (Ericsson);
    - following numerologies have been considered (under PN effects): 120 KHz/100 MHz (66 RBs), 120 KHz/400 MHz (264 RBs), 480 KHz/400 MHz (66 RBs), and 480 KHz/800 MHz (124 RBs).

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Received antenna** | **Maximum number of PDSCH MIMO layers** | **Maximum modulation format** | **Scaling factor** | **MCS** | **PN compensation** | |
| **PRB (66)** | **PRB (124 or 264)** |
| 2Rx UE | 1 | 6 | 1 | 27 | CPE only | CPE+ICI (u=2) |
| 0.8 | 23 | CPE only | CPE+ICI (u=2) |
| 0.75 | 22 | CPE only | CPE+ICI (u=2) |
| 0.4 | 14 | CPE only | CPE+ICI (u=2) |
| 4 | 1 | 16 | CPE only | CPE+ICI (u=2) |
| 0.4 | 10 | CPE only | CPE only |
| 2 | 1 | 9 | CPE only | CPE only |
| 0.4 | 4 | CPE only | CPE only |

* Discussion:
  + - Ericsson: We believe it’s important to verify SDR. We observe there is possibility to improve test ability SNR range.
    - Apple: Given low testable BW, question for the benefits of SDR in FR2-2. Low MCSs not suitable for SDR tests.
    - QC: We share similar view as Apple. PDSCH can choose low CHBW and MCS, but that’s not meaningful for SDR test case.
  + Agreement: FFS whether SDR test cases will be specified for FR2-2 pending further checking on the test feasibility on supporting SNR range

**Issue 3-2-1: Scope of the FR2-2 CQI Requirements:**

* Proposals:
  + Option 1: Only for SCS 120kHz, CBW=100MHz (Qualcomm, Apple, Huawei);
  + Option 2: SCS=120kHz, CBW=100MHz and SCS=480kHz,CBW=400MHz (Nokia, Ericsson);
* Recommended WF
  + Continue discussing it in the second round
* Discussion:
  + - Huawei: We think 120kHz more suitable for deriving CQI test cases since ICI worse in 120kHz SCS.
    - Apple: For CQI requirements, we already agree to introduce CQI test cases under AWGN channel and 120kHz is mandatory SCS in FR2-2. We think introducing test case with 120kHz sufficient. And test feasibility would be another concern for 400MHz CBW/480kHz SCS.
    - QC: We share same view as Huawei and Apple. And from test purpose to verify UE processing, 120kH SCS is enough.
    - Ericsson: We think 120kHz and 480kHz are applied for different deployment (outdoor and indoor).
    - Nokia: Considering in AWGN channel, no much difference between 120kHz and 480kHz from UE processing aspect for CQI reporting.
    - QC: In FR1 per duplex mode and FR2-1, only SCS used for introducing CQI reporting requirements.
    - Ericsson: We can compromise to option 1. Are we going to specify same requirements for FR2-1 or new requirements?
    - QC: We have another issue whether reusing same test metric/SNR points or new.
    - Apple: SNR points can be discussed separately considering test feasibility.
    - Huawei: We share similar view as Apple.
* Agreement: Option 1 agreed, further discuss test metric and test SNR points.

**WF/LS**

**R4-2214390 WF on FR2-2 UE demodulation requirements**

*Type: other For: Approval  
 Source: Qualcomm*

**Decision: Return to.**

**Conclusions after 2nd round**

### 9.15 Enhancements to Integrated Access and Backhaul (IAB) for NR

#### 9.15.4 Moderator summary and conclusions

**[104-e][311] NR\_eIAB\_RFMaintenance, AI 9.15.1, 9.15.2- Yankun Li**

**R4-2214171 Email Discussion Summary for [104-e][311] NR\_eIAB\_RFMaintenance**

*Type: other For: Information  
 Source: Moderator (Samsung)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Revise to R4-2214300**

**R4-2214300 Email Discussion Summary for [104-e][311] NR\_eIAB\_RFMaintenance**

*Type: other For: Information  
 Source: Moderator (Samsung)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Return to.**

**GTW discussion on August 19th**

List of open issues

* Issue 1-1: Test applicability
* Issue 1-2: Test set-up in Annex D for type 1-H receiver requirement
* Issue 1-3: Test model
* Issue 1-4: Test procedure on co-location requirement for IAB type 1-O
* Issue 1-5: Test requirement applied for IAB simultaneous operation

**Issue 1-1: Test applicability**

* Proposals
  + Option 1: New table proposed in R4-2212474
  + Option 2: test applicability can be embedded in test configuration table as in [R4-2213241](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104-e/Docs/R4-2213241.zip)/2
* Discussion:

Whether reference sensitivity should be verified for IAB simultaneous operation

* + Ericsson: reference sensitivity and dynamic range is single carrier test, following legacy test should be fine, no need to consider for IAB simulation operation
  + Samsung: We are ok to skip the TPs if companies agreed no specific test cases on IAB simultaneous operation.
* Agreement
  + Option 2 agreed
  + No need to introduce conformance test cases for reference sensitivity with IAB simultaneous operation.

**Issue 1-2: Test set-up in Annex D for type 1-H receiver requirement**

* Proposals
  + Option 1: Whether update needed for Annex ~~D.2.1,~~ D.2.3 and D.2.6 in TS38.176-1 to enable the illustration of simultaneous reception between IAB-MT and IAB-DU with multiple connectors
  + Option 2: TBA
* Discussion:
  + Nokia: Some additional clarification on single connector and shared connector also needed.
  + Ericsson: We share similar as Nokia
  + Samsung: We make update to allow flexibility. The concern can be addressed by conformance test cases.
* Agreement:
  + Update needed for Annex D.2.3 and D.2.6 in TS38.176-1 to enable the illustration of simultaneous reception between IAB-MT and IAB-DU with multiple connectors
  + Update TPs for test cases to allow flexibility on single connector and shared connectors

**Issue 1-3: Test model**

* Proposals
  + Option 1: To consider power allocation and frequency resource allocation for ACLR testing when IAB-DU and IAB-MT of the same IAB-Node transmit simultaneously in new test model from R4-2212633
  + Option 2: Existing TM including TDD pattern of IAB-DU can be reused for IAB simultaneous operation(R4-2213982)
* Discussion:
  + ZTE: We are ok to further discuss for the new test mode in future release.
* Agreement: Option 2 agreed

**Issue 1-4: Test procedure on co-location requirement for IAB type 1-O**

* Proposals
  + Option 1: clarify on how to handle co-location requirement
  + Option 2: TBA
* Discussion:
  + Ericsson: The co-location requirements declared by manufacture, whether we need to have separate declaration for simultaneous operation? Our view the declaration shall be general.
  + Nokia: IAB-DU/MT can have different classes. We are ok to reduce test burden.
  + Samsung: There are some mandatory requirements on co-located requirements.
* Agreement: Further work based on the drafting CRs.

**Issue 1-5: Test requirement applied for IAB simultaneous operation**

* Proposals
  + Option 1: Whether *to use IAB-MT receiver requirement to test IAB simultaneous operation*
  + Option 2: Whether the new sub-clause should be created for test requirement of simultaneous operation in existing requirement
* Discussion:
  + Ericsson: We could use IAB-MT test requirements for simultaneous operation Rx requirements. We prefer to new sub-clause to be created if necessary. For Tx requirements, IAB-DU requirements can be used.
  + Nokia: Does mean we only apply IAB-MT interference signals?

**Conclusions after 1st round**

**WF/LS**

**Conclusions after 2nd round**

### 9.16 NR coverage enhancements

#### 9.16.3 Moderator summary and conclusions

**[104-e][326] NR\_cov\_enh\_Demod, AI 9.16.2 – Jingzhou Wu**

**R4-2214186 Email Discussion Summary for [104-e][326] NR\_cov\_enh\_Demod**

*Type: other For: Information  
 Source: Moderator (China Telecom)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Revise to R4-2214315**

**R4-2214315 Email Discussion Summary for [104-e][326] NR\_cov\_enh\_Demod**

*Type: other For: Information  
 Source: Moderator (China Telecom)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Return to.**

**GTW minutes on August 16th**

**List of open issues**

* Issue 1-3-3: Additional DM-RS position for BS PUSCH demod requirements with JCE (for FR1)
* Issue 2-1-1: DMRS configuration for PUCCH format 3
* Issue 1-3-6: Phase offset modelling for BS PUSCH demod requirements with JCE
* Issue 1-3-7: CFO modelling for BS PUSCH demod requirements with JCE
* Issue 1-3-1: TDD UL-DL pattern for BS PUSCH demod requirements with JCE
* Issue 1-2-1: Manufacturer declaration for TBoMS

**Issue 1-3-3: Additional DM-RS position for BS PUSCH demod requirements with JCE (for FR1)**

* Companies’ simulation results observations:
  + CTC: For TDD with aTDW length of 2, larger JCE gain can be achieved with DMRS 1+1. For FDD with aTDW length of 8, larger JCE gain can be achieved for DMRS 1+0 because the baseline PUSCH repetition performance is poorer.
  + E///: No clear performance difference between DM-RS 1+0 and 1+1 configurations
* Proposals:
  + Option 1: Use DMRS 1+1 for TDD and DMRS 1+0 for FDD (CTC)
  + Option 2: DMRS 1+1 only (E///)
  + Option 3: Cover both DMRS 1+1 and DMRS 1+0 configurations for JCE requirements (Nokia)
  + Option 4: DMRS 1+0 only (Samsung, Huawei)
* Discussion
  + Ericsson: From JCE feature aspect, more DMRS symbols can achieve more performance gain. We prefer to option 2 covering typical 1+1 case. We didn’t obser much difference between 1+0 and 1+1 case.
  + Samsung: The number of DMRS is pending on channel condition. TDLA with 10Hz, 1+0 and 1+1 no performance difference and meanwhile 1+0 has less overhead.
  + China Telecom: We propose option 1 as we would like to show performance difference between JCE and legacy scheme. From submitted results, 1+0 cannot show enough performance difference for TDD case.
  + Huawei: We observe more performance gain with 1+1 but the difference is negilable . We prefer to consider 1+0 only.
  + Nokia: We observe 1+1 show more performance gain. We prefer option 3.
  + Ericsson: 1+1 can achieve higher MCS.
  + Huawei: The criteria for performance gain: performance with JCE only or the performance delta between JCE and non JCE?
* Agreement:
  + Decide DMRS configuration based on the performance comparison between JCE and non-JCE

**Issue 2-1-1: DMRS configuration for PUCCH format 3**

* Proposals:
  + Option 1: Use the same DMRS configuration for PUSCH JCE (CTC)
  + Option 2: Both DM-RS 1+1 and DM-RS 1+0 (Nokia)
  + Option 3: DMRS 1+1 only (E///, Nokia)
  + Option 4: DMRS 1+0 only (Samsung, Huawei)
* Discussion
  + Samsung: We are ok with option 1.
* Agreement: Option 1: Use the same DMRS configuration for PUSCH JCE

**Issue 1-3-6: Phase offset modelling for BS PUSCH demod requirements with JCE**

* Proposals:
  + Option 1: consider the phase offset in the impairment results (CTC, E///, Samsung)
  + Option 2: phase offset non-idealities to be part of the TE test uncertainty (Nokia, Huawei)
    - Huawei: RAN4 consider Tx error in test uncertainty and consider Rx error in impairment results
* Discussion
  + Nokia: During test, if TE didn’t implement phase offset modeling and usually the performance better than UE; we can leave it to TT.
  + Ericsson: There are 2 modelling from RF session, it seems hard to impact the performance requirements we specified.
  + Huawei: We never consider Tx phase offset in previous performance requirements and strongly pending TE implementation.
* Agreement:
  + No exact phase offset modelling in simulation; how to consider phase offset in the impairment results is subject to interested companies.

**Issue 1-3-7: CFO modelling for BS PUSCH demod requirements with JCE**

* Proposals:
  + Option 1: consider the CFO impact in the impairment results (CTC, E////, Samsung, Huawei)
    - Huawei: RAN4 consider Tx error in test uncertainty and consider Rx error in impairment results
  + Option 2: CFO impact to be part of the TE test uncertainty (Nokia)
* Agreement:
  + No exact CFO modelling in simulation; how to consider CFO in the impairment results is subject to interested companies.

**Issue 1-3-1: TDD UL-DL pattern for BS PUSCH demod requirements with JCE**

* Proposals on the exact TDD patterns for 15/60/120 kHz SCS:
  + Option 1: (CTC, Samsung)
    - 7D1S2U, S=6D:4G:4U for 15kHz
    - DDSUU, S=10G:2G:2U for 60/120kHz
  + Option 2: (Nokia)
    - DDSUU, S=10G:2G:2U for 15/60/120 kHz SCS
  + Option 3: (Huawei)
    - Use DSUUU pattern and disable the UL transmission on the last U slot
* Proposals on the test requirement applicability for different TDD patterns for each SCS (To be captured in the test parameter tables)
  + Proposal 1: (Nokia, Samsung)
    - JCE requirements can be applied for different TDD patterns if the number of consecutive slots (aTDW length) is the same.
  + Proposal 2: (CTC)
    - JCE requirements can be applied for different TDD patterns with more than 1 physical UL consecutive slots.
    - Note that for the TDD pattern with odd number of UL consecutive slots, UL transmission on the first or the last UL slot is disabled.
  + Proposal 3: (HW)
    - JCE requirements can be applied for different other TDD patterns with same number of physical consecutive slots (aTDW length).
    - For the TDD pattern with odd number of consecutive ‘U’ slots, UL transmission on the the last UL slot is disabled.
  + Proposal 4: (E///)
    - JCE requirements can be applied for different TDD patterns by setting repetitions and configurable time domain bundling windows for DM-RS bundling as 2 slots.
* Discussion
  + Huawei: We believe DSUUU is more realistic in deployment.
  + China Telecom: We will discuss test applicable rule later; now we are focused on test set-up for derive performance requirements/simulation.
  + Samsung: We need to ensure 2UL slot available, we would like to respect the operators’ feedback.
  + Ericsson: We need to consider odd number of uplink slots in the end. For 15kHz either option is ok for us.
  + Nokia: We are fine with either option 1 or option 2.
  + China Telecom: For the odd number slots issues, we can address with test applicable rules.
  + Ericsson: We only can configure cTDW instead of aTWD length.
  + China Telecom: The exact aTDW is important from performance requirements aspect.
  + Nokia: We think it’s important to keep aTDW in the test applicable rule.
  + Huawei: We can only control cTDW length. If 1 aTDW disable/not transmitted, then requirements can be applied.
* Agreement:
  + The exact TDD patterns for 15/60/120 kHz SCS (baseline assumption)
    - 7D1S2U, S=6D:4G:4U for 15kHz
    - DDSUU, S=10G:2G:2U for 60/120kHz
  + On the test requirement applicability for different TDD patterns for each SCS (To be captured in the test parameter tables):
    - JCE requirements can be applied for different TDD patterns with 2 or more physical UL consecutive slots and with the same [aTDW] length of 2 consecutive slots.
      * Note: Further work on the clarification for cTDW configuration if needed
    - The UL throughput is not measured on the aTDW including only 1 UL slot

**Issue 1-2-1: Manufacturer declaration for TBoMS**

* Proposals:
  + Option 1 (China Telecom, E///, Nokia)

|  |  |  |
| --- | --- | --- |
| D.yyy | PUSCH TB over Multi-slots (TBoMS) | Declaration of PUSCH TB over Multi-slots support |

* + - CTC: Once supported, TBoMS can be performed regardless of the supported TDD pattern, thus the supportive of TBoMS should be independent on the supported TDD pattern for each SCS.
  + Option 2: (Huawei)

|  |  |  |
| --- | --- | --- |
| D.xxx | SCS for PUSCH TBoMS | Declaration of supported SCS for PUSCH TBoMS, i.e. {15kHz, 30kHz, 60kHz 120kHz} |

* + - Huawei: Need to introduce BS manufacturer declaration with corresponding SCS for PUSCH TBoMS to distinguish a BS support multiple SCS but only support TBoMS feature on 30kHz SCS with 7D1S2U TDD pattern.
* Discussion
  + Nokia: We support option 1.
  + Huawei: We think this feature is special, the processing complexity is pending on TDD pattern with different available UL slots. We prefer option 2 with SCS basis.
  + Ericsson: We think available UL slots not depending on SCSs. We prefer option 1.
  + China Telecom: We prefer option 1, TBoMS should be supported not related TDD pattern and SCS.
  + Huawei: How to deal with the case that BS supports 7D1S2U pattern with 30kHz SCS only case?
    - 15kHz SCS is not typical scenario in real NW deployment. BS may not support 15kHz toghther with this new feature.
  + China Telecom: BS only can be verified based on the declared supported SCSs similar as other features.
  + Ericsson: We share same view as China Telecom, we have dedicated declaration for supporting SCSs.
* Agreement:
  + Introduce new Manufacturer declaration for TBoMS.
    - FFS whether declaration shall be per SCS basis or agnostic to SCSs

**Conclusions after 1st round**

**GTW discussion on August 24th**

Issue 1-3-1A: TDD UL-DL pattern and requirement applicability rule for BS PUSCH demod requirements with JCE

* Agreement:

To be captured in the TS as below:

|  |  |
| --- | --- |
| Parameter | Value |
|  |  |
| **Example** TDD UL-DL pattern (Note 1) | 15kHz: 7D1S2U, 60/120kHz: DDSUU or DSUUU |
| **…..** | ….. |
| **Note 1:** The same TDD requirements are applicable to different UL-DL patterns with more than one consecutive UL slots when both pusch-TimeDomainWindowLength and PUSCH aggregation factor are configured as 2 slots.  The UL (re)transmission of PUSCH is only scheduled for the actual TDW including 2 consecutive UL slots. | |

Issue 1-3-3: Additional DM-RS position for BS PUSCH demod requirements with JCE (for FR1)

* Agreement: Define requirement for both DMRS 1+1 and DMRS 1+0 with the current test applicability rule to test only one of the 2 based on manufacture declaration.

Issue 1-2-1: Manufacturer declaration for TBoMS

* Candidate options:
  + Option 1 (China Telecom, E///, Nokia)

|  |  |  |
| --- | --- | --- |
| D.yyy | PUSCH TB over Multi-slots (TBoMS) | Declaration of PUSCH TB over Multi-slots support |

* + Option 2: (Huawei, Samsung)

|  |  |  |
| --- | --- | --- |
| D.xxx | SCS for PUSCH TBoMS | Declaration of supported SCS for PUSCH TBoMS, i.e. {15kHz, 30kHz, 60kHz 120kHz} |

* + Option 3: (CTC proposed as compromise)

|  |  |  |
| --- | --- | --- |
| D.x1 | PUSCH TB over Multi-slots | BS support TBoMS over physical consecutive UL slots. |
| D.x2 | PUSCH TB over Multi-slots | BS support TBoMS over physical non-consecutive UL slots. |

* Agreement: Option 3 agreed and further work on CR drafting

Issue 1-3-1D: Manufacture declaration for PUSCH and PUCCH JCE

* Agreement:
  + Option 1 with additional manufacture declaration for FDD:

|  |  |  |
| --- | --- | --- |
| D.yyy | Supported SCS for TDD PUSCH JCE and PUCC H JCE | Declaration of supported SCS for TDD PUSCH JCE and PUCCH JCE, i.e. {15kHz, 30kHz, 60kHz 120kHz} |
| D.xxx | Supported FDD PUSCH JCE and PUCCH JCE | Declaration of supporting FDD PUSCH JCE |

Issue 1-3-4: Number of HARQ process for BS PUSCH demod requirements with JCE

* Agreement: Assuming no such limitation needed as baseline and further check in next meeting based on th

**Conclusions after 2nd round**

### 9.17 Further enhancements on MIMO for NR

#### 9.17.5 Moderator summary and conclusions

**[104-e][327] NR\_FeMIMO\_Demod, AI 9.17.4 – Yunchuan Yang**

**R4-2214187 Email Discussion Summary for [104-e][327] NR\_FeMIMO\_Demod**

*Type: other For: Information  
 Source: Moderator (Samsung)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Revise to R4-2214316**

**R4-2214316 Email Discussion Summary for [104-e][327] NR\_FeMIMO\_Demod**

*Type: other For: Information  
 Source: Moderator (Samsung)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Return to.**

**GTW discussion on August 18th**

List of open issues

* + Sub-topic 1-1: Test Setup for PDCCH requirement for Enhancement on Multi-TRP
    - Issue 1-1-1: Receiver Assumption for PDCCH requirement for multi-TRP repetition transmission
    - Issue 1-1-4: SNR setting for each TRP
  + Sub-topic 2-1 Test Scope
    - Issue 2-1-1: Whether to define PDSCH requirement with HST-SFN scheme B
  + Sub-topic 2-2 Test setup for PDSCH requirement for SFN scheme A with Single Carrier
    - Issue 2-2-1: Maximum Doppler Shift
    - Issue 2-2-2: MCS & Rank
  + Sub-topic 4-1: Test Scope
    - Issue 4-1-1: Whether to define PMI requirement for Rel-17 FeTye II PS codebook

**Issue 1-1-1: Receiver Assumption for PDCCH requirement for multi-TRP repetition transmission**

* Observations
  + Observation 1 (Ericsson): There is a big performance gap between applying soft-combining or not.
* Proposals
  + Option 1 (Ericsson, Huawei, Nokia): With UE soft-combining
  + Option 2 (Qualcomm, MTK): Without UE soft-combining
* Discussion:
  + QC: RAN1 didn’t assume any receiver assumption on this feature; we suggest to specify requirements based on non-soft combining.
  + Huawei: From RAN1 capability on BD factors, we can introduce requirements based on UE capability. We can specify requirements based on different BD (blind detection) values.
  + MTK: We agree with QC, reference receiver without soft combining. We need to clarify the simulation assumption for scaling factor to align the results.
  + Apple: We think soft-combing shall be left to UE implementation and requirements can be receiver agnostic. Meanwhile we also think soft-combining shall not considered as advanced receiver. In previous agreed WF, scaling factor assume. We would like to further clarify this issue.
  + Samsung: Regarding BD factors, UE still can have different receiver assumption. For PDCCH transmission, FDM scheme used then we think no scaling factor needed.
  + Nokia: We don’t think soft-combining as advanced receiver; we need to align the receiver assumption.
  + QC: We shouldn’t enforce optional feature as receiver assumption. We also agree with Samsung comment.
  + Ericsson: If UE report BD =3, then UE shall apply soft combining. We agree with Huawei.
* Agreement:
  + Specify requirements without specific receiver assumption, additional margin can be considered for UE supporting BD =2
  + FFS whether specific receiver assumption shall be considered for UE supporting BD =3
    - Option 1: Specify requirements without specific receiver assumption, additional margin can be considered
    - Option 2: Assuming soft-combining

**Issue 1-1-4: SNR setting for each TRP**

* Proposals
  + Option 1 (Apple, Nokia, MTK, Huawei, Ericsson): The SNRs for TRP #1 and TRP #2 are assumed to be balanced with a scaling factor of 1/sqrt(2) for the transmitted signal from each TRP, without considering TRP blocking for multi-TRP PDCCH enhancement
* Agreement: No need to consider scaling factor for PDCCH Multi-TRP test case with FDM scheme.

**Issue 2-1-1: Whether to define PDSCH requirement with HST-SFN scheme B**

* Observations
  + Observation 1(Ericsson):
    - The UE processing is quite different compared to HST scheme A, B and HST single tap.
    - The performance of HST-SFN scheme B is quite different in comparison to both HST-SFN scheme A and HST Single Tap.
    - The SNR for achieving 70% maximum throughput for HST-SFN scheme B is around 11.6dB.
* Proposals
  + Option 1 (Samsung, CMCC, Ericsson, Huawei): Introduce the PDSCH requirement with HST-SFN B,
    - Option 1a (CMCC): with test applicability rule
    - Option 1b(Huawei): If UE supporting both HST SFN scheme A and B and supporting both 15kHz SCS and 30kHz SCS, then UE shall only pass scheme A with 15kHz and scheme B with 30kHz requirements. Do not define any other applicability rule between scheme A and scheme B.
  + Option 2 (Qualcomm, MTK, Apple): Not to introduce the PDSCH requirement with HST-SFN B
* Discussion:
  + Apple: We are not favour of introducing scheme B since it’s related to BS pre-compensation. We think the difference between TRPs is time delay only. We also would like to hear operators’ feedback for the deployment.
  + QC: We share similar view as Apple. Scheme B is simplified scheme compared to scheme A.
  + Huawei: We prefer to introduce HST-SFN scheme B since Scheme A/Scheme B are different features and UE may support Scheme B not support scheme A since the UE processing is different. We can introduce scheme A for 15kHz and scheme B for 30kHz.
  + CMCC: We support option 1a with similar view with Huawei from UE feature and processing capability aspect. Option 1a can minimize test effort.
  + MTK: I don’t think such kind of UE which only supporting scheme B exist.

**Issue 2-2-1: Maximum Doppler Shift.**

* Observations
  + Observation 1 (Huawei): Maximum Doppler 972Hz for 15kHz SCS cannot achieve the maximum throughput for HST SFN scheme A. Maximum Doppler 972Hz for 15kHz SCS cannot achieve the maximum throughput for HST SFN scheme A.
  + Observation 2 (Samsung):
    - for FDD, compared with MCS13, MCS17 has larger SNR difference between maximum Doppler 870Hz and 972Hz.
    - for FDD MCS17, the SNR points difference at 70% of peak rate is 2.6~3dB between maximum Doppler 870Hz and 972Hz.
    - The performance of HST-SFN scheme B is around 1.2~1.4dB worse than that of HST single tap
  + Observation 3 (Ericsson)
    - A much higher SNR (around 19dB with 972Hz) is needed to reach 70% maximum throughput for MCS17 compared to MCS13. After the impairment margin, possibly the requirement will be over 20dB.
    - No clear performance difference between configuring 870Hz and 972Hz with MCS13. Approximately 2dB gap with MCS17.
  + Observation 4 (MTK)
    - UE cannot achieve relative 70% throughput with Rank2 MCS17 and maximum doppler 972Hz.
* Proposals
  + Option 1(CMCC, Qualcomm, Samsung, Huawei, MTK): 870Hz for 15 KHz SCS
  + Option 2 (NTT DoCoMO): 972Hz for 15 KHz SCS
  + Option 3 (Ericsson): MCS 13+ 972Hz
* Discussion:
  + NTT DoCoMo: We prefer option 3 to achieve 500km/h.
  + Ericsson: We share similar view NTT DoCoMo.
  + QC: We think the doppler shift shall still with TRS tracking range. Some companies’ result show peak TP can be achieved with 972Hz.
  + Huawei: We share similar view as QC. Doppler rap issue observed with 972Hz.
  + Apple: We share similar view with QC and Huawei. This is difference compared to single Tap HST scenario with 2 TRP transmission.
  + Samsung: We have similar view as Apple. Timing offset between TRPs can be observed.
  + MTK: We share similar view with other UE vendors, performance loss observed with 972Hz.
  + NTT DoCoMo: In HST SFN scheme A, we have TRPs with separate TRSs; from CMCC, Ericsson and our results, we think 972Hz workable.
  + Ericsson: UE only need to track TRS per TRP basis, we think it’s feasible with 972Hz.
* Agreement: 870Hz

**Issue 4-1-1:** **Whether to define PMI requirement for Rel-17 FeTye II PS codebook**

* Proposals
  + Option 1(Nokia): RAN4 to include performance requirements for Rel-17 eTypeII PS codebooks in the Rel-18 timeframe, and to start from the test setups contributed to, and discussed in, RAN4#104.
  + Option 2 (Ericsson): Postpone the requirement for Rel-17 Type II PS CB to the at least next release to find better test setup with low complexity and better reflection of actual overall performance.
  + Option 3 (Huawei): Define PMI reporting requirement for Rel-17 FeTypeII port selection codebook based on evaluation on the performance gain over eTypeII codebook.
  + Option 4 (Qualcomm): No
* Agreement:
  + RAN4 will not introduce requirement of Rel-17 FeType II PS CB in Rel-17 Timeframe
    - RAN4 can further discuss detailed parameters in RAN4#104 for reference of future work.

**Conclusions after 1st round**

**WF/LS**

**R4-2214397 WF on demodulation and CSI performance requirements for FeMIMO**

*Type: other For: Approval  
 Source: Samsung*

**Decision: Return to.**

**Conclusions after 2nd round**

### 9.18 Support of reduced capability NR devices

#### 9.18.6 Moderator summary and conclusions

**[104-e][328] NR\_RedCap\_Demod, AI 9.18.5 – Kazuyoshi Uesaka**

**R4-2214188 Email Discussion Summary for [104-e][328] NR\_RedCap\_Demod**

*Type: other For: Information  
 Source: Moderator (Ericsson)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Revise to R4-2214317**

**R4-2214317 Email Discussion Summary for [104-e][328] NR\_RedCap\_Demod**

*Type: other For: Information  
 Source: Moderator (Ericsson)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Return to.**

**GTW discussion on August 18th**

**Issue 3-3-1: Whether to define RI reporting requirements for RedCap 2Rx uEs**

* Proposals
  + Option 1: Define RI reporting requirements (Nokia, Ericsson, Qualcomm)
    - Option 1a (Nokia, Ericsson): Apply Test 2 only.
    - Option 1b (Qualcomm): Apply 3 tests.
    - RI reporting is the mandatory capability for RedCap UE. It is necessary to verify 2 Rx RedCap UE reports the appropriate MIMO rank.
  + Option 2 (Huawei, Apple, MTK): Not define RI reporting requirements
    - To reduce the testing burden on a low-complexity device.
    - RI reporting test is only applicable for 2Rx UE and 2 layers which is still subject to the reported UE capability.
    - Performance gain with following RI is limited according to the exiting RI requirements, and in some cases, the negative performance gain can be observed
* Discussion:
  + Moderator suggestion: Another candidate compromise: Replacing fading CQI test (high SNR point) by RI test case
  + QC: RI reporting is mandatory feature, It’s important to verify UE performance. We can comprise to option 1a.
  + Nokia: We think option 1a as compromise considering both test coverage and test effort.
  + Huawei: We still think supporting option 2 considering test effort.
  + MTK: We can compromise to option 1a.
  + Apple: We don’t think RI reporting is important for Redcap UE. We can compromise to the suggestion from moderator.
* Agreement: Replace fading CQI test for 2 Rx UE (high SNR point) by RI test case (Test 2)

**Conclusions after 1st round**

**WF/LS**

**R4-2214394 WF on RedCap UE demodulation and CQI reporting requirements**

*Type: other For: Approval  
 Source: Ericsson*

**Decision: Return to.**

**Conclusions after 2nd round**

### 9.21 Enhanced IIoT and URLLC support

#### 9.21.4 Moderator summary and conclusions

**[104-e][329] NR\_IIOT\_URLLC\_enh\_Demod, AI 9.21.3 – Axel Muller**

**R4-2214189 Email Discussion Summary for [104-e][329] NR\_IIOT\_URLLC\_enh\_Demod**

*Type: other For: Information  
 Source: Moderator (Nokia)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Revise to R4-2214318**

**R4-2214318 Email Discussion Summary for [104-e][329] NR\_IIOT\_URLLC\_enh\_Demod**

*Type: other For: Information  
 Source: Moderator (Nokia)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Return to.**

**GTW minutes on August 16th**

**List of open issues:**

* Issue 1-1-1: Introduction of sub-slot PUCCH repetition requirements
* Issue 1-2-1: PUCCH format
* Issue 1-2-8: PUCCH repetitions across “14-symbol slot” boundaries
* Issue 1-2-9: Symbol level PUCCH resource configuration [Number of PUCCH symbols per sub-slot]
* Issue 1-2-6: Number of UCI information bits
* Issue 1-2-4: SCS/CBW

**Issue 1-1-1: Introduction of sub-slot PUCCH repetition requirements**

* Options
  + Option 1 (Ericsson, Samsung): Define new requirement for sub-slot PUCCH repetition HARQ-ACK.
  + Option 2 (Nokia): RAN4 to define PUCCH demodulation performance requirements for PF0, with sub slot repetition and inter sub-slot hopping, but condition introduction in the specification on the availability of at least 2 simulation inputs.
  + Option 3 (Huawei): Introduce PF0 performance requirements with sub slot repetition.
  + Option 4 (Moderator): Introduce performance requirements with sub slot repetition.
* Agreement: option 3 agreed

**Issue 1-2-8: PUCCH repetitions across “14-symbol slot” boundaries**

* Options
  + Option 1 (Ericsson, Samsung, Huawei): No.
  + Option 2 (Nokia): Yes.
* Discussion
  + Samsung: We think within 1slot configuration already serve test purpose, no need to consider multi-slots configuration.
  + Huawei: We share similar view as Samsung. We shall focus on to verify the repetition performance with 2 repetitions.
  + Ericsson: We share similar view as Huawei and Samsung.
  + Nokia: The test configuration across slot boundaries may bring performance degradation and can be considered to ensure test coverage.
  + Samsung: More repetitions can improve the performance, meanwhile PUCCH should not the bottleneck for uplink; in previous test case for multi-slot PUCCH, also consider 2 slots.
  + Huawei: We share similar as Samsung.
  + Nokia: We are ok to compromise to option 1.
* Agreement: option 1 agreed

**Issue 1-2-9: Symbol level PUCCH resource configuration [Number of PUCCH symbols per sub-slot]**

* Options
  + Option 1 (Ericsson, Samsung): Samsung/Ericsson is correct with inter-(sub)slot
    - Symbols per sub-slot / PUCCH length = 2  
      Sub-slot repetitions (nrofSlots) = 2  
      Sub-slot length (subslotLengthForPUCCH-r16) = 7  
      First symbol of PUCCH (startingSymbolIndex) = 5
  + Option 2 (Nokia):
    - Symbols per sub-slot / PUCCH length = 2  
      Sub-slot repetitions (nrofSlots) = 4  
      Sub-slot length (subslotLengthForPUCCH-r16) = 7  
      First symbol of PUCCH (startingSymbolIndex) = 5
  + Option 3 (Huawei):
    - Symbols per sub-slot / PUCCH length = 2  
      Sub-slot repetitions (nrofSlots) = 2  
      Sub-slot length (subslotLengthForPUCCH-r16) = 2  
      First symbol of PUCCH (startingSymbolIndex) = 12
* Agreement: option 1 agreed

**Issue 1-2-6: Number of UCI information bits**

* Options
  + Option 1 (Ericsson, Huawei): 1 bit.
  + Option 2 (Nokia): 2 bits.
* Agreement: option 1 agreed

**Issue 1-2-4: SCS/CBW**

* Options:
  + Option 1 (Ericsson): 15kHz/5MHz and 30kHz/10MHz.
  + Option 2 (Huawei): 30kHz/20MHz.
* Discussion
  + Huawei: For Rel-15 PUCCH multi-slot, only 30kHz SCS considered. We propose 30kHz as typical configuration to reduce simulation work. For CHBW, either option fine with 1 RB allocation.
  + Samsung: we prefer typical values for different SCSs, but also ok considering minimum CHBW.
  + Ericsson: We proposed minimum CHBW. But also, fine only consider 30kHz.
  + Nokia: We have similar view as Samsung/Ericsson to use minimum CHBW.
* Agreement:
  + 30kHz/10MHz

**Conclusions after 1st round**

**WF/LS**

**R4-2214396 WF on enhanced IIoT and URLLC support demodulation and CSI requirements**

*Type: other For: Approval  
 Source: Nokia*

**Decision: Return to.**

**Conclusions after 2nd round**

### 9.24 Additional enhancements for NB-IoT and LTE-MTC

#### 9.24.7 Moderator summary and conclusions

**[104-e][330] NB-IOT\_MTC\_Demod, AI 9.24.6– Tricia Li**

**R4-2214190 Email Discussion Summary for [104-e][330] NB-IOT\_MTC\_Demod**

*Type: other For: Information  
 Source: Moderator (Huawei)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Revise to R4-2214319**

**R4-2214319 Email Discussion Summary for [104-e][330] NB-IOT\_MTC\_Demod**

*Type: other For: Information  
 Source: Moderator (Huawei)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Return to.**

**Conclusions after 1st round**

**WF/LS**

**R4-2214361 Way forward for performance requirements of Rel-17 NB-IOT and eMTC**

*Type: other For: Approval  
 Source: Huawei*

**Decision: Return to.**

**Conclusions after 2nd round**

## 10 Rel-18 spectrum related WIs for NR

## 11 Rel-18 non-spectrum related work items and study items for NR

### 11.4 Study on NR BS RF requirement evolution

#### 11.4.3 Moderator summary and conclusions

**[104-e][314] FS\_NR\_BS\_RF\_evo, AI 11.4- Liehai Liu**

**R4-2214174 Email Discussion Summary for [104-e][314] FS\_NR\_BS\_RF\_evo**

*Type: other For: Information  
 Source: Moderator (Huawei)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Revise to R4-2214303**

**R4-2214303 Email Discussion Summary for [104-e][314] FS\_NR\_BS\_RF\_evo**

*Type: other For: Information  
 Source: Moderator (Huawei)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Return to.**

**Conclusions after 1st round**

**WF/LS**

**R4-2214375 WF on investigation of mmWave multi-band BS**

*Type: other For: Approval  
 Source: Huawei*

**GTW discussion on August 23th**

**Definition of FR2 multi-band BS**

* **GTW discussion:**
* ZTE: We have comment on 4), do we need to consider sub-band B and full band A?
* Huawei: The intention to cover both.
* Nokia: For 4), 5), 6) what’s the difference for the treatment between FR1 and FR2?
* Huawei : Further study required for these aspects.
* Ericsson: We are ok to further study these items.
* Ericsson: In particular, whether FR2 multi-band definition is different compared to FR1.
* QC: We can focus on whether FR1 definition applicable for FR2.
* Huawei: In TR, we have definition for multi-band BS. In the specification we have definition of multi-band RIB.
* Nokia: In RAN4 discussion history, from conformance test and requirements aspect, no need to specify multi-band BS into specification since the test and requirements are specified by RIB.
* **Agreement:**
* To investigate if the FR1 definition of multi-band RIB can be re-used for FR2
* To revisit the definition of multi-band BS for FR2, and clarify whether the following scenarios should be considered as multi-band BS

1. Multi-band transmitter and/or receiver with common active RF components
2. Single-band transmitter and receiver
3. Configurable BS for different bands with the same hardware
4. BS covers full-band or sub-band of band A and band B
5. BS covers consecutive spectrums with different band number, for example, n258+n261
6. BS covers overlapping spectrums with different band number, for example, n258+n257

* FFS whether need to introduce the definition of multi-band BS for FR2 into specification

**Feasibility of FR2 multi-band BS**

* **GTW discussion:**
* Ericsson: The difficulty shall be multi-band RIB.
* Huawei: We don’t have definition for multi-band RIB for FR2, should be multi-band radio.
* Nokia: Multi-band BS aligned with SID. Whether need to include definition into specification is another issue.
* ZTE: I guess companies have same understanding, propose to multi-band BS supporting wideband radio.
* Ericsson: We are not considering the case to support separate bands with different hardware in the same box. We are considering multi-band with shared hardware.
* Ericsson: For third main bullet, we would like to have the decision on the possible supporting large bandwidth based on feasibility study.
* ZTE: We support the proposal to check the possibility supporting band combinations especially for 28 GHz around and 40GHz around band combinations.
* Nokia: This is already captured into SID. 26+28GHz missing in the list which also included in SID.
* Huawei: We share similar view as Nokia. Band combinations already included in the SID, it’s premature to down-selection. Feasible bandwidth just one of the aspects need to be considered for the feasibility study; we shall not conclude only based on this aspect.
* Ericsson: Band combinations list can be removed from the proposal. We would like to check the feasibility on wide bandwidth then we can focus on possible combinations.
* ZTE: We share similar view as Ericsson. We believe expect 28+26GHz combos, others quite difficulty.
* **Agreement:**
* The following technical challenges need to be studied for FR2 multi-band BS
  + RF front-end
  + Antenna array
  + Phase shifters
  + Beamforming architectures
  + Others are not excluded
* The following topics should be considered for investigation of FR2 multi-band BS:

1. Additional declarations for FR2 multi-band BS
2. The applicability of multi-band requirements
3. OTA transmitter OFF power
4. OTA Adjacent Channel Leakage Power Ratio (ACLR)
5. OTA operating band unwanted emissions
6. OTA transmitter spurious emissions
7. OTA adjacent channel selectivity
8. OTA in-band blocking
9. OTA out-of-band blocking
10. OTA receiver spurious emissions
11. OTA receiver intermodulation
12. OTA EVM
13. EIRP accuracy

* The largest feasible bandwidth for an FR2 multi-band BS should be studied and decided in the SI

**Decision: Return to.**

**Conclusions after 2nd round**

### 11.5 Study on NR FR2 OTA testing enhancements

#### 11.5.4 Moderator summary and conclusions

**[104-e][334] FS\_NR\_FR2\_OTA\_enh, AI 11.5, Bin Han**

**R4-2214194 Email Discussion Summary for [104-e][334] FS\_NR\_FR2\_OTA\_enh**

*Type: other For: Information  
 Source: Moderator (Qualcomm)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Revise to R4-2214323**

**R4-2214323 Email Discussion Summary for [104-e][334] FS\_NR\_FR2\_OTA\_enh**

*Type: other For: Information  
 Source: Moderator (Qualcomm)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Return to.**

**Conclusions after 1st round**

**WF/LS**

**R4-2214357 WF on NR FR2 OTA testing enhancements**

*Type: other For: Approval  
 Source: Qualcomm*

**GTW discussion on August 23**

**Issue 1-1: Work plan**

* GTW Discussion:
  + Moderator: Whether to include the full degree of rotation freedom with 2AoA need to be studied.
  + Keysight: We are fine to further study this aspect but we think this will delay the test system and increase test cost.
  + R&S: We share similar view as Keysight, in the past we have some study and dropped that due to feasibility and cost.
  + vivo: We understand the technical difficulty and suggest to further study this aspect with current proposed work plan given this is first meeting.
  + Samsung: We agree the proposed workplan from QC which aligned with current SID. It’s no harm to study the feasibility before we have concrete RF core requirements.
  + QC: We share similar view with vivo and Samsung; we shall not preclude the study.
  + Huawei: We are fine to further investigate the feasibility meanwhile we share similar concern as R&S and Keysight.
  + Apple: How long this will be taken for test session to conclude the feasibility?
  + QC: We planned to have 2 meetings for the study to conclude based on the proposed work plan.
  + Keysight: Based on the initial analysis, it seems not possible to support full degree of rotation freedom with 2AoA and can be concluded quickly for the feasibility.
  + Apple: Any plan to document the conclusion with the consideration of constraints?
  + QC: We have a new TR which capture the conclusion, WF also can be considered.
  + Samsung: We saw some possibility of supporting full degree freedom.
  + CAICT: We share similar concern as Keysight but ok to further study.
  + Anritsu: We share similar view as Keysight.
* Agreement: Endorse the latest draft work plan
  + RAN4 aims to further discuss and document the feasibility of supporting the full degree of rotation freedom with 2AoA and check the status by RAN4 #106 meeting.

**Issue 1-2: Extend the scoping to also consider multi-panel transmission**

* GTW Discussion:
  + Apple: We don’t think this is in the scope of current SID. Prefer option 2.
  + Samsung: We share similar view as Apple and prefer option 2.
  + Huawei: The scope endorsed in RAN-P was based on long discussion and we should the respect the endorsed SID and prefer option 2.
  + vivo: We agree it’s out of current SID. But we prefer to consider Multi-Tx for future proof; also multi-Tx is in Rel-18 MIMO WI.
  + QC: We agree with vivo. We think it’s helpful to extend the SID.
* Agreement: No consensus in RAN4 for the extending the scope to include the multi-Tx from testability point. Whether this can be included subject to further guidance from RAN-P if any.

**Issue 1-3: Dependence between core requirements and test method**

* GTW Discussion:
  + Samsung: We are fine with the recommended WF in 2nd round discussion other than option 1.
  + Keysight: We provide some suggestion and recommended WF is fine with us.
* Agreement:
  + Study the test method considering both the test system capability as well as the core requirement definition. Study on detailed test methods enhancement ensuring a close connection between progress in requirements

**Issue 1-3: Skeleton for TR 38.871**

* GTW Discussion:
  + Moderator: Update the title as “Multi Rx chain”
  + Keysight: There is preliminary agreement from RF session for core requirement; shall we wait for final decision in RF session?
  + Apple: We think it’s ok to wait for final RF session, the table content not correct.
  + Samsung: Multi Rx panels is not correct wording which not aligned with the agreed requirements WID.
  + Keysight: If Multi Rx panel not suitable, then SID also need to be considered for the update.
* Agreement: Proceed the skeleton with [ ] on title and/or editor note to clarify the title maybe updated in future.

**Issue 2-1-1: Quiet zone size and validation procedure**

* GTW Discussion:
  + Samsung: in TR 38.810, 15 cm also included, why we don’t consider here?
  + Keysight: 15 cm not suitable for devices and replace by 20cm.
  + Apple: Why multi-Tx included here?
  + vivo: We agree with Keysight to remove 15cm. We shall discuss based on latest progress from test aspect in RAN4.
* Agreement:
  + Study the quiet zone size, MU definition and validation procedure for multi-Rx. The same list of QZ sizes defined so far (i.e., 20cm, 30cm, 40cm, and 55cm) is starting point and 30cm QZ is with high priority.

**Issue 3-1: MU impacts for Multi-Rx test system**

* GTW Discussion:
  + Keysight: We already have some methodology for MU assessment.
  + Apple: Does the related to manufacture declaration?
  + vivo: The positioner blocking discussion was from MIMO OTA.
* Agreement:
  + RAN4 to study the impact of positioner blocking on MU element of Quality of Quiet Zone

**Decision: Return to.**

**Conclusions after 2nd round**

### 11.13 Study on evolution of NR duplex operation

#### 11.13.4 Moderator summary and conclusions

**[104-e][315] FS\_NR\_duplex\_evo, AI 11.13, Yankun Li**

**R4-2214175 Email Discussion Summary for [104-e][315] FS\_NR\_duplex\_evo**

*Type: other For: Information  
 Source: Moderator (Samsung)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Revise to R4-2214304**

**R4-2214304 Email Discussion Summary for [104-e][315] FS\_NR\_duplex\_evo**

*Type: other For: Information  
 Source: Moderator (Samsung)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Return to.**

**Conclusions after 1st round**

**WF/LS**

**R4-2214376 Reply LS on interference modelling for duplex evolution**

*Type: LS out For: Approval*

*To: RAN1  
 Source: Samsung*

**Decision: Return to.**

**R4-2214377 WF on feasibility study from RF perspective**

*Type: other For: Approval  
 Source: Samsung*

**GTW discussion on August 23th**

Topic 1: RAN4 feasibility study and RF requirement impact for SBFD operation

* 1. **From gNB perspective**
* GTW discussion:
  + Nokia: We should first focus on the feasibility first. The RF requirements shall be based on the conclusion of feasibility study.
  + ZTE: We are fine to remove the feasibility. The feasibility study also related to RF requirements, we need to consider what’s the basis we can consider and check the feasibility any possibility for performance/requirements improvement.
  + QC: We agreed the feasibility shall be part of RAN4 work meanwhile RF requirements impact.
* Agreement:
  + Proposal 1 and proposal 2 agreed.
  + Open issues will be further discussed in RAN4 for feasibility and RF requirement impact
  1. **From UE perspective**
* GTW discussion:
  + Ericsson: We still need to check UE requirement impact during SI. Our preference is not impact UE requirements.
  + Apple: I agree with Ericsson. We supposed not to impact legacy/existing UE requirements. “Using existing UE RF requirements to estimate UE performance and if needed extrapolating them for system level studies”
  + ZTE: I tend with Ericsson and Apple, in this SI, UE not expected to be impact.
  + QC: We also have same understanding as Apple this SI shall not have any impact on the existing UE RF requirements. And agreed with Apple suggestion.
  + Apple: Once RAN1 received RAN4 response for interference modelling, then RAN1 proceed the work.
  + Samsung: We have same understanding as Apple, legacy UE shall not be impacted.
  + Intel: We have similar view as Apple.
* Agreement:
* Using existing UE RF requirements to estimate UE performance and if needed extrapolating them for system level studies
  1. **Criteria on gNB UL receiver sensitivity degradation due to self-interference**
* GTW discussion:
  + Ericsson: We would like to check 1dB and other values below 1dB for co-existence study and further check feasibility.
  + Nokia: We prefer to check another value besides 1dB and further check the feasibility.
  + ZTE: 1dB is not the arbitrary value, refer to blocking and ACS requirements 6dB considered and 1dB already quite low with 6dB lower than noise floor which seems reasonable and feasible value.
  + Samsung: We agreed with ZTE. 1 dB degradation criteria already widely used in the past RAN4 discussion with 6dB lower than noise floor. We are not precluding other values if feasible.
  + CMCC: We support proposal 1, in our commercial NW 1dB degradation was used. We can take 1dB as starting point.
  + Huawei: Based on our initial evaluation, we believe 1dB is reasonable assumption. 0.1dB is too aggressive.
  + QC: We support proposal 1.
  + Intel: We think 1dB be the typical and reasonable value, 0.1 dB too aggressive.
  + Samsung: Does Ericsson proposed to response to RAN1 by the assumption 0.1 dB ?
  + CMCC: We hold spectrum on Band 39/41, we use 0.8 dB to evaluate emission for the co-existence.
  + Nokia: The value refers to criteria for performance evaluation. We propose to also consider other values for system evaluation.
  + China Telecom: We support the original proposal to consider 1dB. With 1dB degradation on sensitivity, no big impact on NW. We want to clarify the feasibility meaning here.
  + Ericsson: We can further check on the feasibility. We are not sure 0.1 dB feasibility.
* Agreement:
  + Taking 1dB sensitivity degradation due to self-interference of DL transmission as starting point for system level evaluation and feasibility study
    - * Other values lower than 1dB e.g. 0.1dB/0.8dB not precluded pending on the feasibility study
      * Final values used in co-existence evaluation shall be aligned with feasibility analysis conclusion.

Topic 3: co-channel inter-subband gNB-gNB CLI modelling according to RAN1 LS

**How to model co-site gNB-gNB CLI modelling**

* GTW Discussion:
  + Nokia: We think digital IC not feasible for this case.
  + CATT: Blocking issue shall already be analysed. Analog IC also maybe not feasible.
  + Samsung: Co-site case, we think they belongs to same operator. It’s still possible for digital IC.
* Agreement: Proposal 2 agreed.

**How to model inter-site gNB-gNB CLI modelling**

* GTW discussion:
  + ZTE: Sub-band filtering still be one of possible way for consideration.
  + Nokia: Analog filtering or digital filtering, ZTE refereed?
  + Samsung: What’s the candidate requirements considering sub-band filtering?
  + Huawei: Do we want to down-select for the receiver candidate requirements? We think ACS can be selected.
  + ZTE: It should be analogy filtering and digital filtering also can be considered and subject to implementation.
  + Intel: We think the proposal reasonable as baseline assumption and the possible implementation options to improve the performance can be considered further.
  + QC: We can consider the existing requirements as baseline.
  + Apple: We are discussing the co-channel case. Do we plan to treat the sub-band as channel bandwidth? We have separate discussion on UE and BS side.
  + Ericsson: ACLR and ACS can be considered as baseline. Further discuss the possibility to improve the performance considering the feasible implementation.
  + Nokia: We can have separate assumption in BS and UE side.
  + ZTE: We can have separate assumption in BS and UE side, in BS side, sub-band digital filtering can be used.
* Agreement:
  + Proposal: Same Transmitter leakage and receiver impairment model as used for investigating gNB self-interference, but antenna isolation is replaced with inter-site isolation.
    - TX leakage candidate: gNB ACLR
    - Receiver impairment candidate: gNB ACS
    - RAN4 will further study the possibility of improved performance/requirements compared to existing refereed requirements list above.

**Decision: Return to.**

**R4-2214378 WF on adjacent channel co-existence study**

*Type: other For: Approval  
 Source: Samsung*

**Decision: Return to.**

**R4-2214379 WF on Simulation assumption for adjacent co-existence study**

*Type: other For: Approval  
 Source: CMCC*

**Decision: Return to.**

**Conclusions after 2nd round**

## 12 Rel-18 Work Items for LTE

### 12.4 New bands and BW allocation for 5G terrestrial broadcast - part 2

#### 12.4.5 Moderator summary and conclusions

**[104-e][316] LTE\_terr\_bcast\_bands\_BSRF, AI 12.4.4, Susanne Rath**

**R4-2214176 Email Discussion Summary for [104-e][316] LTE\_terr\_bcast\_bands\_BSRF**  *Type: other For: Information  
 Source: Moderator (EBU)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Revised to R4-2214305**

**R4-2214305 Email Discussion Summary for [104-e][316] LTE\_terr\_bcast\_bands\_BSRF**  *Type: other For: Information  
 Source: Moderator (EBU)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Return to.**

**Conclusions after 1st round**

**R4-2214383 WF on Coexisting studies between IMT service around DTT spectrum**

*Type: other For: Approval  
 Source: ZTE*

**Decision: Return to.**

**R4-2214384 WF on List of expected changes to TR 36.104 due to introduction of LTE based 5G terrestrial broadcast band(s)**

*Type: other For: Approval  
 Source: Nokia*

**Decision: Return to.**

**R4-2214385 WF on Reuse of existing regulatory agreements**

*Type: other For: Approval  
 Source: Huawei*

**Decision: Return to.**

**Conclusions after 2nd round**

### 12.5 NB-IoT/eMTC core & perf. requirements for NTN

#### 12.5.6 Moderator summary and conclusions

**[104-e][317] IoT\_NTN\_Co-existence\_SANRF, AI 12.5.2, 12.5.3, Fei Xue**

**R4-2214177 Email Discussion Summary for [104-e][317] IoT\_NTN\_Co-existence\_SANRF**

*Type: other For: Information  
 Source: Moderator (ZTE)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Revise to R4-2214306**

**R4-2214306 Email Discussion Summary for [104-e][317] IoT\_NTN\_Co-existence\_SANRF**

*Type: other For: Information  
 Source: Moderator (ZTE)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Return to.**

**Conclusions after 1st round**

**WF/LS**

**R4-2214380 WF on system parameter for IoT over NTN**

*Type: other For: Approval  
 Source: Ericsson*

**Discussion on August 24th**

**Issue 1-1: Operating bands and band numbering**

* Agreement:
  + Option 1:

**Issue 1-2-1: Channel bandwidth and spectral utilization for eMTC over NTN**

* Agreements:
  + Option 2: For Cat-M1, define only 1.4MHz UE channel bandwidth, with corresponding transmission bandwidth configuration and minimum guardband as defined in 36.101. See no value of a different approach for SAN

**Issue 1-2-2: Channel bandwidth and spectral utilization for IoT over NTN**

* Agreements:
  + Option 2: For NB-IoT, re-use existing requirements from 36.101 for UE channel bandwidth, transmission bandwidth configurations for 15kHz and 3.75kHz SCS, and minimum guardband.

**Issue 1-3: Channel spacing**

* Discussion:
* Huawei: We don’t have co-existence with GSM with IoT over NTN. We are not sure whether 100kHz guard band can be removed for standalone NB-IoT. We may need to consider the co-existence scenario and ACLR/ACS definition.
* ZTE: For MTC part seems ok, for NB-IoT we need more discussion on the 100kHz guard band on standalone mode.
* Ligado: 100kHz gap only required for lowest and highest carrier in current specification.
* Ericsson: Regardless the 100kHz gap, 200kHz channel spacing still valid. We can further discuss the co-existence issue in another WF.
* Huawei: The figure referred by Ligdao is CA case. 100kHz gap required for different operators in adjacent channel.
* MTK: From UE specification, 200kHz is channel spacing. Which is same in 36.104. F\_offset is another issue we can discuss further.
* CMCC: We use 100kHz gap for NB-IoT deployment in NW between NB-IoT carriers.
* ZTE: Same comment as CMCC.
* Huawei: We need to further discuss frequency gap/frequency offset.
* Agreement:
* Reuse TN specification 36.101/36.104 norminal channel spacing for Cat-M1 and NB-IoT
  + Further discuss the frequency gap for NB-IoT over NTN deployment
* Removal of in-band/guard band item.

**Issue 1-4-1: Channel raster and EARFCN**

*Further discuss the 100khz and 200khz channel raster in 2nd round.*

* Option 1: *200khz channel raster*
* Option 2: *100khz raster with signaling*
* Discussion:
* Huawei: We need to be aligned with WID. 200kHz can avoid ambiguity due to frequency offset and minimize the initial search time. In WID, 200kHz is recommended as default and only 200kHz not feasible from RAN4 groups and then 100kHz can be used.
* Ericsson: 200kHz raster together frequency gap equals 300Hz gap. We are flexible option 1 and option 2 pending on operators’ feedback.
* Ligado: As operator who hold real deployment, we prefer option 2 for L band 255.
* QC: We need to respect the feedback from operators. Collect operators’ feedback preferred.
* MTK: RAN4 shall take responsibility to make decision. Operator’s feedback on specific band appreciated.
* ZTE: Both options valid, both options have cons and pros.
* Sateliot: We prefer option 2 for saving spectrum efficiency on both L and S bands.
* Huawei: We also agreed operators’ demand shall be respect. But we also need to respect the WID. We disagree with the observations from Ericsson.
* MTK: RAN4 can make decisions on the selection of channel raster per band.
* Hughues: We prefer option 2 as operator.
* Thales/Ligado: In future if we need to consider NB-IoT over NTN over NTN guard-band, then option 2 provides more flexibility.
* Agreement: option 2 agreed for band 255 and band 256.

**Decision: Return to.**

**R4-2214381 WF on coexistence study for IoT over NTN**

*Type: other For: Approval  
 Source: MTK*

**GTW discussion on August 24th**

**Proposal: It is suggested by companies that NB-IoT results could be used to assume coexistence for cat-M1**

* **Discussion:**
* Ericsson: This is pending on ACIR modelling whether 3 step or flat model assumed. If 3 steps considered, the BW different between NB-IOT and cat-M1.
* QC: Even using 3 step approaching, NB-IoT still be the worse case.
* ZTE: We agree with QC.
* Ericsson: Can we agree using flat ACIR model first?
* QC: Our preference is 3 step which is typical used in RAN4 study.
* MTK: We can first focus on NB-IoT first.
* ZTE: the current ACIR model is flat model instead of 3 step approach.
* **Agreement:** FFS whether the co-existence for cat-M1 need to be evaluated pending on the assumption ACIR modelling; if flat ACIR model adopted, then NB-IoT results could be used to assume coexistence for cat-M1

**Which performance metrics. In this document, we capture a proposal (SINR impact for NB-IoT victim, and throughput loss for NR victim).**

* **Discussion:**
* Ericsson: NR victim with 20MHz CHBW, we are fine with flat model with throughout loss as metric.
* MTK: We didn’t observe any issue with throughput loss as metric.
* QC/ZTE: We support the proposal which is tradition way we did.
* **Agreement:** Adopt the performance metric as following:
* SINR impact for NB-IoT victim, and throughput loss for NR victim pending on ACLR modelling

**Decision: Return to.**

**R4-2214382 WF on SAN RF requirement for IoT over NTN**

*Type: other For: Approval  
 Source: ZTE*

**Decision: Return to.**

**Conclusions after 2nd round**

## 13 Liaison and output to other groups

## BACKUP

**R4-22ABABA Big CR for TS 3x.1xx (Rel-13)**

*Type: CR For: Agreement  
 38.1xx-0y v16.2.0 CR- rev Cat: F (Rel-1x)  
  
 Source: XXXX*

**Decision: Return to.**

**R4-22AAAAA Email discussion summary for [104-e][10x] x**

*Type: other For: Information  
 Source: Moderator (xxx)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**[104-e][10x] R17\_Maintenance, AI x.x.x – XX**

**Conclusions after 1st round**

**Conclusions after 2nd round**

**Decision: Return to.**

**R4-22ABABA WF on**

*Type: other For: Approval  
 Source: XXXX*

**Decision: Return to.**