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

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

**Third Generation Partnership Project (3GPP™)**

**DRAFT Meeting Report  
for  
TSG RAN WG4  
meeting: 104-e**

**Electronic Meeting, Online, 15/08/2022 to 26/08/2022**

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## 1 Opening of the E-meeting

## 2 Approval of the agenda

**R4-2211500 RAN4#103-e Meeting Report**

*Type: report For: Approval  
 Source: ETSI MCC*

**Decision: Approved.**

**R4-2211501 Agenda for RAN4#104-e**

*Type: agenda For: Approval  
 Source: RAN4 Chair (Huawei)*

**Decision: Approved.**

**R4-2211502 RAN4#104-e E-Meeting Arrangements and Guidelines**

*Type: other For: Approval  
 Source: RAN4 Chair (Huawei)*

**Decision: Approved.**

**R4-2214006 RAN4#103-e Meeting Report**

*Type: report For: Approval  
 Source: ETSI MCC*

(Replaces R4-2211500)

**Decision: Approved.**

## 3 Incoming LS and meeting report

### 3.2 Session chair notes

Main session email thread list

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Email title** | **WI** | **Topic areas** | **AI covered in the email thread** | **Moderator & Summary agenda** |
| [104-e][100] Main Session | N.A | N.A | N.A | Xizeng Dai AI 3.2 |
| [104-e][101] R15\_R16\_Maintenance | NR\_newRAT-Core | 4.1 NR UE RF requirements | 4.1 | Jinqiang Xing AI 4.8 |
| [104-e][102] R17\_Maintenance\_part1 | Closed Rel-17 spectrum and non-spectrum related WI | [May need update]: 5.1.1 introduction of operation in full unlicensed band 5925-7125MHz for NR 5.1.2 High power UE (power class 2) for NR FDD band 5.1.3 Adding channel bandwidth support to existing NR bands 5.1.4 BCS4 5.1.5 Increasing UE power high limit for CA and DC 5.1.6 Simultaneous Rx/Tx 5.1.7 Additional LTE bands for UE category M1/M2 and NB1/NB2 5.1.8 others | 5.1.1 5.1.2 5.1.3 5.1.4 5.1.5 5.1.6 5.1.7 5.1.8 | Dominique Evereare AI 5.3 |
| [104-e][103] R17\_Maintenance\_part2 | Closed Rel-17 spectrum and non-spectrum related WI | 5.2.1 UE RF for TxD 5.2.4.2 UE RF requirements (for other WIs) 5.2.4.5 Rel-17 TEI for specific UE RF topics | 5.2.1 5.2.4.2 5.2.4.5 | Peng Zhang AI 5.3 |
| [104-e][104] NR\_6 GHz\_licensed | NR\_6 GHz | 8.1 Introduction of 6GHz NR licensed bands | 8.1 | Liehai Liu AI 8.1.3 |
| [104-e][105] NR\_RF\_FR1\_enh\_maintenance | NR\_RF\_FR1\_enh-Core | 9.3.1 R17 RF requirements enhancement for NR frequency range 1 (FR1) | 9.3.1 | Ye Liu AI 9.3.3 |
| [104-e][106] NR\_RF\_FR2\_enh2\_Part\_1 | NR\_RF\_FR2\_req\_enh2 | 9.4.1 R17 NR RF requirement enhancements for frequency range 2 (FR2) | 9.4.1 | Petri Vasenkari AI 9.4.7 |
| [104-e][107] NR\_RF\_FR2\_enh2\_Part\_2 | NR\_RF\_FR2\_req\_enh2 | 9.4.2 UL gaps for self-calibration and monitoring 9.4.5 UL gaps RRM (part of papers in 9.4.5) 9.4.6.2 UL gap RRM perf | 9.4.2 9.4.5 9.4.6.2 | Yang Tang AI 9.4.7 |
| [104-e][108] NR\_RF\_FR2\_enh2\_Part\_3 | NR\_RF\_FR2\_req\_enh2 | 9.4.3 DC location 9.4.4 CA BW classes | 9.4.3 9.4.4 | Sanjun Feng AI 9.4.7 |
| [104-e][109] NRSL\_enh\_maintenance | NR\_SL\_enh-Core | 9.13.1 R17 NR SL enh UE RF maintenance 9.13.2 con-current and high power maintenance | 9.13.1 9.13.2 | Su Hwan Lim AI 9.13.5 |
| [104-e][110] NR\_ext\_to\_71GHz\_Part\_1 | Extending current NR operation to 71GHz | 9.14.1, 9.14.2, R17 up to 71GHz: general, band, system parameters 9.14.3.3 FR1+FR2-2 DC/CA | 9.14.1, 9.14.2 9.14.3.3 | Aida L Vera Lopez AI 9.14.9 |
| [104-e][111] NR\_ext\_to\_71GHz\_Part\_2 | Extending current NR operation to 71GHz | 9.14.3.1 Tx requirements for R17 up to 71GHz 9.14.3.2 Rx requirements for R17 up to 71GHz | 9.14.3,1 9.14.3.2 | Phil Coan AI 9.14.9 |
| [104-e][112] NR\_cov\_enh\_maintenance | NR\_cov\_enh-Core | 9.16.1 UE RF for R17 NR coverage enhancements | 9.16.1 | Shan Yang AI 9.16.3 |
| [104-e][114] NR\_RedCap | NR\_redcap-Core | 9.18.1, 9.18.2 R17 NR RedCap | 9.18.1 9.18.2 | Chunhui Zhang AI 9.18.6 |
| [104-e][115] NR\_Baskets\_Part\_1 | NR basket WIs: selected topics: | 10.1 Issues arising from basket WIs but not subject to block approval | 10.1 | Dominique Brunel AI 10.1.2 |
| [104-e][116] NR\_Baskets\_Part\_2 | MR-DC Basket WIs: DC\_R18\_1BLTE\_1BNR\_2DL2UL DC\_R18\_2BLTE\_1BNR\_3DL2UL DC\_R18\_xBLTE\_1BNR\_yDL2UL DC\_R18\_xBLTE\_2BNR\_yDL2UL DC\_R18\_xBLTE\_yBNR\_zDL2UL DC\_R18\_xBLTE\_yBNR\_zDL3UL | R18 MR-DC basket WIs 10.3~10.8 | AIs for basket WIs 10.3 10.4 10.5 10.6 10.7 10.8 | Iwo Angelow AI 10.2 |
| [104-e][117] NR\_Baskets\_Part\_3 | NR CA/DC Basket WIs: NR\_CA\_R18\_intra NR\_SUL\_combos\_R18-Core | R18 NR-CA/DC basket Wis 10.9, 10.13 | AIs for basket WIs 10.9 10.13 | Per Lindell AI 10.2 |
| [104-e][118] NR\_Baskets\_Part\_4 | NR CA/DC Basket WIs: NR\_CADC\_R18\_2BDL\_xBUL NR\_CADC\_R18\_3BDL\_xBUL NR\_CADC\_R18\_yBDL\_xBUL | R18 NR-CA/DC basket Wis 10.10, 10.11, 10.12 | AIs for basket WIs 10.10 10.11 10.12 | Johannes Hejselbaek  AI 10.2 |
| [104-e][119] LTE\_Baskets | LTE Basket WIs:  LTE\_CA\_R17\_2BDL\_1BUL | 12.1 LTE\_CA\_R18\_xBDL\_yBUL | Rel-17 basket WIs: 12.1 | Mohammad Abdi Abyaneh AI 12.1.4 |
| [104-e][120] NR\_LTE\_V2X\_PC5\_combos | NR\_LTE\_V2X\_PC5\_combos\_R18 | 10.14 Band combinations for Uu and V2X con-current operation | 10.14 | Qiuge Guo AI 10.14.3 |
| [104-e][121] LTE\_NR\_HPUE\_FWVM | LTE\_NR\_HPUE\_FWVM\_REL18 | 10.15 HPUE fixed-wireless/vehicle-mounted use cases | 10.15 | Man Hung Ng  AI 10.15.4 |
| [104-e][122] Railway\_HPUE\_n100-n101 | RAIL\_HPUE\_n100\_n101 | 10.16 CAB-radio - High Power UE support for band n100 and n101 for Rail Mobile Radio (RMR) in Europe | 10.16 | Ingo Wendler AI 10.16.3 |
| [104-e][123] LTE\_NR\_Other\_WI | DL\_intrpt\_combos\_TxSW\_R18 NR\_bands\_UL\_MIMO NB\_IOTenh4\_LTE\_eMTC6 | 10.17 Rel-18 downlink interruption for NR and EN-DC band combinations at dynamic Tx switching 10.18 Additional NR bands for UL-MIMO in Rel-18 9.24.1 UE RF R17 Additional enhancements for NB-IoT and LTE-MTC | 10.17 10.18 9.24.1 | Jin Wang AI 10.17.3 |
| [104-e][124] NR\_600MHz\_APT | NR\_600MHz\_APT | 10.19 APT 600 MHz NR band | 10.19 | Christian Bergljung AI 10.19.6 |
| [104-e][125] NR\_unlic\_enh | NR\_unlic\_enh | 10.20 Introduction of evolved shared spectrum bands | 10.20. | Daniel Poop AI 10.20.5 |
| [104-e][126] LTE\_intraBandCA\_n8 | LTE\_intra\_band\_CA\_n8 | 12.2 LTE intra-band contiguous CA for band 8 | 12.2 | Chunxia Guo AI 12.2.3 |
| [104-e][127] R18\_LTE\_TDD\_1.6GHz | LTE\_TDD\_1670\_1675MHz | 12.3 Introduction of LTE TDD band in 1670-1675 MHz | 12.3 | Ojas Choksi AI 12.3.4 |
| [104-e][128] LTE\_terr\_bcast\_bands\_UERF | LTE\_terr\_bcast\_bands\_part2 | 12.4 New bands and BW allocation for 5G terrestrial broadcast - part 2 | 12.4 12.4.1 12.4.2 12.4.3 | Gene Fong AI 12.4.5 |
| [104-e][129] FS\_NR\_eff\_BW\_util | FS\_NR\_eff\_BW\_util | 11.1 R18 SI irregular CBW | 11.1 | Esther Sienkiewicz AI 11.1.3 |
| [104-e][130] FS\_NR\_700800900 | FS\_NR\_700800900\_combo\_enh | 11.2 Study on enhancement for 700/800/900MHz band combinations for NR | 11.2 | Huiping Shan AI 11.2.4 |
| [104-e][131] FS\_SimBC | FS\_SimBC | 11.3 Study on simplification of band combination specification for NR and LTE | 11.3 | Zhifeng Ma AI 11.3.4 |
| [104-e][132] FR1\_enh2 | NR\_ENDC\_ RF\_FR1\_enh2 | 11.6 Further RF requirements enhancement for NR and EN-DC in FR1 | 11.6 | Ye Liu AI 11.6.5 |
| [104-e][133] FR2\_enh\_req\_Ph3 | NR\_RF\_FR2\_req\_Ph3 | 11.7 NR RF requirements enhancement for FR2, Phase 3 | 11.7 | Petri Vasenkari AI 11.7.4 |
| [104-e][134] FR2\_multiRx\_UERF | NR\_FR2\_multiRX\_DL | 11.8.1, 11.8.2 Requirement for NR FR2 multi-Rx chain DL reception | 11.8.1, 11.8.2 | Sumant Iyer AI 11.8.4 |
| [104-e][135] NonCol\_intraB | NonCol\_intraB\_ENDC\_NR\_CA | 11.11 Support of intra-band non-collocated EN-DC/NR-CA deployment | 11.11 | Suzuki Yasuki AI 11.11.3 |
| [104-e][136] NR\_ATG\_UERF | NR\_ATG | 11.12.1, 11.12.2, 11.12.3 (UE part ony) Air-to-ground network for NR | 11.12.1, 11.12.2, 11.12.3 | Zhe Shao AI 11.12.5 |
| [104-e][137] FS\_NR\_pos\_UERF | FS\_NR\_pos\_enh2 | 11.14 Study on expanded and improved NR positioning | 11.14 | Aida L Vera Lopez AI 11.14.4 |
| [104-e][138] NR\_MC\_enh | NR\_MC\_enh | 11.15 Multi-carrier enhancements for NR | 11.15 | Shan Yang AI 11.15.3 |
| [104-e][139] LTE\_NBeMTC\_NTN\_UERF | LTE\_NBIOT\_eMTC\_NTN\_req | 12.5.1 General 12.5.4 UE RF requirements | 12.5.1 12.5.4 | Tim Frost AI 12.5.6 |
| [104-e][140] NR\_reply\_LS\_UE\_RF |  | 13.1.2 UE power limitation for STxMP in FR2 (R1-2205639) 13.1.3 UE antenna gain for NR NTN coverage enhancement (R1-2205623) 13.3.1 FR2 requirement applicability over ETC 13.3.2 Lower humidity limit in normal temperature test environment (R5-221604) 13.3.3 Power control for NR-DC (R1-2205448) | 13 | Steven Chen AI 13.4 |
| [104-e][141] R17\_feature\_list | All Rel-17 WIs | 7 Rel-17 feature list | 7 | Xiaoran Zhang AI 7.2 |
| [104-e][142] R18\_HUPE\_basket\_WI | R18 HPUE basket | 14.1 Discussions on R18 high power UE basket work items | 14.1 | Xizeng Dai AI 14.1 |

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

### 4.8 Moderator summary and conclusions

**[104-e][101] R15\_R16\_Maintenance, AI 4.1 – Jingqiang Xing**

**R4-2214079 Email Discussion Summary for [104-e][101] R15\_R16\_Maintenance**

*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**

**Conclusions after 2nd round**

## 5 Rel-17 maintenance for LTE and NR

### 5.3 Moderator summary and conclusions

**[104-e][102] R17\_Maintenance\_part1, AI 5.1.1~5.1.8 – Dominique Evereare**

**R4-2214080 Email Discussion Summary for** **[104-e][102] R17\_Maintenance\_part1**

*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**

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**[104-e][103] R17\_Maintenance\_part2, AI 5.2.1, 5.2.4.2, 5.2.4.5 – Henry(Peng) Zhang**

**R4-2214081 Email Discussion Summary for [104-e][103] R17\_Maintenance\_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**

**Conclusions after 2nd round**

## 6 LS response to ITU

## 7 Rel-17 feature list

### 7.2 Moderator summary and conclusions

**[104-e][141] R17\_feature\_list, AI 7 – Xiaoran Zhang**

**R4-2214119 Email Discussion Summary for [104-e][141] R17\_feature\_list**

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

**Abstract:**

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

**Decision: Return to.**

**Conclusions after 1st round**

**Conclusions after 2nd round**

**GTW on**

## 8 Rel-17 spectrum related WIs for NR

### 8.1 Introduction of 6GHz NR licensed bands

#### 8.1.3 Moderator summary and conclusions

**[104-e][104] NR\_6 GHz\_licensed, AI 8.1 – Liehai Liu**

**R4-2214082 Email Discussion Summary for [104-e][104] NR\_6 GHz\_licensed**

*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

### 9.3 RF requirements enhancement for NR frequency range 1 (FR1)

#### 9.3.3 Moderator summary and conclusions

**[104-e][105] NR\_RF\_FR1\_enh\_maintenance, AI 9.3.1 – Leo(Ye) Liu**

**R4-2214083 Email Discussion Summary for [104-e][105] NR\_RF\_FR1\_enh\_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**

### 9.4 NR RF requirement enhancements for frequency range 2 (FR2)

#### 9.4.7 Moderator summary and conclusions

**[104-e][106] NR\_RF\_FR2\_enh2\_Part\_1, AI 9.4.1 – Petri Vasenkari**

**R4-2214084 Email Discussion Summary for** **[104-e][106] NR\_RF\_FR2\_enh2\_Part\_1**

*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**

**Conclusions after 2nd round**

**GTW on Aug-16**

**Sub-topic 2-1 PC3 requirement for FR2 inter-band UL CA**

**Issue 2-1-1: FR2 UL CA for PC3**

* Discussion
  + PC3 was lower prioritized due to possible power and thermal issues. Should PC3 be supported in Rel-17?

**Discussion:**

Oppo: Rel-17 WI was closed. How can we handle PC3 for FR2 in case that we have paper submitted?

NTT DOCOMO: PC3 is not excluded from Rel-17 WI. PC3 device is the high priority. We would like to discuss it in Rel-17 maitnenance.

Vivo: It is hard to reach consensus on any relaxation value before knowing the complexity.

Apple: it might be good to consider it in Rel-18.

Qualcomm: considering the work that has been done in Rel-17, the proponent chose the relaxed requirements, i.e., conservative values for requirements.

Huawei: we have similar views as Vivo and OPPO. If it was agreed as TEI, it can be further discussed. We need better understand what the requirements should be defined.

Samsung: why PC3 is de-prioritized is the controversial view on the total power concept. If companies can accept the total power concept, we are OK.

Sony: we have similar understanding as Samsung.

LGE: have similar view as Samsung. PC3 requires many meeting cycles. We prefer not to include PC3 in Rel-17. We need focus on Rel-18 from now.

Ericsson: we would like to recall 3dB relaxation. We should be carefully to specify very large relaxation considering the coverage is very constrain.

Qualcomm: not set the requirements but remove some section not to preclude power class 3.

Apple: how do we make sure the hand set UE do not support it?

Qualcomm: intra-band contiguous CA can be supported. If UE does not support it, UE can report capability.

Sony: Qualcomm proposal is a good compromise.

OPPO: what is the meaning to introduce the feature without requirements?

Qualcomm: that is a fair question. There is no requirement for such feature.

Huawei: we have concern on the proposal to have no requirements for a feature.

Samsung: share the similar view.

**Chair =>** further discuss if PC3 can be introduced in Rel-17 together with issue 2-1-2 ~ 2-1-5.

**Issue 2-1-2: ΔTIB relaxation factor (Observation 1)**

* Discussion
  + Is the relaxation breakdown proposed in observation 1 agreeable? Are all necessary factors included? Is there any alternative split of relaxation factors?

**Issue 2-1-3: Factor for thermal issue (Observation 4)**

* Discussion
  + Is the relaxation for thermal issue 3.5 dB agreeable?

**Issue 2-1-4: Total relaxation (Proposal 1)**

* Discussion
  + Is the total relaxation values (5.0/6.0dB for peak/spherical) in Proposal 1 agreeable?

**Issue 2-1-5: Intra-band contiguous case (Proposal 2)**

* Discussion
  + Is proposal 2 option1 ~~option 2~~ agreeable for intraband CA to avoid double-counting of relaxation? Is there any alternative?

**Sub-topic 2-2 Reply LS to RAN5 LS on ModifiedMPR-Behaviour clarification for different power classes**

**Issue 2-2: LS reply text**

* Discussion
  + Is each proposed answer agreeable?
* If not please provide your comment.

**Chair =>** Discuss the Nokia contribution in email thread [140].

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**[104-e][107] NR\_RF\_FR2\_enh2\_Part\_2, AI 9.4.2, 9.4.5, 9.4.6.2 – Yang Tang**

**R4-2214085 Email Discussion Summary for [104-e][107] NR\_RF\_FR2\_enh2\_Part\_2**

*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**

**GTW on Aug-16**

**Sub-topic 1-1: on step 3 test procedure**

Related agreement in RAN#103e

* *Agreement: Step 3 discussion is decoupled with UL gap.*
* *Agreement: When UL gap is not configured/activated and PHR is configured during the test, P bit in PHR shall be 1 during the UL gap test.*

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

* **R4-2213641(Sony, Ericsson)**
  + Proposal 1: step 3 of the proposed test procedure (of the WF in R4-2206604) shall be specified; the Ppeak\_EIRP shall be attained a duty cycle lower than [10]% or for a duty cycle lower than the capability maxUplinkDutyCycle-FR2. No P-MPR shall be applied for this case.
  + Proposal 2: It is proposed to revise the text in 38.101-2 as below:
  + For UE support UL gap, when UL gap for Tx power management is not configured and activated or the configured uplink duty cycle is lower than the maxUplinkDutyCycle-FR2 (or UL duty cycle = [10] % if UE does not report the maxUplinkDutyCycle-FR2), UE shall set the P bit in PHR to 1 in the test when PHR is configured.
* **Proposal:**
  + Option 1: revisit step 3 agreement in RAN4#103 to specify step 3 in UL gap related tests
    - If Yes to option 1, please provide your comments on R4-2213641
  + Option 2: keep the agreement in RAN4#103 unchanged
    - Option 2.1: discuss step 3 in this email thread independently from UL gap
      * If Yes to option 2.1, please provide your comments on R4-2211884
    - Option 2.2: stop step 3 related discussion in this email thread and seek for the guidance from chairman on how to proceed

**Discussions:**

OPPO: we did not expect the discussion in this meeting. In last meeting, step 3 is de-coupled from UL gap. Step 3 is out of scope of this WI. We should not proceed this discussion.

Vivo: we prefer Option 2.2. It is not reasonable to discuss this under FR2 WI.

Sony: For step3, it was decoupled but there was no agreement to stop discussion in this agenda. There is a lack of clarification of UE behavior here. We think it is meaningful test to be verified.

Ericsson: We agree with Sony. This is part of uplink power management. From network, it would be most useful to ensure UE behavior. It is useful for MPE is averaged. It is the general behavior to be tested. This is related to gap behavior. You can reuse the data for measurement. It is most useful addition to the UL gap.

Samsung: in general option 2.2 is aligned with the previous agreement. It is better to discuss the technique issue. Most companies may think step 3 is necessary. Step 3 is for all the UE or not? From Sony CR, it is for all the UEs. For UE who does not support UL gap, why do we need this? We do not see the necessity to introduce this.

Apple: Technically Ericsson is correct. When the reported duty cycle is lower than threshold, UE needs to report p=0. Why should it be limited to UE who supports the UL gap? All the FR2 UE is supposed to meet that requirement. Proposal 2 is not very consistent with the previous agreement.

Sony: Proposal 2 has nothing to do with step 3.

Apple: the content is covered by step 3. Do we think we have the requirements to require FR2 UE to follow Proposal 2? Do we need to repeat what we have in other session for UE to support UL gap?

Sony: Step 3 should be kind of test for all kinds of UE. We are still open to how to organize the specification.

Chair => Further discuss this issue under TEI agenda in future meeting with the understanding that TEI items should be closed within one quarter.

**Proposal after 1st discussions:**

* For UE support UL gap, when UL gap for Tx power management is not configured and de-activated ~~or~~ and the configured uplink duty cycle is ~~lower~~ higher than the maxUplinkDutyCycle-FR2 ~~(or UL duty cycle = [10] % if UE does not report the maxUplinkDutyCycle-FR2)~~, UE shall set the P bit in PHR to 1 in the test when PHR is configured.

**Discussions:**

Moderator: this is the step 3. We should understand whether we should discuss it under this agenda. Sony proposal requires to revisit the existing requirement. It is not completely to follow the agreement in the last meeting. The group needs to decide where and how to proceed the step 3.

OPPO: for proposal 2, the update is OK.

**Sub-topic 2-1: time period between UL gap and CSI report colliding and MAC CE for SCell activation**

Related agreements in RAN4#103e

* *The valid CSI report and/or valid L1-RSRP report during SCell activation procedure, where the valid CSI report is valid CQI with non-zero CQI index defined in clause 5.2.2.1, TS 38.214 and the valid L1-RSRP report is non lowest L1-RSRP defined in clause 10.1.6.*
  + *The UE need not apply UL gap prioritization rules specified above for SCell activation procedure if the time period between UL gap colliding with CSI report of non-zero CQI or L1-RSRP and the slot where the SCell activation MAC CE or CSI report activation command is received is less than [X ms].*
* **Proposals**
  + Remove the bracket and define X=10ms

**Agreement:**

* Remove the bracket and define X=10ms

**Sub-topic 2-2: Test on prioritized procedure over UL gap**

**Sub-topic description**

Open issues and candidate options before e-meeting:

* **Proposal 1: No need to define test cases for UL signal prioritization of RACH, CG-PUSCH, PUCCH for SR and LRR over UL gap.**
* **Proposal 2: If prioritization rule for valid CQI report during Scell activation procedure is to be tested, use FR2 intra-cell Scell activation test case as baseline, with additional specification of UL gap configuration offset fully overlapping with the periodic CQI report.**

**Discussion:**

Moderator: based on RAN1 design, all those are UE behaviour which is hard to be tested. We do not want to define the requirements. Let us focus on the prioritization rule for the test.

Samsung: For proposal 1 we can support. For proposal 2 we need more clarification. Is there any agreement that the prioritization should be tested? For the priotization rule, in RAN1 spec, there are many prioritization rules which there are no test cases for.

Apple: this is restrict for UE behaviour. We are open to discuss whether we need test such behaviour. We just want to make sure the test case is deterministic. We do not have agreement to test it.

Qualcomm: we can agree on proposal 1 first, because it is up to UE implementation. We provide our comments to Apple paper on how the test should be designed.

**Agreement:**

* No need to define test cases for UL signal prioritization of RACH, CG-PUSCH, PUCCH for SR and LRR over UL gap.
* Further discuss proposal 2.

**Sub-topic 2-3: On other prioritized procedure over UL gap**

**Sub-topic description**

Open issues and candidate options before e-meeting:

* **Proposal 1: Similar situation as RACH procedure, in order to finish some RRM procedures in which CSI report is involved in, CSI report can be prioritized over UL gap.**

**Discussions:**

Moderator: consider this as new proposal in the meeting. It is a bit late. Unless we identify some critical, we do not need to discuss. What procedure are you talking about?

ZTE: need further discussion via email

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**[104-e][108] NR\_RF\_FR2\_enh2\_Part\_3, AI 9.4.3, 9.4.4 – Sanjun Feng**

**R4-2214086 Email Discussion Summary for [104-e][108] NR\_RF\_FR2\_enh2\_Part\_3**

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

**Abstract:**

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

**Decision: Return to.**

**Conclusions after 1st round**

**Conclusions after 2nd round**

**GTW on Aug-16**

**Sub-topic 2-1 non-FBG5 issue**

**Issue 2-1-1: Introduce a new CA BW class V for aggregated BW 1200 MHz < BWChannel\_CA ≤ 1600 MHz with 4CCs in FBG#1. (ZTE R4-2213593)**

|  |  |  |  |
| --- | --- | --- | --- |
| NR CA bandwidth class | Aggregated channel bandwidth | Number of contiguous CC | Fallback group |
| A | BWChannel ≤ 400 MHz | 1 | 1,2,3,4 |
| B | 400 MHz < BWChannel\_CA ≤ 800 MHz | 2 | 1 |
| C | 800 MHz < BWChannel\_CA ≤ 1200 MHz | 3 |  |
| V | 1200 MHz < BWChannel\_CA ≤ 1600 MHz | 4 |  |

* **Proposals**
  + Option 1: Yes
  + Option 2: No.
  + Option 3: Others.
* **Recommended WF**
  + TBA

**Discussion:**

Ericsson: we propose not to introduce it from this point of time.

Verizon: we do not prefer to introduce the new bandwidth class.

Xiaomi: we prefer to introduce the new class, which was agreed in previous RAN4 meeting considering the backward compatibility.

Samsung: we agree with Ericsson and Verizon. We should introduce the new bandwidth class based on real demand.

Apple: In general, we do not object this new class according to demand from operators and vendors. It is better to introduce this in later release.

ZTE: We support to introduce 400MHz. We want to keep all the bandwidth class to have their own roadmap. This is the previous RAN4 agreement, like what Xiaomi commented.

Moderator: to Xiaomi, we check the previous document. We have agreement to introduce such 400MHz as the agreement. But with discussion continuing, companies have different understanding.

Huawei: have similar understanding as Xiaomi and ZTE. Keeping 400MHz is still valid.

Samsung: Could Xiaomi clarify the agreement? I did not see the agreement.

Xiaomi: captured in R4-2107859.

OPPO: in future, we can ask companies to update to clearly capture the agreement.

**Agreement:**

* Further discuss the bandwidth class V in the future release depending on the demand from operators.

**Issue 2-1-2: Remove R S T U for now and can be added back when there are industry needs**

* **Proposals**
  + Option 1: Yes
  + Option 2: No.
  + Option 3: Others.
* **Recommended WF**
  + [Option 1]

**Discussion:**

Xiaomi: we disagree with it. FBG2 we should keep them considering the backward compatibility. FBG5 also covers FBG3. Does it mean FBG3 is obsolete?

Huawei: It is not necessary to remove RSTU from now. The development of RSTU and FBG5 are not contradictive.

Ericsson: we would like to understand why there is backward computability issue for the bandwidth class which is not introduced yet. From deployment, R~U have been covered by R5~R8 and they are redundant. The other capability covers them. The FBG3 may be obsolete but UE still need to report to network that does not understand the new FBG. There is no need to introduce the class which has been covered by RAN2 signaling.

Verizon: we fully agree with Ericsson comment. We do not understand why we should discuss something does not exist.

ZTE: we disagree with removing RSTU. FBG2 is not obsolete. FBG2 has been introduced from Rel-15. If we think FBG5 can include all the requirements, how to handle CC with 400MHz? Should we define the new hybrid groups?

Samsung: we support moderator proposal. The background to introduce RSTU is that at that time we just discuss fallback group 1,2,3 but later we agree on fallback group 5 and then fall back group 2 is obsolete. In the future we are open to introduce this.

Qualcomm: It is good for proponent to come up with the concrete proposal where RSTU is useful. It would not be useful for legacy network. FBG5 can work. FBG5 is constructive and can support the future demand.

Ericsson: Agree with Qualcomm. It is beneficial to get clear clarification on the problem of backward compatibility.

Apple: FBG5 has issue on the signalling compatibility. It may need complicated feature set. RSTU can provide the advantage to indicate UE capability of number of 200MHz carriers.

Verizon: There is no legacy issue for this particular bandwidth class. The discussion here is mainly focusing on what we are going to deploy in the system. In the future, we have no clear view. At the current stage, we do not think these requirements are needed.

Xiaomi: have similar view as Apple. It seems FBG 5 covers FBG2. FBG5 have differences for legacy bandwidth class. RAN2 needs further check if UE report its support R12 with limited 1600MHz, the network cannot configure 8 carriers with 200MHz bandwidth.

Qualcomm: I do not believe FBG5 brings any new fall back rules.

Samsung: to Apple, FBG5, RSTU can be helpful for capability. We wonder if UE reports for FBG5 and FBG2 simulatenously.

Ericsson: FBG5 indeed follows the fall back rule. The introduction of new information is to reduce the signalling of capability.

Apple: I have different understanding. CA bandwidth class definition is mixed with configuration of network. UE does not know what the network configuration is when reporting capability. UE needs to indicate the different bandwidth class with different fall back group.

Moderator: in case that we cannot reach agreement, we can also keep them in the spec.

**Chair =>** Encourage experts to further discuss if there is fall-back issue. If there is no fall back issue, it is suggested to further discuss RSTU in the future release depending on the operator demands.

**Sub-topic 2-2 FBG5 related issue**

**Issue 2-2-1: How to enable the blue-but-not-red region in following figure?**

Chart, line chart

Description automatically generated

* **Proposals**
  + Option 1: Use additional FeatureSets
  + Option 2: Introduce MaxAggregatedBW only.
  + Option 3: Introduce MaxAggregatedBW and signal corresponding FBG2 class to indicate the number of individual CC that can support 200MHz. (Apple R4-2212344, Alt3)
* **Recommended WF**
  + TBA

**Discussion:**

Moderator: Most companies support to introduce the MaxAggregatedBW.

Huawei: We do not need to introduce this IE. For the next issue, whether it is per BC or per FS needs further discussion.

Qualcomm: we have example where the signaling can help. We have side by side comparison. This aggregated BW is the baseband capability. It has to be per FS.

Ericsson: The concern from UE vendors is that they can only support a certain aggregated bandwidth. To avoid the heavy signaling load, we introduce this to allow UE to report the maximum aggregated BW. Whether it is per band or per FS is up to RAN2. It could be beneficial to reduce the signaling by introduce this capability. That should be done for FBG5 at least. In the field, the issues were identified. Last time around, there is no fall-back issue for FBG5 but the signaling load is the concern. We can ask RAN2 what is possible. RAN2 can tell signaling design rather than RAN4.

Xiaomi: according to current fall-back rule, if UE report to support higher class, UE needs to support lower class. UE will report the highest bandwidth class. UE does not need to indicate all the lower order classes.

Verizon: we agree to introduce the new IE to avoid the signaling overload. That is useful.

Huawei: This capability has pre-condition. Baseband capability should be the same. Baseband is limited by this new IE. We only see the applicability for intra-band contiguous CA. We wonder how the new IE is applied for intra-band NC CA. To Ericsson, we can list the problem and options in LS to ask RAN2 opinion. RAN4 cannot conclude on the introduction of IE from now.

Qualcomm: We agree that RAN2 can decide the signaling. We agree with Huawei. This is limited to intra-band contiguous. It is applied to intra-band contiguous CA. To comment that the IE is not useful enough since it does not cover the situation where baseband capability is different, this comment would be true…. To Xiaomi, picture of blue is purely FBG5.

Apple: we support the new IE. Many companies have commented. In order to support 2400MHz deployment, it has used 12 CC. But there will be some limitation, that UE cannot support 12 by 200MHz. This number should be supported by R12, 11 and 10. Without it, UE need to indicate multiple feature sets, which is really complicated and even complicated for FR1+FR2. We see the merit of this IE.

Ericsson: Our position is IE should be applicable to FBG5. It may be difficult to introduce for other group.

Samsung: this issue should not totally reply on RAN2. RAN2 may not have RAN4 knowledge. RAN4 needs to have consensus on introduction of such signaling.

ZTE: The current RAN2 signaling design work when we introduce the new fallback group. We can see the potential reduction of signaling load. We cannot judge how much signaling load can be saved. We can leave the judgement to RAN2. They can decide how much we can save. Introduction of such signaling will break the rule of RAN2.

Qualcomm: We should first align on the view. We can add and delete to the framework in our LS proposal.

**Chair =>** Work on the LS provided by Qualcomm, and further discuss the Issue 2-2-1~2-2-4 together.

**Issue 2-2-2: If introduced, the new IE MaxAggregatedBW is applicable for all FBG or only FBG5?**

* **Proposals**
  + Option 1: FBG5 only.
  + Option 2: All FBG
  + Option 3: Others.
* **Recommended WF**
  + [Option 1]

**Issue 2-2-3: If introduced, the new IE is per-band or** **per-FS?**

* **Proposals**
  + Option 1: per-band (Apple R4-2212344, Alt2)
  + Option 2: per-FS. (Qualcomm R4-2212329)
  + Option 3: Others.
* **Recommended WF**
  + TBA

**Issue 2-2-4: If introduced, whether the new IE and FBG5 can be release independent from R15?**

* **Proposals**
  + Option 1: Yes
  + Option 2: No.
  + Option 3: Others.
* **Recommended WF**
  + TBA

**Sub-topic 1-1** **”Edge” Clarification**

**Issue 1-1-1: Whether and how to clarify which of the following definitions is intended for “edge” frequency of the edge component carriers?**

* **Proposals**
  + Option 1: Edge sub-carrier frequency
  + Option 2: Edge sub-carrier boundary frequency
  + Option 3: Not need to clarify
* **Recommended WF**
  + TBA

**Discussions:**

OPPO: in the previous LS to RAN2 the definition of DC location is clear. Lower edge is the lowest frequency of all the component CC. It should be option 2.

ZTE: I have different proposal. For this issue, the definition of upper and lower edge for mixed SCS. We can reuse the existing spec definition in section 5.3A.2. Regarding the necessity to send LS to RAN2, there seems no need.

Qualcomm: if we use the same on the both edges, it means calculation is based on the center. Does it really matter.

Apple: From our side, either option 1 or option 2 are OK. UE definition needs be aligned with network understanding. UE needs this definition to align the LO. If all the CCs have the same SCS, different definition makes no difference. If the SCS is different, we need clarify. The common understanding is needed. We slightly prefer Option 1.

Nokia: we also think either Option works. If we send LS to RAN2 or not depends on the definition of center is written in RAN2 or RAN4. If it was written in RAN4, we do not need to send LS to RAN2.

OPPO: when the SCS is the same, the option 1 = option 2. When SCS is mixed, option 2 gives the fixed location. We think option 2 is proper way.

Vivo: we support Nokia comment for LS. For options, we prefer option 1.

**Issue 1-1-2: Whether send an LS to RAN2 to clarify the definition of “edge” frequency of the edge component carriers for default UL DC location calculation?**

* **Proposals**
  + Option 1: Yes
  + Option 2: No.
* **Recommended WF**
  + TBA

**Chair =>** follow Nokia comment “If it was written in RAN4, we do not need to send LS to RAN2.”

**Sub-topic 1-2 Applicability**

**Issue 1-2-1: Discuss which feature variants which method for DC location signalling is applicable.**

* Proposals
  + Option 1: Tentative proposal from R4-2214039:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Feature/Reporting method | | R15 | R16 | R17 |
| Single CC |  | Yes | Yes | Yes |
| DL CA, single UL CC | UL DC on UL CC | Yes | Yes | Yes |
| UL DC on DL CC | No | No | Yes |
| Contiguous UL CA up to 2 UL CCs | Single LO on UL CC | Yes, but one DC per UL CC | Yes | Yes |
| Single LO outside UL CC | No | No | Yes |
| Dual LO on UL CC | Yes, one DC per UL CC | Yes | Yes |
| Dual LO on DL CC  (N/A in RAN4 specs) | Yes | No | Yes |
| Contiguous UL CA > 2 UL CCs | Single LO, all cases | Yes, one DC per UL CC | No | Yes |
| Non-contiguous UL CA | Single LO on UL CC | Yes, but one per CC | Yes | Yes |
| Single LO outside UL CC | No | No | Yes |
| Dual LO on UL CC | Yes, one per CC | No | Yes |
| Dual LO, at least one outside UL CC | No | No | Yes |

* + Option 2: Others
* **Recommended WF**
  + TBA

**Discussion:**

Qualcomm: we need update RAN4 spec. We need discuss whether we should apply the Rel-17 approach to all the cases?

**Issue 1-2-2: Whether change RAN4 specifications to allow exceptions for carrier leakage and IQ image only if UE declares support for an appropriate method for signalling the DC location?**

* **Proposals**
  + Option 1: Yes.
  + Option 2: No.
  + Option 3: Others
* **Recommended WF**
  + [Option 1]

**Discussion**:

Apple: before reaching agreement, we would like to clarify this exception is only for carrier without RB allocated or including carrier with RB allocated.

OPPO: for issue 1-2-2, does it mean carrier leakage and LO image allowed for UE when DC location is reported. If yes, we are fine.

Nokia: we have similar comment. There is an exception for mask for FR2 only. There is difference between FR1 and FR2. What exception does Qualcomm mention?

Qualcomm: Our intention is that we have such exception. There is unclear part for this exception. Our proposal is exception is applied where UE reports.

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

#### 9.7.5 Moderator summary and conclusions

**[104-e][206] NR\_HST\_FR2\_RRM\_1, AI 9.7.2 – Dmitry Petrov**

**R4-2214126 Email Discussion Summary for** **[104-e][206] NR\_HST\_FR2\_RRM\_1**

*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**

**Conclusions after 2nd round**

**GTW on Aug-17**

**Sub-topic 1-1: Large one-step UL timing adjustment**

**Issue 1-1-1: Time period of relaxed UL transmit timing accuracy**

* **Background:** *Following the requirements from Clause 7.1.2.3*
  + *When highSpeedMeasFlagFR2-r17 is configured and highSpeedLargeOneStepUL-TimingFR2-r17 is enabled for UE supporting FR2 power class 6 and [largeOneStepUL-timingFR2-r17] capability*
  + *And the absolute value*
  + *And the new target TCI state is not in the active TCI state list*

*The UE UL transmission timing error after the TCI state switching procedure shall be less than or equal to ±[7Ts].*

* **Proposals and/or Observations**
  + Observation 1 (Nokia): The UE is able to track fine DL timing after the TCI state switch in HST FR2 scenarios even after the large jump in propagation delay and when target TCI state was not in the active TCI state list.
  + Observation 2 (Nokia): Currently, for some UE categories in HST FR2 deployments, it is allowed to transmit in UL with a larger timing error after the TCI state switch (±7Ts instead of ±3.5Ts= Te). It is defined and unclear on the network side when and how the UE shall adjust its timing back within ±Te.
  + Observation 3 (Nokia): In the case of HO, after the HO interruption time (TS 38.133, Clause 6.1.1.4.2), the UE can transmit in UL with the timing error limit within ±Te.
  + **Proposal 1** (Nokia): RAN4 to specify explicitly when the UE shall adjust its UL timing to within ±Te after the TCI state switch, i.e., when it can follow again the reequipments from 7.1.2.1.
  + **Proposal 2** (Nokia): If target TCI state is not in the active TCI state list, limit the time needed for the UE to follow again clause 7.1.2.1 requirements and to adjust its UL timing within ±Te. It should happen not later than Trs + 2ms after the TCI state switch.
* **Candidate options**
  + Option 1 [Nokia]: Adopt Proposals 1 and 2.
  + Option 2: Keep current spec as it is: *The UE UL transmission timing error after the TCI state switching procedure shall be less than or equal to ±Te as specified in clause 7.1.2 if the new target TCI state is within active TCI state list, otherwise ±[7Ts].*
* **Recommended WF**
  + Companies are encouraged to share their understanding whether UL transmit timing accuracy shall return to within ±Te=4.5Ts from ±7Ts after the TCI state switch and when.

**Discussions:**

Qualcomm: We do not support Proposal 1 and 2. It is incorrect timing.

Samsung: Core part has been closed. We need discuss whether or not this is blocking issue for UE implementation. For gradual timing change based on the new timing after TCI switching, we do not have detailed requirements for it. But that is intention to allow some flexibility. For P2 we need more time to check.

Nokia: our intention is to clarify the unclear requirement when UE starts to follow the requirement. The accuracy is different. It is important for network to know when accraucy will be followed and what is the requirement. How to understand the procedure. When the legacy requirement can be follow.

Huawei: understand the intention. UE will do gradual timing adjustment following Tq. Duration is not easy to be specified.

Ericsson: Propoal 1 is the restric UE. Besides the TE change, it is important to align the timing definition. We need clarification. We suggest to keep the relaxed requirement +/- 7Ts.

ZTE: we understand the motivation of option 1. For option 2, it is not enough to reflect the condition. Option 2 cannot reflect the trasnsition from relaxed to legacy requirements. We prefer option 1.

Qualcomm: Huawei and Samsung comment makes sense. We can have Tq requirements but not Te part. Both UE and network need to catch up. Network should catch up in N\_TA. It is too complicated to specify it. We can compromise to Tq requirement on it.

Samsung: we have similar view as Qualcomm and Huawei. When defining requirement, we should have ideal timing. What is the ideal timing between points of TCI state switching and going back to normal timing. We cannot find way to do it.

Nokia: the Tq gradual timing will be applied. Tq timing should be applied for this case. The transition time is not specified.

OPPO: we can compromise to follow Tq requirements.

**FFS on the following bullet:**

* The gradual timing adjustement step of Tq shall be applied after the one shot uplink timing adjustment after TCI state switch.

**Issue 1-2-1: Initial UL transmit timing after TCI state switch**

* **Background**

The requirements when large one-step timing adjustment mechanism is enabled are described in Clause 7.1.2.3.

The requirements on the UE initial transmission timing error are described in Clause 7.1.2.

Gradual UL transmit timing adjustment requirements are present in Clause 7.1.2.1.

* **Proposals and/or Observations**
  + Observation 1 (Nokia): Using either network-based (e.g., RACH-based) or large one-shot UL timing adjustment mechanisms, the UE should be able to achieve transmit timing error within ±Te after the TCI state switch. However, no UL timing error requirements are defined explicitly for TCI state switch in TS 38.133.
  + **Proposal 1** (Nokia): RAN4 to introduce UE initial transmission timing error requirement after the TCI state switch.
  + **Proposal 2** (Nokia): UE initial transmission timing error shall be less than or equal to ±Te where the timing error limit value Te is specified in Table 7.1.2-1. This requirement applies when it is the first transmission after the TCI state switch.
  + **Proposal 3** (ZTE): In order to align the understanding from different companies, further clarification on the agreement bout the accuracy of UL transmit timing is necessary. Our understanding is as below:
    - If largeOneStepUL-timingFR2-r17 is disabled, accuracy relaxation is not allowed. Otherwise, accuracy relaxation is allowed possibly and needs further decision by the UE.
    - If largeOneStepUL-timingFR2-r17 is enabled, since the one-shot TA adjustment is triggered by TCI state switching plus the contrast between DL timing difference and the threshold, so immediately after each TCI state switching, UE needs to check whether accuracy relaxation is allowed. The following cases are possible:
      * Case 1: If UE can only track one TCI state
        + If the DL timing difference is above the threshold, the accuracy relaxation is allowed.
        + Otherwise, the accuracy relaxation is not allowed.
      * Case 2: If UE can track multiple TCI states and the target TCI state is not in the list
        + If the DL timing difference is above the threshold, the accuracy relaxation is allowed.
        + Otherwise, the accuracy relaxation is not allowed.
      * Case 3: If UE can track multiple TCI states and the target TCI state is in the list
        + The accuracy relaxation is not allowed no matter whether the DL timing difference is above the threshold or not.
* **Candidate options:**
  + Option 1 [Nokia]: UE initial transmission timing error after the TCI state switch shall be less than or equal to ±Te. Enhance the requirement in 7.1.2.
  + Option 2 [ZTE]: If largeOneStepUL-timingFR2-r17 is enabled, target TCI state is not in the active TCI state list, and the DL timing difference is above the threshold the accuracy relaxation is allowed.
* **Recommended WF**
  + Companies are invited to share their view on the general understanding of UL TX timing accuracy after the TCI state switch.
  + Companies are encouraged to discuss whether a general requirement (Option 1) can be introduced, and/or an exception (Option 2) shall be kept.

**Discussions:**

ZTE: whether companies have common understanding on the previous agreement. Comparison of timing with threshld is missed in the previous agreement.

Qualcomm: Option 2 is good and aligned with the current spec.

Nokia: Option 2 does not conflict with Option 1. Uplink timing should be within Te. For many other cases, it is not clear whether all the requiremetns can be applied.

Samsung: Nokia provide good flow chart. For option 2, this is already reflected in the spec.

Ericsson: Option 1 is identical to the legacy requirements. Since in legacy requirement, we have no limit for timing and why do we need the new requirement. For option 2, we concern whether there is anything new.

Huawei: to option 2, does it mean the agreement last meeting is confirmed or tend to introduce the new thing. Why do we consider the only case where target TCI state is not in the active TCI state list?

Qualcomm: we should only focus on FR2 HST.

Nokia: In HST we have non-collocated TCI state. The RRH is far away from each other. For legacy requirement, which legacy requirement will be applied. To Qualcomm, our proposal is to apply to PC6 UE. To Huawei, we have defined the requirement when target TCI state is active state. UE can track and keep timing.

ZTE: to option 2, we do not think option 2 is reflected in the spec totally.

Samsung: to ZTE, in the requirement, we say if the timing error shall be less than or equal to Te if the TCI is within the list. What is the difference. To Nokia, I still understand what the intention is here. It seems conflict with the proposal for the previous issue.

Qualcom: we can work on CR for option 1. For option 2 we agree with Samsung. Our spec has already covered all the collocated and non-collocated cases.

Nokia: to Samsung, we want to introduce the general requriements to cover all the possible cases when TRS procedure and larg uplink timing adjustment procedure is used.

Huawei: we also have question on the target TCI state in the active TCI state list. There is Tnew and also have Told. For Tnew and Told, both has Te. Then we have 2Te = 7Ts.

**Issue 1-2-2: UL timing requirement when large one-step mechanism is disabled**

* **Background**

Chairman notes from RAN4#102-e [RP-220925]:

|  |
| --- |
| Agreement:   * The conditions when one shot large UL timing adjustment requirements apply are FFS * Requirements for the case when [*largeOneStepUL-timingFR2-r17*] is not enabled need to be defined and are FFS. It is not precluded to reuse legacy requirements. |

At RAN4#103-e, the discussion continued, and the following agreement and WF were achieved [R4-2210608]:

|  |
| --- |
| **Issue 1-3-1: Requirements for the case when highSpeedLargeOneStepUL-TimingFR2-r17 is disabled**  **Agreement**:  No need to introduce new UL timing requirements for the case when highSpeedLargeOneStepUL-TimingFR2-r17 is disabled.  **Issue 1-3-2: Scheduling/Transmit restriction after TCI state switch**  **Way Forward**:  Further discussion is needed whether and how to define transmit or scheduling restriction for UL after the TCI state switch when highSpeedLargeOneStepUL-TimingFR2-r17 is disabled.   * Option 2: No impact on UE behavior * Option 3: Define scheduling restriction on DL and UL after inter-RRH TCI state switch and before PRACH transmission when highSpeedLargeOneStepUL-TimingFR2-r17 is disabled * Option 4: after the TCI state switch, the UE shall not transmit except for RACH preamble in the new target TCI before one of the following conditions is fulfilled:   - the new timing advance is acquired and applied in the target TCI state according to the requirements in clause 7.3;  - the UL transmission is scheduled by the gNB.  In this case, the requirements in clause 7.1.2.1 apply.   * Other options are not precluded |

* **Proposals and/or Observations**
  + Observation 1-1 (QC): The transmission restriction or any other requirement imposed before RACH can’t eliminate the interference across UEs on UL since the UL transmission after RACH has a misaligned frame boundary with the UL transmission from UEs in the old TCI state. Moreover, DL signals from different RRHs also arrived with misaligned frame boundaries due to propagation delay difference.
  + Observation 1-2 (QC): Since UL gradual timing adjustment is still applicable to UE, before RACH procedure and 200ms after TCI state switch, UE still follow the previous TCI state timing up to Tq autonomous adjustment, which is much smaller than CP and frame boundary misalignment has negligible impact to the UEs on the previous TCI state, at least much smaller than UE Tx after RACH.
  + Observation 2 (QC): We can eliminate cross UE interference on UL only when all UEs are transmitting on the same timing regardless of TCI state, otherwise UL transmission from UEs with different TCI states from different RRHs have misaligned frame boundaries.
  + **Proposal 1** (QC): Network applies different offsets to DL frame boundaries of different RRHs to pre-compensate the propagation delay difference across different RRHs to eliminate UL and DL interference across UEs when UEs in the same region are on different TCI states from different RRHs. Network doesn’t schedule UL transmission if network can’t handle different UL reception timing on different RRHs. After all the UEs are on the TCI states from the same RRH in the same region, network schedules RACH session to all UEs to acquire new UL and (uncompensated) DL timing.
  + **Proposal 2** (QC): If proposal 1 is too complicated for network implementation, given that transmission restriction can not eliminate UL interference across different TCI states, no additional requirement should be defined.
  + **Proposal 3** (CATT): When highSpeedLargeOneStepUL-TimingFR2-r17 is disabled, after the TCI state switch, option 4 is acceptable.
  + Observation 3 (Samsung): There are different ways in practice to perform RA-based UL timing adjustment, by considering PDCCH-order (for RA triggering) is sent from the source RRH or target RRH.
  + Observation 4 (Samsung): The issue of UE transmission in the new TCI state after TCI state switching but before the new TA is acquired cause more negative influence for the case in which PDCCH-order is sent from new TCI after TCI switching.
  + **Proposal 4** (Samsung): No need to transmit or scheduling restriction for UL after the TCI state switch, when highSpeedLargeOneStepUL-TimingFR2-r17 is disabled.
  + **Proposal 5** (Ericsson): Support Option2, no impact on UE behavior after TCI state switch.
  + **Proposal 6** (ZTE): Compared with Option 1 and Option 3, Option 4 is more feasible. However Option 4 is somehow radical since no matter inter-RRH TCI state or intra-RRH TCI state switch occurs, the transmit restriction is always applied.
* **Candidate options:**
  + Option 2 [Ericsson, QC, Samsung]: No impact on UE behavior (no additional requirements)
  + Option 3: Define scheduling restriction on DL and UL after inter-RRH TCI state switch and before PRACH transmission when highSpeedLargeOneStepUL-TimingFR2-r17 is disabled
  + Option 4 [CATT, ZTE]: After the TCI state switch, the UE shall not transmit except for RACH preamble in the new target TCI before one of the following conditions is fulfilled:
    - the new timing advance is acquired and applied in the target TCI state according to the requirements in clause 7.3;
    - the UL transmission is scheduled by the gNB.  
      In this case, the requirements in clause 7.1.2.1 apply.
  + Option 5 [QC]: Network applies different offsets to DL frame boundaries of different RRHs to pre-compensate the propagation delay difference to eliminate UL and DL interference.
* **Recommended WF**
  + Companies are invited to discuss the candidate options in the 1st round.

**Issue 2-2: SMTC in HST FR2 enhanced requirements**

* **Background**

This issue was actively discussed at the RAN4#103-e, and the following WF was achieved [R4-2210608]

**GtW Agreement:**

Option 1 agreed as starting point and further work on the drafting CR revision including table heading and note 3.

**Way forward:**

Further discussion is needed on how to define HST FR2 requirements if SMTC periodicity is > 40 ms.

* Option 1: Apply the FR2 HST enhanced requirement only when SMTC <=40ms cases. When SMTC period > 40ms, requirements in Table 9.2.5.2-2 apply.
* Option 2: Delete NOTE 3, keep table titles without changes and set M2 = 1.5
* Other options are not precluded

In the discussions, NOTE 3 was defined in the following way: When SMTC period > 40ms, requirements in Table 9.2.5.2-2 apply

For reference, the subtract from the latest version of TS 38.133 is presented below:

For UE supporting power class 6 with *highSpeedMeasFlagFR2-r17* configured, if SMTC <= 40ms, TPSS/SSS\_sync\_intra is given in Table 9.2.5.1-11; [otherwise, TPSS/SSS\_sync\_intra is given in Table 9.2.5.1-2.]

**Table 9.2.5.1-2: Time period for PSS/SSS detection, (Frequency range FR2)**

|  |  |
| --- | --- |
| **DRX cycle** | **TPSS/SSS\_sync\_intra** |
| No DRX | max(600ms, ceil(Mpss/sss\_sync\_w/o\_gaps x Kp x Klayer1\_measurement)x SMTC period)Note 1 x CSSFintra |
| DRX cycle≤ 320ms | max(600ms, ceil(1.5 x Mpss/sss\_sync\_w/o\_gaps x Kp x Klayer1\_measurement)x max(SMTC period,DRX cycle)) x CSSFintra |
| DRX cycle>320ms | ceil(Mpss/sss\_sync\_w/o\_gaps x Kp x Klayer1\_measurement) x DRX cycle x CSSFintra |
| NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified | |

**Table 9.2.5.1-11: Time period for PSS/SSS detection when [*highSpeedMeasFlagFR2-r17*] is configured, (Frequency range FR2) when SMTC period <= 40ms**

|  |  |
| --- | --- |
| **DRX cycle** | **TPSS/SSS\_sync\_intra** |
| No DRX | max(600ms, ceil(M1Note 2 x Kp x Klayer1\_measurement)x SMTC period)Note 1 x CSSFintra |
| DRX cycle≤ 80ms | max(600ms, ceil(M1Note 2 x Kp x Klayer1\_measurement)x max(SMTC period,DRX cycle)) x CSSFintra |
| 80ms< DRX cycle≤ 320ms | ceil(1.5x Mpss/sss\_sync\_w/o\_gaps Note 3 x Kp x Klayer1\_measurement)x max(SMTC period,DRX cycle) x CSSFintra |
| DRX cycle>320ms | ceil(Mpss/sss\_sync\_w/o\_gaps Note 3 x Kp x Klayer1\_measurement) x DRX cycle x CSSFintra |
| NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified  NOTE 2: For UE supporting power class 6, M1= 6 if [*highSpeedMeasFlagFR2-r17* = set1] or M1= 18 if [*highSpeedMeasFlagFR2-r17* = set2]  NOTE 3: Mpss/sss\_sync\_w/o\_gaps =24. | |

* **Proposals and/or Observations**
  + Proposal 1 (Samsung): For SMTC limit in HST FR2 enhancement requirements, to adopt the below Option 1, i.e.,
    - Option 1: Apply the FR2 HST enhanced requirement only when SMTC <=40ms cases. When SMTC period > 40ms, requirements in Table 9.2.5.2-2 apply.
  + Proposal 2 (CATT): support option 1: Apply the FR2 HST enhanced requirement only when SMTC <=40ms cases. When SMTC period > 40ms, requirements in Table 9.2.5.2-2 apply. The same principle is applied in intra-frequency measurement with measurement gaps.
  + Proposal 3 (ZTE): We prefer to respect the previous agreement. So Option 1 is recommended.
  + Observation 1 (Nokia): Legacy requirements for PSS/SSS detection and measurement delays apply to FR2 HST when SMTC periodicity > 40 ms.
  + Observation 2 (Nokia): When the legacy requirements for PSS/SSS detection and measurement delays apply to FR2 HST UE travelling at the maximum speed 350 km/h, complete mobility failures occur as shown by the simulation results.
  + Proposal 4 (Nokia): For UE supporting power class 6 with highSpeedMeasFlagFR2-r17 configured, if SMTC <= 40ms, TPSS/SSS\_sync\_intra is given in Table 9.2.5.1-11; [otherwise, TPSS/SSS\_sync\_intra is given in Table 9.2.5.1-2.]
    - Note: Operation with TPSS/SSS\_sync\_intra in Table 9.2.5.1-2 may not be guaranteed for the maximum speed under high-speed deployment scenarios considered in this release.
  + Proposal 5 (Nokia): For UE supporting power class 6 with highSpeedMeasFlagFR2-r17 configured, if SMTC <= 40ms, TSSB\_measurement\_period\_intra is given in Table 9.2.5.2-7; [otherwise, T SSB\_measurement\_period\_intra is given in Table 9.2.5.2-2.]
    - Note: Operation with T SSB\_measurement\_period\_intra in Table 9.2.5.2-2 may not be guaranteed for the maximum speed under high-speed deployment scenarios considered in this release.
* **Candidate options:**
  + Option 1 [Samsung, CATT, ZTE]: Apply the FR2 HST enhanced requirement only when SMTC <=40ms cases. When SMTC period > 40ms, requirements in Table 9.2.5.2-2 apply.
  + Option 2 [Nokia]: Add a clarification Note in Clause 9.2.5.1:  
    Operation with TPSS/SSS\_sync\_intra in Table 9.2.5.1-2 (TSSB\_measurement\_period\_intra in Table 9.2.5.2-2) may not be guaranteed for the maximum speed under high-speed deployment scenarios considered in this release.
* **Recommended WF**
  + Based on the online and offline discussions at RAN4#103-e it is Moderator’s understanding that even though the companies would like to have more flexibility in the configuration, there is not intent to use legacy requirements in the HST FR2 scenario.  
    Can Option 2 be agreeable?

**Discussions:**

**Agreement:**

**Issue 2-3: Mpss/sss\_sync\_w/o\_gaps and Mmeas\_period\_w/o\_gaps for power class 6 UEs**

* **Background**

The requirements on intrafrequency measurement without measurement gaps are defined in Caluse 9.2.5 of TS 38.133:

Mpss/sss\_sync\_w/o\_gaps : For a UE supporting FR2 power class 1 or 5, Mpss/sss\_sync\_w/o\_gaps =40. For a UE supporting power class 2, Mpss/sss\_sync\_w/o\_gaps =24. For a UE supporting FR2 power class 3, Mpss/sss\_sync\_w/o\_gaps =24. For a UE supporting FR2 power class 4, Mpss/sss\_sync\_w/o\_gaps =24

Mmeas\_period\_w/o\_gaps : For a UE supporting power class 1 or 5, Mmeas\_period\_w/o\_gaps =40. For a UE supporting FR2 power class 2, Mmeas\_period\_w/o\_gaps =24. For a UE supporting power class 3, Mmeas\_period\_w/o\_gaps =24. For a UE supporting power class 4, Mmeas\_period\_w/o\_gaps =24.

However, power class 6 UEs are not present in the requirements above.

Note, that Mpss/sss\_sync\_w/o\_gaps and Mmeas\_period\_w/o\_gaps are not used for the enhanced requirements when DRX cycle <= 80 ms.

* **Proposals and/or Observations**
  + Proposal 1 (CATT): In Table 9.2.5.1-11 & Table 9.2.5.2-7, use Mpss/sss\_sync\_w/o\_gaps and Mmeas\_period\_w/o\_gaps as 24 for power class 6 when DRX cycle > 80ms. The same principle is applied in intra-frequency measurement with measurement gaps.
* **Recommended WF**
  + Companies are welcomed to discuss whether Proposal 1 is agreeable.
  + If Proposal is agreeable, then shall “NOTE 3: Mpss/sss\_sync\_w/o\_gaps =24” be needed in HST FR2 enhanced tables?

**Discussions:**

**Agreement:**

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**[104-e][207] NR\_HST\_FR2\_RRM\_2, AI 9.7.3 – He(Jackson) Wang**

**R4-2214127 Email Discussion Summary for** **[104-e][207] NR\_HST\_FR2\_RRM\_2**

*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**

**GTW on Aug-17**

**Sub-topic 1-2: RRM performance Scope**

* [Background] Based on the analysed during RAN4 103-e, the necessity of several TCs is still under discussion.

**Issue 1-2-1: Necessity of Test Cases for Re-establishment Delay Requirement**

**Channel model**

* **Proposals:**
  + Option 1 (Ericsson, Qualcomm): Apply bi-directional deployment channel model, AWGN with 19444Hz frequency offset
  + Option 1 (Samsung): Apply unidirectional deployment channel model, AWGN with 9722Hz frequency offset

**Discussions:**

**Agreement:**

**DRX cycle**

* **Proposals:**
  + Option 1 (Qualcomm): non-DRX

**Discussions:**

**Agreement:**

**TC**

* **Proposals:**
  + Option 1 (Samsung, Qualcomm): TCs for Re-establishment Delay Requirement can be skipped
  + Option 2 (CATT): Need new test case
    - Option 1-1 (CATT) :
      * Need new TC for Intra-frequency RRC Re-establishment in FR2 for PC6 UE configured with *highSpeedMeasFlagFR2-r17*
* **Recommended WF:**
  + Initial discussion provided in the 1st round discussion, on confirm/disconfirm the necessity of this test case.

**Discussions:**

**Agreement:**

**Issue 1-2-2: Necessity of Test Cases for gradual timing adjustment**

* **Proposals:**
  + Option 1 (Samsung, CATT, Nokia, Nokia Shanghai Bell): Need new test case (similar as A.7.4.1.1)
    - Option 1-2 (CATT):
      * If FR2 PC6 UE is really to test, define new test case similar as A.7.4.1.1
    - Option 1-3 (Nokia, Nokia Shanghai Bell) :
      * A new TC for the gradual timing adjustment with the adjustment value equals 10\*64\*Tc with DRX off
  + Option 2 (Samsung, Ericsson): Applying PC6 UE new requirement into A.7.4.1.1, and no need to define new test case
  + Option 3 (CATT, QC): No new test case needed
  + Option 4 (QC): introduce a base station test to ensure proper network operation
* **Recommended WF:**
  + Initial discussion provided in the 1st round discussion, on confirm/disconfirm the necessity of this test case.

**Discussions:**

Qualcomm: support option 2. Our understanding is option 2 and 3 are the same.

Ericsson: support comment from Qualcomm and Samsung. Regarding option 4, it does not belong to test case.

Nokia: we have comment for option2. How can Option 2 work? For HST, there is new requirement.

Qualcomm: we have all the test. The original test A 7.4.1.1 does not inclue PC6. But not applicability needs be added.

**Agreement:**

* Applying PC6 UE new requirement into A.7.4.1.1, and no need to define new test case

**Issue 1-2-3: Necessity of TC for one shot large UL timing adjustment for FR2 PC6 UE**

* **Proposals on necessity of TC:**
  + Option 1 (Samsung, CATT, Nokia): New test defined in clause A.7.4.1, similar as A.7.4.1.1
    - Option 1-1 (Samsung):
* New TC shall be introduced to verify (1) the condition to apply one shot large UL timing adjustment, and (2) new transmit timing behavior and accuracy for one shot large UL timing adjustment
  + Option 2: (Qualcomm, Ericsson, Nokia, Nokia Shanghai Bell): One shot large UL timing adjustment test is combined into MAC-CE based TCI switch delay test
* **Proposals of others:**
  + Proposal (Nokia): For the one shot large UL timing adjustment,
    - (a) It is sufficient to perform one test assuming the unidirectional scenario;
    - (b) Set the one-way differential delay
* **Recommended WF:**
  + Initial discussion provided in the 1st round discussion, on confirm/disconfirm the necessity of this test case.

**Discussions:**

**Agreement:**

**Sub-topic 1-1: General Configuration and Applicability**

**Issue 1-1-1: Applicability of Set-1 and Set-2 of enhanced RRM requirements**

* [Background] The approved WF on the applicability of Set-1 and Set-2 of enhanced RRM requirements is summarized as follows, the TC category with “TBD” in the column of “applicability of set1 and set2” is needed to be defined

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ***<WF>****:*   * Applicability of Set-1 and Set-2 of enhanced RRM requirements:  |  |  | | --- | --- | | TC category  (if confirmed in Sub-Topic 1) | Applicability of set1 and set2 (either set1 with 2RX beams or set2 with 6RX beams, or both) | | TC for Cell Re-selection Requirement | TBD | | TC for Re-establishment Delay Requirement | TBD | | TC for Timing Related Requirement | N/A (not differentiated by set1 and set2) | | TC for MAC-CE based TCI State Switch Delay Requirement | TBD (for target TCI is unknown, SSB-based TCI switching to a RS with new QCL-TypeD reference) | | TC for L3 measurement | TBD | | TC for L1-RSRP/SINR Measurement Requirement | TBD | |

* **Proposals:**
  + Option 1 (Samsung, Qualcomm, Ericsson): Different sets for different TCs
    - Option 1-1 (Samsung): Use NW RRC configuration *highSpeedMeasFlagFR2-r17 = set1 or set2* as TC condition
    - Option 1-2 (Ericsson): Adopting set2 in L3 relevant tests and adopting set1 in L1 relevant tests

**Discussions:**

**Agreement:**

**The details from Samsung and Qualcomm proposals:**

* **For MAC-CE based TCI state switching delay TC:**
  + Option 1-a (Samsung):
    - Set 1 only
  + Option 1-b (Qualcomm):
    - No need to decide
* **For Re-establishment Delay Requirement TC :**
  + Option 1-a (Samsung):
    - Set 2 only (if TC for re-establishment delay confirmed)
* **For L1-RSRP/SINR measurement Requirement TC:**
  + Option 1-a (Samsung):
    - Set1 for L1-RSRP measurement and Set2 for L1-SINR measurement (if TC for L1-SINR measurement confirmed)
  + Option 1-b (Qualcomm):
    - Choose a different set than L3 measurement (e.g., set 2)
* **For Cell Re-selection Requirement TC:**
  + Option 1-a (Samsung):
    - Set1 only
  + Option 1-b (Qualcomm):
    - Choose between set 1 and 2
* **For L3 measurement TC:**
  + Option 1-a (Samsung):
    - Set2 only
  + Option 1-b (Qualcomm):
    - Choose a different set than L1-RSRP (e.g., set 1)
* Recommended WF:
  + Initial discussion provided in the 1st round discussion, on confirm/disconfirm the necessity of this test case.

**Discussions:**

**Agreement:**

**Sub-topic 1-4: Measurement accuracy for FR2 HST UE**

**Issue 1-4-1: L1-measurement simulation result and alignment**

* Proposals:
  + Option 1 (Samsung, Ericsson): The legacy accuracy of L1-RSRP, LI-SINR in Rel-16 can be reused for L1 measurement in FR2 HST.
  + Option 2 (Qualcomm): The legacy accuracy of L1-RSRP can be reused, but Legacy L1-SINR need satisfy SNR < 5dB if reused
  + Option 3 (Nokia, Nokia Shanghai Bell): L1 measurement simulation is provided

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ***<LI-SINR measurement accuracy>***  Table 11: Absolute L1-SINR measurement accuracy for AWGN with 19444 Hz frequency offset (frequency tracking disabled)   |  |  |  |  |  | | --- | --- | --- | --- | --- | | CMR | IMR | 5th percentile (dB) | 50th percentile (dB) | 95th percentile (dB) | | CSI-RS | N/A | -1.47 | 0.13 | 1.55 | | SSB | NZP-IMR | -1.74 | -0.13 | 1.38 | | CSI-IM | -1.71 | -0.1 | 1.3 | | CSI-RS | NZP-IMR | -1.53 | -0.01 | 1.32 | | CSI-IM | -1.32 | -0.02 | 1.14 |   Table 12: Absolute L1-SINR measurement accuracy for AWGN with 19444 Hz frequency offset (frequency tracking enabled for bidirectional scenarios)   |  |  |  |  |  | | --- | --- | --- | --- | --- | | CMR | IMR | 5th percentile (dB) | 50th percentile (dB) | 95th percentile (dB) | | CSI-RS | N/A | -0.82 | 0.64 | 1.94 | | SSB | NZP-IMR | -1.06 | 0.53 | 2.07 | | CSI-IM | -1.07 | 0.47 | 1.98 | | CSI-RS | NZP-IMR | -0.88 | 0.53 | 1.91 | | CSI-IM | -0.77 | 0.48 | 1.61 |   Table 13: Absolute L1-SINR measurement accuracy for AWGN with 0 Hz frequency offset   |  |  |  |  |  | | --- | --- | --- | --- | --- | | CMR | IMR | 5th percentile (dB) | 50th percentile (dB) | 95th percentile (dB) | | CSI-RS | N/A | -0.41 | 0.37 | 1.29 | | SSB | NZP-IMR | -1.04 | 0.45 | 1.75 | | CSI-IM | -1.1 | 0.44 | 1.78 | | CSI-RS | NZP-IMR | -0.81 | 0.57 | 1.88 | | CSI-IM | -0.7 | 0.58 | 1.71 | |
| ***<*** ***L1-RSRP measurement accuracy >***  Table 15: Absolute L1-RSRP measurement accuracy for AWGN with 19444 Hz frequency offset (frequency tracking disabled)   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | CMR | IMR | SINR | 5th percentile (dB) | 50th percentile (dB) | 95th percentile (dB) | | CSI-RS | N/A | -3 dB | -1.17 | 0.14 | 1.24 | | SSB | N/A | -3 dB | -1.54 | 0.04 | 1.44 |     Table 16: Absolute L1-RSRP measurement accuracy for AWGN with 19444 Hz frequency offset (frequency tracking enabled)   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | CMR | IMR | SINR | 5th percentile (dB) | 50th percentile (dB) | 95th percentile (dB) | | CSI-RS | N/A | -3 dB | -0.7 | 0.48 | 1.53 | | SSB | N/A | -3 dB | -0.98 | 0.42 | 1.73 |   Table 17: Absolute L1-RSRP measurement accuracy for AWGN with 0 Hz frequency offset   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | CMR | IMR | SINR | 5th percentile (dB) | 50th percentile (dB) | 95th percentile (dB) | | CSI-RS | N/A | -3 dB | -0.63 | 0.54 | 1.55 | | SSB | N/A | -3 dB | -1.11 | 0.43 | 1.64 | |

* Recommended WF:
  + Initial discussion provided in the 1st round discussion, on confirm/disconfirm the necessity of this test case.

**Discussions:**

**Agreement:**

**Issue 1-4-2: L3-measurement simulation result and alignment**

*Moderator’s Note: Whether SS-SINR can be reused or not is not mentioned in paper R4-2213340*

* **Proposals:**
  + Option 1 (Samsung, Ericsson): All the legacy accuracy in Rel-15/Rel-16 including SS-RSRP, SS-RSRQ, SS-SINR can be reused
  + Option 2 (Nokia, Nokia Shanghai Bell): All the legacy accuracy except SS-SINR can be reused

**Discussions:**

**Agreement:**

**The details from Nokia, Nokia Shanghai Bell’s option:**

* Option 2 (Nokia, Nokia Shanghai Bell): Whether SS-SINR can be reused or not depend on deployment scenarios
  + For Rel-17 FR2 HST unidirectional scenarios, the Rel-15 FR2 SS-SINR accuracy requirements can be reused.
  + For Rel-17 FR2 HST bidirectional scenarios, the Rel-15 FR2 SS-SINR accuracy requirements can be limited to SNR ≤ 10 dB
* Recommended WF
  + Initial discussion provided in the 1st round discussion, and companies’ view are collected.

**Discussions:**

**Agreement:**

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

#### 9.11.8 Moderator summary and conclusions

**[104-e][214] NR\_NTN\_solutions\_RRM\_1, AI 9.11.5 – CH Park**

**R4-2214134 Email Discussion Summary for [104-e][214] NR\_NTN\_solutions\_RRM\_1**

*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**

**Conclusions after 2nd round**

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**[104-e][215] NR\_NTN\_solutions\_RRM\_2, AI 9.11.6 – Xuhua Tao**

**R4-2214135 Email Discussion Summary for [104-e][215] NR\_NTN\_solutions\_RRM\_2**

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

**Abstract:**

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

**Decision: Return to.**

**Conclusions after 1st round**

**Conclusions after 2nd round**

### 9.12 UE Power Saving Enhancements for NR

#### 9.12.4 Moderator summary and conclusions

**[104-e][216] NR\_UE\_pow\_sav\_enh, AI 9.12.1, 9.12.2 – Hsuanli Lin**

**R4-2214136 Email Discussion Summary for** **[104-e][216] NR\_UE\_pow\_sav\_enh**

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

**Abstract:**

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

**Decision: Return to.**

**Conclusions after 1st round**

**Conclusions after 2nd round**

**GTW on Aug-15**

**Topic #2: RRM performance requirements**

**Issue 2-1-1: Test set up on relaxation criterion**

* Proposals
  + Option 1: Only good serving cell quality criterion is configured. (QC, Huawei)
  + Option 2: Test cases are configured when both low mobility and good serving cell quality criteria are configured and fulfilled. (CATT, CMCC)
  + Option 3: Good serving cell criterion is always configured in testing, while low mobility criteria is configured, i.e. tested, in some of the test cases. (vivo)
  + Option 3a: For TC1, both low mobility criterion and good serving cell quality criterion are configured. For other TCs, only good serving cell quality criterion is configured (MTK)
* Recommended WF
  + Consider Option 3 or Option 3a as WF.

**Discussions:**

Huawei: we prefer option 1. For option 3, we do not see the companies provide the methodology. How is the evaluation done?

CMCC: low mobility is the same important as cell quality criterion. In the test both should be configured. Low mobility should be configured.

CATT: we also support option 2. Low mobility criterion is also important. For Huawei question, in last meeting, the agreement is that T1 has been extended. RAN2 defined two threshold. It can be evaluated for low mobility criterion.

Qualcomm: we support Huawei.

Nokia: we also think we should consider low mobility criterion. Low mobility criterion for BFD or RLM

Ericsson: similar to Nokia.

Huawei: for low mobility criterion, we choose either RLM or BFD.

**Agreement:**

* Configure low mobility criterion and good cell quality criterion for limited number of test cases
  + Futher discussion on candidate test cases considering the following options:
    - Option 1: one FR1 SSB-based RLM test case (test case #1) and one FR2 BFD test case (test case #16).
    - Option 2: Test case(s) where low mobility criterion is evaluated based on SSB, and RLM or BFD are evaluated based on CSI-RS
* Configure only good cell quality criterion for the rest of test cases

**Issue 2-1-2: Test set up on the number of RSs**

* Proposals
  + Option 1: To simplify the test configuration, configure one reference signal for RLM and BFD power saving test cases. (QC, vivo)
  + Option 2: Distribute the test cases under the multiple RLM/BFD-RSs configured scenario and the single RLM/BFD-RS configured scenario. For example, TC1 and TC16 configure two RLM/BFD-RSs, TC4, TC5 and TC13 configure single RLM/BFD-RS. (CMCC)
* Recommended WF
  + Discuss proposals.

**Discussions:**

CMCC: multiple RSes are allowed to be configured. The UE behaviour is different from single RS case. We are fine to choose one or two test cases to verify the UE behaviour.

Mediatek: We suggest to agree on the single RS for FR1. We are open to discuss FR2 test case.

Qualcomm: FR2 BFD can be with multiple RS. The rest test cases are with single RS. For one functionality, we just test one case.

Vivo: for multiple RS case, they are not tested. In Rel-17 why should we test it?

**Agreement:**

* Choose one test case with multiple RS configured
  + Revisit the above agreement if needed when the maintenance part for multiple RS is concluded.
* For the rest test cases, configure the single RS.

**Issue 2-2-1: RLM OOS test – exit relaxation mode during T2 or T3**

* Proposals
  + Option 1: UE is expected to exit relaxation mode during T2 (Huawei)
    - SNR2 is set to be lower than the threshold (Qin + XdB) but higher than the threshold Qout.
    - UE shall send OOS indication based legacy RLM evaluation during T3.
    - The length of D1 is calculated based on legacy RLM evaluation period.
  + Option 2: UE is expected to exit relaxation mode during T3 (Huawei)
    - SNR2 is set as same as SNR1 which is higher than the threshold (Qin + XdB).
    - UE is allowed to send OOS indication based relaxed RLM evaluation during T3.
    - The length of D1 is calculated based on relaxed RLM evaluation period.
* Recommended WF
  + Moderator’s understanding is most of proposals on D1 assumed Option 2 based on relaxed RLM evaluation period.

**Discussions:**

Moderator: most companies agree on option 2.

Qualcomm: we support option 2.

Vivo: for option 2, threshold is under discussion in the core part maintainence.

CATT: support option 2.

Nokia: why do we consider D1 is calculated depend on the relaxation mode?

Qualcomm: D1 includes the evalution. When you drop SNR, you have to allow UE to evaluate and then exit. Exit part should follow the normal behavior. Evaluation part needs relaxation.

CMCC: we also notice that there is open issue 1-4 whether there is typo in the last meeting agreement.

Qualcomm: Your concern is that whether there is impact on core requirement for entering threshold if we agree on this.

CMCC: if we configure multiple referenc signals, we should

Mediatek: Option 2 does not preclude multiple RS case.

**Agreement:**

* Option 2: UE is expected to exit relaxation mode during T3
  + SNR2 is set as same as SNR1 which is higher than the entering threshold~~.~~
  + UE is allowed to send OOS indication based relaxed RLM evaluation during T3.
  + The length of D1 is calculated based on relaxed RLM evaluation period.
* Option 2 does not preclude multiple RS configurations. Option 2 is only applied the first configured RS.

**Issue 2-2-2: RLM OOS test – N310**

* Proposals
  + Option 1: Configure N310 = 2 (QC, vivo, MTK)
    - Option 1a: configure N310 = 2 in OOS test to test UE behavior after exiting power saving mode (QC)
    - Option 1b: Configure N310 = 2 to validate whether UE is able to fall back to normal mode when it has send out-of-sync to higher layers. (vivo)
  + Option 2: Use N310 = 1 in test cases. (CATT, CMCC)
* Recommended WF
  + Discuss proposals.

**Discussions:**

**Agreement:**

**Topic #1: RRM core requirement maintenance**

**--------------------------------- RAN2 LS --------------------------------------**

**1. Overall Description:**

*RAN2 would like to thank RAN4 for the Reply LS to RAN2 on RLM/BFD relaxation for ePowSav. Based on further RAN4 progress, RAN2 discussed the signaling for RLM/BFD relaxation, and achieved the following agreements:*

|  |
| --- |
| * *Keep the current configuration for serving cell quality criterion as per-serving cell basis in RRC specification.**More specifically, this means that the goodServingCell threshold for BFD can be configured per serving cell, and for RLM can be configured per SpCell.* |

*RAN2 would like to check with RAN4 whether you have any concern.*

*Besides, for low mobility criterion, RAN2 also made the following agreements:*

|  |
| --- |
| * *For low mobility criterion, reuse the values of Rel-16 s-SearchDeltaP and t-SearchDeltaP for Rel-17 s-SearchDeltaP-Connected and t-SearchDeltaPConnected, respectively.* * *MN informs SN when low mobility criterion has been configured in NR PCell. How to capture it could be further discussed in CR (assume impact to TS38.331 and TS37.340)* * *For the R17 low mobility criterion, the UE considers the relaxed measurement criterion is fulfilled only when the defined criterion formula is fulfilled for a period of TSearchDeltaP-Connected. (Assume this is consistent with RAN4 decisions).* * *Capture TSearchDeltaP-Connected for low mobility criterion in RAN2 specification (as long as this does not contradict R4).* |

**2. Actions:**

**To RAN WG4**

*RAN2 kindly request RAN4 to take the above information into account during the following work, and provide feedback, if any.*

**--------------------------------- RAN2 LS --------------------------------------**

**Issue 1-1: Clarifications for Low mobility criteria evaluation**

*Background:* in the incoming LS R2-2206675, Reply LS to RAN4 on RLM/BFD relaxation, RAN2:

|  |
| --- |
| * MN informs SN when low mobility criterion has been configured in NR PCell. How to capture it could be further discussed in CR (assume impact to TS38.331 and TS37.340) |

* Proposals
  + Option 1: keep the previous agreement that evaluate low mobility criteria on PCell. (CATT, vivo, MTK)
  + Option 2: We are fine with network could also configure the low mobility criteria in PSCell. (CMCC)
    - If the low mobility criterion is configured only on the PCell
      * UE should evaluate the low mobility criterion on the PCell, and apply the evaluated low mobility state in both MCG and SCG.
    - If the low mobility criterion is configured on the PCell and PSCell
      * UE should evaluate the low mobility criterion on the PCell and PSCell respectively, and apply the evaluated low mobility state in the corresponding cell group.
  + Option 3 (Ericsson)
    - In NR-DC, the UE configured with low mobility criteria evaluates the low mobility criterion only on SpCell.
    - In NR-DC, if the relaxed measurement criterion (low mobility criteria) is met on a SpCell then the UE assumes that the relaxation criterion is met on all serving cells in the CG of that SpCell.
* Recommended WF
  + Option 1 is aligned with RAN2 LS in Moderator’s understanding.

**Discussions:**

**Agreement:**

**Issue 1-7: Reply LS on how to capture TSearchDeltaP-Connected**

* Background: in the incoming LS R2-2206675, TSearchDeltaP-Connected has be mentioned.
* Proposals
  + Option 1: RAN4 has no concern on goodServingCell criterion for BFD can be configured per serving cell, and for RLM can be configured per SpCell. (MTK)
    - RAN4 has already captured in the spec TS38.133 that UE shall consider the low mobility criterion is fulfilled only when the defined criterion formula is fulfilled for a period of TSearchDeltaP-Connected. There is no need to further modify the RAN2 spec.
  + Option 2: Prefer to capture the period TSearchDeltaP-Connected for determining low mobility scenario in RAN2 spec. RAN4 remove this part in TS 38.133 and feed back the decision to RAN2. (vivo)
    - Reply LS draft provided in R4-2212661
* Recommended WF
  + Discuss the two options in the 1st round.
  + The corresponding Reply LS will be discussed in the 2nd round

**Issue 1-2: Introduce minimum requirement at transitions**

*Issue description:* whether to define the minimum requirement at transitions between relaxed and non-relaxed RLM/BFD measurements for OOS evaluation.

* Proposals
  + Option 1: No requirements are specified for transitions between relaxed and non-relaxed RLM/BFD measurements. (QC, Ericsson, MTK)
  + Option 2: Define the minimum requirement at transitions between relaxed and non-relaxed RLM/BFD measurements. (Nokia)
  + Option 2a: For the RLM/BFD measurement, when UE is changed from non-relaxed mode to relaxed mode or from relaxed mode to non-relaxed mode, UE shall use the evaluation period of non-relaxed mode at transitions period (CATT)
* Recommended WF
  + Discuss proposals.

**Discussions:**

**Agreement:**

### 9.13 NR Sidelink enhancement

#### 9.13.5 Moderator summary and conclusions

**[104-e][109] NRSL\_enh\_maintenance, AI 9.13.1, 9.13.2 – Su Hwan Lim**

**R4-2214087 Email Discussion Summary for [104-e][109] NRSL\_enh\_maintenance**

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

**Abstract:**

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

**Decision: Return to.**

**Conclusions after 1st round**

**Conclusions after 2nd round**

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**[104-e][217] NR\_SL\_enh\_RRM, AI 9.13.3, 9.13.4 – Yoonoh Yang**

**R4-2214137 Email Discussion Summary for [104-e][217] NR\_SL\_enh\_RRM**

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

**Abstract:**

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

**Decision: Return to.**

**Conclusions after 1st round**

**Conclusions after 2nd round**

**GTW on Aug-15**

**Sub-topic 1-1 : Interruption on SL due to Uu BWP switch (12.7.6)**

**Issue 1-1-1: Whether FDM based requirement applies also to TDM based intra-band concurrent SL & Uu operation for interruption on the SL due to BWP switch.**

* Proposals
  + Option 1: Apply (MTK)
  + Option 2 : Not apply
* Recommended WF
  + Moderator’s view
    - Based on companies’ views, make a decision.
    - If no consensus, recommendation is to keep the current status.

**Discussions:**

Mediatek: UE may use the same RF chain for Uu and SL. UE is assumed to use common RF chain for Uu and SL. The interruption will be caused when SL BWP switches.

Qualcomm: this is TDM. In the slot of Uu, there is no SL operation. It should address the concern of Mediatek.

LGE: we have the same view as Qualcomm. TDM has no concurrent operation of Uu and SL.

Huawei: we also have the same view as Qualcomm. This is TDM.

Mediatek: to Qualcomm, do you mean that there is no SL slot during BWP switching happens on Uu slot. That is some different between two.

Qualcomm: referring to BWP switching delay, your understanding is correct. But delay should be counted as Uu slot.

Mediatek: We can agree with Qualcomm. TO Huawei comment, since SL configuration is different, if interruption always happen to Uu, UE need adjust, it is not reasonable.

**Agreement:**

* No sidelink communication happens during Uu BWP switching delay period for TDM based intra-band concurrent SL & Uu operation.

**Issue 1-1-2: To avoid the impact on BWP switch delay for TDM based intra-band concurrent SL & Uu operation, whether to allow for UE to drop SL transmission during BWP switch delay.**

* Proposals
  + Option 1: Allow (MTK)
  + Option 2 : Not allow
* Recommended WF
  + Moderator’s view
    - Based on companies’ views, make a decision.
    - If no consensus, recommendation is to keep the current status.

**Discussions:**

**Agreement:**

**Sub-topic 1-2 : Scheduling availability of UE switching between NR Uu and NR SL (12.9.2)**

**Issue 1-2: Whether to include both transmission slot and reception slot considering that switching is not limited to only the transmission slot.**

* Proposals
  + Option 1: Consider both transmission slot and reception slot (Huawei)
  + Option 2: Consider only transmission slot (keep current spec)
* Recommended WF
  + Moderator’s view
    - Based on companies’ views, make a decision.
    - If no consensus, recommendation is to keep the current status.

**Discussions:**

Huawei: option 1 is based on RF spec. In 38.101 the switching between Uu slot and SL slot is defined. In 38.133 we should follow.

LGE: RF spec is capturing the figure. It is time mask.

Vivo: the requirement is about the transmitted requirement. It is used for On-off and time mask. At least it is fine to consider the SL slot. In the current spec it is read transmission slot. For Uu it has to be transmit slot.

Qualcomm: Option 1 can be upaded.

**Agreement:**

* For scheduling availability of UE switching between NR Uu and NR SL, consider SL transmission slot and SL reception slot, and Uu uplink slot.

### 9.14 Extending current NR operation to 71GHz

#### 9.14.9 Moderator summary and conclusions

**[104-e][110] NR\_ext\_to\_71GHz\_Part\_1, AI 9.14.1, 9.14.2, 9.14.3.3 – Aida L Vera Lopez**

**R4-2214088 Email Discussion Summary for [104-e][110] NR\_ext\_to\_71GHz\_Part\_1**

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

**Abstract:**

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

**Decision: Return to.**

**Conclusions after 1st round**

**Conclusions after 2nd round**

**GTW on Aug-18**

**Sub-topic 1-2: LS reply to RAN1**

RAN4 received an LS from RAN1 with the following question (R1-2200796):

**Question to RAN4**: How many symbol(s) is/are needed to accommodate the required minimum guard time for SRS antenna switching for 480 and 960 kHz respectively, in FR2-2?

For reference, the following was specified in Rel-15 (38.214 Section 6.2.1.2) for subcarrier spacing up to 120 kHz:

**Table 6.2.1.2-1: The minimum guard period between two SRS resources of an SRS resource set for antenna switching**

|  |  |  |
| --- | --- | --- |
|  |  | ***Y* [symbol]** |
| 0 | 15 | 1 |
| 1 | 30 | 1 |
| 2 | 60 | 1 |
| 3 | 120 | 2 |

**Issue 1-2: LS reply to RAN1**

* Proposals
  + Option 1: CATT, R4-2211697
    - **Answer from RAN4:** The absolute switching time for FR2-2 is the same as the capability evaluated in R15, i.e., the antenna switching time is 15 µsec. The detail evaluation results for every possible switching scenario are included in the R15 reply LS R4-1710048 [1]. The decision on the symbol(s) needed to accommodate the required minimum guard time for SRS antenna switching for 480 and 960 kHz SCS is up to RAN1 discussion based on the absolute switching time in R4-1710048.
  + Option 2: Huawei, R4-2213370
    - **Answer to RAN1:** The SRS antenna switching time is 15us for both 480 and 960 kHz in FR2-2. The minimum guard time needed to accommodate the required antenna switching time could be calculated as 7.2 symbols for 480kHz SCS and 14.4 symbols for 960kHz SCS, which are rounded up in below table. RAN1 could further discuss and determine on the final values.
* Recommended WF
  + Companies are encouraged to provide comments on the specific wording and content of the LS reply. Draft LS reply R4-2211697 can be taken as baseline and updated based on feedback received.

**Discussions:**

CATT: the situation does not change. We should target approving LS in this meeting.

Ericsson: Did you analyze the consequence of 15us? The implementation perspective, does it requires UE to support other optional features specified in Rel-16 and Rel-17? RAN1 asks for another number which can be used in future. These values requires UE to support some new feature groups to get SRS antenna switching to work.

CATT: In my understanding, for RF discussion, we only discussed the hardware complexity. RAN1 features are not scope of RAN4.

**Sub-topic 2-1: FR2 band for unlicensed operation**

**Issue 2-1: Note on unlicensed operation**

* Proposal (Apple, R4-2211873)
  + RAN4 to agree on either Alt. 1 or Alt. 2 for Table 5.2-1.
    - Alt. 1: NOTE 1: This band is for unlicensed operation
    - Alt. 2: NOTE 1: This band is for unlicensed operation and subject to regional and/or country specific regulations
* Recommended WF
  + Companies are encouraged to provide feedback on the two alternatives listed to capture the unlicensed operation of band n263

**Discussions:**

Intel: NOTE XX: This band is restricted to operation with shared spectrum channel access as defined in TS 37.213 [reference for 37.213].

Nokia: we prefer alt2.

Apple: it is indeed unlicensed band. As Nokia mentioned, there is different understanding. Alt2 is the best one.

Ericsson: same understanding as Intel. We do not discuss the unlicensed operation in 3GPP.

**Sub-topic 2-2: Operating bands and channel arrangement for CA**

**Issue 2-2a: Operating bands for CA**

* Proposal (Nokia, R4-2212845)
  + Add NR CA band CA\_n263 to table 5-2A.1-1 in TS 38.101-2 together with a note clarifying that only contiguous CA is applicable for this band.

|  |  |
| --- | --- |
| **NR CA Band** | **NR Band**  **(Table 5.2-1)** |
| CA\_n257 | n257 |
| CA\_n258 | n258 |
| CA\_n259 | n259 |
| CA\_n260 | n260 |
| CA\_n261 | n261 |
| CA\_n263 (Note) | n263 |
| NOTE: Only contiguous CA is applicable for this operating band. | |

* Recommended WF
  + Companies should share their views on the proposal and note wording. Agreement will be captured in a CR for TS 38.101-2.

**Discussions:**

Nokia: the requirement can be introduced as package.

**Agreement:**

* If all the UE CA requirements are finalized,
  + Add NR CA band CA\_n263 to table 5-2A.1-1 in TS 38.101-2 together with a note clarifying that only contiguous CA is applicable for this band.

|  |  |
| --- | --- |
| **NR CA Band** | **NR Band**  **(Table 5.2-1)** |
| CA\_n257 | n257 |
| CA\_n258 | n258 |
| CA\_n259 | n259 |
| CA\_n260 | n260 |
| CA\_n261 | n261 |
| CA\_n263 (Note) | n263 |
| NOTE: in the current release, only contiguous CA is applicable for this operating band. | |

**Issue 2-2b: NR CA bandwidth class**

* Proposals (Nokia, R4-2212845)
  + Proposal 1: In Rel-17 only support for n\*100 MHz and m\*400 MHz contiguous CA is specified.
  + Proposal 2: No new bandwidth classes are specified for n\*100 MHz
  + Proposal 3: Two new bandwidth classes are specified and placed within fallback group 1 to cover 4\*400 MHz and 5\*400 MHz. These new bandwidth classes are applicable only for FR2-2.

|  |  |  |  |
| --- | --- | --- | --- |
| **NR CA BW class** | **Aggregated channel bandwidth** | **# cont. CC** | **Fallback group** |
| A | BWChannel ≤ 400 MHz | 1 | 1,2,3,4,5 |
| B | 400 MHz < BWChannel\_CA ≤ 800 MHz | 2 | 1 |
| C | 800 MHz < BWChannel\_CA ≤ 1200 MHz | 3 |
| V (Note 4) | 1200 MHz < BWChannel\_CA ≤ 1600 MHz | 4 |
| W (Note 4) | 1600 MHz < BWChannel\_CA ≤ 2000 MHz | 5 |
| NOTE 3: In this release of the specification, the minimum requirements for intra-band contiguous CA configurations apply for aggregated channel bandwidths up to 1600 MHz for FR2-1 (this note is not relevant for UE capability parsing by the network).  NOTE 4: In this release of the specification, this bandwidth class is applicable only for operating bands within FR2-2. | | | |

* Recommended WF
  + Companies should share their views on the three proposals listed, including how the proposed CA bandwidth classes are captured in the above table.

**Discussions:**

Huawei: further check #1. No big deal. We can proceed with #2. For #3, the note can be modified. It creates impress that we are willing to modify them in future.

Nokia: The new BW class is applied to FR2-2.

Apple: even though it looks quite straightforward, the discussion in FR2-1 is quite involved about the fall back and how to signal. We proposed to consider it addition to FR2-1. For urgency, there is still some time for RAN4 to consider. There is no rush.

Nokia: it is fine to limit. To Apple, how to proceed?

Apple: currently FR2-1 discussion take place in email [108]. Let us wait for the discussion there as maintenance. We are open to any other suggestion. Our main concern is that not to treat as trivial.

Nokia: we can treat them as maintenance.

**Agreement:**

* No new bandwidth classes are specified for n\*100 MHz
* The discussion on the new channel bandwidth classes for FR2-2 is allowed in the maintenance of this WI.

**Issue 2-2c: Channel spacing for CA**

* Proposals
  + Proposal 1: For NR operating bands in FR2-2, nominal channel spacing is when the center frequencies of two closest channels are multiple of 100.8MHz or multiple of 100.8MHz plus 50.4MHz and the two channels do not overlap. Note CA of 2000MHz CBW with another CBW is not considered. (Apple, R4-2211873)
  + Proposal 2: Specify channel spacing for adjacent NR carriers and channel spacing for CA using the following rules: (Nokia, R4-2212845)
    - Channel centers are integer multiple of 100.8 MHz apart and
    - Channels are centered at closest available RF raster point with no overlap between carriers
  + Proposal 3: Align channel spacing for CA for FR2-2 between TS 38.104 and TS 38.101-2. (Nokia, R4-2212845)
* Recommended WF
  + Companies are encouraged to provide feedback on the three proposals listed
  + Note that this issue can be sub-divided into two parts: channel spacing for adjacent carriers and the definition of contiguous CA
    - Proposal 1 and Proposal 2 are aligned on channel spacing for adjacent carriers
    - For contiguous CA definition, revisions may be needed

**Discussions:**

Nokia: Intel formulation is good. One thing need to be clarified is that we do not enable any cases.

Intel: some bandwidth combination may exceed the nominal spacing. Do you have case that it does not work?

Nokia: need re-checking.

Apple: In general, Intel formulation can work.

**Chair** => check Intel’s concreate proposal:

*Nominal channel spacing*

Adjacent channel spacing can be expressed in compact form below for FR2-2 operating bands:

Nominal Channel spacing = ceil((BWChannel(1) + BWChannel(2))/100.8 MHz) \* (100.8/2) [MHz]

*Channel spacing for CA*

Since contiguous CA is intended for CA between adjacent carriers, we can simply re-use the nominal channel spacing for adjacent carrier captured above.

**Issue 2-2d: Configurations for intra-band contiguous CA**

* Proposals (Nokia, R4-2212845)
  + Proposal 1: Include CA configurations up to 5\*400 MHz and 8\*100 MHz.
  + Proposal 2: Include a note in CA configuration table to clarify that only multiples of the same channel bandwidth are allowed for FR2-2.

| **NR CA configuration / Bandwidth combination set / Fallback group** | | | | | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA configs.** | **Uplink CA configs.** | **BWChannel (MHz)** | **BWChannel (MHz)** | **BWChannel (MHz)** | **BWChannel (MHz)** | **BWChannel (MHz)** | **BWChannel (MHz)** | **BWChannel (MHz)** | **BWChannel (MHz)** | **Max aggregated**  **BW (MHz)** | **BCS** | **Fallback group** |
| CA\_n263B | CA\_n263A | 400 | 400 |  |  |  |  |  |  | 800 | 0 | 1 |
| CA\_n263C | CA\_n263A | 400 | 400 | 400 |  |  |  |  |  | 1200 | 0 | 1 |
| CA\_n263V | CA\_n263A | 400 | 400 | 400 | 400 |  |  |  |  | 1600 | 0 | 1 |
| CA\_n263W | CA\_n263A | 400 | 400 | 400 | 400 | 400 |  |  |  | 2000 | 0 | 1 |
| CA\_n263G | CA\_n263A | 100 | 100 |  |  |  |  |  |  | 200 | 0 | 3 |
| CA\_n263H | CA\_n263A | 100 | 100 | 100 |  |  |  |  |  | 300 | 0 | 3 |
| CA\_n263I | CA\_n263A | 100 | 100 | 100 | 100 |  |  |  |  | 400 | 0 | 3 |
| CA\_n263J | CA\_n263A | 100 | 100 | 100 | 100 | 100 |  |  |  | 500 | 0 | 3 |
| CA\_n263K | CA\_n263A | 100 | 100 | 100 | 100 | 100 | 100 |  |  | 600 | 0 | 3 |
| CA\_n263L | CA\_n263A | 100 | 100 | 100 | 100 | 100 | 100 | 100 |  | 700 | 0 | 3 |
| CA\_n263M | CA\_n263A | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 800 | 0 | 3 |
| NOTE 1: Void  NOTE 2: For the NR CA configuration with more than two component carries, the bandwidths in a BCS which may introduce combinations more than requested unintentionally should be listed in a row separately.  NOTE 3: In this release of the specification, contiguous DL CA configurations within FR2-2 may only contain multiples of the same channel bandwidth. | | | | | | | | | | | | |

* Recommended WF
  + Companies should share their views on the proposed configurations captured in the above table

**Discussions:**

Nokia: we do not have CR to introduce CA if we can have agreement in place.

Intel: that is my intention. We are going to have two separate CRs allocated.

**Sub-topic 3-1: Defining a band combination for FR1 + FR2-2 DC/CA**

At least one band combination for the case of FR2-2 DC/CA with an anchor in FR1 needs to be included to complete the work item. Alignment on an approach to take is encouraged.

**Issue 3-1: Approach to introduce an FR2-2 DC/CA with an anchor in FR1 combination**

* Option (Intel, R4-2212118)
  + RAN4 targets completing one example band combination FR2-2 DC/CA with an anchor in FR1 within the maintenance phase of the WI
  + Additional band combinations can be added in a release-independent manner as part of a Release 18 basket WI
  + To specify the example band combination FR2-2 DC/CA with an anchor in FR1, RAN4 could take a corresponding FR2-1 DC/CA combination with anchor in FR1 as a baseline in this meeting, with square brackets around the requirements, and aim to remove the brackets in the maintenance phase
* Recommended WF
  + Please share your views on the suggested approach, and any modifications or recommendations to introduce band combinations
  + Based on operator interest, companies are asked to consider n48 + n263 as a potential FR2-2 DC/CA + FR1 band combination to be completed within this work item

**Discussions:**

Nokia: is there no additional band combination added? In WI we consider three combinations.

CHTTL: how many configurations will be under this combination n48+n263? The list of configurations is long.

**Chair=>** further check if all the configurations can be finalized in this WI.

**Agreement:**

* Specify n48 + n263 within this work item and if n48 + n263 is completed, then the WI is viewed as completed.

**Agreement:**

* RAN4 targets completing one example band combination FR2-2 DC/CA with an anchor in FR1 within the maintenance phase of the WI
* Additional band combinations can be added in a release-independent manner as part of a Release 18 basket WI
* To specify the example band combination FR2-2 DC/CA with an anchor in FR1, RAN4 could take a corresponding FR2-1 DC/CA combination with anchor in FR1 as a baseline in this meeting, with square brackets around the requirements, and aim to remove the brackets in the maintenance phase

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**[104-e][111] NR\_ext\_to\_71GHz\_Part\_2, AI 9.14.3.1, 9.14.3.2 – Phil Coan**

**R4-2214089 Email Discussion Summary for [104-e][111] NR\_ext\_to\_71GHz\_Part\_2**

*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**

**Conclusions after 2nd round**

**GTW on Aug-18**

**Topic #0: Unwanted emissions and signal quality**

**Issue 0.1.1 EVM PTRS processing**

*Important to decide as it affects the MPR for 16QAM and 64QAM*

* Proposals

Proposal 10: The DMRS based channel estimate shall utilize CPE-corrected DMRS symbols

Proposal 11: The PTRS extraction and correction stage is used as the final refinement of the received signal.

Proposal 12: For CP-OFDM, all non-DMRS symbols in a slot must be equipped with PTRS, and frequency density of PTRS tones maximized.

Proposal 13a: For DFT-s-OFDM, PTRS is specified with 4 symbols per group, and the groups are configured in a ‘head and tail’ configuration.

Proposal 13b: For DFT-s-OFDM, the number of PTRS groups is maximised so the ratio of PUSCH symbols to PTRS symbols stays at 1 or higher.

* Recommended WF
  + Agree with all the proposals

**Agreement:**

* The DMRS based channel estimate shall utilize CPE-corrected DMRS symbols
* The PTRS extraction and correction stage is used as the final refinement of the received signal.
* For CP-OFDM, all non-DMRS symbols in a slot must be equipped with PTRS, and frequency density of PTRS tones maximized.
* For DFT-s-OFDM, PTRS is specified with 4 symbols per group, and the groups are configured in a ‘head and tail’ configuration.
* For DFT-s-OFDM, the number of PTRS groups is maximised so the ratio of PUSCH symbols to PTRS symbols stays at 1 or higher.

**FFS on PTRS configuration:**

* PTRS configuration during the test will be based on UE declaration.

**Discussion:**

Oppo: it causes the RAN5 test problem.

Apple: we are open. But we are not sure about the benefit. We should evaluate.

**Issue 0.1.2 EVM compliance power levels**

power range over which the EVM requirement applies

**CCBW = 100 MHz Power class 1 and 2**

* Proposals

Proposal 1: EVM compliance levels for FR2-2 CBW=100MHz in PC2 and PC1 are the same as FR2-1

****

* Recommended WF
  + Agree proposal 1

**Agreement:**

* Agree proposal 1.

**CCBW = 100 MHz Power class 3**

* Proposals

**Proposal 1: EVM compliance levels for FR2-2 CBW=100MHz in PC3 is the same as FR2-1**

**PC3 FR2-2 proposal**

|  |  |  |
| --- | --- | --- |
| **Parameter** | **Unit** | **100 MHz** |
| UE EIRP | dBm | [≥ -13] |
| UE EIRP for UL 16 QAM | dBm | [≥ -10] |
| UE EIRP for UL 64 QAM | dBm | [≥ -6] |

* Recommended WF
  + Agree proposal 1

**Agreement:**

* Agree proposal 1

**CCBW >= 400 MHz Power class 3**

* Proposals

Proposals in R4-2111628 and R4-2212372 differ by 3 dB



* Recommended WF
  + Discuss between the two proposals

**Discussions:**

Moderator: wonder where 3dB difference comes from in Apple paper.

Apple: the intention is to correct the values. We start with FR2-1 range.

**CCBW >= 400 MHz, Power class 1 and 2**

Proposal in R4-2111628



* Recommended WF
  + Agree the proposal for PC1 and PC2 for CBW >= 400 MHz

**Discussions:**

LGE: These numbers are aligned with ours.

**Agreement:**

* The numbers in the table of the proposal are agreeable, but further checking is needed.

**Issue 0.1.3 Phase noise mask assumption for EVM**

Companies may choose to align on PN mask assumption as a means to arrive at MPR, however MPR values between companies are pretty close so in the end agreement on PN mask may not be necessary

* Proposals

**Proposal 1: RAN4 uses the proposed PN mask for development of EVM requirements. (R4-2211628)**

* Recommended WF
  + Agree proposal 1

**Issue 0.1.4 Carrier leakage for PC1 and PC3**

*Carrier leakage values*

* Proposal 1: PC1 carrier leakage for n263 as shown in the table:

|  |  |
| --- | --- |
| **Parameters** | **Relative Limit (dBc)** |
| EIRP > 13.4 dBm | -25 |
| 0.4 dBm ≤ EIRP ≤ 13.4 dBm | -20 |

* Proposal 2: PC3 carrier leakage for n263 as shown in the table:

|  |  |
| --- | --- |
| **Parameters** | **Relative Limit (dBc)** |
| EIRP > -1.9 dBm | -25 |
| -14.9dBm ≤ EIRP ≤ -1.9 dBm | -20 |

* Recommended WF
  + Agree with the proposals

**Agreement:**

* Agree proposal 1 and proposal 2.

**Issue 0.1.5 Inband emissions for PC1, PC2, and PC3**

* Proposals
  + Proposal 1: Use the PC1 and PC3 inband emissions as in the tables. (R4-2211628)

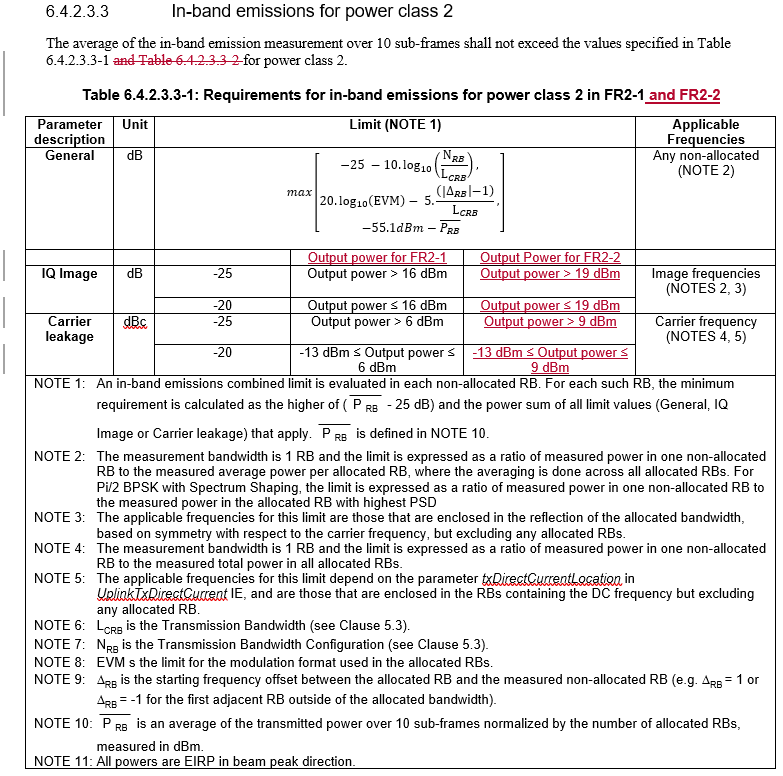
**Table 6.4.2.3.2-1: Requirements for in-band emissions for power class 1**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Parameter description** | **Unit** | **Limit (NOTE 1)** | | | **Applicable Frequencies** |
| **General** | dB |  | | | Any non-allocated (NOTE 2) |
|  |  |  | Output power for FR2-1 | Output Power for FR2-2 |  |
| **IQ Image** | dB | -25 | > 27 dBm | > 23.4 dBm | Image frequencies (NOTES 2, 3) |
|  |  | -20 | ≤ 27 dBm | ≤ 23.4 dBm |  |
| **Carrier leakage** | dBc | -25 | > 17 dBm | > 13.4 dBm | Carrier frequency (NOTES 4, 5) |
|  |  | -20 | 4 dBm ≤ Output power ≤ 17 dBm | 0.4 dBm ≤ Output power ≤ 13.4 dBm |  |

**Table 6.4.2.3.4-1: Requirements for in-band emissions for power class 3**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Parameter description** | **Unit** | **Limit (NOTE 1)** | | | **Applicable Frequencies** |
| **General** | dB |  | | | Any non-allocated (NOTE 2) |
|  |  |  | Output power for FR2-1 | Output Power for FR2-2 |  |
| **IQ Image** | dB | -25 | > 10 dBm | > 8.1 dBm | Image frequencies (NOTES 2, 3) |
|  |  | -20 | ≤ 10 dBm | ≤ 8.1 dBm |  |
| **Carrier leakage** | dBc | -25 | > 0 dBm | > -1.9dBm | Carrier frequency (NOTES 4, 5) |
|  |  | -20 | -13 dBm ≤ Output power ≤ 0 dBm | -14.9 dBm ≤ Output power ≤ -1.9 dBm |  |

* + Proposal 2 on formatting of PC2 agreed inband emissions (from LGE comment in thread)



* Recommended WF
  + WF #1 Agree with the proposal 1
  + WF #2 Agree with proposal 2 using modified table title with the “in FR2-1 and FR2-2” removed

**Agreement:**

* Agree with the proposal 1
* Agree with proposal 2 using modified table title with the “in FR2-1 and FR2-2” removed

**Topic #1: MPR and A-MPR**

Open issues summary

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

**Issue 1.1.1 MPR**

MPR for power class 1 and power class 3 all SCS and CBW

**Power class 1**

* Proposals
  + Proposal 1: RAN4 adopt the PC1 MPRWT values in the tables and use the same MPRNARROW definition and values as FR2-1. (R4-2211628). The numbers for 16 and 64QAM assume the PTRS proposal in R4-

**Table 6.2.2.1-3 MPRWT for power class 1, BWchannel = 100 MHz in FR2-2**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Modulation** | | **MPRWT (dB), BWchannel = 100 MHz** | | |
|  | | **Outer RB allocations** | **Inner RB allocations** | |
|  | |  | **Region 1** | **Region 2** |
| DFT-s-OFDM | Pi/2 BPSK | ≤ 5.5 | 0.0 | ≤ 3.5 |
|  | QPSK | ≤ 6.5 | 0.0 | ≤ 3.5 |
|  | 16 QAM | ≤ 7.0 | ≤ 2.5 | ≤ 2.5 |
|  | 64 QAM | ≤ 8.0 | ≤ 8.0 | ≤ 8.0 |
| CP-OFDM | QPSK | ≤ 8.0 | ≤ 1.5 | ≤ 3.5 |
|  | 16 QAM | ≤ 8.0 | ≤ 3.5 | ≤ 4.0 |
|  | 64 QAM | ≤ 9.5 | ≤ 9.5 | ≤ 9.5 |

**Table 6.2.2.1-4 MPRWT for power class 1, BWchannel >= 400 MHz in FR2-2**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Modulation** | | **MPRWT (dB), BWchannel = 400, 800, 1600, 2000 MHz** | | |
|  | | **Outer RB allocations** | **Inner RB allocations** | |
|  | |  | **Region 1** | **Region 2** |
| DFT-s-OFDM | Pi/2 BPSK | ≤ 6.0 | ≤ 1.0 | ≤ 3.5 |
|  | QPSK | ≤ 6.0 | ≤ 1.0 | ≤ 4.0 |
|  | 16 QAM | ≤ 4.5 | ≤ 3.0 | ≤ 3.0 |
|  | 64 QAM | ≤ 8.0 | ≤ 8.0 | ≤ 8.0 |
| CP-OFDM | QPSK | ≤ 6.0 | ≤ 1.5 | ≤ 3.5 |
|  | 16 QAM | ≤ 6.0 | ≤ 4.0 | ≤ 5.5 |
|  | 64 QAM | ≤ 10.0 | ≤ 10.0 | ≤ 10.0 |

* Recommended WF
  + Agree proposal 1. Note the 16QAM and 64QAM values are valid only if PTRS proposal is agreed as the values will change without PTRS.

**Discussions:**

Huawei: need further checking.

Nokia: there is significant jump of 64QAM over other modulations.

Qualcomm: to Nokia, 64QAM values that Qualcomm provided are not based on phase noise achievable and we base on the simulation. The phase noise mask is even cleaner. PTRS compensation is conducted to improve the MPR and achievable phase noise.

Ericsson: to look at the implementation of values. We looks at one example of proposal 3 of 16QAM DFT. In practice UE may be better. We recognize the difficulty but we need consider the usefulness of these numbers. We provided the comments and encouraged companies to check.

**Chair=>** discuss further together with the following MPR proposals for power classe 3

**Power class 3 100 MHz**

* Proposal 1: Numbers in the “PROP #1” column assuming QCOM PTRS processing is agreed
* Proposal 2: PROP2 column

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Modulation | | PC3 MPRWT, BWchannel = 100 MHz | | | |
| **Inner RB allocations,**  Region 1 | | **Edge RB allocations** | |
| ***PROP #1*** | ***PROP #2*** | ***PROP #1*** | ***PROP #2*** |
| DFT-s-OFDM | Pi/2 BPSK | 0.0 | 0 | ≤ 0.5 | 2 |
|  | QPSK | 0.0 | 0 | ≤ 0.5 | 2 |
|  | 16 QAM | ≤ 3.0 | 3 | ≤ 2.5 | 3.5 |
|  | 64 QAM | ≤ 8.5 | 5 | ≤ 8.5 | 5.5 |
| CP-OFDM | QPSK | ≤ 1.5 | 3.5 | ≤ 1.5 | 4 |
|  | 16 QAM | ≤ 4.0 | 5 | ≤ 4.0 | 5 |
|  | 64 QAM | ≤ 10.0 | 7.5 | ≤ 10.0 | 7.5 |

* Recommended WF
  + Discuss proposal 1 and proposal 2

**Power class 3 > 100 MHz**

* Proposal 1 option A: MPR is the same for 400, 800, 1600, and 200 MHz and uses the PROP#1 numbers
* Proposal 1 option B: MPR is the same for 400, 800, 1600, and 200 MHz and uses the PROP#2 numbers

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Modulation | | PC3 MPRWT, BWchannel >= 400 MHz | | | |
| **Inner RB allocations,**  Region 1 | | **Edge RB allocations** | |
| ***PROP #1*** | ***PROP #2*** | ***PROP #1*** | ***PROP #2*** |
| DFT-s-OFDM | Pi/2 BPSK | 1.0 | 0 | ≤ 1.0 | 3 |
|  | QPSK | 1.0 | 0 | ≤ 1.0 | 3 |
|  | 16 QAM | ≤ 3.5 | 4.5 | ≤ 3.0 | 4.5 |
|  | 64 QAM | ≤ 9.5 | 6.5 | ≤ 9.0 | 6.5 |
| CP-OFDM | QPSK | ≤ 2.0 | 5 | ≤ 2.0 | 5 |
|  | 16 QAM | ≤ 4.0 | 6.5 | ≤ 4.0 | 6.5 |
|  | 64 QAM | ≤ 10.0 | 9 | ≤ 10.0 | 9 |

* Proposal 3: Consider the following MPR delta for CBW of 800MHz, 1600MHz and 200MHz
  + X1 = 1.0, Y1 = 1.0 for 800MHz
  + X2 = 2.0, Y2 = 2.5 for 1600MHz
  + X3 = 2.0, Y3 = 2.5 for 2000MHz

**Table 6.2.2.3-3 MPRWT for power class 3, BWchannel = 800 MHz, FR2-2**

|  |  |  |  |
| --- | --- | --- | --- |
| **Modulation** | | **MPRWT, BWchannel = 800 MHz** | |
|  | | **Inner RB allocations,**  **Region 1** | **Edge RB allocations** |
| DFT-s-OFDM | Pi/2 BPSK | 0.0 | ≤ 4.0 |
|  | QPSK | 0.0 | ≤ 4.0 |
|  | 16 QAM | ≤ 5.5 | ≤ 5.5 |
|  | 64 QAM | ≤ 7.5 | ≤ 7.5 |
| CP-OFDM | QPSK | ≤ 6.0 | ≤ 6.0 |
|  | 16 QAM | ≤ 7.5 | ≤ 7.5 |
|  | 64 QAM | ≤ 10.0 | ≤ 10.0 |

**Table 6.2.2.3-4 MPRWT for power class 3, BWchannel = 1600 and 2000 MHz, FR2-2**

|  |  |  |  |
| --- | --- | --- | --- |
| **Modulation** | | **MPRWT, BWchannel = 1600 MHz** | |
|  | | **Inner RB allocations,**  **Region 1** | **Edge RB allocations** |
| DFT-s-OFDM | Pi/2 BPSK | 0.0 | ≤ 5.0 |
|  | QPSK | 0.0 | ≤ 5.0 |
|  | 16 QAM | ≤ 7.0 | ≤ 7.0 |
|  | 64 QAM | ≤ 9.0 | ≤ 9.0 |
| CP-OFDM | QPSK | ≤ 7.5 | ≤ 7.5 |
|  | 16 QAM | ≤ 9.0 | ≤ 9.0 |
|  | 64 QAM | ≤ 11.5 | ≤ 11.5 |

* Proposal 4: Same as proposal 3 except the 800 MHz table is slightly different.
  + X1=[1.0], X2=[2.0], X3=[2.0] dB, Y1=[1.5], Y2=[2.5] and Y3=[2.5] dB.

**Table 6.2.2.3-3 MPRWT for power class 3, BWchannel = 800 MHz, FR2-2**

|  |  |  |  |
| --- | --- | --- | --- |
| **Modulation** | | **MPRWT, BWchannel = 800 MHz** | |
|  | | **Inner RB allocations,**  **Region 1** | **Edge RB allocations** |
| DFT-s-OFDM | Pi/2 BPSK | 0.0 | ≤ 4.0 |
|  | QPSK | 0.0 | ≤ 4.0 |
|  | 16 QAM | ≤ 6.0 | ≤ 6.0 |
|  | 64 QAM | ≤ 8.0 | ≤ 8.0 |
| CP-OFDM | QPSK | ≤ 6.5 | ≤ 6.5 |
|  | 16 QAM | ≤ 8.0 | ≤ 8.0 |
|  | 64 QAM | ≤ 10.5 | ≤ 10..5 |

* Recommended WF
  + For PC3 > 100 MHz Discuss between proposal 1, 2, and 3

**Issue 1.1.2 A-MPR for EN 303753**

Emissions mask in EN 303753

* Proposals
  + Proposal 1: No A-MPR requirement needed for the EN 303753 emissions mask.
* Recommended WF
  + No A-MPR needed for EN 303753

**Agreement:**

* No A-MPR requirement needed for the EN 303753 emissions mask.

**Topic #2: Other TX power related issues**

**Issue 2.1.1 PC3 max TRP**

* Proposals
  + Observation 1: The 27 dBm value listed for band n263 in Table 6.2.1.3-2 is a conducted limit that can be verified by max TRP ≤ 27dBm when suitable methods to measure maximum power level at antenna port or ports are not available. Therefore, we should consider whether a clarifying note is needed in the table:

****

* Recommended WF
  + Discuss in round 1

Chair=> this issues is missed during GTW.

**Issue 2.1.2 UL gap for TX power management**

* Proposals
  + Proposal 1: The UL gap for Tx power measurement doesn’t apply to FR2-2 in Rel-17.
* Recommended WF
  + Discuss in round 1

**Discussions:**

Huawei: uplink gap for power measurement is based on FR2-1. We do not think the requirements can be applied for FR2-2.

Apple: We believe that UL gap helps UE handles MPE. I think the basic feature should be equally applicable to FR2-2.

Huawei: we does not object it but we want to check the requirements.

Apple: What do you mean by saying any particular action?

Huawei: the whole discussion of UL gap for requirement is based on the assumption of FR2-1. For example the measurement period and duty cycle. We have not discussed the details for FR2-2.

Apple: FR2-2 is introduce the new band. UL gap is a general feature.

**Issue 2.1.3 Multi-band relaxation**

* Proposals
  + Proposal 1: Remove the brackets on the multi-band relaxation factors (∆MBP,n and ∆MBS,n) of band n263 and confirm both values are 1.0 dB.

****

* Recommended WF
  + Agree proposal 1

**Agreement:**

* Agree proposal 1.

**Issue 2.1.4 Pmin**

* Proposal 1: PC1 Pmin to be 4 dBm. PC2 and PC3 Pmin to be -13 dBm as shown in the tables
* Recommended WF
  + PC1 Pmin to be 4 dBm. PC2 and PC3 Pmin to be -13 dBm

**Agreement:**

* PC1 Pmin to be 4 dBm. PC2 and PC3 Pmin to be -13 dBm

**Issue 2.1.5 TX OFF power**

* Proposals
  + Proposal 1: Reuse FR2-1 requirements for minimum output power and OFF power, specifically remove the [] from this table

****

* Recommended WF
  + Agree proposal 1

**Agreement:**

* Agree proposal 1.

**Topic #3: CA unwanted emissions and signal quality**

**Issue 3.1.1 Carrier leakage for power classes 1 and 3 in CA**

* Proposals
  + Proposal 1: For CA carrier leakage use the PC1 and PC3 values in the tables.
  + Proposal 2: For n263 PC2 use the same value as in FR2-1 since the min peak EIRP values are nearly the same.

**PC1 carrier leakage for n263 as shown in the table:**

|  |  |
| --- | --- |
| **Parameters** | **Relative Limit (dBc)** |
| EIRP > 13.4 dBm | -25 |
| 0.4 dBm ≤ EIRP ≤ 13.4 dBm | -20 |

**PC3 carrier leakage for n263 as shown in the table:**

|  |  |
| --- | --- |
| **Parameters** | **Relative Limit (dBc)** |
| EIRP > -1.9 dBm | -25 |
| -14.9dBm ≤ EIRP ≤ -1.9 dBm | -20 |

* Recommended WF
  + Agree proposal 1 and proposal 2

**Agreement:**

* Agree proposal 1 and proposal 2.

**Issue 3.1.2 Inband emissions for power classes 1 and 3 in CA**

* Proposals
  + Proposal 1: Re-use the FR2-1 CA inband emissions method for PC1 and PC3 CA with the same output power values we are proposing for FR2-2 single carrier. (R4-2211628)
* Recommended WF
  + Agree proposal 1

**Agreement:**

* Agree proposal 1.

**Issue 3.1.3 SEM for CA**

* Proposals
  + Proposal 1: Re-use the FR2-1 CA SEM requirements for FR2-2.
* Recommended WF
  + Agree proposal 1

**Agreement:**

* Agree proposal 1

**Issue 3.1.4 ACLR for CA**

* Proposals
  + Proposal 1: Use the FR2-2 single carrier 15 dB ACLR value for CA
* Recommended WF
  + Agree proposal 1

**Discussions:**

Huawei: in previous RAN4 agreement, OBW is more stringent than ACLR. Should we send RAN5 to indicate the RAN4 agreement?

Nokia: We agree with moderator. This is RAN5 discussion. To Huawei, we do not believe it is necessary. Huawei can raised it in RAN5.

**Agreement:**

* Agree proposal 1
* The common understanding in RAN4 is that OBW requirement is more stringent than ACLR for FR2-2.

**Issue 3.1.5 OBW for CA**

* Proposals
  + Proposal 1: Re-use the FR2-2 single carrier 99% OBW for CA
* Recommended WF
  + Agree proposal 1

**Agreement:**

* Agree proposal 1

**Topic #4: CA output power, MPR, and A-MPR**

**Issue 4.1.1 Maximum output power for CA**

* Proposals
  + Proposal 1: FR2-2 PC1 and PC3 power classes for CA are the same as for FR2-2 single carrier. Note this is the same approach as in FR2-1.
* Recommended WF
  + Agree proposal 1

**Agreement:**

* Agree proposal 1.

**Issue 4.1.2 MPR for CA**

* Proposals
  + Proposal 1: Adopt the CA MPR tables for PC1 and PC3. (R4-2211628)

**Table TBD Maximum power reduction (MPRWT\_C\_CA) for FR2-2 UE power class 1**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Waveform Type** | **Cumulative aggregated channel bandwidth** | | | |
| **< 400 MHz** | **≥ 400 MHz and < 800 MHz** | **≥ 800 MHz and ≤ 1400 MHz** | **> 1400 MHz and ≤ 2000 MHz** |
| Pi/2 BPSK | ≤ 7.0 | ≤ 5.0 | ≤ 2.0 | ≤ 2.0 |
| QPSK | ≤ 8.0 | ≤ 6.0 | ≤ 3.0 | ≤ 3.0 |
| 16 QAM | ≤ 8.0 | ≤ 6.0 | ≤ 4.0 | ≤ 4.0 |
| 64 QAM | ≤ 10.0 | ≤ 10.0 | ≤ 10.0 | ≤ 10.0 |

**Table TBD Maximum power reduction (MPRWT\_C\_CA) for FR2-2 UE power class 3**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Waveform Type** | **Cumulative aggregated channel bandwidth** | | | |
| **< 400 MHz** | **≥ 400 MHz and < 800 MHz** | **≥ 800 MHz and ≤ 1400 MHz** | **> 1400 MHz and ≤ 2000 MHz** |
| Pi/2 BPSK | ≤ 1.0 | ≤ 1.0 | ≤ 1.0 | ≤ 1.0 |
| QPSK | ≤ 2.0 | ≤ 2.0 | ≤ 2.0 | ≤ 2.0 |
| 16 QAM | ≤ 4.0 | ≤ 4.0 | ≤ 4.0 | ≤ 4.0 |
| 64 QAM | ≤ 10.0 | ≤ 10.0 | ≤ 10.0 | ≤ 10.0 |

* Recommended WF
  + Agree proposal 1

Chair=> need futher discusions.

**Issue 4.1.3 A-MPR for CA**

*Sub-topic description*

* Proposals
  + Proposal 1: No CA A-MPR needed for the EN 303753 emissions mask.
* Recommended WF
  + Agree proposal 1

**Agreement:**

* Agree proposal 1

**Topic #5: Other TX or general Issues**

**Issue 5.1.1 Minimum guard band (Table 5.3.3-1)**

* Proposals
  + Proposal 1: Agree TP#1 above to 38.101-2 removing the square brackets in Table 5.3.3-1

**Table 5.3.3-1: Minimum guardband for each UE channel bandwidth and SCS (kHz)**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **SCS (kHz)** | **50 MHz** | **100 MHz** | **200 MHz** | **400 MHz** | **800 MHz** | **1600 MHz** | **2000 MHz** |
| 60 | 1210 | 2450 | 4930 | N/A | N/A | N/A | N/A |
| 120 | 1900 | 2420 | 4900 | 9860 | N/A | N/A | N/A |
| 480 | N/A | N/A | N/A | 9680 | 42640 | 85520 | N/A |
| 960 | N/A | N/A | N/A | 9440 | 42400 | 85280 | 147040 |

* Recommended WF
  + Agree proposal 1

**Agreement:**

* Agree proposal 1

**Issue 5.1.2 PRACH time mask**

* Proposals
  + Proposal 1: PRACH ON power measurement period table should be updated for 480 and 960 SCS as shown. (R4-2211628)

**Table 6.3.3.4-1: PRACH ON power measurement period**

|  |  |  |  |
| --- | --- | --- | --- |
| **Format** | **SCS** | **Measurement period** | **Note** |
| A1 | 60 kHz | 0.035677 ms |  |
|  | 120 kHz | 0.017839 ms |  |
|  | 480 kHz | 0.004460 ms |  |
|  | 960 kHz | 0.002230 ms |  |
| A2 | 60 kHz | 0.071354 ms |  |
|  | 120 kHz | 0.035677 ms |  |
|  | 480 kHz | 0.008919 ms |  |
|  | 960 kHz | 0.004460 ms |  |
| A3 | 60 kHz | 0.107031 ms |  |
|  | 120 kHz | 0.053516 ms |  |
|  | 480 kHz | 0.013379 ms |  |
|  | 960 kHz | 0.006690 ms |  |
| B1 | 60 kHz | 0.035091 ms |  |
|  | 120 kHz | 0.0175455 ms |  |
|  | 480 kHz | 0.004386 ms |  |
|  | 960 kHz | 0.002193 ms |  |
| B4 | 60 kHz | 0.207617 ms |  |
|  | 120 kHz | 0.103809 ms |  |
|  | 480 kHz | 0.025952 ms |  |
|  | 960 kHz | 0.012976 ms |  |
| A1/B1 | 60 kHz | 0.035677 ms for front X1 occasion 0.035091 ms for last occasion  X | X1 = [2,5] |
|  | 120 kHz | 0.017839 ms for front X1occasion 0.017546 ms for last occasion  X |
|  | 480 kHz | 0.004460 ms for front X1 occasion  0.004387 ms for last occasion |
|  | 960 kHz | 0.017839 ms for front X1occasion 0.017546 ms for last occasion |
| A2/B2 | 60 kHz | 0.071354 ms for front X2 occasion 0.069596 ms for last occasion  X | X2 = [1,2] |
|  | 120 kHz | 0.035677 ms for front X2 occasion 0.034798 ms for last occasion  X |
|  | 480 kHz | 0.008919 ms for front X2 occasion 0.008700 ms for last occasion |
|  | 960 kHz | 0.004460 ms for front X2 occasion 0.004350 ms for last occasion |
| A3/B3 | 60 kHz | 0.107031 ms for first occasion 0.104101 ms for second occasion |  |
|  | 120 kHz | 0.053515 ms for first occasion 0.052050 ms for second occasion |  |
|  | 480 kHz | 0.013379 ms for first occasion 0.013013 ms for second occasion |  |
|  | 960 kHz | 0.006689 ms for first occasion 0.006506 ms for second occasion |  |
| C0 | 60 kHz | 0.026758 ms |  |
|  | 120 kHz | 0.013379 ms |  |
|  | 480 kHz | 0.003345 ms |  |
|  | 960 kHz | 0.001672 ms |  |
| C2 | 60 kHz | 0.083333 ms |  |
|  | 120 kHz | 0.0416667 ms |  |
|  | 480 kHz | 0.010417 ms |  |
|  | 960 kHz | 0.005208 ms |  |
| NOTE: For PRACH on PRACH occasion start from begin of 0ms or 0.5 ms boundary, the measurement period will plus 0.032552 μs | | | |

* Recommended WF
  + Agree proposal 1

**Discussions:**

Huawei: I have no concern on the values. The maximum period is only 2us. The off power mask in RAN5. I do not know if 2us is feasible or not for measurement from test perspective.

Qualcomm: we can have discussion with TE vendor.

**Issue 5.1.3 Beam correspondence**

* Proposals
  + Proposal 1: All FR2-2 UEs shall support beamCorrespondenceWithoutUL-BeamSweeping.
  + Proposal 2: RAN4 shall apply the minimum SSB and minimum CSI-RS as provided in Table 1 and Table 2 for band n263. (re: 38.101-2 6.6.4.3.1)

**Table 1: Conditions for SSB based L1-RSRP measurements for beam correspondence**

|  |  |
| --- | --- |
| **Band** | **Minimum SSB (dBm/SCSSBB)** |
| n257 | -96.2 |
| n258 | -96.2 |
| n259 | -90.7 |
| n260 | -91.9 |
| n261 | -96.2 |
| n262 | -88.5 |
| n263 | -88.2 |

**Table 2: Conditions for CSI-RS based L1-RSRP measurements for beam correspondence**

|  |  |
| --- | --- |
| **Band** | **Minimum CSI-RS (dBm/SCSSBB)** |
| n257 | -96.2 |
| n258 | -96.2 |
| n259 | -90.7 |
| n260 | -91.9 |
| n261 | -96.2 |
| n262 | -88.5 |
| n263 | -88.2 |

* Recommended WF
  + Discuss during round 1

**Discussions:**

Qualcomm: prefer proposal 1.

Huawei: I do think we can agree on proposal 2 without proposal 1. Regarding proposal 1, for FR2-2, people have different design for the antenna the frequency range is different from FR2-1. We can keep the capability optional.

Qualcomm: for table 2, it is said CSI-RS based …

Nokia: we prefer option 1. The UL sweeping is agreed in Rel-15. In Rel-17 it is not needed. Proposal 2 needs further discussions.

OPPO: regarding proposal 1, we slightly prefer not to mandate without beam sweeping. In market no device can support 71. The propagation condition would be different from below 71Ghz. And the antenna is different. We would like to be conservative.

Sony: for proposal 1 we echo Qualcomm and Nokia. From antenna, even if we is moving up to higher frequency, there is no fundamental difference.

**Issue 5.1.4 ON/ON transient periods**

* Options
  + Option 1: The transient period from FR2-1 is based on the capability of the UE to configure the transmitter and receiver. The same capability will exist in FR2-2. Use the same 5usec for FR2-2.
  + Option 2: Introduce 2 µS improved ON/ON transient period as optional UE capabilities for 480 and 960 kHz SCS.
* Recommended WF
  + Discuss during round 1

**Discussions:**

OPPO: we prefer Option 1. For option 2, where is 2us coming from?

Intel: we had it a few meetings ago. We presented the benefit. If companies want to discuss the exact numbers, we are open to discussion. But we want to have it as optional feature.

AT&T: it was discussed for many meetings. The views are diverse. We agreed the benefit and optional features. We would like to introduce it in Rel-17. We would like to consider it in Rel-18 if needed and if we get the alignment in RAN4 to add it into FR2 enhancement.

Nokia: we support AT&T. We should consider it for Rel-18.

**Chair=>** align companies’ view if it needs be discussed in Rel-18.

**Issue 5.1.5 Beam direction only switching time**

* Proposals
  + Proposal 1: Use a UE beam direction switching time of 59 ns.
* Recommended WF
  + Discuss during round 1

**Discussions:**

Ericsson: 200us requirement is not feasible. It is longer than CP. I wonder if we could consider the compromised value 100ns at least for 480KHz SCS.

Nokia: from many meetings, we know 200us is longer than CP which does not work.

Qualcomm: the UE architecture of FR2-2 is similar as FR2-1. From feasibility perspective, it does not work. We think 200ns is needed for FR2-2.

Huawei: we agree with Qualcom’s view. 200ns is generated based on practical design. 59ns is not feasible.

**Topic #6: RX issues**

**Issue 6.1.1 REFSENS**

* Proposals
  + Proposal 1: Implement the agreed PC1 REFSENS in the specification. (-79 dBm/400 MHz)
  + Proposal 2: Specify the uplink configuration for band n263 as in Table 2.6-1. (R4-2213369)

**Table 2.6-1**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Operating band** | **NR Band / Channel bandwidth / NRB / SCS / Duplex mode** | | | | | | | | |
|  | **50 MHz** | **100 MHz** | **200 MHz** | **400 MHz** | **800 MHz** | **1600 MHz** | **2000 MHz** | **SCS** | **Duplex Mode** |
| n257 | 32 | 64 | 128 | 256 | N.A | N.A | N.A | 120 kHz | TDD |
| n258 | 32 | 64 | 128 | 256 | N.A | N.A | N.A | 120 kHz | TDD |
| n260 | 32 | 64 | 128 | 256 | N.A | N.A | N.A | 120 kHz | TDD |
| n261 | 32 | 64 | 128 | 256 | N.A | N.A | N.A | 120 kHz | TDD |
| n262 | 32 | 64 | 128 | 256 | N.A | N.A | N.A | 120 kHz | TDD |
| n263 | N.A | 64 | N.A | 256 | N.A | N.A | N.A | 120 kHz | TDD |
| N.A | N.A | N.A | N.A | 120 | 243 | N.A | 480 kHz | TDD |
| N.A | N.A | N.A | N.A | N.A | N.A | 144 | 960 kHz | TDD |

* + Proposal 3: vivo in thread

The NRB number for uplink configuration for band n263 is not the same with what we agreed for.

The numbers for 400M with 480/960k and 800M/1600M with 960k are missing.

**Table 5.3.2-1: Maximum transmission bandwidth configuration NRB**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **SCS (kHz)** | **50 MHz** | **100 MHz** | **200 MHz** | **400 MHz** | **800 MHz** | **1600 MHz** | **2000 MHz** |
|  | **NRB** | **NRB** | **NRB** | **NRB** | **NRB** | **NRB** | **NRB** |
| 60 | 66 | 132 | 264 | N/A | N/A | N/A | N/A |
| 120 | 32 | 66 | 132 | 264 | N/A | N/A | N/A |
| 4801 | N/A | N/A | N/A | 66 | [124] | [248] | N/A |
| 9601 | N/A | N/A | N/A | 33 | [62] | [124] | 148 |
| Note 1: This SCS is optional in this release of the specification. | | | | | | | |

* Recommended WF
  + WF #1 Agree proposal 1
  + WF #2 - discuss the discrepancy between proposals 2 and 3

**Discussions:**

Huawei: Proposal 2 comes from Huawei. The uplink configuration is not targeting to provide all the combinations of channel bandwidth and SCS. When the REFSEN test is conducted for one SCS, we do not need to do it for other SCS. We are not sure if UE can support 480KHz all the time. So we should add 800 and 1600MHz for 960KHz to ensure all the bandwidths combination can be tested.

**Agreement:**

* Agree proposal 1.

**Issue 6.1.2 EIS relaxation for intraband contiguous CA**

* Proposals
  + Proposal 1: Use the same values as in FR2-1. For 1600-2000 MHz FR2-2 EIS relaxation dB value as [1.5]

**Table 7.3A.2.1-1: EIS Relaxation for CA operation by aggregated channel bandwidth**

|  |  |
| --- | --- |
| **Aggregated Channel BW 'BWChannel\_CA' (MHz)** | **(dB)** |
| BWChannel\_CA ≤ 800 | 0 |
| 800 < BWChannel\_CA ≤ 1200 | 0.5 |
| 1200 < BWChannel\_CA ≤ 1600 | 1.0 |
| 1600 < BWChannel\_CA ≤ 2000 | [1.5] |

* Recommended WF
  + Agree proposal 1

**Agreement:**

* Agree proposal 1.

**Issue 6.1.3 In-band blocking**

* Proposals
  + Proposal 1: Agree the IBB values as shown in the table (R4-2213221 and identical proposal in R4-2211629)

**Table 7.6.2-1: In band blocking requirements**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Rx parameter** | **Units** | **Channel bandwidth** | | | | | | | | | |
|  |  | **50 MHz** | **100 MHz** | **200 MHz** | **400 MHz** | | **800 MHz** | | **1600 MHz** | | **2000 MHz** | |
| Power in Transmission Bandwidth Configuration | dBm | REFSENS + 14 dB | | | |  | |  | |  | |
| BWInterferer | MHz | 50 | 100 | 200 | 400 | | 800 | | 1600 | | 2000 | |
| PInterferer  for bands n257, n258, n261 | dBm | REFSENS + 35.5 dB | REFSENS + 35.5 dB | REFSENS + 35.5 dB | REFSENS + 35.5 dB | | N.A. | | N.A. | | N.A. | |
| PInterferer  for bands n259, n260, n262 | dBm | REFSENS + 34.5 dB | REFSENS + 34.5 dB | REFSENS + 34.5 dB | REFSENS + 34.5 dB | | N.A. | | N.A. | | N.A. | |
| PInterferer  for band n263 | dBm | N.A. | REFSENS + 33.5 dB | N.A. | REFSENS + 33.5 dB | | REFSENS + 33.5 dB | | REFSENS + 33.5 dB | | REFSENS + 33.5 dB | |
| FIoffset | MHz | ≤ -100 & ≥ 100  NOTE 5 | ≤ -200 & ≥ 200  NOTE 5 | ≤ -400 & ≥ 400  NOTE 5 | ≤ -800 & ≥ 800  NOTE 5 | | ≤ -1600 & ≥ 1600  NOTE 5 | | ≤ -3200 & ≥ 3200 | | ≤ -4000 & ≥ 4000 | |
| FInterferer | MHz | FDL\_low + 25  to  FDL\_high - 25 | FDL\_low + 50  to  FDL\_high - 50 | FDL\_low + 100  to  FDL\_high - 100 | FDL\_low + 200  to  FDL\_high - 200 | | FDL\_low + 400  to  FDL\_high - 400 | | FDL\_low + 800  to  FDL\_high - 800 | | FDL\_low + 1600  to  FDL\_high - 1600 | |

* Recommended WF
  + Agree proposal 1

**Discussions:**

Huawei: to the format, we have similar changes with different format to introduce the requirements in the separate tables.

**Agreement:**

* Agree the IBB values as shown in the table in proposal 1
  + FFS whether to use one table or separate tables to capture the requriements.

**Issue 6.1.4 CA In-band blocking**

* Proposals
  + Proposal 1: Agree CA IBB requirements as given in TP#3 and TP#4. (R4-2213221 and identical proposal6 in R4-2211629 )

**Table 7.6A.2.1-1: In band blocking minimum requirements for intra-band contiguous CA**

|  |  |  |
| --- | --- | --- |
| **Rx Parameter** | **Units** | **All CA bandwidth classes** |
| Power in Transmission Bandwidth Configuration, per CC |  | REFSENS + 14 dB |
| Pinterferer for band n257, n258, n261 | dBm | Aggregated power + 21.5 |
| Pinterferer for band n260, n262 | dBm | Aggregated power + 20.5 |
| Pinterferer for band n263 | dBm | Aggregated power + 19.5 |

* Recommended WF
  + Agree proposal 1

**Agreement:**

* Agree proposal 1

**Issue 6.1.5 Maximum input level for** **Intra-band contiguous CA**

* Proposals
  + Proposal 1: Use the FR2-1 max input for intra-band contiguous requirement for FR2-2.
* Recommended WF
  + Agree proposal 1

**Agreement:**

* Agree proposal 1

**Issue 6.1.6 Adjacent channel selectivity**

* Proposals
  + The tables below with:
    - Option 1: using 21 dB for the ACS for all CCBWs.
    - Option 2: using 21 dB for CCBW <= 400 MHz and 20 dB for > 400 MHz.

**Table 7.5-1: Adjacent channel selectivity**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Operating band** | **Units** | **Adjacent channel selectivity / Channel bandwidth** | | | | | | |
|  |  | **50 MHz** | **100 MHz** | **200 MHz** | **400 MHz** | **800 MHz** | **1600 MHz** | **2000 MHz** |
| n257, n258, n261 | dB | 23 | 23 | 23 | 23 | N.A. | N.A. | N.A. |
| n259, n260, n262 | dB | 22 | 22 | 22 | 22 | N.A. | N.A. | N.A. |
| n263 | dB | N.A. | 21 | N.A. | 21 | 21 or 20 | 21 or 20 | 21 or 20 |

**Table 7.5-2: Adjacent channel selectivity test parameters, Case 1**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Rx Parameter** | **Units** | **Channel bandwidth** | | | | | | |
|  |  | **50 MHz** | **100 MHz** | **200 MHz** | **400 MHz** | **800 MHz** | **1600 MHz** | **2000 MHz** |
| Power in Transmission Bandwidth Configuration | dBm | REFSENS + 14 dB | | | | | | |
| PInterferer for band n257, n258, n261 | dBm | REFSENS  + 35.5 dB | REFSENS +35.5 dB | REFSENS  +35.5 dB | REFSENS  +35.5 dB | N.A. | N.A. | N.A. |
| PInterferer for band n259, n260, n262 | dBm | REFSENS  + 34.5 dB | REFSENS +34.5 dB | REFSENS  +34.5 dB | REFSENS  +34.5 dB | N.A. | N.A. | N.A. |
| PInterferer for band n263 | dBm | N.A. | REFSENS +33.5 dB | N.A. | REFSENS  +33.5 dB | REFSENS  +33.5 dB or 32.5 | REFSENS  +33.5 dB or 32.5 | REFSENS  +33.5 dB  or 32.5 |
| BWInterferer | MHz | 50 | 100 | 200 | 400 | 800 | 1600 | 2000 |
| FInterferer (offset) | MHz | 50  /  -50  NOTE 3 | 100  /  -100  NOTE 3 | 200  /  -200  NOTE 3 | 400  /  -400  NOTE 3 | 800  /  -800  NOTE 3 | 1600  /  -1600  NOTE 3 | 2000  /  -2000  NOTE 3 |

**Table 7.5-3: Adjacent channel selectivity test parameters, Case 2**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Rx Parameter** | **Units** | **Channel bandwidth** | | | | | | |
|  |  | **50 MHz** | **100 MHz** | **200 MHz** | **400 MHz** | **800 MHz** | **1600 MHz** | **2000 MHz** |
| Ptxbc for bands n257, n258, n261 | dBm | -46.5 | -46.5 | -46.5 | -46.5 | -N.A. | -N.A. | -N.A. |
| Ptxbc for bands n259, n260, n262 | dBm | -45.5 | -45.5 | -45.5 | -45.5 | -N.A. | -N.A. | -N.A. |
| Ptxbc for band n263 | dBm | -N.A. | -44.5 | -N.A. | -44.5 | -44.5 or -43.5 | -44.5  or -43.5 | -44.5 or -43.5 |
| PInterferer | dBm | -25 | | | | | | |
| BWInterferer | MHz | 50 | 100 | 200 | 400 | 800 | 1600 | 2000 |
| FInterferer (offset) | MHz | 50  /  -50  NOTE 2 | 100  /  -100  NOTE 2 | 200  /  -200  NOTE 2 | 400  /  -400  NOTE 2 | 800  /  -800  NOTE 2 | 1600  /  -1600  NOTE 2 | 2000  /  -2000  NOTE 2 |
| NOTE 1: The interferer consists of the Reference measurement channel specified in Annex 3.2 with one sided dynamic OCNG Pattern TDD as described in Annex A and set-up according to Annex C.  NOTE 2: The absolute value of the interferer offset FInterferer (offset) shall be further adjusted to (CEIL(|FInterferer|/SCS) + 0.5)\*SCS MHz with SCS the sub-carrier spacing of the wanted signal in MHz. Wanted and interferer signal have same SCS.  NOTE 3: The transmitter shall be set to 4 dB below the PUMAX,f,c as defined in clause 6.2.4, with uplink configuration specified in Table 7.3.2.1-2.  NOTE 4: Ptxbc is the power in the transmission bandwidth configuration | | | | | | | | |

* Recommended WF
  + Discuss between options 1 and 2

**Discussions:**

Apple: 1dB relaxation is needed.

**Agreement:**

* Option 2: using 21 dB for CCBW <= 400 MHz and 20 dB for > 400 MHz.

**Issue 6.1.7 Adjacent channel selectivity for Intra-band contiguous CA**

* Proposals
  + Proposal1: For CA Agree ACS the tables below based on 21 dB ACS. This proposal may need modification based on the single carrier ACS discussion above as 20 dB is being proposed for BW > 400 MHz.

**Table 7.5A.1-1: Adjacent channel selectivity for intra-band contiguous CA**

|  |  |  |
| --- | --- | --- |
| **Operating band** | **Units** | **Adjacent channel selectivity / CA bandwidth class** |
|  |  | **All CA bandwidth class** |
| n257, n258, n261 | dB | 23 |
| n259, n260, n262 | dB | 22 |
| n263 | dB | 21 |

**Table 7.5A.1-2: Adjacent channel selectivity test parameters for intra-band contiguous CA, Case 1**

|  |  |  |
| --- | --- | --- |
| **Rx Parameter** | **Units** | **All CA bandwidth Classes** |
| Pw in Transmission Bandwidth Configuration, per CC |  | REFSENS + 14 dB |
| PInterferer for band n257, n258, n261 | dBm | Aggregated power + 21.5 |
| PInterferer for band n259, n260, n262 | dBm | Aggregated power + 20.5 |
| PInterferer for band n263 | dBm | Aggregated power + 19.5 |
| BWInterferer | MHz | BWChannel\_CA |
| FInterferer (offset) | MHz | + BWchannel CA  /  - BWchannel CA  NOTE 3 |
|
|
| NOTE 1: The interferer consists of the Reference measurement channel specified in Annex 3.2 with one sided dynamic OCNG Pattern as described in Annex A and set-up according to Annex C.  NOTE 2: The Finterferer (offset) is the frequency separation between the center of the aggregated CA bandwidth and the center frequency of the Interferer signal  NOTE 3: The absolute value of the interferer offset FInterferer (offset) shall be further adjusted to (CEIL(|FInterferer|/SCS) + 0.5)\*SCS MHz with SCS the sub-carrier spacing of the carrier closest to the interferer in MHz. The interfering signal has the same SCS as that of the closest carrier.  NOTE 4: The transmitter shall be set to 4 dB below the PUMAX,f,c as defined in clause 6.2.4, with uplink configuration specified in Table 7.3.2.1-2. | | |

**Table 7.5A.1-3: Adjacent channel selectivity test parameters for intra-band contiguous CA, Case 2**

|  |  |  |
| --- | --- | --- |
| **Rx Parameter** | **Units** | **All CA bandwidth classes** |
| Pw in Transmission Bandwidth Configuration, aggregated power for band n257, n258, n261 | dBm | - 46.5 |
| Pw in Transmission Bandwidth Configuration, aggregated power for band n259, n260, n262 | dBm | - 45.5 |
| Pw in Transmission Bandwidth Configuration, aggregated power for band n263 | dBm | - 44.5 |
| Pinterferer | dBm | - 25 |
| BWInterferer | MHz | BWChannel\_CA |
| FInterferer (offset) | MHz | + BWchannel CA  /  - BWchannel CA  NOTE 3 |
|
|
| NOTE 1: The interferer consists of the Reference measurement channel specified in Annex A.3.3.2 with one sided dynamic OCNG Pattern OP.1 TDD as described in Annex A.5.2.1 and set-up according to Annex C.  NOTE 2: The Finterferer (offset) is the frequency separation between the center of the aggregated CA bandwidth and the center frequency of the Interferer signal  NOTE 3: The absolute value of the interferer offset FInterferer (offset) shall be further adjusted to (CEIL(|FInterferer|/SCS) + 0.5)\*SCS MHz with SCS the sub-carrier spacing of the carrier closest to the interferer in MHz. The interfering signal has the same SCS as that of the closest carrier.  NOTE 4: The transmitter shall be set to 4 dB below the PUMAX,f,c as defined in clause 6.2.4, with uplink configuration specified in Table 7.3.2.1-2. | | |

* Recommended WF
  + Agree proposal 1. If 20 dB ACS is decided for BW> 400 MHz there would need to be modification.

**Discussions:**

Moderator: need further discussion considering the format of table.

-------------------------------------------------------------------------------------------------------------------

**[104-e][218] NR\_ext\_to\_71GHz\_RRM\_1, AI 9.14.6 – Zhongyi Shen**

**R4-2214138 Email Discussion Summary for [104-e][218] NR\_ext\_to\_71GHz\_RRM\_1**

*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**

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**[104-e][219] NR\_ext\_to\_71GHz\_RRM\_2, AI 9.14.7 – Prashant Sharma**

**R4-2214139 Email Discussion Summary for [104-e][219] NR\_ext\_to\_71GHz\_RRM\_2**

*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**

**Conclusions after 2nd round**

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

#### 9.15.4 Moderator summary and conclusions

**[104-e][220] NR\_IAB\_enh\_RRM, AI 9.15.3 – Richie Leo**

**R4-2214140 Email Discussion Summary for [104-e][220] NR\_IAB\_enh\_RRM**

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

**Abstract:**

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

**Decision: Withdrawn.**

### 9.16 NR coverage enhancements

#### 9.16.3 Moderator summary and conclusions

**[104-e][112] NR\_cov\_enh\_maintenance, AI 9.16.1 – Shan Yang**

**R4-2214090 Email Discussion Summary for [104-e][112] NR\_cov\_enh\_maintenance**

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

**Abstract:**

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

**Decision: Return to.**

**Conclusions after 1st round**

**Conclusions after 2nd round**

**GTW on Aug-16**

**Issue 1-3: CA capability for DMRS bundling**

* **Background:** Updated RAN1 UE feature list in LS [R4-2211513](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104-e/Docs/R4-2211513.zip)/R1-2205609
  + Per band granularity was agreed for FG30-4
  + The granularities for FG30-4a/b/…./h are still in []

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Features** | **Index** | **Feature group** | **Components** | **Type** |
| 30. NR\_cov\_enh | 30-4 | The maximum duration for DM-RS bundling | The maximum duration during which UE is able to maintain power consisitency and phase continuity to support DM-RS bundling for PUSCH/PUCCH | Per band |
| 30. NR\_cov\_enh | 30-4a | DM-RS bundling for PUSCH repetition type A | Support DM-RS bundling for PUSCH repetition type A | [Per UE] |
| 30. NR\_cov\_enh | 30-4b | DM-RS bundling for PUSCH repetition type B | Support DM-RS bundling for PUSCH repetition type B | [Per UE] |
| 30. NR\_cov\_enh | 30-4c | DM-RS bundling for TB processing over multi-slot PUSCH | Support DM-RS bundling for TB processing over multi-slot PUSCH | [Per UE] |
| 30. NR\_cov\_enh | 30-4d | DMRS bunding for PUCCH repetitions | Support DM-RS bundling for PUCCH repetitions for PUCCH formats 1/3/4 | [Per UE] |
| 30. NR\_cov\_enh | 30-4e | Enhanced inter-slot frequency hopping with inter-slot bundling for PUSCH | Support enhanced inter-slot frequency hopping with inter-slot bundling for PUSCH | [Per UE] |
| 30. NR\_cov\_enh | 30-4f | Enhanced inter-slot frequency hopping for PUCCH repetitions with DMRS bundling | Enhanced inter-slot frequency hopping for PUCCH repetitions with DMRS bundling | [Per UE] |
| 30. NR\_cov\_enh | 30-4g | [Restart DM-RS bundling after the events that violate power consistency and phase continuity] | [Support restarting DM-RS bundling after the events that violate power consistency and phase continuity] | [Per UE] |
| 30. NR\_cov\_enh | 30-4h | DM-RS bundling for non-back-to-back transmission | Support DM-RS bundling for [non-back-to-back transmission for consecutive slots] for PUSCH and PUCCH only for [corresponding supported back-to-back transmission FGs (30-4a, 30-4b, 30-4c, or 30-4d)] | [Per UE] |

* **Proposals**
  + Option 1: DMRS bundling capabilities are per band per band combination. (QC)
* **Recommended WF**
  + Discuss in GTW

**Discussion:**

Huawei: granularity should be decided by RAN1. From 30-4x, they are RAN1 capability.

ZTE: tend to agree with Huawei. Some capability comes from RAN1. If we have the agreement in RAN4, we can send them to RAN1. We see the intention to leave more flexibility for UE to implement.

Qualcomm: we recognize the capability is initiated by RAN1. If RAN4 identifies some difficulty to implement, RAN4 can give the feedback. There is implementation and challenge.

Apple: question to Qualcomm to clarify the motivation. Is the intention to enable DL CA or UL&DL CA?

China Telecom: to Qualcomm, is the proposal for 30-4 or 30-4a/b/c? We cannot reach any agreement for 30-4a/b/c. When RAN1 starts their work, they can take our input. To Apple, this proposal can be applied to DL CA or DL&UL CA.

Mediatek: we need be careful not to confuse RAN1. We should not send LS based on the LS sent in the last meeting. We should wait for RAN1 decision.

Qualcomm: LS does not say RAN4 has concluded. It is open item. To CTC, our view, 30-4 and 30-4a/b/d should be per band per band combination. To Apple it is for future release.

Samsung: we agree with Huawei and Mediatek.

**Issue 1-2: Pcmax reference time**

* **Background:**
  + In TS 38.214 v17.1.0 section 6.1.7 it states that “The UE shall maintain power consistency and phase continuity within an actual TDW…”.
* **Proposals**
  + Option 1: Define Pcmax reference time as “Actual TDW” for DMRS bundling. (QC)
    - QC: TS 38.214 and TS 38.101-1 are not aligned for the power control timing parts.
* **Recommended WF**
  + Discuss in GTW

**Discussion:**

Huawei: we would like to better understand the intention for the change. It is clearly defined in RAN1 and RAN4 during actual TDW as long as the feature is activated UE needs to maintain the phase continuity. No need to clarify.

Apple: 38.213 has already defined what transmission occasion is.

Mediatek: last meeting we asked the question about the ambiguity. We should wait for RAN1 response and discussion.

Qualcomm: To Huawei, we do not agree on the actual spec. Physical channel length last for a number of OFDM symbols. If 38.214 is not aligned with TS38.101-1, 214 says that UE needs to maintain in the whole bundling. To Apple, why is there LS to ask the alignment if transmission occasion is well defined? Maybe the 38.101-1 is misaligned with UE behaviour. To MTK, we do not think RAN1 will discuss. We can wait for the next meeting.

Ericsson: our view is that in the test we only test UE capability which is the maximum time for UE to keep to consistent. That is not specified from power perspective. We do not see the need to update the Pcmax. If the actual TDW really needs be updated, we need further discuss how we should reflect this.

Qualcomm: It just means removing the whole Pcmax section.

**Issue 1-1: FR1 inter-band CA and SUL with DMRS bundling**

* **Background: RAN4 LS to RAN1 in R4-2211225**

*RAN4 discussed whether applying DMRS bundle to FR1 inter-band UL CA would have any RAN1 spec impacts, and would appreciate RAN1 feedback before making further decision:*

|  |
| --- |
| *Considering DL CA with “additional” UL carrier configured with SRS only (i.e. no PUCCH/PUSCH configured) with the following conditions:*   * *For carrier switching back and forth between UL carrier and SRS carrier, if the switching happens within the DMRS bundling duration, then the phase continuity is not maintained by the UE.*   *Considering FR1 inter-band UL CA with DMRS bundling with following conditions:*   * *UE shall only have ongoing transmissions on a single uplink carrier at the same time. If overlapping transmissions of PUSCH, PUCCH, and/or SRS are erroneously scheduled/configured by the gNB on more than one carrier, then the phase continuity of DMRS bundling will be broken.* * *Only configuration of a single TAG is supported.* * *If there is any carrier switching back and forth between two carriers and the switching happens within the DMRS bundling duration, then the phase continuity is not maintained by the UE.* * *Can only one band can be configured with DMRS bundling at a time?* |

*RAN4 also discussed whether applying DMRS bundle to SUL would have any RAN1 spec impacts, and would appreciate RAN1 feedback before making further decision:*

|  |
| --- |
| *Considering SUL with DMRS bundling with following conditions:*   * *Can only one band can be configured with DMRS bundling at a time?* * *If there is any carrier switching back and forth between SUL and NUL carriers and the switching happens within the bundling duration, then the phase continuity is not maintained by the UE.* |

* **Proposals** 
  + Proposal 1: Ran4 to define DMRS bundling requirement applicability to cover FR1 inter-band UL CA with the restriction that UE is not schedule to transmit simultaneously on two bands (Qualcomm)
  + Proposal 2: Ran4 to define DMRS bundling requirement applicability to cover SUL band (Huawei)
* **Moderator’s Recommendation**
  + From RAN4 perspective, it is feasible to define DMRS bundling requirement applicability to cover the following 3 scenarios:
    - FR1 inter-band UL CA with the restriction that UE is not schedule to transmit simultaneously on two bands
    - SUL band
    - DL CA with “additional” UL carrier configured with SRS only
  + RAN4 CRs on DMRS bundling requirements applicability for the above 3 scenarios can be agreed ONLY if:
    - it is also confirmed as feasible from RAN1 perspective, and,
    - based on the conditions stated in the RAN4 LS to RAN1 in R4-2211225 as well as other conditions (if any) introduced in RAN1

**Discussions:**

Apple: our view is quite clear that we do not consider UL CA and SUL. They are not the scope of physical layer design. It is premature. We do see the benefit for UL-CA scenario. This work is definitely worthy to see in Rel-18. Strongly urge proponents to propose them for Rel-18.

Ericsson: it seems like inter-band UL CA has already been agreed in the latest spec. There are something that need be clarified here. For the detailed analysis, we need wait for RAN1.

ZTE: for inter-band UL CA, it should be supported. The consistence can be maintained in one carrier.

Huawei: in last meeting, we agreed that we should wait for RAN1 decision.

China Telecom: firstly, we support the scenarios here. The use of SUL is to extend the coverage. SUL+DMRS bundling would be beneficial. We would like to clarify RAN1 meeting starts next week. We are OK to postpone the discussion. Regarding Ericsson discussion on the UL-CA, actually the CR for UL-CA has been agreed in the merged final.

Mediatek: we should wait for RAN1. Last meeting we agree the DL CA with one uplink configured. We should wait.

Qualcomm: to Apple, how feasible to propose them for Rel-18. Can Apple comment? Is there any activity in RAN1?

Apple: In Rel-17 RAN1 will discuss the LS we sent. From our side, we think the physical layer design cannot be adapted to UL-CA.

**Issue 1-1A: RAN4 specfication for FR1 CA DMRS bundling**

* **Background:**
  + *The CR in R4-2207659 (content shown below) was marked as agreed in the RAN4 #103e final EOM report and already implemented in v17.6.0 of TS 38.101-1.*

|  |
| --- |
| 6.4A.2.3 Transmit modulation quality for inter-band CA For inter-band carrier aggregation with one uplink carrier assigned to one NR band, the transmit modulation quality requirements in subclause 6.4.2 apply including phase continuity requirements for DMRS bundling [IE name].  For inter-band carrier aggregation with two contiguous carriers assigned to one NR band, the transmit modulation quality requirements in subclause 6.4A.2.1 apply for those carriers.  For inter-band carrier aggregation with two uplink non-contiguous carrier assigned to one NR band, the transmit modulation quality requirements in subclause 6.4A.2.2 apply for those carriers.  For inter-band carrier aggregation with uplink assigned to two NR bands, the transmit modulation quality requirements shall apply on each component carrier as defined in clause 6.4.2 with all component carriers active: PCC with PRB allocation and SCC without PRB allocation and without CSI reporting and SRS configured. For DMRS bundling [ IE name], requirements for phase continuity in clause 6.4.2.5 apply for PCC when SCC has no UL allocation for the duration of the bundle on PCC.  For combinations of intra-band and inter-band carrier aggregation with three uplink component carriers (up to two contiguously aggregated carriers per operating band), the transmit modulation quality requirements specified in subclause 6.4.2 apply for the NR band supporting one component carrier, and for the NR band supporting two contiguous component carriers the requirements specified in subclause 6.4A.2.1 apply. |

* **Recommended WF**
  + Discuss in GTW

**Discussions:**

China Telecom: it seems that the CR was mistakenly marked as agreed and implemented.

Apple/Mediatek: in last meeting, only DL CA with one uplink carrier configured was agreed.

**Chair=>** Double check with MCC. If there was a mistake, consider email to RAN1 chair or session chair to avoid confusion. Ask for help from rapporteur company to check if there is a big confusion in RAN1.

### 9.17 Further enhancements on MIMO for NR

#### 9.17.5 Moderator summary and conclusions

**[104-e][113] NR\_feMIMO\_maintenance, AI 9.17.1 – Taekhoon Kim**

**R4-2214091 Email Discussion Summary for [104-e][113] NR\_feMIMO\_maintenance**

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

**Abstract:**

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

**Decision: Withdrawn.**

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**[104-e][221] NR\_feMIMO\_RRM\_1, AI 9.17.2 – Hua Li**

**R4-2214141 Email Discussion Summary for [104-e][221] NR\_feMIMO\_RRM\_1**

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

**Abstract:**

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

**Decision: Return to.**

**Conclusions after 1st round**

**Conclusions after 2nd round**

**GTW on Aug-15**

**Topic #2: Rel-17 RRM performance requirements**

---------------------------------- RAN1 LS --------------------------------

***1. Overall Description:***

*In Rel-17 FeMIMO, for inter-cell beam management, RAN1 has agreed to support PDCCH/PDSCH rate matching around the SSBs indicated by ssb-PositionsInBurst-r17 for the same PCI as that associated with TCI state of the PDSCH/PDCCH as working assumption.*

**Working assumptionOn inter-cell beam management, the PDCCH /PDSCH should be rate matched around the SSBs indicated by ssb-PositionsInBurst-r17 for the same PCI as that associated with TCI state of the PDSCH /PDCCH**

* **Send LS to RAN4 on whether there is requirements in RAN4 that assumes UE to measure SSB for L1-RSRP measurement and receiving PDSCH /PDCCH on the same RE in FR1. Revisit this issue after there is RAN4 feedback.**

*RAN1 would kindly like to ask RAN4 to provide feedback on whether there are any requirements that are related to UE measurements of L1-RSRP and reception of PDSCH/PDCCH on the same RE in FR1 for inter-cell beam management. RAN1 would revisit this issue when there is RAN4 feedback.*

***2. Actions:***

***To RAN4 group.***

***ACTION:*** *RAN1 would kindly like to ask RAN4 to provide feedback on whether there are any requirements that are related to UE measurements of L1-RSRP and reception of PDSCH/PDCCH on the same RE in FR1 for inter-cell beam management.*

---------------------------------- RAN1 LS --------------------------------

**Issue 2-6-1: Whether there is scheduling restriction in RAN4 when SSB and PDCCH/PDSCH are overlapped on the same RE**

* Proposals:
  + Proposal 1: No restrictions are introduced in FR1 except for the case when SSB and PDCCH/PDSCH SCS are different, and UE doesn’t support *simultaneousRxDataSSB-DiffNumerology*.
* Recommended WF
  + Please company to check whether proposal 1 is common understanding of RAN4. if yes, RAN4 may need to further discuss issue 2-6-2 before sending reply LS.

**Discussions:**

Qualcomm: we are talking about SSB from neighour cell and try to receive PDCCH from serving cell, right?

Moderator: yes.

Mediatek: SSB and data channel cannot be transmitted in the same RE. If SSB and data channel are transmitted in the same RE, the performance will be degraded.

Apple: The scheduling restriction is the same as requirement for serving cell. We have restriction for the case where the SCSs are different. RAN1 has defined the rate matching. We do not introduction any restriction. RAN1 has rate matching in place.

Ericsson: We have different understanding on the scearion. Neighbour has different PCI. Could you clarify the scenario?

Vivo: It is RAN1 issue for the overlapping on the same RE. There is no overlapping for SSB and PDCCH on the same RE.

Intel: to Ericsson, RAN1 has the agreement that SSB and PDCCH won’t be overlapped. SSB and data are from different PCIs. In RAN4, we have no restriction on the scenario for the same PCI. From RAN4 perspective, proposal 1 is valid. To MTK, the performance will be degraded, which can be discussed later. We would like to discuss if RAN4 needs the requirement for this scenario.

ZTE: we are fine with Proposal 1. The scheduling restriction focuses on the scenario where SSB overlappes with PDSCH/PDCCH on the same symbol. Rate matching belongs to RAN1 scope.

Huawei: We share the same view as Apple and Intel. RAN4 has no restriction requirement for overlapping on the same RE case. It is RAN1 issue.

CMCC: for scenario, according to our understanding, the scenario in LS is about the same PCI. SSB and PDCCH from different PCIs are not considered in LS.

Nokia: we share the same view that the same PCI scenario is to be addressed. Propsoal 1 is OK.

Mediatek: Our understanding is that the current spec is for SSB and PDCCH exist in the same symbol not same RE.

Qualcomm: if we are talking about the same PCI, what exactly the scenario is? Can gNB transmit the two signals at the same time.?

Ericsson: share the same understanding as Nokia and CMCC. SSB and PDCCH/PDSCH are transmitted from the same PCI.

Intel: RAN1 working assumption is for the inter-cell beam management.

Samsung: We have the same understanding as Intel and support the proposal 1.

Apple: Same as Intel. The scenario is for the case where SSB and PDCCH/PDSCH are sent from different PCIs.

Vivo: In previous release, RAN4 does not assume reception of SSB and PDCCH/PDSCH at the same time.

**Chair =>** Need alignment of the views on the scenario to be discussed.

**Issue 2-6-2: Whether any clarification or update is needed in RAN4 spec when SSB and PDCCH/PDSCH are overlapped on the same RE**

* Proposals:
  + Proposal 1: No. Just inform RAN1 about the current status in RAN4.
  + Proposal 2: Clarify that performance degradation is expected when overlapping happen in RAN4.
  + Proposal 3: Clarify that there is no UE requirement when overlapping happen in RAN4.
  + Proposal 4: Define scheduling restriction to avoid overlap between SSB and data on the same RE in RAN4.
* Recommended WF
  + Collect companies’ view for these proposals in 1st round

If the time still allow, we can further discuss issue 1-4-1.

**Topic #1: Maintenance of Rel-17 RRM core requirements**

**Issue 1-4-1 Whether to consider unknown TCI state in the active TCI state list**

* Proposals
  + Proposal 1(vivo, Nokia, Ericsson, ZTE):
    - Yes
  + Proposal 2(MTK):
    - No
  + Proposal 3(Apple, Intel):
    - Don’ t consider unknown TCI state. Longer delay applies if any TCI state is unknown in TCI state list update.
* Recommended WF
  + Collect companies’ view for these proposals in 1st round

**Discussions:**

Mediatek: we can agree with Proposal 3.

Ericsson: In Rel-17 UE can connect to more than two. If we agreed proposal 3, we need define the exact number of delay. From UE complexity point of view, we do not think anything more UE need to do.

Huawei: we can agree with proposal 3. We do not define the exact number.

Samsung: unknown TCI and known TCI are RAN4 concept. RAN1 does not preclude the other possibility. We do not think we have certain answer to the question. We support proposal 3. RAN4 does not define the requirement for TCI stat list update.

Vivo: network may configure TCI state without UE L1-RSRP report. We can compromise to Proposal 3.

Apple: RAN4 cover DCI based TCI switch. It is the fast switch. That the intention to introduce such TCI switching requirement. We do not think unknown PCI should be covered.

ZTE: I am not sure about the difference between Proposal 1 and Proposal 3. Proposal 3 seems that RAN4 has no requirement for unknown case.

Nokia: we suggest to go with proposal 1. We agree with Ericsson. I do not see the big work even to define the longer delay.

Samsung: to ZTE, RAN4 does not define the unknow TCI state requirement.

Intel: Support proposal 3.

Ericsson: we do not see the difference between known and unknown TCI.

ZTE: we have the requirements for both known and unknown.

Intel: in the TCI state list update requirement, we only consider unknown case.

Ericsson: in multiple TRP case, we do not see the reason that UE…

Apple: we are fine with the compromise on the screen.

**Agreement:**

* [Longer delay applies if any TCI state is unknown in TCI state list update]. Active TCI state list can contains known and unkown TCI states.

**Issue 1-2-1 Joint TCI switching delay requirement**

--------------------- previous agreement ---------------------

*The following was agreed in GTW session in RAN4#101bis-e:*

|  |
| --- |
| * *No extra requirement needed for Joint TCI mode, DL and UL requirements can be applicable independently*   + *Note: it is not expected that UE will be required to make DL reception or UL transmission before UE completes the DL or UL TCI state switching, respectively* |

***In 38.133, for DL TCI state switching,***

*[In case of joint TCI state switch, UE is not expected to receive on DL before UE completes the DL and UL TCI state switch.]*

***In 38.133, for UL TCI state switching,***

*[In case of joint TCI state switch, UE is not expected to transmit on UL before UE completes the DL and UL TCI state switch.]*

--------------------- previous agreement ---------------------

* Proposals:
  + Proposal 1(Apple, Intel):
    - Keep the previous clarification for Joint TCI state switch in the specification, i.e.joint TCI state switch UE is not expected to receive on the DL or transmit on the UL until it completes both UL and DL TCI state switch.
  + Proposal 2(vivo):
    - RAN4 to confirm again the understanding of agreements in RAN4 101-bis-e as
    - If when both DL TCI(s) and UL TCI(s) are activated by one MAC CE, or when at least one joint TCI(s) are activated by one MAC CE
    - For DL TCI switching delay requirements, UE is not expected to be able to make DL reception when either DL TCI switching is not finished or UL TCI switching is not finished.
    - For UL TCI switching delay requirements, UE is not expected to be able to make UL transmission, when either DL TCI switching is not finished or UL TCI switching is not finished
  + Proposal 3(Nokia, ZTE):
    - Joint TCI switching delay is regarded as same as a pair of separate DL/UL TCI switching.
    - In case of joint TCI state switch, UE is expected to receive on DL, when UE completes the DL state switch.
    - In case of joint TCI state switch, UE is expected to transmit on UL, when UE completes the UL state switch.
  + Proposal 3a(Ericsson):
    - RAN4 to revise the agreement as “No extra requirement needed for Joint TCI mode, DL and UL requirements can be applicable independently” by removing note.
    - During joint TCI state switch, if DL TCI state switch is completed before UL TCI state switch is completed, HARQ for new DL TCI state transmissions to be transmitted using old TCI state.
* Recommended WF
  + Collect companies’ view for these proposals in 1st round

**Discussions:**

Vivo: CR has been agreed in RAN4#102. Therefore, it is quite time-wasting to further discuss this issue. The harq-feedback can not be transmitted if DL is ready while UL is not.

Nokia: We see the point from Ericsson. The note is not prefect clear. We need clarify the note from the agreement. We have concern about having the harq feedback on the old TCI state.

Mediatek: we share the same view as Vivo. We can keep the current spec as it is. Even though DL TCI state is completed clearly, but ACK/NACK transmission is not stable if UL is not swichted completely.

ZTE: we agree with Ericsson. The note is not very clear. For the concern from Vivo, we believe Proposal 3a provides the solution.

Apple: for joint TCI state, the intention is for UE to swtich DL and UL together. We do not think 3a is valid solution.

Vivo: we share the same view as Apple.

Nokia: we can keep the previous agreement and work on the CRs.

Intel: We can keep the previous agreement. For DL, it needs the uplink feedback. We should consider them together.

**Chair => keep the prevous agreement and further work on the CR to further clarify the following wordings in the CR:**

* ***In 38.133, for DL TCI state switching,***
  + *[In case of joint TCI state switch, UE is not expected to receive on DL before UE completes the DL and UL TCI state switch.]*
* ***In 38.133, for UL TCI state switching,***
  + *[In case of joint TCI state switch, UE is not expected to transmit on UL before UE completes the DL and UL TCI state switch.]*

**Issue1-1-1 Whether UE need to track UL time/frequency for DL-RS associated with active UL TCI state**

* Proposals:
  + Proposal 1(Apple, Intel, Ericsson):
    - UE don’t need to track UL time/frequency for DL-RS associated with active UL TCI state for UL transmission.
  + Proposal 2(MTK):
    - The source RS in active UL TCI state should be subset of source RS in DL TCI state to guarantee the timing of UL TCI state is under tracking.
  + Proposal 3(vivo):
    - RAN4 further discuss whether/how to optimize the case ‘UE might not be able to obtain DL timing of the target TRP when UE is able to transmit UL based on the corresponding UL TCI from the target TRP’ in R17, i.e. whether to further require UE to track time and/or frequency on DL-RS associated with active UL TCI in R17.
  + Proposal 4(Nokia):
    - Rel-17 active UL TCI state should be under time and frequency tracking. This means that active UL TCI list belongs to active DL TCI state list.
    - Add the time and frequency tracking condition to the active TCI state for UL.
  + Proposal 5(ZTE):
    - Option 1: UL timing is derived from current DL timing
    - Option 2: UL TCI state timing is derived from the RS of the UL TCI state.
    - Option 1 is common understanding in general. However referring to the multi-TRP scenario, Option 2 is reasonable since different TRPs for DL and UL is possible. For the case that not any DL timing can be referenced, UE needs to perform time/frequency tracking for target UL TCI state.
* Recommended WF
  + Collect companies’ view for these proposals in 1st round

**Discussions:**

Intel: what is the relation between the active UL TCI state and active DL TCI state? If we agree with this, and if uplink TCI state is within DL TCI state, then proposal 1 can work.

Mediatek: Support proposal 2. We do not consider RS for tracking. The source for UL TCI state should be the subset of DL TCI state, because DL TCI state in TCI list that UE required to track time/frequency for source RS.

ZTE: Proposal 2, 3, 5 share the same concern about how to guarantee the timing/frequency tracking. We wonder if it can be guaranteed if the UL TCI is the subset of DL TCI. Otherwise UE needs to do fine timing/frequency tracking for target.

Apple: UL TCI only indicates the beam rather than indication any other relationship. UE always follows the serving timing for DL transmission.

Nokia: The uplink TCI state should be active DL TCI state. UE is required to track the timing. Our view is the same as ZTE.

Vivo: share the similar view as Mediatek and Apple. It can be solved by network implementation. Network can ensure the relation or send the command.

Huawei: we have the similar view as Apple. UL TCI has no any RS for tracking. We do not need such relationship between UL TCI and DL TCI.

Intel: to question of Apple and Huawei, in legacy we only consider the serving cell. If the uplink TCI state is related to the cell with different TCI.

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**[104-e][222] NR\_feMIMO\_RRM\_2, AI 9.17.3 – Yiyan Zhang**

**R4-2214142 Email Discussion Summary for [104-e][222] NR\_feMIMO\_RRM\_2**

*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**

**GTW on Aug-15**

**Sub-topic 1-2: Test configuration for unified TCI state switching**

**Issue 1-2-1: Pathloss RS in joint TCI test case**

* Proposals
  + Option 1: Configure Pathloss RS in joint TCI case
    - Option 1a: Pathloss RS is maintained
    - Option 1b: Pathloss RS is not maintained
  + Option 2: Do not configure Pathloss RS in joint TCI case
* Recommended WF
  + Companies’ views are collected in 1st round discussion.

**Discussions:**

Samsung: in last meeting, we do not specify the Pathloss RS configuration or not for the join TCI. Pathloss RS is optional IE. Pathloss RS has been tested in the UL TCI state switching case.

Huawei: we are OK with not to configure Pathloss RS. If we do not configure Pathloss RS, does it means source RS in the joint TCI will be used as pathlosss RS.

Ericsson: Joint TCI state switching supports both UL and DL switching. We could configure Option 1a.

Apple: the joint TCI is configuring the TCI for both UL and DL. We do not understand Option 2. It should be part of configuration. The requirement is based on the pathloss maintained or not maintained. We slightly prefer Option 1a. We can futher discussion whther Pathloss RS is maintained or not maintained.

Samsung: to Huawei and Apple concern, Pathloss RS is optional UL TCI signaling. Pathloss RS is tested in UL TCI switching test case. We do not need to test it again.

Apple: even if it is option IE, why should we not configure it?

Ericsson: How about power control.

Samsung: For this test case, we are testing the joint TCI state switching including UL and DL switching.

Intel: If pathloss is not configured, it means pathloss is associated with TCI state. It is possible not to configure Pathloss RS.

Mediatek: slightly prefer Option 1a.

Vivo: prefer Option 1a. If pathloss is not configured, UE behaviour should be specified in RAN1 and RAN2.

**Issue 1-2-2: Pathloss RS in UL (and joint TCI) test case**

* Proposals
  + Option 1: Use CSI-RS as the Pathloss RS in the test case, and the CSI-RS is QCLed Type-D with the corresponding SSB
    - Option 1a: Reuse existing CSI-RS configuration in 38.133
    - Option 1b: Introduce new configuration of CSI-RS for pathloss RS (Periodic CSI-RS with repetition on)
  + Option 2: Use the same SSB as Pathloss RS
  + Option 3: other solution
* Recommended WF
  + Companies’ views are collected in 1st round discussion.

**Discussions:**

Huawei: we can go with option 1. But for option 1b, we prefer to use option 1a.

Samsung: we pefer to Option1b. The current CSI-RS configuration, we do not find the proper CSI-RS configuration as Pathloss RS. For Pathloss RS, the CSI-RS should be with repetition on. If no existing configuration can be used, we prefer option 1b.

Apple: we are not sure the entire configuration. We need to check what the issue is. The simply solution is to configure pathloss RS as the same for UL TCI state.

Huawei: To Samsung, for option 1b, we are not sure if repetition on is needed. Huawei provides the CR for the new TCI configuration for DL and UL TCI state switching. We encourage companies to see the configuration.

Mediatek: for these pathloss RS, could it be applied for nonserving cell. Whether CSI-RS could be pathloss RS for non-serving cell.

Huawei: for test cases, UL TCI and joint TCI state switching, it is assume for serving cell. For non-serving cell it is tested in DL TCI state switching.

Apple: we have the same understanding as Huawei. It should be periodic RS but have question on repetition on.

**Agreements:**

* For Pathloss RS in UL (and joint TCI) test case, use CSI-RS as the Pathloss RS in the test case, and the CSI-RS is QCLed Type-D with the corresponding SSB.
* Further discuss the detailed configurations of CSI-RS considering the following options.
  + Option 1a: Reuse existing CSI-RS configuration in 38.133
  + Option 1b: Introduce new configuration of CSI-RS for pathloss RS (Periodic CSI-RS with repetition on)

**Issue 1-2-3: Introduce new unified TCI state configurations**

* Proposals
  + Option 1: Introduce separate DL, UL and joint TCI state configuration in unified TCI configuration section
  + Option 2: Introduce unified TCI state configuration in existing TCI configuration section
  + Option 3: No need for new DL TCI state
* Recommended WF
  + Companies’ views are collected in 1st round discussion.

**Discussions:**

Huawei: we support Option 1. The test case is different from legacy one.

Moderator: I observe the different writing method about introduction of TCI state configuration. Option 1 is more clear.

Apple: we also support option 1. We have the same view that configuration for unified TCI is different from legacy.

**Agreements:**

* Introduce separate DL, UL and joint TCI state configuration in unified TCI configuration section

**Issue 1-2-4: Data transmission on cell with different PCI in the test case**

* Proposals
  + Option 1: No DL/UL data transmission to cell with different PCI during the test, and measurement only
  + Option 2: DL/UL data transmission to both serving cell and cell with different PCI during the test
* Recommended WF
  + Companies’ views are collected in 1st round discussion.

**Discussions:**

Moderator: we observe the different test cases. We need to specify whether UE has the data transmission with different PCIs. From our side, we prefer to Option 2. We need check the switching via data transmission.

Huawei: Since the cell with different PCI is used as TRP, there is no need to simulate data transmission from two cells. We can set two different AoA.

Apple: for test cases with different PCI, UE receives data from one cell. After known state is met, UE will receive TCI switch and then UE will receive the data from the other cell. We have only DL TCI swithing not both DL and UL.

Vivo: We do not see big difference between option 1 and option 2. We can simply use the wording from RAN1 spec.

Huawei: this is only for DL TCI state switch.

**Agreements:**

* For DL TCI state switching test case(s), data transmission is based on TCI state which is QCLed with the SSB from cells with different PCIs.

**Issue 1-2-5: Introduce new RS configuration for cell with different PCI in the test case**

* Proposals
  + Option 1: Introduce new TRS and DL TCI state for cell with different PCI in the test case
  + Option 2: No need to introduce more configuration, and reuse existing ones
* Recommended WF
  + Companies’ views are collected in 1st round discussion.

**Sub-topic 2-1: Test configuration for L1-RSRP measurement on cell with different PCI**

**Issue 2-1-1: Whether configure L1-RSRP on the serving cell in the test case**

* Proposals
  + Option 1: No need to configure L1-RSRP on the serving cell
  + Option 2: Configure L1-RSRP measurement on both serving cell and cell with different PCI
* Recommended WF
  + Companies’ views are collected in 1st round discussion.

**Discussions:**

Huawei: support option 2. SSB is always configured to be associated with serving cell SSB. It is for inter-cell beam management different PCI should be configured.

Ericsson: we support option 2.

Apple: We would like to understand more about the issue. The test case focuses on testing the L1-RSRP on non-serving cell? Do we need configure L1-RSRP on both serving cell and non-serving cell and test L1-RSRP for cell with different PCI?

Huawei: we do not understand is that both configured with L1-RSRP.

Vivo: prefer Option 2, which is more typical.

Samsung: prefer option 2. For test case, two cells are both configured for L1-RSRP, but we only test the cell with different PCI.

Mediatek: prefer option 2. Test under discussion is beam management. We do not need perform L1-RSRP for serving cell in this test case.

Intel: prefer option 2.

**Agreements:**

* Configure L1-RSRP measurement on both serving cell and cell with different PCI
* For test case, two cells are both configured for L1-RSRP, but we only test the cell with different PCI.

**Issue 2-1-2: SSB configuration for serving cell and cell with different PCI**

* Proposals
  + Option 1: the same period for SSBs from serving cell and cell with different PCI, clarify which PCI the SSB is associated to in the test, and the sharing factor PSC/CDP=2
  + Option 2:Other SSB configurations
* Recommended WF
  + Companies’ views are collected in 1st round discussion.

**Discussions:**

**Agreements:**

**Issue 2-1-3: CP length configuration in the test case**

* Proposals (Timing offset between SSB with different PCI should be within CP)
  + Option 1: Specify the CP length configuration in the test
  + Option 2: No need to specify the CP length configuration
* Recommended WF
  + Companies’ views are collected in 1st round discussion.

**Discussions:**

**Agreements:**

**Issue 2-1-4: AOA setup for tested FR2 cell in the test case**

* Proposals
  + Option 1: AoA setup of FR2 cell for the test case is Setup 1
  + Option 2: AoA setup of FR2 cell for the test case is Setup 3, one AoA is for FR2 serving cell, and another is for cell with different PCI.
* Recommended WF
  + Companies’ views are collected in 1st round discussion.

**Discussions:**

**Agreements:**

**Sub-topic 3-2: Test Configurations for TRP specific BFR**

**Issue 3-2-1: BFD/CBD RS configuration for TRP specific link recovery tests**

* Proposals
  + Option 1: Following the table below and introduce new SSB configurations

**Table 2: BFD/CBD RS configuration for TRP specific link recovery tests**

|  |  |  |
| --- | --- | --- |
| **Resource set** | **SSB based link recovery test** | **CSI-RS based link recovery test** |
| BFD-RS set (q0,0) | SSB#0 | CSI-RS#0 |
| CBD-RS set (q1,0) | SSB#1 | CSI-RS#1 |
| BFD-RS set (q0,1) | SSB#2 | CSI-RS#2 |
| CBD-RS set (q1,1) | SSB#3 | CSI-RS#3 |
| RLM-RS set | SSB#0, SSB#1, SSB#2, SSB#3 | CSI-RS#0, CSI-RS#1, CSI-RS#2, CSI-RS#3 |

* + Option 2: Other RS settings
* Recommended WF
  + Companies’ views are collected in 1st round discussion.

**Discussions:**

**Agreements:**

**Issue 3-2-2: AOA setup in FR2 test**

* Proposals
  + Option 1: Two AoAs are configured in the test, each of which is for one of two TRPs
  + Option 2: other AoA setup
* Recommended WF
  + Companies’ views are collected in 1st round discussion.

**Discussions:**

**Agreements:**

**Issue 3-2-3: Beam failure occurred during the test case**

* Proposals
  + Option 1: For R17 TRP-specific link recovery tests, it is suggested that beam failure occurs on one BFD-RS resource set. SNR level of TRP 2 will always keep at high level.
  + Option 2: Beam failure occurs on both TRPs in the test
* Recommended WF
  + Companies’ views are collected in 1st round discussion.

**Discussions:**

**Agreements:**

**Issue 3-2-4: BFR-RS configured for 2 TRPs in the test**

* Proposals
  + Option 1: BFD-RS of two TRPs are overlapped
  + Option 2: Other configuration
* Recommended WF
  + Companies’ views are collected in 1st round discussion.

**Discussions:**

**Agreements:**

### 9.18 Support of reduced capability NR devices

#### 9.18.6 Moderator summary and conclusions

**[104-e][114] NR\_RedCap, AI 9.18.1, 9.18.2 – Chunhui Zhang**

**R4-2214092 Email Discussion Summary for [104-e][114] NR\_RedCap**

*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**

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**[104-e][223] NR\_redcap\_RRM\_1, AI 9.18.3, 9.18.3.1, 9.18.4 – Santhan Thangarasa**

**R4-2214143 Email Discussion Summary for** **[104-e][223] NR\_redcap\_RRM\_1**

*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**

**GTW on Aug-16**

**Sub-topic 6-2: Cell-specific RSRP offset**

**Issue 6-2-1: Applicability of cell-specific RSRP offset**

* Proposals
  + **Option 1 (Ericsson):** RedCap UE with 1 Rx branch should apply the offset to all the cell-specific RSRP thresholds used in RAN2 specifications except those discussed in proposal 2 below.
    - RAN4 does not recommend that the RedCap UE with 1 Rx branch applies the offset to any of the conditions or thresholds used for any relaxed measurement criteria defined in Rel-16 or Rel-17.
  + **Option 1a (Intel):** 
    - Introduce separate offset of offsetRSRPChange, cg-SDT for TA validation of cg-SDT procedure for 1 Rx. RedCap UE in INACTIVE.
    - include *cg-SDT-RSRP-ThresholdSSB* among the candidate of 1 Rx. RSRP absolute configuration margin
    - For 1 Rx. RedCap UE, introduce separate offset of offsetRSRQ and offsetSINR used for *absThreshSS-BlocksConsolidation*.
    - For 1 Rx. RedCap UE, reuse offsetRSRP and offsetRSRQ for *Q-RxLevMin / Q-QualMin* level determination.
  + **Option 2 (Apple, Nokia):** A RedCap UE with 1 Rx branch applies the offset to all cell-specific RSRP thresholds, including the ones used for Rel-16 low mobility and/or not at cell edge conditions, and Rel-17 stationary and not at cell edge conditions for RRC idle/inactive state.
  + **Option 3 (HW):** Not introduce threshold offset in spec and the measurement difference gap between 1Rx and 2RX is up to UE implementation.
  + **Option 4 (MTK):** If RAN4 would like to introduce offset for other RSRP threshold (for all cell-specific RSRP thresholds) then this shall be discussed case by case
  + **Option 5(vivo)**: A configurable offset can be applied to cell (re)selection thresholds.
* Recommended WF
  + Discuss the options.

**Discussons:**

Apple: we support option 2, which was the previous agreement. This offset reflects the difference of 1Rx and 2Rx. We can also compromise to option 3 if there is too much work to do. We can leave it to implementation.

Huawei: We support option 3. Although there is uncertainty, there are some parts which needs be discussed. There would be enomorous work to do. There are many threshold that should be discussed. For some threshold, the positive offset is needed while for others like stationary the negative value needs be set. It is impossible to analyze case by case. If we can focus on L3 evaluation, the difference between 1Rx and 2Rx is just 1dB, which is marginal.

Ericsson: we can compromise to Option 2. We completely disagree with Huawei. The LS was sent to RAN2 to list examples and RAN2 is asking whether it can be applied to all the cell specific RSRP threshold. For 1dB, it is 20dB extended coverage. We have long debate.

CMCC: we think in previous RAN4 meeting we just discussed some of parameters. Regarding RAN2, we are worried about applying the offset to all the threshold. For 2-step rach, we would like to prevent UE to do 2-step. For cell-reselection, we would like to apply the threshold to let UE to camp on the cell stably. We are open to discuss them case by case. We should be careful.

Nokia: the offset is needed. There is accuracy degradation. The same offset may not be applicable to all the cases. We can consider whether the offset is the absolute value. The other issue is whether the threshold is applied in lower SNR and higher SNR. The accuracy is different. In the next issue, we are also open to whether to define the configurable offset.

Intel: our proposal is the same as the approach as Nokia. The work load is heavy. But considering the gain and operation, we can categorize the inputs. Which operation can be benefit from most of gain. Separate offsets can be defined. It is option 1a. I do not agree to apply all the single offset to all the measurement. We can pick some offset to cover some operation.

Vivo: to our understanding, the offset was introduced by RAN4 for some cases. It is applied to some cases with different levels. We do not want to consider all the cases considering just 1dB difference. RAN2 has different understanding on how to apply it. This information we provided to RAN2 may mis-lead RAN2 decision. The better way is to limit to RAN4 and apply it to idle cell selection case.

Qualcomm: offset is needed. We agree with Ericsson. It is needed for some threshold. The offset is needed. We are open to discuss case by case. We can discuss the important cases. The threshold should be fixed number. We just need to have RAN4 spec impacted. We are open to discuss them case by case rather applying the offset to all the cases.

Mediatek: We have similar comment as Qualcomm. We have already agreed that the value should be fixed value.

Ericsson: we have list of threshold of R4-2206951. We can consider them to address the problem. In stead of debate of negative and positive, we can consider configurable. If not agreeable, we can consider case by case.

Huawei: The threshold listed five IE. *rsrp-ThresholdCSI-RS is per UE. msgA-RSRP-Threshold and rsrp-ThresholdBFR* are for 2-step rach. We have concern on configurable which has more impact on RAN2.

Ericsson: some item is per-UE. But RAN2 can solve this. If there is fixed value, RAN2 will give the referent to RAN4 spec 38.133. We can add them in the performance part. This is the way to move forward.

Vivo: the concern is the workload. We just stick to the threshold mentioned in RAN4 LS.

Intel: at least RSRP change threshold, we can consider configurable offset.

Apple: to CMCC, the specifc value in the spec, we need study case by case. We need stick to the previous agreement and we should use the fixed value, which gives UE more flexibility to apply the threshold. To narrow down the case, the case in the LS is too limited. For RRM relaxation criterion, we also need carefully check.

Ericsson: offset should not be different for those five cases. We can give the flexibility to RAN2.

Huawei: for option2, the workload in RAN4 needs be carefully considered. The case-by-case analysis is needed. Could we use the relaxed measurement accuracy to solve the issue.

Nokia: our preference is to do it configurable. If going with fixed one the workload in RAN4 is high.

Qualcomm: we do not agree with the configurable threshold. We should stick to fixed one. It would be different for most cases.

OPPO: We do not prefer to configurable value. We should keep fixed value. We share the concern of the workload is high. We may consider relax the accuracy of 1Rx compared to 2Rx.

Intel: even going with fixed threshold, we need consider RSRP change threshold. The RSRP change threshold, the threshold should be negative value.

Vivo: The threshold is related to coverage. We have reached the agreement. Some threshold needs fixed values. Some threshold is UE specific. There is only one threshold which is related to coverage.

Mediatek: we agree that threshold is related to coverage.

Ericsson: single offset is enough. For intel, some scenario needs negative value. We need to get input from RAN2.

Apple: for single or multiple, we need to do study. Some threshold depends on L3, for which the 1dB difference. For one-shot measurement, 3dB difference. We need to categorize cases.

Intel: agree with Apple approach.

Ericsson: we have studied the cell specific procedure. Cell specifc procedure is based on L3.

CMCC: we do not want to consider the RRC connected mode. Idle mode and inactive mode are enough.

Vivo: considering L3 is sufficient.

Apple: regarding the idle mode and connected mode, I do not think connected mode is the new case to RAN4. We are open to discuss it.

**Agreement:**

* Only consider L3 measurement and the cell specific threshould
* Down-select to
  + **Option 2 :** A RedCap UE with 1 Rx branch applies the offset to all cell-specific RSRP thresholds, including the ones used for Rel-16 low mobility and/or not at cell edge conditions, and Rel-17 stationary and not at cell edge conditions for RRC idle/inactive state.
    - FFS on the offset values
  + **Option 3:** Not introduce threshold offset in spec and the measurement difference gap between 1Rx and 2RX is up to UE implementation.
  + **Option 6:** Consider the listed five scenario in LS R4-2206951 and define the fixed value case by case for each scenario.
    - Further discuss whether to limit the scenario which is related to coverage
    - Need consider SDT scenario.
* Remove the rsrp-ThresholdBFR from the previous LS and send the new LS to RAN2, if RAN4 agreed to limit to idle and inactive modes.

**Issue 6-2-2: Applicability of cell-specific RSRP offset to relaxed measurement criteria**

* Proposals
  + **Option 1 (Ericsson):** 
    - RAN4 does not recommend that the RedCap UE with 1 Rx branch applies the offset to any of the conditions or thresholds used for any relaxed measurement criteria defined in Rel-16 or Rel-17.
  + **Option 2 (Apple, Nokia):**
    - RedCap UE with 1 Rx branch applies the offset to all cell-specific RSRP thresholds, including the ones used for Rel-16 low mobility and/or not at cell edge conditions, and Rel-17 stationary and not at cell edge conditions for RRC idle/inactive state.
  + **Option 2a (Intel):**
    - introduce separate offsetRSRPChange, RRM Relxation, offsetReselectionThreshold and offsetReselectionThresholdQ for RRM relaxation evaluation in IDLE/INACTIVE if RAN4 agree to consider them within the scope of 1 Rx. configuring margin for Rel-17 RedCap UEs.
    - consider separate offsetL3, RSRPChange and offsetL3, Quality for RLM/BFD relaxation evaluation in CONNECTED if RAN4 agree to consider them within the scope of 1 Rx. configuring margin for Rel-17 RedCap UEs.
  + **Option 3 (HW):** Not introduce threshold offset in spec and the measurement difference gap between 1Rx and 2RX is up to UE implementation.
  + **Option 4 (MTK):** If RAN4 would like to introduce offset for other RSRP threshold (for all cell-specific RSRP thresholds) then this shall be discussed case by case
* Recommended WF
  + Discuss the options.

**Issue 6-2-3: Applicability of cell-specific RSRP offset to cell (re)selection thresholds**

* Proposals
  + **Option 1 (Ericsson, Nokia):** 
    - RAN4 considers that it is beneficial for the RedCap UE with 1 Rx branch to apply configurable offset to the cell (re)selection thresholds: *Qrxlevmin* and *Qqualmin*
  + **Option 2 (Apple):** 
    - RAN4 to confirm that a RedCap UE with 1 Rx branch can apply a predefined offset to cell (re)selection thresholds, i.e., Qrxlevmin and Qqualmin.
* Recommended WF
  + Discuss the options.

**Discussion:**

Ericsson: the previous agreement applies to cell specific RSRP offset to cell (re)selection thresholds. The value should be the same.

CMCC: the prevous agreement has already captured this.

Ericsson: it is not very clear if the cell (re)seletion is included.

**Chair=>** discuss this issue together with Issue 6-2-1.

**Issue 6-2-4: Fixed or configurable offsets**

* Proposals
  + **Option 1 (Nokia, vivo):** RAN4 to discuss whether to define configurable offsets to all RSRP/ RSRQ thresholds for 1 Rx RedCap UEs either from Rel-17 or from Rel-18.
  + **Option 2 (MTK, Apple):** RAN4 can agree to provide offset if it is given as a constant value in the RAN4 specification.
* Recommended WF
  + Discuss the options.

**Chair**=> this issue should not be discussed in this meeting.

**Sub-topic 5-2 CSSF, gap related issues**

**Issue 5-2-1: CSSF assumptions for intra/inter-frequency measurement with MG**

* Proposals
  + **Option 1 (Apple):** If intra-frequency measurement is with MG, CSSFoutside\_gap,i = Y for inter-frequency measurement with no measurement gap, Y is the number of configured inter-frequency MOs without MG that are being measured outside of MG.
  + **Option 2 (CMCC, HW):** When SMTC occasions of inter-frequency measurement object are partially overlapped by the measurement gap are measured outside of MG, RedCap UEs should perform inter-frequency MOs outside MG. If UE supports this inter-frequency without gap, the flag of [inter-frequency\_config\_R16] is configured by network
* Recommended WF
  + Discuss the options

**Discussion:**

Huawei: we can agree with both options.

Apple: support two options. For option 2, even though it is not explicitly mentioned network flag, I think the network flag will be used to indicate UE to do measurement outside the gap.

Nokia: We support both options.

CMCC: we support two options. We confirm understanding from Apple.

**Agreement:**

* If intra-frequency measurement is with MG, CSSFoutside\_gap,i = Y for inter-frequency measurement with no measurement gap, Y is the number of configured inter-frequency MOs without MG that are being measured outside of MG.
* When SMTC occasions of inter-frequency measurement object are partially overlapped by the measurement gap are measured outside of MG, RedCap UEs should perform inter-frequency MOs outside MG. If UE supports this inter-frequency without gap, the flag of [inter-frequency\_config\_R16] is configured by network.

**Issue 5-2-2: Whether to support for per-FR gap**

* Proposals
  + **Option 1 (OPPO, CMCC, Ericsson, HW, vivo, Nokia):**  If a RedCap UE support both FR1 and FR2, whether RedCap UE can support per-FR gap(e.g., independentGapConfigdf) depends on UE capability.
    - **Option 1a (Nokia):** Specify separate measurement requirements and interruption requirements for per-FR gap compared to per-UE gap. Support of per-UE gap is mandatory for RedCap UE supporting FR1 and FR2, whilst support of per-FR gap is optional and indicated as UE capability.
    - **Option 1b (OPPO):** As compromise, it is also fine for Redcap UE to only support per UE gap in R17.
  + **Option 2 (MTK):** If MG is needed, both per-UE and per-FR MG can be supported by UE, but they both share the same per-UE MG based cell identification/measurement requirements.
* Recommended WF
  + Discuss the options.

**Discussion:**

Mediak: we can support both. The requirement should be per-UE MG to make it simple. The requirement is the same.

Apple: for option1, if UE claims to support per-RF gap, does it mean UE do measurement on one FR and receive the data from the other FR since WID limits the single carrier.

Nokia: we agree option 1 and option 1a. Per-FR is optional capability.

Ericsson: We support option 1. If UE supports per-FR gap, it means UE to support measurement in one FR and receive data.

Vivo: we can use option 1 as compromise. Maybe in the end there is no difference between per-UE and per-FR gap.

CATT: we consider per-FR gap. Option 1 is the baseline. We can further discuss the interruption.

CMCC: we cannot change the definition of per-FR gap. We can use the same approach to treat the other features. The specification should explicitly preclude the features and at the same time no additional work is expected.

Qualcomm: we generally agree with per-FR gap. But RedCap has only one searcher which cannot measure two FR simultaneously. There will be some interruption requirements. We wonder how it can work with single searcher.

OPPO: Define the requirments only for per-UE gap in Rel-17.

Huawei: in our understanding, per-FR is not related to single or multiple searcher, which is related to UE behaviour. It is not related to do measurement on one FR and do reception on the other FR.

Qualcomm: How perform the measurement in one FR and receive data in other RF is related to searcher somehow. It is not CA case. UE can deactive one FR at the same time.

Huawei: here we are discussing the data reception and measurement. For CA, we discusse two serving cells for which UE need receive data at the same time.

Ericsson: we have the same understanding as Huawei.

Nokia: we have no assumption on the searcher number.

Qualcomm: I understand the optional capability. We disagree with UE should do measurement on one band and receive data on the other band.

Mediatek: On the number of searcher, we have different views from Huawei and Ericsson. The gap has the same offset. UE needs to do concurrent measurement on FR1 and FR2 within the same gap.

**Agreement:**

* If a RedCap UE support both FR1 and FR2, whether RedCap UE can support per-FR gap(e.g., independentGapConfigdf) depends on UE capability.
* Define the requirements only considering per-UE gap in Rel-17.

**Topic #7: Performance part of RedCap**

**Issue 7-2-1: Test configurations**

* Proposals
* Recommended WF
  + Companies are encouraged to provide comments directly to the CRs.

**R4-2213752, R4-2213003, R4-2211692**

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**[104-e][224] NR\_redcap\_RRM\_2, AI 9.18.3.2~9.18.3.4 – Xusheng Wei**

**R4-2214144 Email Discussion Summary for [104-e][224] NR\_redcap\_RRM\_2**

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

**Abstract:**

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

**Decision: Return to.**

**Conclusions after 1st round**

**Conclusions after 2nd round**

**GTW on Aug-16**

**Sub-topic 3-2 Reply LS for R2- 2201760**

**------------------------------------ LS --------------------------------**

***1. Overall Description:***

*Regarding the following scenario mentioned by RAN1 in the LS provided in R1-2112802:*

* *For a separate initial DL BWP (if it does not include CD-SSB and the entire CORESET#0) from RAN1 perspective,*
  + *If it is configured for random access while not for paging in idle/inactive mode, RedCap UE does NOT expect it to contain SSB/CORESET#0/SIB.*

*RAN2 has discussed this scenario and how a RedCap UE performs RSRP measurements before Msg1 or MsgA retransmission on separate initial UL BWP and agreed on the following."*

* *“From RAN2 perspective, if a RedCap UE in idle/inactive mode is configured with a separate initial BWP associated with no SSB (CD or NCD) for RACH, it is up to UE implementation to perform new RSRP measurement in a DL BWP associated with CD-SSB before Msg1/A retransmission.”*

*RAN2 respectfully asks RAN4 and RAN1 to take the agreement above into consideration and check if any update is required in their specifications.*

***2. Actions:***

***To RAN4 and RAN1***

***ACTION:*** *RAN2 kindly asks RAN4 and RAN1 to take the agreement above into consideration and check, as it is up to RAN4 and RAN1, if any update is required in their specifications.*

**------------------------------------ LS --------------------------------**

**Issue 3-2-1: On draft reply LS to R2- 2201760**

* Proposals
  + Option 1: RAN4 concludes that RAN2’s understanding on “it is up to UE implementation to perform new RSRP measurement in a DL BWP associated with CD-SSB before Msg1/A retransmission” is right and it is up to RAN2 to determine how to progress this work (vivo)
* Recommended WF
  + To moderator’s understanding it is good to have this LS replied from procedure point of view even there is no RAN4 impact.

**Discussions:**

Vivo: the majority view is that there is no impact on RAN4 spec. Our preference is still to send LS.

Nokia: Similar view like Chair. There is no action for RAN4. We should not have LS.

Vivo: the other way is that we just have agreement that there is no impact on RAN4 agreement.

**Agreement:**

* There is no impact on RAN4 RRM specification from LS R1-2112802.

**Sub-topic 3-1 On offset to transmit CD-SSB and NCD-SSB at different times**

**Issue 3-1-1: NCD-SSB time offset**

* Proposals
  + Option 1 (Huawei, Ericsson): The MGRP of MG can be a candidate values for NCD-SSB time offset.
    - Option 1a(Ericsson): At least MGRP=40ms should be introduced.
    - Option 1b(Huawei): Additional offset values, i.e., 20ms, 40ms, 60ms
  + Option 2 (Apple): Support the RAN2 proposal with the value {sf5, sf10, sf15, spare5, spare4, spare3, spare2, spare1}.
* Recommended WF
  + Discuss the options.

**Discussions:**

Ericsson: our view is option 1. We need consider MGRP offest. We are fine to use 20 and 40ms.

Vivo: similar view as Ericsson. We try to agree with minimum set of offest values (20 and 40ms) and further discuss others.

Apple: we can compromise to option 1. For MGRP, 20 and 40 is good choice.

Huawei: we also compromise to add addtional 20 and 40 ms.

Nokia: agree to 20 and 40ms, which are most important.

Qualcomm: we are fine to 20 and 40 and need further discussion on other values.

**Agreement:**

* For NCD-SSB time offset, add the addtional MGRP values of 20ms and 40ms, and further discuss whether and what other values are needed.

**Issue 3-1-2: NCD-SSB time offset impact**

* Proposals
  + Option 1: When the SSB for intra-frequency measurement is fully-partially overlapping with the MG due to SSB offset, UE is required to perform intra-frequency measurement and drop the configured MG. (Ericsson)
* Recommended WF
  + Discuss the options.

**Discussions:**

Ericsson: This scenario is for intra-frequency. NCD-SSB offset is 5ms. When network configure CD-SSB, after the BWP is switching, UE is switched from CD-SSB to NCD SSB but the configuration of MG is fixed somehow.

Qualcomm: we cannot agree with the proposal, which has implication on hwo UE handels the colliding case. We need more analysis.

Vivo: We can have more offline discussion.

Apple: it would be easier for network to coordinate the measurement gaps.

**Sub-topic 2-1 General aspects for RRM measurment relaxation for Redcap**

**Issue 2-1-1: Whether Scenario 8 should be allowed or not**

|  |  |  |  |
| --- | --- | --- | --- |
| **No** | **Rel-16 relaxation criterion** | **Rel-17 relaxation criterion** | **Applicability** |
| 8 | Rel-16 not-at-cell-edge | Rel-17 stationary |  |

* Proposals
  + Option 1: Case 8 is supported (Apple Xiaomi Huawei vivo MTK)
  + Option 2: Case 8 is not supported (CMCC Ericsson)
* Recommended WF
  + Could company compromise to option 1.

**Discussions:**

Moderator: we have conclusion before case 8 is not supported. We simply followed the RAN2 LS. In previous meetings, we got the new LS from RAN2 that case 8 is allowed. It is quite straightforward.

Qualcomm: we support option 1.

Mediatek: we agree with moderator. Case 8 should be supported.

Nokia: we have different opinion. RAN2 clearly indicates case 8 should not be considered. We would like to stick to the previous agreement. We do not want to go back to touch the core requirement. There is no advantage to introduce the combination.

CMCC: based on RAN2 latest LS, network can configure Rel-16 and Rel-17 criterion. UE just needs to meet one of them to perform RRM relaxation. Case 8 can be supported from signalling perspective and further discuss the requirement.

Ericsson: we are fine with Option 1.

Apple: we also support option 1. In the network, both Rel-16 and Rel-17 UEs exist. Netowrk can configure both. UE won’t apply the further relaxation on top of each other. UE just needs to follow the most relaxed one.

Vivo: to Nokia, Nokia comment is based on the previous LS. In the latest one, RAN2 clearly indicate case 8 is supported.

Mediatek: to Nokia, basically the confusion is what happens to combine them. To requirements, we have agreed that UE needs follow the most relaxed requirements.

Ericsson: It is related to whether it can be supported or not.

**Agreement:**

* Scenario 8 is supported

**Issue 2-1-1-1: Requirements for scenario 8 if scenario 8 is allowed**

* Proposals
  + Option 1: If UE can meet both Rel-16 not-at-cell-edge and Rel-17 stationary conditions, the UE is allowed to meet the requirements that are the most relaxed out of Rel-16 not-at-cell-edge and Rel-17 stationary RRM relaxation requirements. (Apple Huawei)
  + Option 2: UE could follow the requirements when both Rel-17 not-at-cell-edge criteria and Rel-17 stationary criteria are satisfied. (vivo)
* Recommended WF
  + To moderator understanding when multiple criteria are configured and met, it is more logic for the requirements to be based on similar requirements when multiple criteria are satisfied in Rel-16/Rel-17 instead of basing on the most relaxed requirements when a single criteria is satisfied.

**Discussions:**

Mediatek: we have already had agreement that UE is required to meet the most relaxed requirement.

Ericsson: Aligned with Mediatek

**Chair=>** Follow the previous agreement that UE is required to meet the most relaxed requirement

**Agreement:**

* For scenario 8, if UE can meet both Rel-16 not-at-cell-edge and Rel-17 stationary conditions, the UE is allowed to meet the requirements that are the most relaxed out of Rel-16 not-at-cell-edge and Rel-17 stationary RRM relaxation requirements.
  + The most relaxed requirement is the Rel-17 stationary RRM relaxation requirements.

--------------------------------------------- LS -------------------------------------------

***1. Overall Description:***

*RAN2 would like to thank RAN4 for the LS on RRM relaxation. Based on further RAN4 progress, RAN2 discussed the coexistence of Rel-16 and Rel-17 RRM relaxation, and achieved the following agreements:*

***Regarding the coexistence cases of Rel-17 and Rel-17 RRM relaxation:***

1. *Simultaneous configuration of R16 not-at-cell-edge criterion and R17 stationary criterion for idle/inactive mode is a valid configuration from the network’s point of view, where the network supports RRM relaxation for both R16 and R17 UEs in idle/inactive mode.*
2. *From signalling’s point of view, any R16 RRM relaxation criterion and any R17 RRM relaxation criterion for idle/inactive mode can be configured in a same cell at a same time, as independent criteria (i.e., without requiring a UE to fulfil both the R16 and the R17 criteria in order to relax its RRM measurements).*
3. *If combined with a not-at-cell-edge criterion (i.e. for Rel-17 stationary & Rel-17 not-at-cell-edge), the R17 stationary criterion can only be combined with the R17 not-at-cell-edge criterion, not with the R16 one.*

***In this way, RAN2 kindly request RAN4 to consider support cases#8 and case #9 in the previous LS [R2-2204487/R4-2207109]. But it is up to RAN4 to make the final decision on whether support case#8 and case#9, for example, considering other reasons from RAN4 (if any).***

*Besides, RAN2 also discussed the relaxation criteria, and achieved the following agreements:*

***Regarding the relaxation criteria:***

1. *RAN2 assume to change the “Srxlev” for stationary criterion to “SS-RSRP” in RRC\_CONNECTED, pending confirmation by RAN4. Please find the below TP (which has been agreed and will be implemented in TS 38.331) for your reference:*

|  |
| --- |
| ***5.7.4.4 Relaxed measurement criterion for a stationary UE*** *The relaxed measurement criterion for a stationary UE is met when:*  *- (~~Srxlev~~SS-RSRP RefStationaryConnected – SS-RSRP~~Srxlev~~) < SSearchDeltaP-StationaryConnected,*  *Where:*  *- ~~Srxlev~~ SS-RSRP = ~~current Srxlev value of the PCell~~ current L3 RSRP measurement of the PCell based on SSB (dB).*  *- ~~Srxlev~~ SS-RSRP RefStationaryConnected = reference SS-RSRP~~Srxlev~~ value of the PCell cell (dB), set as follows:*  *- At the end of RRC reconfiguration procedure as specified in 5.3.5.3, when rrm-MeasRelaxationReportingConfig is included in the RRCReconfiguration message; or*  *- If (~~Srxlev~~ SS-RSRP–~~Srxlev~~ SS-RSRP RefStationaryConnected) > 0; or*  *- If the relaxed measurement criterion has not been met for TSearchDeltaP-StationaryConnected:*  *- The UE shall set the value of ~~Srxlev~~ SS-RSRP RefStationaryConnected to the current ~~Srxlev~~ SS-RSRP value of the serving cell.* |

***RAN2 would like to confirm with RAN4 whether it is reasonable, or whether there is any concern from RAN4.***

***2. Actions:***

***To RAN WG4:***

*RAN2 kindly request RAN4 to take the above information into account during the following work, and provide feedback, if any.*

--------------------------------------------- LS -------------------------------------------

**Issue 2-1-2 Update the “Srxlev” for stationary criterion to “SS-RSRP” in RRC\_CONNECTED (question from RAN2 LS R2-2206418)**

* Proposals
  + Option 1: the SS-RSRP in stationary condition TP from RAN2 LS shall be revised as: SS-RSRP = current L3 RSRP measurement of the PCell based on an identical SSB (dB) (Apple)
  + Option 2: It is proposed to check with RAN2 whether CSI-RSRP can be used to evaluate the relaxed measurement criterion for stationary UE in addition to SS-RSRP (CMCC)
  + Option 3: From RAN4 perspective, it is reasonable to change the “Srxlev” for stationary criterion to “SS-RSRP” in RRC\_CONNECTED (Huawei Ericsson vivo)
* Recommended WF
  + Could option 3 is used as the baseline for replying LS, whether other options (option 2) included in the reply LS or not is up to further discussion.

**Discussions:**

Moderator: majority view is option 3.

Apple: we are OK with the terminolgiy change. The definition shuld be clarified based on RAN4 discussion.

CMCC: we need clarify whether CSI-RS RSRP is artificially precluded from RAN2.

Huawei: we agree to use option 3 as baseline. For option 1, we wonder if there is difference UE evaluate based on different SSB. RAN4 needs to first evaluate. RAN2 has discussed this issue and they sent the LS without mentioning the issue identified for different SSB based measurement.

Nokia: support option 3. We have the same understanding as Huawei that no consensus in RAN2.

Qualcomm: for option 1, what does identical SSB mean? It is not clear to me. For option 2, we can stick to SS-RSRP for simplicity.

Vivo: RAN2 has discussed for option 1. We need focus on the question from RAN2.

Apple: For RAN1,

**Agreement:**

* Option 3 is used as the baseline for replying LS.

### 9.19 Positioning enhancements for NR

#### 9.19.3 Moderator summary and conclusions

**[104-e][225] NR\_pos\_enh\_1, AI 9.19.1, 9.19.1.2, 9.19.1.4, 9.19.2 – Muhammad Kazmi**

**R4-2214145 Email Discussion Summary for** **[104-e][225] NR\_pos\_enh\_1**

*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**

**GTW on Aug-17**

**Sub-topic 3-1: Test configuration**

**Issue 3-1-2: PRS BW in accuracy tests**

* Proposals
  + Proposal 1: HW
    - For accuracy TCs with reduced sample number, the PRS BW is the two sub-tests are
      * Sub-test 1: serving cell RF BW, with Nsample=1
      * Sub-test 2: large BW in existing PRS RMC, with Nsample=2
* Recommended WF
  + Discussion needed

**Discussions:**

Ericsson: in the last meeting, we have already had the agreement. We agreed to consider only 1 sample under the condition.

Qualcomm: Similar comment as Ericsson. For Nsample=2, there is discussion on-going about applicability. Keep the previous agreement.

CATT: Similar view. In Rel-16 we have two sub tests since the bandwidth is different. In Rel-17 the accuracy for N=1 or 2 is the same. There is no need to define two tests.

Huawei: we would like to clarify. We have different accuracy for different bandwidth rather than sample numbers. If majority view is to have only one set, we are OK to Sub-set1.

Intel: Prefer one test. If company had concern on the test coverage, the compromise is to define two test cases with different bandwidth and N=1.

**Agreement:**

* For accuracy test case with reduced sample number, define only the Sub-test 1
  + Sub-test 1: serving cell RF BWs and with Nsample=1 which applies to all the test cases with reduced number of samples
    - FFS on the range of serving cell RF BWs

**Sub-topic 3-3: Side conditions for PRS measurements**

**Issue 3-3-1: PRS-RSRP higher side condition**

* Proposals
  + Proposal 1: E///
    - Rel. 16 PRS RSRP values corresponding to PRS BW ≥ 24 and Es/Iot ≥ -3dB shall be reused to define PRS RSRP accuracy requirement corresponding to side conditions Es/Iot≥ [-3dB] applicable to AWGN channel and PRS BW ≥ 48 PRBs.
* Recommended WF
  + Discussion needed

**Discussions:**

Qualcomm: we had agreement to reuse the Rel-16. We need to talk about the timeline to complete the test. It is not realistic.

Vivo: what is the channel condition? We specify the accuracy requirement for both AWGN and fading channel. We need some clarification. If we want to have new side condition, we need simulation. But it is difficult at this stage.

Huawei: we are open to proposal 1. It makes sense. We also agree with Qualcomm that some new simulation is needed. We need simulation to verify the accuracy can be met at -3dB. Es/Iot condition should be TBD.

Intel: about Huawei proposal, if we need time to evaluate condition, how can we define the requirements?

Ericsson: for vivo question, the accuracy applies for both channel conditions. We agree with Huawei suggestion. Keeping Es/Iot as TBD but the accuracy value can be taken from Rel-16 table.

**Issue 3-3-2: UE Rx-Tx time difference higher side condition (with reduced number of samples)**

* Proposals
  + Proposal 1: E///
    - Rel. 16 UE Rx-Tx accuracy values corresponding to PRS BW ≥ 24 and Es/Iot ≥ -3dB shall be reused to define UE Rx-Tx accuracy requirement corresponding to side conditions Es/Iot≥ [-3dB] applicable to AWGN channel and PRS BW ≥ 48 PRBs.
* Recommended WF
  + Discussion needed

**Discussions:**

**Chair=>** discuss it together with issue 3-3-1.

**Agreement:**

**Issue 1-2-3: Measurement period for multiple PFLs**

* Proposals
  + Proposal 1: QC
    - When the UE is configured to measure multiple PFLs without measurement gaps,
    - If the UE supports DL-PRS processing component 2b (N2, T2) on all the activated PPWs. the measurement period is the maximum measurement period across layers
      * The starting point of the measurement period for each PFL would be different depending on the corresponding PPW slot offset (activated PPWs cannot overlap in time)
      * The overall measurement period ends when the measurement periods for all the PFLs have ended.
    - Otherwise, the measurement period requirement is based on the sum-approach as for measurements within gap.
  + Proposal 2: HW
    - If there are more than one PFLs within an active BWP, it is up to UE implementation to choose one PFL to measure, and no measurement requirements would apply.
    - Define requirements for multiple PFLs as
      * sum(Tmeas,i) + (L-1)\*max(Teffect,i), if multiple PFLs are in Case 1 (same as measurement within MG)
      * max(Tmeas,i + Tuncertainty,i), if multiple PFLs are in Case 2, where Tuncertainty,i is the time from the start of the first PPW occasion for PFL#i to the start of measurement period.
* Recommended WF
  + Discussion needed

**Discussions:**

Huawei: both proposal 1 and proposal 2 address the separate scenarios. Both proposals are the similar. The multiple PFLs are based on max approach. There is another scenarios, for which we are not sure if we need to define requirements.

Ericsson: first issue is to address N2 T2 values. They are corner case. We should not define requirements. RAN1 agreed the single PFL. We should define the requirement for it.

Vivo: it is not clear what the typical scenario for multiple PFLs is. There is only one PPW activated at a time. I am not sure if we just use one PPW to cover all the frequency layers. It may be possible. The necessity needs further discussion.

Qualcomm: It is not correct only one PPW is activated. It is up to 4 which can be activated at a time. There is only one PPW activated per carier. We are not sure what the typical scenario is but they should be supported. To Ericsson, for the case we proposed, each PPW measure one layer. Within each window, one layer is measured.

Huawei: similar understanding as Qualcomm. The RAN1 agreement is for single PPW corresponding to single BWP. RAN1 agrees up to 4 which can be activated.

CMCC: Support to consider scenario with multiple frequency layers. RAN1 agree up to 4. About the scenario, in addition, there are another scenario the measurement is done under N and T value.

Nokia: we bebate on PRS processing window or PPW occasions. We should differentiate the number of PPW configured. We propose considering them in different issues.

Vivo: It is not very clear to me. Based on Qualcomm comment, one PPW is activated per carrier. On single carrier, there is only one PPW. I am not sure if there is something new to define.

Ericsson: We are not fine to define the requirements with multiple positioning frequency layers without clear understanding the sope.

**Issue 1-2-6: Applicability of PRS measurements without gaps under gap configuration/activation**

* Proposals
  + Proposal 1: QC
    - If the network configures/activates measurement gaps applicable for positioning measurements and activates PPWs simultaneously
      * Positioning measurements within measurement gaps are prioritized over measurements within PPW.
      * Measurement period requirement for measurements with gaps apply.
      * Measurement period for gapless measurements is extended by an unspecified amount of time.
  + Proposal 2: CATT, E///
    - For PRS measurement outside MG, the measurement requirements apply provided that no POS MG is activated during the measurement period.
  + Proposal 3: HW
    - RAN4 to define requirements for the scenario where one group of PFLs are measured outside MG while another group of PFLs are measured with MG: the total measurement delay is defined as the sum of measurement delays of each group.
* Recommended WF
  + Discussion needed

**Discussions:**

Qualcomm: our proposal is to prioritize the measurement within gap and gapless requirement is relaxed. For proposal #2, we are sure if it refer to specific gap or legacy gap. In our proposal, we think any gap can be used for positioning.

Nokia: we have commented for us we also look to the combination of gap and gapless. It is not clear to us for proposal 1 when the condition can be met. The combinations of modes has not been discussed so far. It is quite some effort needed if we want to achieve the combination. We want to discuss what we can get in Rel-17 and some other scenarios can be shifted to Rel-18.

Huawei: it is reasonable to consider where some is measured within the gap and others are measured outside gap. There is another which can be considered, i.e., inter-frequency layer. Proposal 2 preclude such case.

CATT: when we propose the proposal 2, the MG is pre-configured gap. We agree with Qualcomm. The legacy gap can be used. For scenario that Huawei mentioned, we are open.

Ericsson: on propsal 1, PPW and gap cannot be activated at the same time. Proposal 2 is fine. For proposal 3, why do we need mix two things.

Vivo: we also think use cases is not clear enough that network configure measurement with/without gap. If it has to be supported, we may consider simple case where PPW window is not overlapped with gap. The measurement with/without gap can be done separately.

Qualcomm: to Ericsson, is that PPW and gap cannot be activated at the same time captured somewhere? To Huawei, it is optimized scenario, which can be considred in future.

CATT: for proposal 3, we are open because RAN2 signaling can configure PPW and MG simultaneously. The case should be PPW and MG are configured simultaneous but are not collided to each other in time domain.

CMCC: we support considering the scenario. For the details of requirements, we are open.

Ericsson: to Qualcomm, it depends on what data will be provided. Only one will be activated. For CATT comment, PPW and MG can be activated at the different time. For proposal, we are not OK with “sum”. We are OK with the scenario where the PPW and MG are not colliding in time.

Nokia: If there is combination considered, we should have measurement delay impacting both type.

Qualcomm: If PPW and MG are not collided, in Rel-16 the only way to do is measurement within gap. Does it mean UE should do two measurement at a time? It is not feasible. That is the reason for our proposal 1. We should consider the processing load.

Vivo: in general, the simultaneous configuration PPW and MG is not feasible for UE to implement. It means that measurement within gap and outside gap should be done separately. It means uselss to configure both.

**Agreement:**

* For PRS measurement outside MG, the measurement requirements apply provided that no MG is activated during the measurement period.
  + Where MG includes pre-configured gap for positioning and any other measurement gaps used for positioning.
* FFS PRS measurement within gap.

**Issue 1-2-8: UE capability on M-sample for measurement with MG and outside MG**

* Proposals
  + Proposal 1: HW
    - RAN4 to introduce separate UE capabilities on M-sample for measurement with MG and outside MG.
* Recommended WF
  + Discussion needed

**Discussions:**

**Agreement:**

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**[104-e][226] NR\_pos\_enh\_2, AI 9.19.1.1, 9.19.1.3, 9.19.1.5, 9.19.1.6 – Qiuge Guo**

**R4-2214146 Email Discussion Summary for [104-e][226] NR\_pos\_enh\_2**

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

**Abstract:**

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

**Decision: Return to.**

**Conclusions after 1st round**

**Conclusions after 2nd round**

**GTW on Aug-17**

**Sub-topic 2-2 Performance requirements with TEG**

**Issue 2-2-2 Whether to define UE Rx-Tx accuracy and test case related to TEG?**

**Proposals**

* Option 1: (CATT, vivo)
  + Define relative UE Rx-Tx accuracy requirements and corresponding test cases for the case where two measurements are in same RxTx TEG.
* Option 2: (Huawei)
  + Do not define relative UE Rx-Tx accuracy requirements and related test cases
* Option 3: (Ericsson)
  + Define only absolute measurement accuracy requirement and test case for UE Rx-Tx time difference measurement
* Recommended WF
  + Need more discussion

**Discussions:**

Moderator: we can discuss the issue based on option 1 and option 2.

Vivo: We agree with CATT that we can derive the accuracy based on the results submitted last meeting. In Rel-16 we also derive the relative accuracy. The same approach can be reused here. For 2-2-3 we propose some approach.

Qualcomm: The propsal is not sufficient clear. According to CATT comment, we can leverage the RSTD results? This need be clarified. Which side condition are we going to use for the requirement? We suggest keeping discussion and clarify the assumption.

CATT: our proposal is to leverage the absolute RSTD simulation results. In our understanding, the applied side condition should be same as Rel-16: one cell is -6dB the other is -13dB.

Huawei: To CATT, we are going to define the relative RxTx accuracy, should we define it based on side condition with one cell is -6dB the other is -13dB? We are OK to define the relative accuracy with such side condition.

Ericsson: similar comment as Huawei.

Vivo: CATT suggestion is not clear to me. Why should we not use RxTx results?

CATT: Huawei understanding is correct. In Rel-16 we only have one cell measurement for RxTx. We only have one value for 90 pecentile.

Intel: CATT proposal is feasible. After checking results, the difference coming from -3dB and -6dB is comparable to margin. Considering the timeline, we can leverage the results even if the side condition is different.

Vivo: From our side, we have already had results for 5 pecentile. We can provide the corresponding result in this meeting. For RSTD approach, generally it is fine.

**Agreement:**

* Define relative UE Rx-Tx accuracy requirements and corresponding test cases for the case where two measurements are in same RxTx TEG based on side condition with one cell is -6dB the other is -13dB by using the absolute RSTD simulation results from Rel-16.

**Issue 2-2-3 How to define UE Rx-Tx accuracy related to TEG?**

**Proposals**

* Option 1: (CATT)
  + When defining relative UE Rx-Tx accuracy requirements related to RxTx TEG, the simulation results for RSTD measurement in R16 can be reused
* Option 2: (Qualcomm)
  + New simulations are required to derive UE Rx-Tx relative accuracy requirements for 90th percentile of absolute differential error
  + Frequency drift margin does not need to be added to the relative UE Rx-Tx accuracy requirements on the difference between two UE Rx-Tx measurements that belong to the same RxTx TEG
* Option 3: (vivo)
  + For the error from baseband of relative UE Rx-Tx time difference accuracy, the result of (95%-ile of UE Rx errors – 5%-ile of UE Rx errors) can be used.
  + The relative Rx-Tx accuracy can be defined as the sum of the error from baseband and the timing error margin.
* Recommended WF
  + Need more discussion

**Discussions:**

Huawei: to frequency drift margin, we have different view as Option 2. We should consider it as the same way as for Rel-16 RSTD requirement. Rx and Tx time are taken at the different points.

Qualcomm: We are doing UE Rx and Tx measurement separately. Tx and Rx time are separated by one subframe. That is different from RSTD. We first take difference locally and take the other difference.

CATT: to Huawei and Qualcomm, we would like to clarify whether the frequency drift is included in the report. In Rel-16 accuracy requirement is defined as base band error + timing error margin +frequency drift margin. This requirement should be defined as base band error + timing margin. Timing margin includes frequency drift.

Huawei: to CATT, we understand frequency drift only impact the relative measurement and is not included in any report. To Qualcomm, within each Rx and Tx measurement, the difference is small. But here we discuss the different RxTx report at the different time.

Qualcomm: we are OK to have time for discussion. Baseband + frequency margin. Maybe all the error can be absorbed in time error.

Huawei: everying including clarification and drift should be included in timing error. We need applicability rule.

Qualcomm: we agree with Huawei. For applicability of time error margin, we need discuss it.

**Issue 2-2-5 How to define the test case related to TEG?**

**Proposals**

* Option 1: (CATT)
  + Define applicability for the test cases related to TEG, i.e. the tests apply for the UE supporting TEG feature and reporting the same Rx TEG/RxTx TEG for the two cells.
* Option 2: (Huawei)
  + UE should not be mandated to use the same TEG to perform the measurement on both cells during the test.
* Option 3: (Ericsson)
  + Rel.16 setup can be reused to define test case for TEG based UE Rx-Tx measurement accuracy requirement.
  + Rel.16 setup shall be updated to support UE reported RxTx TEG margin value and UE is expected to meet the accuracy requirement corresponding to the RxTx TEG to pass the test.
  + Applicability rules for RxTx TEG accuracy requirement test case are not precluded.
* Recommended WF
  + Need more discussion

**Discussions:**

Moderator: we should try to reuse Rel-16 test with update. But companies comment this is optional feature.

Qualcomm: options are not exclusive. We support Huwei option. For option 3, this is a good approach. We can reuse the test. When UE reports TEG the additional requirement can be applied.

CATT: for option 2, if UE supports TEG feature, it is required by LMF. What is the UE beahvior? Should UE report TEG margin?

Ericsson: we confirm Qualcomm understanding on Option 3.

Huawei: to CATT, UE may or may not report TEG. It is up to implemetaion. If reporting, UE will report two measurements. It should be mandated. On Option 3, we also agree. The approach Option 3 can be applied to RSTD enh.

**Agreement:**

* UE should not be mandated to use the same TEG to perform the measurement on both cells during the test.
* For UE Rx-Tx test and RSTD enhanced accuracy test
  + Rel.16 setup can be reused to define test case for TEG based UE Rx-Tx/RSTD measurement accuracy requirement.
  + Rel.16 setup shall be updated to support UE reported RxTx TEG/Rx TEG margin value and UE is expected to meet the accuracy requirement corresponding to the RxTx TEG/Rx TEG to pass the test.
  + Applicability rules for Rx-Tx/RSTD accuracy test case are not precluded.

**Sub-topic 2-1 Timing error margin**

**Issue 2-1-2 Candidate timing error margin for RxTx TEG?**

**Proposals**

* Option 1: (CATT, Ericsson)
  + Reuse the candidate timing error margins of Rx TEG
* Option 2: (Huawei, MTK, Qualcomm, vivo)
  + (16 values): 1/2 Tc, 1 Tc, 2 Tc, 4 Tc, 8 Tc, 12 Tc, 16 Tc, 20 Tc, 24 Tc, 32 Tc, 40 Tc, 48 Tc, 64 Tc, 80 Tc, 96 Tc, 128 Tc.
* Option 2a: (Huawei)
  + The applicable timing error margin values that can be selected by the UE are the pre-defined values that are not larger than the sum of twice the Rel-16 group delay margin (dependent on PRS/SRS BW) and frequency drift margin
* Recommended WF
  + Need more discussion

**Discussions:**

Qualcomm: Option 2 has signaling impact.

Nokia: support Option 2.

**Agreement:**

* (16 values): 1/2 Tc, 1 Tc, 2 Tc, 4 Tc, 8 Tc, 12 Tc, 16 Tc, 20 Tc, 24 Tc, 32 Tc, 40 Tc, 48 Tc, 64 Tc, 80 Tc, 96 Tc, 128 Tc.
* The applicable timing error margin values that can be selected by the UE are the pre-defined values that are not larger than the sum of twice the Rel-16 group delay margin (dependent on PRS/SRS BW) and frequency drift margin
  + FFS on the frequency drift margin
  + FFS on “sum of twice the Rel-16 group delay margin and frequency drift margin”

**Sub-topic 1-2 Measurement in RRC\_INACTIVE state**

**Issue 1-2-1 PRS collision with PDSCH in RRC\_INACTIVE state**

**Proposals**

* Option 1: (CMCC, Huawei)
  + For PRS collision with PDSCH in RRC inactive state, in order not to miss paging, UE shall wait for receiving the PDSCH symbols other than retuning to PRS resources even the DCI is too close to the PRS symbols,
  + and the PRS measurement period can be extended when there is collision with PDSCH
* Option 2: (Qualcomm)
  + When the UE is performing positioning measurements in inactive state, if the UE determines that other higher priority DL signals/channels collide with PRS (as defined previously by RAN4) later than [N symbol/T ms] before the collision starts, the UE is not required to receive the other higher priority DL signals/channels and may receive the PRS resources (RAN1 conclusion)
* Option 3: (vivo)
  + If a PRS resource is within the initial DL BWP, when the time T between DCI and PRS resource is less than the DCI processing time, UE may receive the DL PRS symbols.
  + If a PRS resource is outside the initial DL BWP, when the time T between DCI and PRS resource is larger than the sum of DCI decoding time and RF retuning time, and scheduled PDSCH symbols do not collide with PRS, UE may receive the DL PRS symbols.
* Option 4: (Ericsson)
  + Depending on collision timeline (similar to gapless PRS measurement), a UE may continue receiving PRS over PDSCH or drop PRS over PDSCH on symbols carrying PRS in RRC\_INACTIVE state.
* Recommended WF
  + Need more discussion

**Discussions:**

Moderator: most companies are OK with Option 1. Others are based on RAN1 conclusion.

Vivo: RAN1 has made the agreement for connected mode measurement. In our view the same approach can be used in inactive mode. In inactive mode RF retuning is needed. We have almost the same behavior for connected and inactivated modes.

Qualcomm: we support Option 2, following RAN1 conclusion. Option 3 and Option 4 are aligned with the approach of Option 2. Vivo option is essential the same. The value N is not agreed by RAN1. We need wait for the decision on N value. Option 2, 3, 4 are similar. Option 1 is different from RAN1 approach.

Nokia: in our view, there are quite overlapping between options. Option 2 should be taken into account. Option 1 should be taken into consideration. We do not see too much conflict of option 1 with RAN1.

**Agreement:**

* Down-select to Option 1 and Option 2 and have further discussions.
  + RF retuning time is considered in Option 2.

**Issue 1-2-2 PRS measurement window in RRC\_INACTIVE state**

**Proposals**

* Option 1: (Qualcomm, vivo, Huawei)
  + Requirements for PRS measurement in INACTIVE apply provided that all PRS resources within a PFL are configured within up to [2] separate windows within TPRS, where each window is up to [5] ms.
* Option 1a: (vivo)
  + For the PRS measurement window in RRC\_INACTIVE state, the location of windows shall be close to paging occasion (i.e., after the paging occasion or before the paging occasion).
* Option 2: (Ericsson)
  + Do not define PRS measurement window in RRC\_INACTIVE state in Rel-17
* Recommended WF
  + Need more discussion

**Discussions:**

Moderator: we can compromise to Option 1 if the window is up to 10ms.

Ericsson: we consider option 1 is the new feature after the WI is closed. We do not want to define the window.

Qualcomm: Support option 1. Is there need to extend window only for single window or two separate windows.

Intel: option 1 is meaningful. From compromise, I want to check if the time duration is too long such that UE needs to keep on for long time and lead to more power consumption. Prefer to keep the value TBD or 5.

Huawei: to Ericsson, this is not new feature rather applicability. The power comsuption should be considered. We are fine with 10ms.

Vivo: support option 1 and fine with 10ms. If the location of window is not specified, it may not help to save the power. We propose option 1a where two window is closed enough.

CATT: we should also consider the network configuration.

**Agreement:**

* Requirements for PRS measurement in INACTIVE apply provided that all PRS resources within a PFL are configured within up to [2] separate windows within [Tavailable], where each window is up to [5 or 10] ms.
  + FFS on the location of windows.
  + FFS on whether there is impact on signalling

### 9.20 Multi-Radio Dual-Connectivity enhancements

#### 9.20.3 Moderator summary and conclusions

**[104-e][227] LTE\_NR\_DC\_enh2, AI 9.20 – Jing Han**

**R4-2214147 Email Discussion Summary for [104-e][227] LTE\_NR\_DC\_enh2**

*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**

**GTW on Aug-16**

**Issue 4-3: Whether to specify conditional PSCell change TC**

**Moderator’s note:**

1. TC for conditional PSCell **addition** are agreed to be specified.

2. No new conditional PSCell **change** requirements are specified in this WI.

* Proposals
  + Option 1(vivo): Given that conditional PSCell change includes both inter-frequency and intra-frequency measurements, RAN4 shall develop new test cases for conditional PSCell change based on the legacy tests for conditional handover.
* Recommended WF
  + Further discussion

**Discussions:**

Moderator: in Rel-16 there is no conditional PSCell change related test case specified. In Rel-17 we have no core requirement for it.

Vivo: support option 1. Actually according to justification, there is some leftover on Rel-16 for CPC. CPC does not simply for inter-frequency but also for intra-frequency. We see the necessity to specify test case for it.

Apple: We have concern on option 1. On top of inter-frequency, what is the point to have inter-frequency test. There are many many test cases already.

Huawei: We think when we discuss CPC core requirement we think from UE perspective UE cannot see it is inter-or intra CPC. That is why there is no new requirement in the WI. Since there is no core it is straightforward to have no test.

Vivo: it does not means it is out of scope. We can see the current CHO both inter-frequency and intra-frequency test cases are defined.

**Issue 1-1: Additional****condition for scenario #3**

Background

The below agreement is achieved in RAN4#102e. The only open issues is whether add one additional condition.

|  |
| --- |
| **Scenario #3: SCell to be activated belongs to FR2, if there is no active serving cell on that FR2 band, and target SCell is known to UE.**  Assuming PDCCH TCI and PDSCH TCI (when applicable) shall be associated with the triggered temporary RS burst:  if semi-persistent CSI-RS is used for CSI reporting, Tactivation\_time is 3ms + max (Ttemp\_RS+ 2ms, Tuncertainty\_SP)  if periodic CSI-RS is used for CSI reporting, Tactivation\_time is max (Ttemp\_RS + 5ms, Tuncertainty\_RRC + TRRC\_delay-THARQ)   * under the condition that   One of the candidate TCI states configured in TCI-StatesPDCCH-ToAddList has the same QCL source of the triggered A-TRS,  The QCL source of CSI-RS for CQI reporting is the same as the triggered A-TRS,  The TCI state for PDCCH/PDSCH that is the same as A-TRS is assumed during SCell activation until changed by network after SCell activation.   * **FFS**: whether add one additional condition:   + UE receives the SCell activation command and TCI state activation command at the same time. |

* Proposals
  + Option 1(Apple, MTK, Huawei): Add one additional condition
    - UE receives the SCell activation command and TCI state activation command at the same time.
  + Option 2 (Nokia, Ericsson): Allow the UE the additional activation time for receiving the TCI state activation command if not provided in the same MAC command as the SCell activation command.
* Recommended WF

Further discussion

**Discussions:**

Nokia: what we proposed here is to follow what we defined cell activation/deacation for legacy. We do understand it is for the first Scell activation. The fast activation is always benefit. It does not mean we should not define the requirement when the commands do not arrive the same time.

Apple: one different from legacy is the it is reply on L1 measurement. Tempoary RS is used. We do not see the reason.

Huawei: we understand the motivation. We have had agreement that we do not consider uncertainty of MAC. The reason is to save the additional delay. We support option 1.

Qualcomm: we share the similar views as Apple and Huawei. The payload is significantly high for RAN2 new IE. Why does network not send the IEs simultaneously. We support Option 1.

Nokia: I fully agree the purpose to speed up. However it seems strange that if network cannot send the signaling the same time then there is no requirement for UE.

Qualcomm: We do not need preclude this scenario from core requirement. At least we should consider condition in the test cases.

Huawei: does the tentative agreement means that we need add back MAC delay.

Mediatek: we have concern on it. It seems we go back.

Nokia: I does not fully see the reason not to define.

Mediatek: here we use the temporary RS. UE does not need to wait for TCI indication of PDCCH and PDSCH.

Qualcomm: no matter what is written, if we look at all the agreements, UE needs to active at one shot. From UE behaviour, there is no ambiguity.

**FFS on the following bullets:**

* whether or not to preclude the scenario where UE does not receive the SCell activation command and TCI state activation command at the same time.
* In the test case, only consier the condition that UE receives the SCell activation command and TCI state activation command at the same time

**Issue 2-6: Relax measurements on inter-frequency configured by SCG when SCG is deactivated**

* Proposals
  + Option 1 (Apple, MTK, vivo): Use the parameter measCyclePSCell to relax measurements on inter-frequency configured only by SCG when SCG is deactivated
  + Option 2 (Ericsson): No, RAN4 shall keep the new introduced parameter measCyclePSCell within agreed scope
* Recommended WF
  + Further discussion

**Discussions:**

Mediatek: inter-frequency is configured only by SCG. It is reasonable to relax the requirement, since the PSCell change… If we do not relax inter-frequency, then the inter-frequency measurement would be faster than intra-frequency which is wiered.

Ericsson: we would like to clarify there is deactive PScell there is only deactivated SCG. There is no agreement on inter-f relaxation when we introduce the requirement. The timer is kept running. The relaxation on inter-frequency will impact the performance for mobility. We do not support the relaxation at the late stage of Rel-17.

Vivo: in general we support option1. RAN4 needs ask for RAN2 to clarify the scenario if RAN4 agree option 1.

Nokia: it is clear whether the measCyclePScell is used for measurement of SCG.

Mediatek: we use the maximum value of measurement cycle of PSCell to replace the maximum value of …DRX cycle and STMC measurement period.

Apple: Support option 1. We consider the reasonable power saving. The relaxation is only for inter-f for SCG. Inter-f for MCG can guarantee the mobility. For vivo, it is duable.

Qualcomm: support option 1. We agree it is a bit late stage. From our side, it comes from all the companies. We want to equally relax the measurement configured for SCG. UE mobility is important. UE will know the situation based on measurement. UE won't lose the connect and do proper measurement.

Huawei: there is many way (DRX) for network to let UE relaxe the measurement.

Mediatek: if we use DRX, DRX is also be used for deactived PSCell. It reduces flexilbilty.

Ericsson: We have another concern. WE do not discuss the relaxation requirement. It is new requirement. It is not good idea to introduce the new requirement at this stage. Huawei points out there is another way.

Nokia: Agree with Ericsson and Qualcomm. It is a bit late. But this is something we overlooked. It is easy to relax but we have no full study it.

Apple: the simplest way is to replace the DRX with measCyclePSCell.

Ericsson: I did not really get it. Inter-f is the layer of active of PSCell. We are no comfortable to relax the requirement. The performance cannot be guaranteed. There would be deadlock between RAN2 and RAN4.

Mediatek: about the performance impact, any relaxation will lead to performance loss but the intention of WI is for power saving. About the deadlock, we do not quite get it.

Huawei: as the WI is completed in two meetings ago, some kind of enhancement. Could we suggest if we cannot reach agreement in the next meeting, then we won’t introduce the relaxation. If companies want it, we can discuss it in Rel-18 TEI or new WI.

Qualcomm: Apple makes the good point. Although the core part is completed, there is no impact on other WG. The workload on RAN4 is low.

**Chair=>** Encourage experts to address the issues as soon as possible. If there is no consensus by next meeting, suggest to discuss it in Rel-18.

**Issue 2-7: Change on measCyclePSCell range**

* Proposals
  + Option 1 (Ericsson): allow the value range of measCyclePSCell to be set from 80ms to 1280ms
  + Option 2 (Apple, Huawei, vivo): keep the low bound 160ms for measCyclePSCell.
* Recommended WF
  + Further discussion

**Discussions:**

Moderator: we discussed the issue for long time. The previous LS was sent out. We do not need reopen the discussion.

Ericsson: the reason is at that time we guarantee the sync condition but there is no guarantee on the DL synchronization. UE is not required to monitor SSB with longer cycle. We should maintain the DL sync. This is something that we can configure. We just want to allow the flexibility.

Qualcomm: we do not fully get point. When UE wants, UE can receive SSB.

Apple: We have concern on option 1. Similar comment as Qualcomm. Even if we follow logic, any value larger than 160ms cannot guarantee the sync. RAN4 had agreement. Unless critical issue identified we do not need to revisit it.

Vivo: we agree with moderator suggestion. We do not need reopen the discussion. Vivo have proposed 320ms and we accept 160ms as trade-off in the previous discussions.

Nokia: even though we proposed the shorter one before, we support Ericsson proposal. For the sake of process, we can stick to the existing one and we can discuss it later in the later release.

Huawei: To ericsson, we do not observe the strong relation between cycle and DL sync. UE can maintain DL sync based on SSB and SSB is always transmitted. When longer DRX is configured, there is no sync issue.

**Conclusions: No consensus on the change of lower bound. No discuss is expected in future meetings.**

**Agreement:**

* keep the low bound 160ms for measCyclePSCell.

**Issue 2-3: Tsearch in RACH-based PSCell activation delay**

**Background**

In RAN4#103e meeting, the below open issue is captured in WF [R4-2210605]:

|  |
| --- |
| **<Way forward>**: **Issue 2-1-4: Tsearch in RACH-based PSCell activation delay**   * + Option 1(Nokia, Ericsson): For RACH based PSCell activation, or if bfd\_and\_RLM is not configured for the deactivated PSCell, if the target cell is a known NR FR2 PSCell, Tsearch = 0 ms. If the target cell is an unknown FR2 PSCell and Es/Iot ≥ -2 dB, then Tsearch = 24\* Trs ms.   + Option 2(Qualcomm, vivo, Huawei, Apple, MTK, OPPO): No need to add the yellow highlight part. |

(**Moderator’s note:** the yellow highlight is added compared to the legacy requirement)

* Proposals
  + Option 1(Apple, Huawei, vivo): There is no necessity to explicitly add the yellow part (*bfd\_and\_RLM is not configured for the deactivated PSCell*) to RACH based PSCell activation in the spec.
  + Option 2 (Nokia): For RACH based PSCell activation, if the target cell is a known NR FR2 PSCell or if RLM and BFD are configured and TCI state is known, Tsearch = 0 ms. ~~If~~Otherwise the target cell is an unknown FR2 PSCell and Es/Iot ≥ -2 dB, then Tsearch = 24\* Trs ms.
* Recommended WF
  + Further discussion

**Discussions:**

**Agreements:**

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

#### 9.24.7 Moderator summary and conclusions

**[104-e][123] LTE\_NR\_Other\_WI, AI 10.17, 10.18, 9.24.1 – Jin Wang**

## 10 Rel-18 spectrum related WIs for NR

### 10.1 Issues arising from basket WIs but not subject to block approval

#### 10.1.2 Moderator summary and conclusions

**[104-e][115] NR\_Baskets\_Part\_1, AI 10.1 – Dominique Brunel**

**R4-2214093 Email Discussion Summary for [104-e][115] NR\_Baskets\_Part\_1**

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

**Abstract:**

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

**Decision: Return to.**

**Conclusions after 1st round**

**Conclusions after 2nd round**

### 10.2 Moderator summary and conclusions (for basket WI AI 10.3 to AI 10.13)

**[104-e][116] NR\_Baskets\_Part\_2, AI 10.3~10.8 – Iwo Angelow**

**R4-2214094 Email Discussion Summary for** **[104-e][116] NR\_Baskets\_Part\_2**

*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**

**Conclusions after 2nd round**

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**[104-e][117] NR\_Baskets\_Part\_3, AI 10.9, 10.13 – Per Lindell**

**R4-2214095 Email Discussion Summary for [104-e][117] NR\_Baskets\_Part\_3**

*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**

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**[104-e][118] NR\_Baskets\_Part\_4, AI 10.10~10.12 – Johannes Hejselbaek**

**R4-2214096 Email Discussion Summary for** **[104-e][118] NR\_Baskets\_Part\_4**

*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**

**Conclusions after 2nd round**

### 10.14 Rel-18 band combinations for concurrent operation of NR/LTE Uu bands/band combinations and one NR/LTE V2X PC5 band

#### 10.14.3 Moderator summary and conclusions

**[104-e][120] NR\_LTE\_V2X\_PC5\_combos\_R18, AI 10.14 – Qiuge Guo**

**R4-2214098 Email Discussion Summary for [104-e][120] NR\_LTE\_V2X\_PC5\_combos\_R18**

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

**Abstract:**

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

**Decision: Return to.**

**Conclusions after 1st round**

**Conclusions after 2nd round**

### 10.15 High-power UE operation for fixed-wireless/vehicle-mounted use cases in LTE bands and NR bands

#### 10.15.4 Moderator summary and conclusions

**[104-e][121] LTE\_NR\_HPUE\_FWVM, AI 10.15 – Man Hung Ng**

**R4-2214099 Email Discussion Summary for [104-e][121] LTE\_NR\_HPUE\_FWVM**

*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**

**Conclusions after 2nd round**

### 10.16 CAB-radio - High Power UE support for band n100 and n101 for Rail Mobile Radio (RMR) in Europe

#### 10.16.3 Moderator summary and conclusions

**[104-e][122] Railway\_HPUE\_n100-n101, AI 10.16 – Ingo Wendler**

**R4-2214100 Email Discussion Summary for** **[104-e][122] Railway\_HPUE\_n100-n101**

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

**Abstract:**

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

**Decision: Return to.**

**Conclusions after 1st round**

**Conclusions after 2nd round**

### 10.17 Rel-18 downlink interruption for NR and EN-DC band combinations at dynamic Tx switching

#### 10.17.3 Moderator summary and conclusions

**[104-e][123] LTE\_NR\_Other\_WI, AI 10.17, 10.18, 9.24.1 – Jin Wang**

**R4-2214101 Email Discussion Summary for [104-e][123] LTE\_NR\_Other\_WI**

*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**

### 10.18 Additional NR bands for UL-MIMO in Rel-18

#### 10.18.3 Moderator summary and conclusions

**[104-e][123] LTE\_NR\_Other\_WI, AI 10.17, 10.18, 9.24.1 – Jin Wang**

### 10.19 APT 600 MHz NR band

#### 10.19.6 Moderator summary and conclusions

**[104-e][124] NR\_600MHz\_APT, AI 10.19 – Christian Bergljung**

**R4-2214102 Email Discussion Summary for** **[104-e][124] NR\_600MHz\_APT**

*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**

**GTW on Aug-17**

**Sub-topic 2-2 channel bandwidth**

Sub-topic description: channel bandwidth and possible support of asymmetric bandwidths

Open issues and candidate options before e-meeting:

**Issue 2-2-1: supported channel bandwidth**

* Proposals
  + Option 1: follow the WID (see e.g. R4-2214001)
  + Option 2: other
* Recommended WF
  + TBA

**Issue 2-2-2: asymmetric channel bandwidths**

* Proposals
  + Option 1: shall be supported like for n71 with a mandatory set
  + Option 2: asymmetric BCS shall not be mandated
  + Option 3: to be considered further (R4-2213679)
  + Option 4: not specified in this WI
* Recommended WF
  + TBA

**Discussions:**

Moderator: the asymmetric bandwidth has been in the WID.

Skyworks: The uplink bandwidth is limited to 20MHz. The question is whether we supports the same asymmetric bandwidth as n71. We prefer to support bandwidth above 20MHz.

ZTE: We support option 3. FDD band is pending on operators’ demand.

Qualcomm: we have similar view as ZTE. We are OK to have asymmetric bandwidth especially for larger bandwidth. That is operator driven. Skyworks comment makes sense.

Telstra: we share the same view as Qualcomm and skyworks that for bandwidth < 20Mhz we can have symmetric bandwidth.

Ericsson: We needs address the Tx-Rx separation.

Moderator: Option 3 seems OK.

Nokia: we should minimize the numbers of combination set. We can only define one set.

**Agreement:**

* As per WID, to support DL bandwidth larger than 20MHz, specify the asymmetric DL and UL channel bandwidth.
* For bandwidth less than or equal to 20MHz, follow Option 3.

**Sub-topic 2-3 TX/RX frequency separation**

Sub-topic description: TX/RX spacing and compatibility with n71 system parameters (e.g. use of MFBI)

Open issues and candidate options before e-meeting:

**Issue 2-3-1: UE TX/RX separation**

* Proposals
  + Option 1: Specify a RX-TX separation of -46MHz for DL/UL frequency pairs within the frequency range 617-652MHz (DL) and 663-698MHz (UL), other separations between -51 and -86MHz are used if one or both channels are not within this frequency range. (R4-2212353)
  + Option 2: -51 MHz (R4-2214001)
  + Option 3: other, state what
* Recommended WF
  + TBA

**Discussions:**

Apple: the proposal intends for inter-operation capability for existing UE in the market to support n71.

Qualcomm: 51 Tx-Rx separation fits the band. 2x40 can fully utilize the spectrum. This is not good way to use the spectrum. This is different band. 51 is better.

Skyworks: We need to support variable duplex. There needs flexibility.

Spark: we share the same view as Qualcomm, which is requested. Option 2 is more compliant.

Apple: the flexible frequency duplex can allow the use case.

Qualcomm: checking with Indian colleagues, one operator BSNL has been given 10MHz …/663-673. I am not against flexible idea. At least we would like to include -51MHz.

Apple: it is exactly possible to use flexible separation.

Skyworks: for asymmetric, should we only keep -51MHz.

Mediatek: we should only take -51MHz. For n71, Tx-Rx separate is only -46MHz.

Apple: if we fix it to 51MHz, then we cannot have existing n71 operating in this frequency range. If we do not use -46, the legacy device cannot be used.

Mediatek: 46MHz is for n71 cooperation only? If yes, there is MFBI approach. For this new band, we can only consider 51.

Apple: MFBI works only when 46 is defined.

Qualcomm: there is no requirement that n71 device should work on this new band.

Apple: it would be highly desirable to reuse n71. If we fix the separation to -51, it preclude reusing n71 device.

Spark: We agree with the compromise solution. For n71, in our region, the device does not support n71 usually.

**Agreement:**

* At least -51 Rx-Tx separation will be specified.
* FFS on the other separation and/or variable frequency separation.

**Issue 2-3-2: MFBI and duplex spacing**

* Proposals
  + Option 1: The network should use -46MHz duplex spacing and signal MBFS for n71, if the frequencies used are within the n71 frequency range to enable. (R4-2212353)
  + Option 2: other, state what
* Recommended WF
  + TBA

**Discussions:**

Apple: MFBI works only when 46 is defined.

**Sub-topic 2-4 blocking requirements, coexistence with broadcast**

Sub-topic description: discuss the need of a blocking requirement for protection from broadcast services below the band, e.g. similar to the in-band requirement for n71

Open issues and candidate options before e-meeting:

**Issue 2-4-1: protection from interference from broadcast**

* Proposals
  + Option 1: specify a requirement similar to that for n71
  + Option 2: as proposed in R4-2214001 (-15 dBm at 605 MHz with restrictions on range 3 interferer power)
* Recommended WF
  + TBA

**Discussions:**

Qualcomm: we support option 2. For option 1, the n71 requirement is derived based on TV regulation in US, i.e., 1 watts transmission power for TV. The situation in Asian pacific region is different, i.e., 200 kwatts. There are restriction depending on the offset.

Skyworks: agree with Qualcomm about the difference. However, we always discussed APT 600 implementation could work to support n71. If we do not define the same requirement, when UE implements APT 600, UE supporting n71 needs pass n71 requirements. We should make sure the implementation to support both bands.

Apple: we should not agree any option. Both specify -15 dBm. We should lower -15dBm by 7dB. We should consider UE can fulfil the blocking on both bands.

Qualcomm: it seems to suggest that device should support new band and n71. To comment not including blocking requirement, we disagree with it.

Spark: we support that most device will comply with n71 anyway.

Skyworks: we are not saying every device shall. We should make sure APT requirements allow UE to support n71.

Apple: to -15dBm, it should be -22.

Qualcomm/Mediatek: OK with -22.

Skyworks: offset should be the same?

Qualcomm: For the lowest channel, I propose to relax the value.

**Agreement:**

* Specify [-22] dBm blocking requirements for coexistence with broadcast
  + FFS whether the relaxation of -22dB for lowest channel with smaller offset

**Sub-topic 3-2 Reference sensitivity**

Sub-topic description

Open issues and candidate options before e-meeting:

**Issue 3-2: Reference sensitivity**

* Proposals
  + Option 1: as proposed in R4-2212097

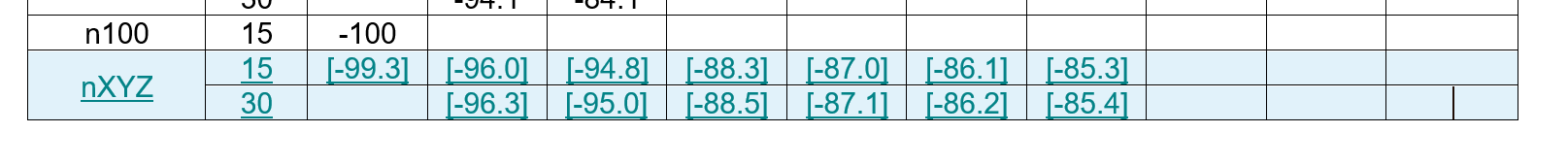
**Table 4a: REFSENS level for APT600 band**

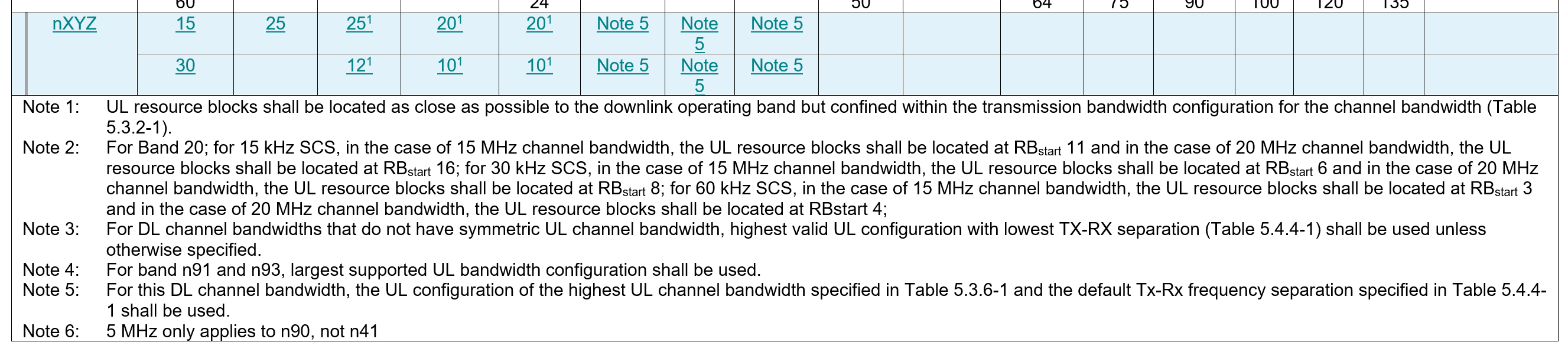
| **Operating band / SCS / Channel bandwidth** | | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Operating Band** | **SCS kHz** | **5**  **MHz (dBm)** | **10**  **MHz (dBm)** | **15**  **MHz (dBm)** | **20**  **MHz (dBm)** | **25**  **MHz (dBm)** | **30 MHz (dBm)** | **35 MHz (dBm)** |
| APT600  (n10X?) | 15 | -97.2X | -94.0Y | -91.6Y | -86.0Y | -84.1Y | -82.5Y | -80.7Y |
| 30 |  | -94.3Y | -91.9Y | -87.4Y | -84.2Y | -82.6Y | -80.8Y |
| Note X: 5MHz channels overlapping the 612-617MHz range are allowed [1]dB REFSENS degradation  Note Y: >5MHz channels overlapping the 612-617MHz range are allowed [0.5]dB REFSENS degradation | | | | | | | | | |

**Table 4b: UL configuration for REFSENS**

| **Operating band / SCS (kHz) / Channel bandwidth (MHz) / Duplex mode** | | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Operating Band** | **SCS** | **5** | **10** | **15** | **20** | **25** | **30** | **35** | **Duplex Mode** |
| APT600 | 15 | 25 | 251 | 201 | 201 | Note 5 | Note 5 | Note 5 | FDD |
| (n10X?) | 30 |  | 121 | 101 | 101 | Note 5 | Note 5 | Note 5 |  |
| Note 1: UL resource blocks shall be located as close as possible to the downlink operating band but confined within the transmission bandwidth configuration for the channel bandwidth (Table 5.3.2-1).  Note 5: For this DL channel bandwidth, the UL configuration of the highest UL channel bandwidth specified in Table 5.3.6-1 and the default Tx-Rx frequency separation specified in Table 5.4.4-1 shall be used. | | | | | | | | | |

* + Option 2: as proposed in R4-2214001





* + Option 3: other
* Recommended WF
  + TBA

**Discussions:**

Apple: comparing two values, option 2 tightens 2dB, which is not correct.

Qualcomm: the reason for tightening is that we think refsens of n71 is too relaxed. Based on our analysis, we think the reference sensitivity we proposed is the proper one.

Skyworks: Values that we proposed for n71 was better than the agreed value. Considering the larger distance, we think using current technology can maintain the same refsens. N71 requirement can be used as baseline.

Mediatek: share the same view as Skyworks. We can start with n71. For bandwidth smaller than 20MHz, we put relaxation based on TR.

Xiaomi: sensitivity for n71 can be used as the starting point. APT band has more 5MHz separation which could not bring 2dB tightening. We need more study on how to tighten.

Skyworks: at least for 5, 10 15Mhz, they are not impacted by UL transmission noise. They can be used as the starting point. We are open to discuss whether we can improve for higher bandwidth.

**Agreement:**

* For 5MHz, 10MHz, 15MHz, use the requirements of n71 as the starting point, and further discuss whether to add 0.5dB relaxation or to tighten the requirement of n71.
* For larger channel bandwidth, FFS on the improvement of reference sensitivity compared to n71.

### 10.20 Introduction of evolved shared spectrum bands

#### 10.20.5 Moderator summary and conclusions

**[104-e][125] NR\_unlic\_enh, AI 10.20 – Daniel Poop**

**R4-2214103 Email Discussion Summary for** **[104-e][125] NR\_unlic\_enh**

*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**

**GTW on Aug-17**

**Sub-topic 2-3 (Expanding range for NS values)**

With the large amount of new network signaling values the limit for the available NS values is at least hit for band n96. It is expected that more values are required in the future. The existing additionalSpectrumEmission IE is encoded as a 3-bit value thus allowing 8 different values.

**Issue 2-3: Expanding range for NS values**

* Proposals
  + Option 1: Send LS to RAN WG2 asking to extend the existing range of NS values up to 32.
  + Option 2: Other (please specify)
* Recommended WF
  + TBA

**Discussions:**

Qualcomm: I have a concern. I wonder if the traditional approach is better solution. We want to step back to consider if there is a better way to do this.

Charter: if we go with Option 1, we support it. Otherwise, people to fight the limited values.

Skyworks: Agree with thinking about whether we should consider the better idea. We probably need more. One option is to use one value for different modes. For example for Korean, we can use one NS value for two modes.

LGE: our preference is option 1, because we need acquire NS value and at the same time we can discuss the better solution. On one hand we can ask for extension of values. On the other hand, we can discuss the better solution in RAN4.

Mediatek: our preference is Option 1. The five bit extension is enough. Better solution is not precluded.

Ericsson: one other option is to use different band number within the same range. There is enough available number for bands.

T-Mobile USA: we can use mobile country codes.

**Agreement:**

* Send LS to RAN WG2 asking to extend the existing range of NS values up to 32.
  + The extension is applicable for unlicensed band
* Further discuss the better solution to address the issue of running out the NS values.

**Issue 3-1: PC3 ACLR requirement**

* Proposals
  + Option 1: Remove ACLR requirement for both PC5 and PC3
  + Option 2: Same 27dB ACLR requirement for PC5 and PC3
  + Option 3: Same 30dB ACLR requirement for PC3
  + Option 4: Other (please specify)
* Recommended WF
  + TBA

**Discussions:**

Skyworks: if looking at the competition tech, it has no such requirement. If we use 30dB ACLR for PC3, in the case we use 2Tx (two PC5) there would be no power gain.

Huawei: we consider the co-existence when deciding the ACLR.

Skyworks: we had some results for it.

Nokia: we have the same understanding. For NR-U, we have relative mask.

Huawei: in our understanding, when deciding ACLR, we do the co-existence study. In this case, if we would like to take 27 ACLR, we should have more analysis on this aspects

**Agreement**

* Evaluate ACLR for 27 and 30dB to be able to make an informed decision
  + Co-existence study is needed for evaluation of 27dB ACLR

**Sub-topic 5-1 (Channel at band edge)**

3GPP bands n96 and n102 both start at 5925MHz. However, no channel raster points were defined that would allow utilizing first 20MHz chunk of spectrum, i.e. 5925-5945MHz. This sub-topic discusses the introduction of additional channel raster points enabling true edge channel support for the named bands.

**Issue 5-1-1: New channels at band edge**

* Proposals
  + Option 1: Additional channels should map to the current A-MPR values or to the in-band PSD limited A-MPR as proposed in R4-2211606. Additional channels validity should be clarified per NS.
  + Option 2: Channel at band edge which have larger A-MPR than current edge channels shall be downlink only
  + Option 3: As a baseline, enable first 20MHz for band n96 and n102 only for NR-U DL channels.

First 20MHz can be considered for NR-U UL channels later (depending on the progress of the technical work).

* + Option 4: Do not define the additional channel raster points
  + Option 5: Other (please specify)
* Recommended WF
  + TBA

**Discussions:**

LGE: it depends on the country region. The starting point can be different depending on country. In Korea, 20MHz is not available. Option 4 works.

Skyworks: similar to LGE. There are bands where these additional channel are not feasible or it will require higher MPR than the existing. If we introduces the new channel bandwidth, they need be optional for some bands. One way is to enable additional channels as optional using the existing NS values.

Charter: we have same view. Pending on the region, the higher A-MPR is needed. We support option 4.

Apple: we prefer not to define. Option 2 and 4 would be way forward.

Qualcomm: same comment. We can assume DL only and base station can meet the emission requirement.

Skyworks: we agree that if we use DL only the BS can decide whether to implement the channel or not depending on local regulation. For country there is no out-of-band requirements, what should we do? Are we open to see the UL?

Qualcomm: either option 4. We just do DL only and sacrifis the UL.

Skyworks: there are cases. Only sub-band is used. The channel space is not always ideal and there is no out-of-band requirements.

**Agreement:**

* Down-select to Option 2 and Option 4.

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

### 11.1 Study on Efficient utilization of licensed spectrum that is not aligned with existing NR channel bandwidths

#### 11.1.3 Moderator summary and conclusions

**[104-e][129] FS\_NR\_eff\_BW\_util, AI 11.1 – Esther Sienkiewicz**

**R4-2214107 Email Discussion Summary for** **[104-e][129] FS\_NR\_eff\_BW\_util**

*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**

### 11.2 Study on enhancement for 700/800/900MHz band combinations for NR

#### 11.2.4 Moderator summary and conclusions

**[104-e][130] FS\_NR\_700800900, AI 11.2 – Huiping Shan**

**R4-2214108 Email Discussion Summary for [104-e][130] FS\_NR\_700800900**

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

**Abstract:**

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

**Decision: Return to.**

**Conclusions after 1st round**

**Conclusions after 2nd round**

### 11.3 Study on simplification of band combination specification for NR and LTE

#### 11.3.4 Moderator summary and conclusions

**[104-e][131] FS\_SimBC, AI 11.3 – Zhifeng Ma**

**R4-2214109 Email Discussion Summary for [104-e][131] FS\_SimBC**

*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**

### 11.6 Further RF requirements enhancement for NR and EN-DC in FR1

#### 11.6.5 Moderator summary and conclusions

**[104-e][132] FR1\_enh2, AI 11.6 – Leo(Ye) Liu**

**R4-2214110 Email Discussion Summary for [104-e][132] FR1\_enh2**

*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**

### 11.7 NR RF requirements enhancement for FR2, Phase 3

#### 11.7.4 Moderator summary and conclusions

**[104-e][133] FR2\_enh\_req\_Ph3, AI 11.7 – Petri Vasenkari**

**R4-2214111 Email Discussion Summary for** **[104-e][133] FR2\_enh\_req\_Ph3**

*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**

**Conclusions after 2nd round**

### 11.8 Requirement for NR FR2 multi-Rx chain DL reception

#### 11.8.4 Moderator summary and conclusions

**[104-e][134] FR2\_multiRx\_UERF, AI 11.8.1, 11.8.2 – Sumant Iyer**

**R4-2214112 Email Discussion Summary for [104-e][134] FR2\_multiRx\_UERF**

*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**

**Conclusions after 2nd round**

### 11.11 Support of intra-band non-collocated EN-DC/NR-CA deployment

#### 11.11.3 Moderator summary and conclusions

**[104-e][135] NonCol\_intraB, AI 11.11 – Suzuki Yasuki**

**R4-2214113 Email Discussion Summary for** **[104-e][135] NonCol\_intraB**

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

**Abstract:**

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

**Decision: Return to.**

**Conclusions after 1st round**

**Conclusions after 2nd round**

### 11.12 Air-to-ground network for NR

#### 11.12.5 Moderator summary and conclusions

**[104-e][136] NR\_ATG\_UERF, AI 11.12.1~11.12.3 – Zhe Shao**

**R4-2214114 Email Discussion Summary for** **[104-e][136] NR\_ATG\_UERF**

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

**Abstract:**

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

**Decision: Return to.**

**Conclusions after 1st round**

**Conclusions after 2nd round**

### 11.14 Study on expanded and improved NR positioning

#### 11.14.4 Moderator summary and conclusions

**[104-e][137] FS\_NR\_pos\_UERF, AI 11.14 – Aida L Vera Lopez**

**R4-2214115 Email Discussion Summary for** **[104-e][137] FS\_NR\_pos\_UERF**

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

**Abstract:**

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

**Decision: Return to.**

**Conclusions after 1st round**

**Conclusions after 2nd round**

### 11.15 Multi-carrier enhancements for NR

#### 11.15.3 Moderator summary and conclusions

**[104-e][138] NR\_MC\_enh, AI 11.15 – Shan Yang**

**R4-2214116 Email Discussion Summary for [104-e][138] NR\_MC\_enh**

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

**Abstract:**

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

**Decision: Return to.**

**Conclusions after 1st round**

**Conclusions after 2nd round**

## 12 Rel-18 Work Items for LTE

### 12.1 Rel-18 LTE-Advanced Carrier Aggregation for x bands (2<=x<= 6) DL with y bands (y=1, 2) UL

#### 12.1.4 Moderator summary and conclusions

**[104-e][119] LTE\_Baskets, AI 12.1 – Mohammad Abdi Abyaneh**

**R4-2214097 Email Discussion Summary for** **[104-e][119] LTE\_Baskets**

*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**

### 12.2 LTE intra-band contiguous CA for band 8

#### 12.2.3 Moderator summary and conclusions

**[104-e][126] LTE\_intraBandCA\_n8, AI 12.2 – Chunxia Guo**

**R4-2214104 Email Discussion Summary for [104-e][126] LTE\_intraBandCA\_n8**

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

**Abstract:**

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

**Decision: Return to.**

**Conclusions after 1st round**

**Conclusions after 2nd round**

### 12.3 Introduction of LTE TDD band in 1670-1675 MHz

#### 12.3.4 Moderator summary and conclusions

**[104-e][127] R18\_LTE\_TDD\_1.6GHz, AI 12.3 – Ojas Choksi**

**R4-2214105 Email Discussion Summary for** **[104-e][127] R18\_LTE\_TDD\_1.6GHz**

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

**Abstract:**

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

**Decision: Return to.**

**Conclusions after 1st round**

**Conclusions after 2nd round**

**GTW on Aug-17**

**Sub-topic 1-1: Band Numbering and Operating Band Parameters**

Sub-topic description: In RAN4 #103-e, it was agreed to assign number 105 to the new LTE TDD Band in 1670 – 1675 MHz. There are proposals to assign instead the number 54 given that TDD band numbers between 0 – 63 have not yet been exhausted

Open issues and candidate options before e-meeting:

**Issue 1-1-1: Band number allocation for the new band**

There is a proposal to assign #54 to the new band instead of #105 that was agreed to in RAN4#103-e

* Proposals
  + Option 1: Change the assigned band number to 54 for the new band and draft CR to add the highlighted text below to clause 5.5 of TS 36.101 (Table 5.5-1)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **E‑UTRA Operating Band** | **Uplink (UL) operating band BS receive UE transmit** | | | **Downlink (DL) operating band BS transmit  UE receive** | | | **Duplex Mode** |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| 54 | 1670 MHz | – | 1675 MHz | 1670 MHz | – | 1675 MHz | TDD |

* + Option 2: Keep Band number 105 for the new band and draft CR to add the highlighted text below to clause 5.5 of TS 36.101 (Table 5.5-1)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **E‑UTRA Operating Band** | **Uplink (UL) operating band BS receive UE transmit** | | | **Downlink (DL) operating band BS transmit  UE receive** | | | **Duplex Mode** |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| 105 | 1670 MHz | – | 1675 MHz | 1670 MHz | – | 1675 MHz | TDD |

* Recommended WF
  + Companies are encouraged to review the proposal for any issues/concerns. While expressing a view, it is suggested that each company provide a brief summary/reason for the expressed view.

**Agreement:**

* Option 1.

**Sub-topic 2-1: A-MPR assessment for the new band**

Sub-topic description: Assessing whether A-MPR needs to be specified or not for the new band to be included in the draft CR for the TS 36.101 at this meeting. R4-2212090 presents PAout measurements and filter data for the proposed new band to facilitate the assessment.

Open issues and candidate options before e-meeting:

**Issue 2-1-1:** UE transmission in 1670 – 1675 MHz is required to meet certain OOBE limits in the 1541 – 1625 MHz frequency range. The frequency range 1541 – 1625 MHz falls in the spurious region and the general spurious emission limits specified in Clause 6.5.3.1 of TS 36.101 will not be adequate to meet the required OOBE limits. It was agreed in RAN4#103-e meeting to evaluate if A-MPR will be required to meet these additional requirements.

* Proposals
  + Option 1: No A-MPR needs to be specified for the new band in 1670 – 1675 MHz to meet the additional spurious emissions associated with the new band.
  + Option 2: TBA
* Recommended WF
  + Companies are encouraged to review the data presented and the proposal for any issues/concerns. Companies should also review Issue 2-3-1 to assess if A-MPR may be required to meet the spurious emission co-existence requirement for protecting the DL of legacy E-UTRA/NR bands. While expressing a view, it is suggested that each company provide a brief summary/reason for the expressed view.

**Discussions:**

Skyworks: we do have an issue. The evaluation is done by doing average. It would be good to cross check the worst case.

Ligado: we provide the analysis for worst case. There are enough margin.

Skyworks: I would like to cross check. One unclear part is how the PA is calibrated 30dB ACLR.

Ligado: Yes.

**Sub-topic 2-3: Spurious emission limits for band UE co-existence**

Sub-topic description: Assessing the spurious emission limits for UE co-existence for the new band as well as legacy US bands. The E-UTRA/NR bands with either DL or UL operations in proximity of the new band are depicted below in blue:

Table

Description automatically generated

Open issues and candidate options before e-meeting:

**Issue 2-3-1: UE spurious emission co-existence limit for the new band to protect DL of legacy E-UTRA/NR bands in the US.**

* Proposals
  + Option 1: Given the distance to US legacy DL bands and the fact that H2 falls outside the n77 US range, -50dBm/MHz protection can be granted for all US bands. Draft CR forTS 36.101 be prepared accordingly.
  + Option 2: TBA
* Recommended WF
  + Companies are encouraged to review the proposal for any issues/concerns. While expressing a view, it is suggested that each company provide a brief summary/reason for the expressed view.

**Agreement:**

* Option 1: Given the distance to US legacy DL bands and the fact that H2 falls outside the n77 US range, -50dBm/MHz protection can be granted for all US bands. Draft CR forTS 36.101 be prepared accordingly.

**Issue 2-3-2: UE spurious emission co-existence limit for nearby legacy US E-UTRA/NR bands, B24/n24/n99, B66/n66, B70/n70 and n255 to protect the DL of the new band**

Proposals

* Option 1:
  + -50dBm/MHz protection level by band n24/n99, n70 and n66 is not specified
  + Relaxed protection can be specified but must account for legacy devices:
* Band n24 UL filter is focussed on the critical protection of the GNSS bands on the lower frequency side which is regulatory and thus provides only a small rejection at the new band frequencies at the higher frequency side
* Band n70 and n66 UL use a consolidated UL filter, which only provides moderate rejection at the new band frequencies
* The relaxation could be limited to UL BW above a given value and/or at a given position
* For some cases, it may be feasible to provide the -50dBm/MHz protection level but only up to a given channel bandwidth, while not specifying protection for a higher CBW (for n66 for example)
* Option 2:
  + Collect additional B24 duplexer rejection data as well measurements to finalize exception/relaxation, if any, for the UE coexistence spurious emission limit for protection of the new band by B24/n24 at the next meeting.
  + Collect additional B70 duplexer data as well measurements to finalize exception/relaxation, if any, for the UE coexistence spurious emission limit for protection of the new band by B70/n70 at the next meeting.
* Option 3:
  + Collect duplexer rejection data as well as measurements for different channel bandwidths for legacy bands B24/n24/n99, B66/n66, B70/n70 and n255 and finalize exception/relaxation for the UE coexistence spurious emission limits for these legacy bands for protection of the new band at the next meeting.
* Recommended WF
  + Companies are encouraged to review the proposal for any issues/concerns. While expressing a view, it is suggested that each company provide a brief summary/reason for the expressed view.

**Discussions:**

Skyworks: For collecting data, we have the devices, which do not look into this protection. We may have issue for legacy. If we collect data, we should consider the existing devices.

Qualcomm: we agree with Skyworks. The bands are closed. In addition to that for band 66, the range is extended over the entire spectrum. More work is needed on it. Making the emission requirement based on filter rejection is some kind of frustructing

**Chair =>** when collecting data, take the comments from Skyworks and Qualcomm into account.

**Agreement:**

* Option 3

**Issue 2-3-3: UE spurious emission co-existence limit for other legacy US E-UTRA/NR bands to protect the DL of the new band**

Moderator Proposal

* Option 1:
  + -50dBm/MHz protection level can be specified for other legacy US bands (B2/n2, B5/n5/n89, B12/n12, B13/n13, B14/n14, B17, B25/n25, B26/n26, B29/n29, B30/n30, B41/n41, B48/n48, B53/n53, B71/n71, B77/n77, B85/n85, n86) to protect the new band. Draft CR for TSs 36.101, 38.101-1 and 38.101-5 be prepared accordingly.
* Option 2:
  + TBA
* Recommended WF
  + Companies are encouraged to review the proposal for any issues/concerns. While expressing a view, it is suggested that each company provide a brief summary/reason for the expressed view.

**Discussions:**

Verizon: for n5, should we consider both 5 and n5?

Skyworks: n255.

T-mobile USA: why n66 and B66 not included?

Ligado: n66 is with larger channel bandwidth. The first ACLR falls. There may be more work.

Skyworks: when 35Mhz CBW is used for n66, filter does not help too much. It is not feasible to guarantee -50dBm.

**Agreement:**

* -50dBm/MHz protection level can be specified for other legacy US bands (B2/n2, B5/n5/n89, B12/n12, B13/n13, B14/n14, B17, B25/n25, B26/n26, B29/n29, B30/n30, B41/n41, B48/n48, B53/n53, B71/n71, B77/n77, B85/n85, n86) to protect the new band. Draft CR for TSs 36.101, 38.101-1 and 38.101-5 be prepared accordingly.

**Sub-topic 3-1: Rx reference sensitivity power level for the new band**

Sub-topic description: Expected changes to key band specific Rx requirements to be included in the draft CR for the TS 36.101.

Open issues and candidate options before e-meeting:

**Issue 3-1-1: The highlighted text is proposed to be introduced for Rx reference sensitivity power level requirement in the Draft CR for TS 36.101, Clause 7.3, Table 7.3.1-1. The band number to be populated will be based on agreement reached for Issue 1.1.1.**

* Proposals
  + Option 1: The following reference sensitivity table for the new band Clause is proposed

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **E-UTRA Band** | **1.4 MHz** | **3 MHz** | **5 MHz** | **10 MHz** | **15 MHz** | **20 MHz** | **Duplex**  **Mode** |
| **(dBm)** | **(dBm)** | **(dBm)** | **(dBm)** | **(dBm)** | **(dBm)** |
| 54 or 105 | -106.2 | -102.2 | -100 |  |  |  | TDD |

* + Option 2: TBA
* Recommended WF
  + Companies are encouraged to review the proposal for any issues/concerns. While expressing a view, it is suggested that each company provide a brief summary/reason for the expressed view.

**Discussions:**

Huawei: refsens should be based on the whole noise figure rather than only insertion loss.

Mediatek: we agree with Huawei comment.

**Agreement:**

* Option 1: The following reference sensitivity table for the new band Clause is proposed

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **E-UTRA Band** | **1.4 MHz** | **3 MHz** | **5 MHz** | **10 MHz** | **15 MHz** | **20 MHz** | **Duplex**  **Mode** |
| **(dBm)** | **(dBm)** | **(dBm)** | **(dBm)** | **(dBm)** | **(dBm)** |
| 54 | -106.2 | -102.2 | -100 |  |  |  | TDD |

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

#### 12.4.5 Moderator summary and conclusions

**[104-e][128] New\_Bands\_BW\_5G\_broadcast, AI 12.4, 12.4.1~12.4.3 – Gene Fong**

**R4-2214106 Email Discussion Summary for [104-e][128] New\_Bands\_BW\_5G\_broadcast**

*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**

**Conclusions after 2nd round**

**GTW on Aug-17**

**Topic #1: System parameters**

**Sub-topic 1-1 Coexistence**

Aspects related to system parameters was discussed in a number of papers. It was recognized by all companies that the WID indicates coordination between systems operating in the same geography is expected

The operation and planning of transmitters in these bands is different from cellular. In most cases, coordination mechanisms are in place so that when a new transmitter is proposed to be deployed in a given region, appropriate measures are taken (e.g. in terms of specific requirements for that transmitter, or usage of guard channels) to ensure coexistence with other systems in the same geography.

Nonetheless, Nokia in R4-2212071 proposes that the HPHT deployment was not the scenario studied in 3GPP when the general coexistence parameters were derived and when MBMS was specified. Therefore, before applying the general coexistence parameters (ACLR, ACS, etc), some study should first be conducted. On the other hand, ZTE in R4-2213699 (treated in thread 316) agrees that currently TN BS is not applicable for HPHT scenario. However, for how to protect the DTT service, there were some discussions in the past e.g., Band 20 or Band n71 (9 MHz guard band) and its coexistence requirement were also captured in BS spec. ZTE suggest to follow the legacy regulatory requirement instead of further do the evaluation study again.

**Issue 1-1: Coexistence**

* Is a coexistence study for HPHT deployment needed?
  + Option 1: Yes
  + Option 2: No
* Recommended WF
  + Discuss in the first round.

**Discussions:**

SWR: we support Option 2. We did operate as the existing one. There is no need for further study.

Nokia: we are not sure how the existing requirements of ACLR.. can be reused. We are not sure if we can skip the study.

Ericsson: We would like to see the study since HPHT is not considered in 3GPP before.

Qualcomm: I have concern on the open-ended co-existence study. The HPHT deployment has been there for long time.

T-Mobile: we often have requirements on top of regulation requirements. We support the idea to study here.

Verizon: study is needed. We need align on the regulation requirements.

**Agreement:**

* A coexistence study for HPHT deployment is needed

**Sub-topic 1-2 New band type**

It was recognized that the existing band types FDD, TDD, SDL are not well suited for the 5G broadcast band(s) and that a new type should be created. It was also suggested that a new suffix could be used to capture the specific requirements related to these downlink-only bands.

If there is a new band type created, is there any impact to other specifications in other working groups?

**Issue 1-2: New band type**

* Is a new band type needed?
  + Option 1: Yes
  + Option 2: No
* Recommended WF
  + If the answer is Yes, then please also comment whether there is impact to other WG’s
  + If the answer is No, then please comment on how existing band types could be used

**Discussions:**

SWR: we are in favor of Option 1.

Nokia: we only have FDD/TDD in RAN1 and RAN2. We can introduce the new band type in RAN4 but do not have impact on other WGs.

Ericsson: we are OK to define the new band type.

ZTE: this broadcast is different from SDL or other band.

T-mobile USA: do we need LS to other WG.

Qualcomm: something has already been included in other WGs.

ZTE: Feature has been captured in other WGs. Maybe we can send LS to RAN1/2 to check. The impact should be marginal.

Huawei: share the similar view as Qualcomm. In RAN1 the receiving only mode. For this mode UE has no need to report capability. We do not send LS.

Nokia: Agree with Qualcomm and Huawei.

**Agreement:**

* A new band type is needed.

**Sub-topic 1-3 Channel bandwidths**

The bandwidths allocated for broadcast in the UHF band are 6, 7, and 8 MHz depending on the region. However, LTE specifications only define bandwidths of 1.4, 3, 5, 10, 15, and 20 MHz. One option is to explicitly define new 6, 7, and 8 MHz channels (recognizing on the UE side that new filters should not necessarily be assumed). The other option is to reuse the existing bandwidths, perhaps taking into account some of the ideas explored in the NR study item on efficient use of non-standard bandwidths.

**Issue 1-3: Channel bandwidths**

* How should the channel bandwidths be handled?
  + Option 1: New channel bandwidths 6, 7, and 8 MHz are defined in both BS and UE specifications, applicable only to the 5G broadcast bands. It is recognized that the UE will not necessarily incorporate a new filter, rather only the existing 10 MHz filter should be assumed.
  + Option 2: The existing LTE bandwidths are used to cover the 5G broadcast channels.
  + Option 3: Other solutions?
* Recommended WF
  + Based on the contributions submitted, companies seem to recommend option 1 but all options can be discussed in the first round.

**Discussions:**

SWR: go with Option 1.

ZTE: prefer to Option 1 since the band is dedicated.

T-Mobile USA: we have concern on defining the new UE channel bandwidths. Some mobile operators requires supporting of 6, 8 bandwidths. We got a lot of push-back from vendors. They do not want to support the bands. We discussed it for years. Why we should go ahead for broadcast spectrum but not for IMT spectrum?

Qualcomm: I have the similar view as T-Mobile. It seems quick significant change. It is possible to accommodate the broadcast in the existing requirements, like 10MHz filter. We want to see if the existing implementation before agreeing on defining the requirements.

Apple: agree with T-Mobile USA and Qualcomm.

Mediatek: regarding new channel bandwidths or irregular channel bandwidth, it is feasible from base station side. For UE, more discussion is needed.

Nokia: for irregular channel bandwidth, we have many issue (ACS or blocking) not being addressed. We need study more before going for option 2.

Huawei: I think we reach any agreement. It should have no impact on the NR on-going SI for irregular channel bandwidth. We do not have strong view to define 6,7,8Mhz. But we need the whole picture on whether the new bandwidth for BS or UE.

Qualcomm: in WID, we assume 10MHz filter. Nokia concern cannot be addressed anyway.

Ericsson: it makes sense to introduce new bandwidths on BS side. For UE we need more discussion.

ZTE: agree with Ericsson. For UE side, 10MHz filter is assumed. But how it can protect DTT system. Probably the degradation is expected.

Nokia: we have already had study, which is captured in the TR. There is quite large degradation.

**Agreement:**

* For BS, define new channel bandwidths 6, 7, and 8 MHz.
* FFS for UE

**Sub-topic 1-4 Channel spacing and channel raster**

The conventional channel raster resolution for LTE is 100 kHz. However, the broadcast channelization for the UHF band is fixed for 6, 7, or 8 MHz channels.

**Issue 1-4: Channel spacing and channel raster**

* How should the channel spacing and channel raster be handled?
  + Option 1: Maintain the 100 kHz channel raster for generality. Some channel raster points may not be used.
  + Option 2: Downsample the channel raster to 3 sets of possibilities, for 6, 7, and 8 MHz channelizations.
* Recommended WF
  + Decide between the two options for channelization stating the reason for your preference

**Discussions:**

ZTE: Option 2. Fixed raster can make initial access easier.

SWR: Option 1 is flexible one.

Qualcomm: We favour option 1. Some country may off set the channel allocation. 100KHz would address that problem. We support flexibility.

Ericsson: Option 1.

ZTE: We are fine with Option 1 if no concern on the initial access complexity. If the offset 5 and 15khz, how to manage that?

Qualcomm: need further discussion.

**Agreement:**

* Option 1: Maintain the 100 kHz channel raster for generality. Some channel raster points may not be used.

**Sub-topic 1-5 Spectrum utilization**

**Table 2.3.1-1: Maximum transmission bandwidth configurations for MBMS**

|  |  |  |  |
| --- | --- | --- | --- |
| **Bandwidth** | **6 MHz** | **7 MHz** | **8 MHz** |
| **NRB** | 30 | 35 | 40 |

**Issue 1-5: Spectrum utilization**

* Any concerns with the above? Any other aspect that needs consideration?

**Discussions:**

SWR: this was already agreed. This is less efficient. If there is any solution for improvement we are happy.

**Topic #2: Band definition**

**Sub-topic 2-1 Number of bands**

Sub-topic description:

Open issues and candidate options before e-meeting:

**Issue 2-1: Number of bands**

* Proposals
  + Option 1: Single global band from 470 – XXX MHz defined for 6, 7, and 8 MHz bandwidths
  + Option 2: Three bands from 470 – XXX MHz with one band for 6 MHz bandwidth, one band for 7 MHz bandwidth, and one band for 8 MHz bandwidth. Each of these bands would be intended for deployment in regions compatible with the defined channel bandwidth.
  + Option 3: Other
* Recommended WF
  + Discuss options in the first round

**Discussions:**

Qualcomm: most companies are interested in global band. We do have concern about the feasibility. The relative bandwidth is very large. Using the existing filter technology, we do not think such wide band can be supported. We should use multiple bands. Do operators will use the whole spectrum? More interested part is the higher part of the band. There are some overlapping IMT band (71, APT). The hardware of n71 and APT can be used for this broadcast band. Our preference is to consider smaller band rather than massive global band.

SWR: a single band is very appealing. Higher part of band is more favourable since smaller antenna. There is another choise. To filter there is existing DTT receiver which can cover the whole band. Thus the single band can be supported.

Ericsson: We share the similar view as Qualcomm.

ZTE: In general, a global band is better. When taking about the DTT to support the whole band, it is for smart phone or other device?

SWR: we intend to have smart phone and tablet.

Qualcomm: I am not familiar with DTT. I concern the case in US. 71 is used for IMT. If there is no filter, the system will be hammered by band 71. We should consider the regional.

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

#### 12.5.6 Moderator summary and conclusions

**[104-e][139] LTE\_NBeMTC\_NTN\_UERF, AI 12.5.1, 12.5.4 – Tim Frost**

**R4-2214117 Email Discussion Summary for [104-e][139] LTE\_NBeMTC\_NTN\_UERF**

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

**Abstract:**

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

**Decision: Return to.**

**Conclusions after 1st round**

**Conclusions after 2nd round**

## 13 Liaison and output to other groups

### 13.1 R18 related

### 13.4 Moderator summary and conclusions

**[104-e][140] NR\_reply\_LS\_UE\_RF, AI 13 – Steven Chen**

**R4-2214118 Email Discussion Summary for [104-e][140] NR\_reply\_LS\_UE\_RF**

*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**

## 14 Revision of the Work Plan

### 14.1 Discussions on R18 high power UE basket work items

**[104-e][142] R18\_HUPE\_basket\_WI, AI 14.1 – RAN4 Chair**

**R4-2214120 Email Discussion Summary for [104-e][142] R18\_HUPE\_basket\_WI**

*Type: other For: Information  
 Source: Moderator (RAN4 Chair)*

**Abstract:**

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

**Decision: Return to.**

**Conclusions after 1st round**

**Conclusions after 2nd round**

### 14.2 Other R18 item proposals

## 15 Any other business

## 16 Close of the E-meeting

Report prepared by: MCC