**3GPP TSG-RAN WG4 Meeting # 96-e R4-2012726**

**Electronic Meeting, 17 – 28 August 2020**

**Agenda item:** 7.1.4 (Rel-16 NR-U BS RF requirements)

**Source:** Moderator (Nokia)

**Title:** Email discussion summary for [96e][305] NR\_unlic\_RF\_BS

**Document for:** Information

# Introduction

This email discussion focuses on NR-U BS RF requirements (AI 7.1.4). Following sub-AIs are covered in this discussion:

7.1.4 BS RF requirements [NR\_unlic-Core] – 6 Tdocs submitted

7.1.4.1 Transmitter characteristics [NR\_unlic-Core] – 1 Tdocs submitted

7.1.4.2 Receiver characteristics [NR\_unlic-Core] – 3 Tdocs submitted

There are 3 Topics proposed to be discussed under this summary:

* **Topic #1:** CRs with NR-U introduction to specifications
  + Issue 1-1: CRs to TS 38.104
  + Issue 1-2: CR to TS 37.107
  + Issue 1-3: CRs to TS 36.104
  + Issue 1-4: CR to TS 37.104
  + Issue 1-5: CR to TS 37.105
* **Topic #2:** Details of NR-U BS transmitter requirements
  + Issue 2-1: Details of NR-U BS transmitter requirements
* **Topic #3:** Details of NR-U BS receiver requirements
  + Issue 3-1: Discussion on BS core specification drafting
  + Issue 3-2: NR-U BS RX ACS, IBB, OOBB, IMD requirements

# Topic #1: CRs with NR-U introduction to specifications

CRs with introduction of NR-U feature for respective specification are discussed under this topic #1. CR R4-2010961 was submitted to sub agenda 7.1.4.2 but moderator moved it to set of other CRs.

## Companies’ contributions summary

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| **T-doc number** | **Company** | **Proposals / Observations** |
| **R4-2010738**  (CR to TS 38.104: Introduction of NR-U into BS core specification) | Nokia, Nokia Shanghai Bell | This is running Big CR with introduction of NR-U requirements to BS core specification TS 38.104.  Following changes were made compare to big CR after RAN4#95e meeting (R4-2008762):  - Latest version of specification (v16.4.0) is used  - Inclusion of values for Rx requirements: Reference sensitivity, Dynamic range, In-channel sensitivity according as captured in R4-2008694  - Introduction of the requirements for a 6 GHz band for NR-U (band n96). |
| **R4-2010739**  (CR to TS 37.107 with introduction of NR-U feature – core part) | Nokia, Nokia Shanghai Bell | This CR introduces NR-U feature to specification TS 37.107. Changes are introduced to core part. |
| **R4-2010962**  (CR to 36.104: Introduction of Band n46 in 36.104) | ZTE Corporation | Introduction of Band n46 in 36.104 |
| **R4-2011409**  (CR to 36.104: Introduction of NR-U co-existence requirements) | Nokia, Nokia Shanghai Bell | Introduction on NR-U co-existence requirements. |
| **R4-2011410**  (CR to 37.104: Introduction of NR-U co-existence requirements) | Nokia, Nokia Shanghai Bell | Introduction on NR-U co-existence requirements. |
| **R4-2011411**  (CR to 37.105: Introduction of NR-U co-existence requirements) | Nokia, Nokia Shanghai Bell | Introduction on NR-U co-existence requirements. |
| **R4-2010961**  (CR to 38.104: Introduction of NR-U BS RX requirement into TS38.104) | ZTE Corporation | CR adds NR-U BS RX requirement. |

Submitted CRs for respective specification:

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| --- | --- |
| **Specification** | **CR Tdoc** |
| 38.104 | R4-2010738  R4-2010961 |
| 37.107 | R4-2010739 |
| 36.104 | R4-2010962  R4-2011409 |
| 37.104 | R4-2011410 |
| 37.105 | R4-2011411 |

## Open issues summary

Below submitted CR are split for given issue according specifications.

### Sub-topic 1-1

It should be noted that big CR to TS 38.104 may require additional corrections or complements when discussion some details in topic #2 (BS Tx requirements) and topic #3 (BS Rx requirements).

**Issue 1-1: CRs to TS 38.104**

* Proposals
  + Option 1: to agreed R4-2010738 (big CR)
  + Option 2: to agreed R4-2010961 (focused on BS Rx part only)
  + Option 3: TBA
* Recommended WF
  + TBA

ZTE: 2010738 include sys parameters, better to align sys parameter email thread in main session.

Plan for handling of CRs?

6GHz band have quite pass band >900MHz. More technical issues need to be addressed. We prefer to prioritize 5Ghz band introduction.

Nokia: we should final approve these CRs in this meeting as a package. For 6GHz band definition, we understand the uncertainty pending on main session email thread decision.

Huawei: share similar view as ZTE for 6GHz, we even no decision for 6GHz band plan, not feasible to apply same requirements.

Nokia: we have decision to include both 5GHz and 6GHz in the exception sheet.

We don’t have separate CR for system parameter in main session email thread and AI. Channel raster and sync raster common for BS and UE.

* Agreement:
* One single big CR for TS 38.104 based on R4-2010738, contents of R4-2010961 merged with this big CR.
* The target to agree these CRs in this meeting.
* 6GHz band definition: ~~First focused on 5GHz and related RF requirements in the CRs.~~ Wait for the decision for 6GHz band introduction in Main session Thursday GTW session.
* System parameter:
  + ~~Have a separate CR for introduction of system parameters into BS core specification and treated in main session email thread~~
  + Still include in the big CR and align the decision which discussed in the assigned system parameters email thread.

(Note: Nokia will inform main session email thread for this treatment)

### Sub-topic 1-2

**Issue 1-2: CR to TS 37.107**

* Proposals
  + Option 1: to agreed R4-2010739
  + Option 2: TBA
* Recommended WF
  + TBA

### Sub-topic 1-3

**Issue 1-3: CRs to TS 36.104**

* Proposals
  + Option 1: to agreed R4-2010962
  + Option 2: to agreed R4-2011409
  + Option 3: TBA
* Recommended WF
  + TBA

### Sub-topic 1-4

**Issue 1-4: CR to TS 37.104**

* Proposals
  + Option 1: to agreed R4-2011410
  + Option 2: TBA
* Recommended WF
  + TBA

### Sub-topic 1-5

**Issue 1-5: CR to TS 37.105**

* Proposals
  + Option 1: to agreed R4-2011411
  + Option 2: TBA
* Recommended WF
  + TBA

## Companies views’ collection for 1st round

### Open issues

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| **Company** | **Comments** |
| Nokia | Sub topic 1-1: Our preference is to support option 1 since all relevant requirements shall be in one CR, some details discussed below for R4-2010961 can be used in revision of R4-2010738.  Sub topic 1-3: We can wait for outcome of 6GHz discussion. In order to reduce the number of CRs, all relevant NR-U bands shall be in one CR.  ….  Others: |
| CableLabs | We agree to use the big CR, but here are three comments. Please see our comment to R4-2010738 below. |
|  |  |

### CRs/TPs comments collection

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

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| **CR/TP number** | **Comments collection** |
| R4-2010738  CR to 38.104 | Huawei: The discussion on 6GHz band should wait for the conclusion of email thread 106. |
| CableLabs: we have three comment:   1. Consensus was achieved in previous meetings that the 10 MHz bandwidth is only available regionally in India markets. Can we add a note in R4-2010738 underneath Table 5.3.5-1: *BS channel bandwidths* and SCS per *operating band* in FR1? “Note 7: 10 MHz bandwidth for bands n46 and n96 only applies regionally to India markets.”   2. “f\_BE\_offset” in tables 6.6.4.2.4A-3 and 6.6.4.2.4A-4 are not defined. Is it a typo? Perhaps it should be “f\_offset”.   1. For edge punctured SEM in Section 6.6.4.2.4A, “… is floored at ,…” “f\_offset” achieved the floor of -28 dBr is not specified. The slope is a function of transmitted channel bandwidth (20, 40 or 60 MHz), the frequency offset achieves the floor is half of the transmitted bandwidth. Can we add such description in the big CR? |
|  |
| ZTE: all system parameter related sections should be removed from this CR as this thread is only to treat NR-U BS RF requirements. System parameters should be treated in NR-U system parameter section.  In addition, regarding band n96, we propose to remove that and we need to wait for the decision in system parameter thread.  Lots of RX requirements is not correct and some Tx requirement like spurious emission is not specified. |
|  | Nokia:  Reply to Cable-labs comments:  Ad.1 10MHz is only for n46. No 10MHz CBW for n96. We already have such note: “NOTE 6: This bandwidth can only be applied in certain regions where the absence of non 3GPP technologies can be guaranteed on a long term basis in this version of specification.” For n46 in Table 5.3.5-1. So issue is clear (the same was done for LAA).  Ad.2 “f\_BE\_offset” is defined in the text: The spectrum emission mask for non-transmitted channels apply to frequencies (ΔfBE\_offset) starting from the edge of the last transmitted channel of the channels assigned for NR-U channel bandwidth.  Ad.3 This is absolute power. This is just calculation what is the absolute level of power when it is floored. We think it is quite clear with current text. |
| R4-2010739  CR to 37.107 | ZTE:band n96 should be removed as I mentioned before. |
| Nokia: n96 is part of NR-U Rel’16 exception and shall be included |
|  |
| R4-2010962  CR to 36.104 | ZTE: okay for that |
| Nokia: n96 is missing |
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| R4-2011409  CR to 36.104 | ZTE: band n96 should be removed |
| Nokia: n96 is part of NR-U Rel’16 exception and shall be included |
|  |
| R4-2011410  CR to 37.104 | ZTE: band 96 should be removed, in addition, where is CS impacts according to comments made in last meeting? Please clarify more on that? |
| Nokia: n96 is part of NR-U Rel’16 exception and shall be included. It is not clear why there would be impact to CS, only co-existence requirements are included due to introduction of NR-U. |
|  |
| R4-2011411  CR to 37.105 | ZTE: band n96 should be removed |
| Nokia: n96 is part of NR-U Rel’16 exception and shall be included |
|  |
| R4-2010961  CR to 38.104 | Nokia:  This CR is focus on RX part only in core spec. Some specific comments are as follow:  - New table 7.4.1.2-1a is not needed as respective CBW are known for NR-U bands and signal powers are the same as legacy NR.  - Proposed new table 7.4.1.2-2a for NR-U bands make sense (current modification of 7.4.1.2-2 is already now in big CR, but not all CBW are included there) – better readability with separate table.  - As commented in sub topic 3-2 we are not ok to change ΔfOOB thus modification to table 7.4.2.2-0 is no needed.  - Table 7.4.2.2-1a is not needed.  - Table 7.6.2-1 modification is not needed.  - New table for interfering signal for intermodulation make sense – better readability |
| ZTE: new table 7.4.1.2-1a for band n46 could help the readability, no strong opinions on that, if companies are all fine with unified table.  For ΔfOOB for 1-C, we intend to change back to 20MHz, as we don;t have any reason to relax that requirements compared with legacy LAA BS. That’s also the basic logic when defining legacy NR sepc.  - Table 7.4.2.2-1a, i don;t see the reason to change that compare with LAA.  - Table 7.6.2-1, it’s needed otherwise how to cover 5.925GHz of n46? |
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## Summary for 1st round

### Open issues

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

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

*Recommendations on WF/LS assignment*

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| --- | --- | --- |
|  | **WF/LS t-doc Title** | **Assigned Company,**  **WF or LS lead** |
| #1 |  |  |

### CRs/TPs

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

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| **CR/TP number** | **CRs/TPs Status update recommendation** |
| R4-2010738  CR to 38.104 | To be revised.  - Agreement to use this as big CR to 38.104.  - To merge with some agreeable parts of R4-2010961 (that was for Rx only)  - To align parts related to decision of NR-U system parameter thread [106] i.e. 6 GHz band |
| R4-2010739  CR to 37.107 | No other comment received except comment on 6GHz.  - To be agreed in 2nd round if band n96 agreed in system parameter thread  Or  -To be revised to remove band n96 if band n96 not agreed in system thread |
| R4-2010962  CR to 36.104 | No other comment received except comment on 6GHz.  - To be agreed in 2nd round if band n96 is NOT agreed in system parameter thread |
| R4-2011409  CR to 36.104 | No other comment received except comment on 6GHz.  - To be agreed in 2nd round if band n96 IS agreed in system parameter thread |
| R4-2011410  CR to 37.104 | Comment received on 6GHz and CS.  CS issue needs to be further discussed. |
| R4-2011411  CR to 37.105 | Comment received on 6GHz and CS.  CS issue needs to be further discussed. |
| R4-2010961  CR to 38.104 | - To be noted.  - Some agreeable parts to be merge with revised big CR to 38.104. |

## Discussion on 2nd round (if applicable)

After 1st round of discussion following new Tdoc was assigned:

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| **CR** |  |
| R4-2012608 | Revision of R4-2010738  Big CR to 38.104 with NR-U introduction. |

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| **CR/TP number** | **Comments** |
| R4-2012608  (revision of R4-2010738)  CR to 38.104 | Huawei: We think there should be more discussion on 6GHz.  1. The channelization for 6GHz need to be revised which need wait for the decision in thread 106.  2. OOB boundary for TX and RX should be studied for 6GHz. We do not have proposal for the band larger than 900 MHz  3. The feasibility study for Medium Range BS is needed.  4. The co-existence between 5GHz and 6GHz band need to be considered  5. On NF, 11dB for Medium Range BS and 14dB for Local Area BS adopted in IMT 6425-7125 SI should be considered |
| ZTE:   1. For 6GHz with 1.2GHz frequency spanning which is much larger than maximum 900MHz defined in Rel-15, therefore some further evaluation work is needed. 2. For NF for 6GHz should be further discussed, there are no discussion in this email thread. |
|  | Nokia  Response to Huawei comments:  Ad 1. We are fine with the channelization to be further revised if that will be the conclusion in thread 106. It should be noted there are only Nokia and QC proposal on this since 2 or 3 meetings.  Ad 2. Nokia proposal is to reuse NR boundary that is already set for up to 900MHz, although this is 1200 MHz band.  Ad. 3. As discussed in GTW, we could compromise to define Local Are BS at this meeting and study further MR BS in the coming meeting.  Ad. 4. We do not understand this comment. It was already commented in thread 106 co-existence with ITS was already studied by regulatory bodies.  Ad. 5. We are ok to update NF for n96, 1dB difference would be taken into account for relevant Rx requirements.  Response to ZTE comments:  Ad. 1 response is similar to Ad. 2 above.  Ad. 2 response is similar to Ad 5 above. |
|  | CableLabs  We are exchanging offline emails with Nokia to tweak technical description in the big CR about the last two comments we raised in round 1 discussion. We cannot finish before the commenting deadline of 11 pm UTC time on Wednesday (Aug.26), but we will keep working on it. |

## Summary on 2nd round (if applicable)

*Following status of CRs after Thursday GTW sessions (BS RF and Main session)*

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| **CR/TP number** | **CRs/TPs Status update recommendation** |
| R4-2012608  (revision of R4-2010738)  CR to 38.104 | Return to,  Draft available with captured agreements from GTW sessions. |
| R4-2010739  CR to 37.107 | Return to, includes both n46 and n96 |
| R4-2010962  CR to 36.104 | Return to, includes n46 only |
| R4-2012768 (revision of R4-2011409  CR to 36.104 | Return to, includes both n46 and n96  Draft available with captured agreements from GTW sessions. |
| R4-2012766  (revision of R4-2011410)  CR to 37.104 | Return to,  Draft available with captured agreements from GTW sessions. |
| R4-2012767 (revision of R4-2011411)  CR to 37.105 | Return to,  Draft available with captured agreements from GTW sessions. |

# Topic #2: Details of NR-U BS transmitter requirements

## Companies’ contributions summary

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| **T-doc number** | **Company** | **Proposals / Observations** |
| **R4-2010959**  (Discussion on NR-U BS Tx requirements) | ZTE Corporation | Observation 1: even considering higher maximum output power for NR-U BS type 1-H, ED threshold setting could still alleviate the interference radiated by NR-U BS type 1-H to neighbour APs correspondingly;  Proposal 1: Prated,C,AC used in WF [4] and CR [3] should be updated as Prated,x;  Proposal 2: For NR-U BS type 1-C, to reuse the OBUE offset 10MHz and ΔfOOB offset 20MHz from LAA;  Proposal 3: to reuse OBUE offset 40MHz and ΔfOOB offset 60MHz of NR BS type 1-H for NR-U BS type 1-H at band n46;  Proposal 4 : to remove LO leakage exception requirements for NR-U BS. |

## Open issues summary

### Sub-topic 2-1

**Issue 2-1: Details of NR-U BS transmitter requirements**

* Proposals
  + Option 1: To agree respective proposals:
    - Proposal 1: Prated,C,AC used in WF [4] and CR [3] should be updated as Prated,x;
    - Proposal 2: For NR-U BS type 1-C, to reuse the OBUE offset 10MHz and ΔfOOB offset 20MHz from LAA;
    - Proposal 3: to reuse OBUE offset 40MHz and ΔfOOB offset 60MHz of NR BS type 1-H for NR-U BS type 1-H at band n46;
    - Proposal 4: to remove LO leakage exception requirements for NR-U BS.
  + Option 2: TBA
* Recommended WF
  + TBA

Agreement:

Proposal 1 agreed

Proposal 2

ZTE: we follow same logic as NR BS 1-c from LTE BS 1-c.

Option 1: same as LTE LAA: with OBUE 10MHz and deltafooB =20MHz

Option 2: Same as NR BS 1-C, with OBUE 40MHz and deltafooB =60MHz

Nokia: We want to double check.

Huawei: Even we take the mask from EC-Bran on unlicensed band; do we need to also keep the definition for ΔfOOB.

Nokia: we need to double check. But we need to in mind to align with UE mask.

ZTE: This is not only based on unwanted emission also depending on spurious emission. That’s why we propose.

E///: Due to larger BW compared LTE, that’s the reason with larger offset. But here you want to align with LAA, clarification?

ZTE: FROM implementation aspect, for Type 1-c, follow LAA approach. For 1-H, follow NR approach. Filtering response similar as NR.

* Further discuss in this meeting for the NR-U BS 1-C/1-H , OBUE offset and ΔfOOB offse in Tx side.

Question: In our understanding shifting ΔfOOB will relax mask for BS type 1-H compare to BS type 1-C. The prerequisite for defining mask was ETSI BRAN which apply regardless of the test method. Thus what is the intention to relax mask for BS type 1-H?

Proposal 3

Proposal 4

ZTE: Non-contiguous transmission in BS side isn’t new, but we don’t have LO exception in BS core specification.

For the CR in Nokia CR, the equation need to further improved.

Nokia: we have different view, this first time we have punction function.

Huawei: This LO from LAA punctured channel, we think we need to keep, the wideband operation probably compared to CA. We would like to keep for NR-U BS. Another issue is measurement channel bandwidth. It’s still open for UE side.

* FFS whether LO exception needed or not; if needed further improvement for the equation and the measurement bandwidth also need to decided.

## Companies views’ collection for 1st round

### Open issues

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| --- | --- |
| **Company** | **Comments** |
| XXX | Sub topic 2-1: |
| Huawei | Sub topic 2-1:  We do not agree on P2 and P4. For band n46, the band is larger than 200 MHz, hence we need to adopt 40 MHz offset for TX and 60 MHz for RX even for BS type 1-C. On the LO leakage the exception may be needed for punctured channel mask. |
| Ericsson | Sub topic 2-1:  Can ZTE clarify the intension of proposal 2, is it the intension to change the current NR-U requirements for type 1-C? For proposal 3, if the intension is to introduce BS type 1-H the larger operating bandwidth characteristics of NR type 1-H; we are ok. |
| Nokia | Sub-topic 2-1:  On Proposal 1: We agree on propose change to update Prated,C,AC to Prated,x.  On Proposal 2: We do not agree. We cannot change Foffset without changing the mask, as the mask is aligned with UE specification, we align with UE mask that is align with regulations for unlicensed spectrum.  On Proposal 3: We do not agree. We cannot relax requirements for wider channel bandwidths as well. Mask does not depend on BS types, and regulations don’t distinguish BS types.  On Proposal 4: We do not agree. LO leakage exception is related with non-transmitted channels (punctured channels). We didn’t have this issue in LAA before as no wider channel available there. |
| ZTE | For P2, we don’t see the reason why LAA and NR-U 1-C is different from front-end filter perspective.  For P3, offset value for NR-U 1-H is the same as NR 1-H, don;t see the reason why object that.  In addition, for In-band blocking and OOBB requirement, we should align with LAA instead of NR.  For P4, to non-transmitted channels in LAA which is the same as non-contiguous BS transmission, we also didn’t specify any LO leakage requirement, we don;t see the reason why we need that requirements. |
| Nokia | We further checked P2 and P3 from R4-2010959 (and R4-2010960 as are similar). This is true that maximum offset of OBUE outside the band is relaxed in NR compare to LAA. We are ok to be align with LAA. But our understanding is that these proposals try to relax only requirements for BS type 1-H compare to BS type 1-C. I.e. Proposal 2 should be as follow:  **Table 6.6.1-1: Maximum offset of OBUE outside the downlink *operating band***   |  |  |  | | --- | --- | --- | | **BS type** | ***Operating band* characteristics** | **ΔfOBUE (MHz)** | | *BS type 1-H* | FDL,high – FDL,low < 100 MHz | 10 | | 100 MHz  FDL,high – FDL,low  900 MHz | 40 | | *BS type 1-C* | FDL,high – FDL,low  200 MHz | 10 | | 200 MHz < FDL,high – FDL,low  900 MHz | 40 | | NOTE 1: for band n46, ΔfOBUE for *BS type 1-C and BS type 1-H*  is equal to 10MHz;  ~~NOTE 2: for band n46, Δf~~~~OBUE~~ ~~for~~ *~~BS type 1-H~~* ~~is equal to 40MHz;~~ | | |   And then also proposal 3 like follow:  Similar issue is with ΔfOOB. In our understanding it should be the same requirement regardless of test method, thus proposal 3 should be like follow (added marked yellow and removed NOTE 2):  **Table 7.4.2.2-0: ΔfOOB offset for NR *operating bands***   |  |  |  | | --- | --- | --- | | **BS type** | ***Operating band* characteristics** | **ΔfOOB (MHz)** | | *BS type 1-C* | FUL,high – FUL,low ≤ 200 MHz | 20 | | 200 MHz < FUL,high – FUL,low ≤ 900 MHz | 60 | | *BS type 1-H* | FUL,high – FUL,low < 100 MHz | 20 | | 100 MHz ≤ FUL,high – FUL,low ≤ 900 MHz | 60 | | NOTE 1: for band n46, ΔfOOB for *BS type 1-C* and BS type 1-H is equal to 20MHz;  ~~NOTE 2: for band n46, Δf~~~~OOB~~ ~~for~~ *~~BS type 1-H~~* ~~is equal to 60MHz;~~ | | |   On Proposal 4:  We still think that LO leakage exception requirement is needed for puncture channels (non-transmitted channels) and we should keep it. Issue might be when puncture occur when there is double puncture channel in the center of 80 MHz channel. We agree that LO exception should not be general exception, but this is apply only for puncture channels. That is our understanding. |

### CRs/TPs comments collection

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

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

## Summary for 1st round

### Open issues

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

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|  | **Status summary** |
| **Sub-topic#1** | *Following proposal is agreed:*  *Proposal 1: Prated,C,AC used in WF [4] and CR [3] should be updated as Prated,x;*  *Recommendations for 2nd round:*   * + - Further discuss in this meeting for the NR-U BS 1-C/1-H , OBUE offset and ΔfOOB offset in Tx side     - FFS whether LO exception needed or not; if needed further improvement for the equation and the measurement bandwidth also need to decide.   Moderator note’s: There are already submitted some clarification from Nokia on above open issues. Further views and comments from other companies are welcome.  It is proposed to assign WF on remaining open issues including OBUE from this topic and topic #3 to finalize discussions and capture agreements. |

*Suggestion on WF/LS assignment*

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|  | **WF/LS t-doc Title** | **Assigned Company,**  **WF or LS lead** |
| #1 | WF on BS Tx and Rx remaining requirements for NR-U | ZTE |

### CRs/TPs

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

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

## Discussion on 2nd round (if applicable)

Following WF was assigned for 2nd round discussions:

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|  | **WF/LS t-doc Title** | **Assigned Company,**  **WF or LS lead** |
| R4-2012607 | WF on BS Tx and Rx remaining requirements for NR-U | ZTE |

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| **Company** | **Comments** |
| Ericsson | Moderator’s notes indicate there is a WF on remaining RX requirements, it looks like the current open issues is only related for TX. Other than band definition can there be clarification regarding what RX requirements are still open for discussion?  Upon further checking, the 1-H requirement proposal which originally discussed in sub topic 2-1.  Option 1: same as LTE LAA: with OBUE 10MHz and deltafooB =20MHz  Option 1 is ok with us. Similar comment as Nokia (above) regarding same level/requirement for both 1-H and 1-C for this.  Regarding LO, we do not see a need to update LO exception at this time. However, a WF to further understand the issue is good approach. It would be helpful for ZTE to share their analysis specifically the punctured channel case in order for us to better understand the issue. |
| Huawei | In our view, for band n46 we should take the values defined in 38.104, i.e. 40 MHz ΔfOBUE applies for 1-C and 1-H.   |  |  |  | | --- | --- | --- | | BS type | *Operating band* characteristics | ΔfOBUE (MHz) | | *BS type 1-H* | FDL,high – FDL,low < 100 MHz | 10 | | 100 MHz ≤ FDL,high – FDL,low ≤ 900 MHz | 40 | | *BS type 1-C* | FDL,high – FDL,low ≤ 200 MHz | 10 | | 200 MHz < FDL,high – FDL,low ≤ 900 MHz | 40 | |
| Nokia | After further checking the issue we think that for NR-U we should reuse values defined for NR in 38.104 for both 1-C and 1-H. There is no need to align with LAA, as NR is different RAT technology, and compare to LAA with different spectrum utilization, wider channel bandwidths. We don’t see technical arguments to align NR-U BS type 1-C with LAA.  Thus first, for NR-U BS type 1-C and 1-H should be aligned and use legacy NR values:  **Table 6.6.1-1: Maximum offset of OBUE outside the downlink *operating band***   |  |  |  | | --- | --- | --- | | **BS type** | ***Operating band* characteristics** | **ΔfOBUE (MHz)** | | *BS type 1-H* | FDL,high – FDL,low < 100 MHz | 10 | | 100 MHz ≤ FDL,high – FDL,low ≤ 900 MHz | 40 | | *BS type 1-C* | FDL,high – FDL,low ≤ 200 MHz | 10 | | 200 MHz < FDL,high – FDL,low ≤ 900 MHz | 40 |   **Table 7.4.2.2-0: ΔfOOB offset for NR *operating bands***   |  |  |  | | --- | --- | --- | | **BS type** | ***Operating band* characteristics** | **ΔfOOB (MHz)** | | *BS type 1-C* | FUL,high – FUL,low ≤ 200 MHz | 20 | | 200 MHz < FUL,high – FUL,low ≤ 900 MHz | 60 | | *BS type 1-H* | FUL,high – FUL,low < 100 MHz | 20 | | 100 MHz ≤ FUL,high – FUL,low ≤ 900 MHz | 60 |   We still think that LO leakage exception requirement is needed for puncture channels (non-transmitted channels) and we should keep it. Issue might be when puncture occur when there is double puncture channel in the center of 80 MHz channel. We agree that LO exception should not be general exception, but this is apply only for puncture channels.  In summary:  - We don’t agree with proposal 2, 3 and 4 from R4-2010959 as there is no technical arguments to introduce proposed changes.  - We don’t agree with proposal 2, 3 from R4-2010960 as there is no technical arguments to introduce proposed changes. |
| ZTE | To Nokia:  **ΔfOBUE and ΔfOOBB is not related with NR SU discussion, this is two different topics and I have alreay shared background, please reconsider that. Front-end filter design is not dependent on SU!!!**  We fully DISAGREE with Nokia that there is no technical arguments to introduce the proposed changes, please review the whole Tdoc firstly, your suggestions is not aligned with your comments for our proposal, please double check that.  For LO leakage exception, it should be only used for UE side to indicate where there are LO leakage and gNB needs to calibrate the LO leakage. To define LO leakage exception for BS, it will put potential risk for UE as there are no such kind of indication to calibrate that.  In addition, non-contiguous transmission for BS is not new and we never define LO leakage for BS RF requirements, therefore we think this is not necessary. |

## Summary on 2nd round (if applicable)

*WF on NR-U Tx and Rx remaining requirements discussesd in R4-2012607 during two GTW sessions:*

* + - *WF for ΔfOBUE and ΔfOOBB,* 
      * *For NR-U BS type 1-C for n46: Agreement to use NR values in [ ]*
      * *For NR-U BS type 1-H for n46: Agreement to use NR values*
    - *IBB and OOBB requirements*
      * *For NR-U BS type 1-C and 1-H for n46: to follow previous agreement in R4-1902505 proposal 6 (means to reuse NR requirement)*
    - *Agreed additional band n96 aspects:*
    - *To define Local Are BS at RAN4#96e meeting and study further MR BS in the coming meeting.*
    - *The the following NF will be used to derive Rx requirements:*
    - *11dB for Medium Range BS*
    - *14dB for Local Area BS*
    - *The Receiver requirements need to be updated following above agreements*
    - *For co-existence and co-location Tx requirements, keep the requirements with [ ], which can be further discussed and updated if needed*

*BS RF Chair recommended to further discuss remaining open issues in main session GTW session together with system parameters and UE RF as a package considering there are some dependency on NR-U system parameters for these open issues.*

|  |  |
| --- | --- |
| **CR/TP/LS/WF number** | **T-doc Status update recommendation** |
| WF R4-2012607 | Return to  Agreements on slide 4,6,9.  No agreements on slide 5,7,8. |

1. Topic #3: Details of NR-U BS receiver requirements

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

* 1. Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| **R4-2010743**  (Discussion on BS core specification drafting) | Nokia, Nokia Shanghai Bell | Proposal: It is proposed to use option 1 for introduction of 60 kHz SCS Rx requirements that are based on legacy NR FRCs i.e. Option 1) Have NR-U Rx 60 kHz requirements in 2 places in specification (once in nominal NR tables and once in NR-U tables). |
| **R4-2010960**  (NR-U BS RX ACS, IBB, OOBB, IMD requirements) | ZTE Corporation | Proposal 1: to use the following frequency offset for ACS interfering signal in Table 7.4.1.2-2a;  Proposal 2: for NR-U BS 1-C, it should reuse interfering signal and freq offset of LAA BS IBB/OOBB requirement;  Proposal 3: for NR-U BS 1-H, ΔfOOB could be defined as 60MHz.  Proposal 4: to use the following frequency offset for RX IMD interfering signal in Table 7.7.2-2a; |
| **R4-2010961**  (CR to 38.104: Introduction of NR-U BS RX requirement into TS38.104) | ZTE Corporation | NR-U BS RX requirements are not defined in TS38.104 and propose to add this feature.  CR is adding NR-U BS Rx requirement to TS 38.104.  Moderator’s note: This CR was moved to Topic #1 and discussed there. |

* 1. Open issues summary
     1. Sub-topic 3-1

**Issue 3-1: Discussion on BS core specification drafting**

* Proposals
  + Option 1: To agree option 1 for introduction of 60 kHz SCS Rx requirements that are based on legacy NR FRCs i.e. Option 1) Have NR-U Rx 60 kHz requirements in 2 places in specification (once in nominal NR tables and once in NR-U tables).
  + Option 2: TBA
* Recommended WF
  + TBA

Agreement: we have separate tables

* + 1. Sub-topic 3-2

**Issue 3-2: NR-U BS RX ACS, IBB, OOBB, IMD requirements**

* Proposals
  + Option 1: To agreed respective proposals:
    - Proposal 1: to use the following frequency offset for ACS interfering signal in Table 7.4.1.2-2a;
    - Proposal 2: for NR-U BS 1-C, it should reuse interfering signal and freq offset of LAA BS IBB/OOBB requirement;
    - Proposal 3: for NR-U BS 1-H, ΔfOOB could be defined as 60MHz.
    - Proposal 4: to use the following frequency offset for RX IMD interfering signal in Table 7.7.2-2a;
  + Option 2: TBA
* Recommended WF
  + TBA

Agreement:

Proposal 1 agreed

P2:

Nokia: we need to double check.

ZTE: How to define IBB/OOBB requirements? In LAA, we have some medium range for transition bandwidth, similar issue as Tx side.

Huawei: The boundary for RX requirements, we prefer to align with the definition on OOBUE not reusing from LAA BS.

FFS for NR-U BS type 1-C for below issues:

* IBB interference signal power levels
* Frequency offset for OOBB requirements

Option 1: Align with NR BS OOBB requirements

Option2: Reusing LAA approach.

P3:

* FFS for NR-U BS type 1-H: Frequency offset for OOBB requirements

P4 is agreed.

* 1. Companies views’ collection for 1st round
     1. Open issues

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX | Sub topic 2-1:  Sub topic 2-2:  ….  Others: |
| Huawei | Sub topic 3-1: Discussion on BS core specification drafting  Separate table for NR-U is preferred.  Sub topic 3-2: NR-U BS RX ACS, IBB, OOBB, IMD requirements  Comment to P2, even for NR-U BS 1-C, ΔfOOB should also be 60 MHz due to the large band width. |
| Ericsson | Sub topic 3-1: Option 2 is preferred. From specification maintenance point of view to avoid having the same information in two places.  Sub topic 3-2: Preference to keep in alignment with LAA BS requirements. |
| Nokia | Sub topic 3-1:  Our preference is to have NR-U Rx 60 kHz requirements in 2 places in specification (once in nominal NR tables and once in NR-U tables. This will not cause harm, and will ensure to have all NR-U requirements in the same places regardless of SCS.  Sub topic 3-2  On Proposal 1: It is fine. type of interfering signal is ok and is already in draft big CR, offset should be added as ZTE proposed.  On Proposal 2: In general ok. We think new table is not needed but new NOTE to table 7.4.2.2-1 is enough.  On Proposal 3: We don’t agree. We think this will be against regulations on unlicensed band.  On Proposal 4: In general ok. But also here we could add 40/60/80 CBW interfering signals to current table 7.7.2-2 as we added there 10 and 20 MHz. |
| ZTE | Sub topic 3-1: no strong opinion on drafting rule, maybe separated table helps the readability.  Sub-topic 3-2:  Proposal 1: some offsets should be added  Proposal 2: why LAA is not aligned with regulation requirements? We just propose to reuse LAA requirement for NR-U 1-C.  Proposal 3: fine with Nokia’s proposal to add some clarifications in table 7.7.2-2. |
| Nokia | Further comments on Proposal 3:  This is similar issue that is discussed above for Tx part. What is proposed in ZTE is to have tighter requirements (align with LAA) only for BS type 1-C and to keep relaxed requirement (based on legacy NR) for BS type 1-H. Thus we don’t agree. We can accept to have the same requirements for both BS type 1-C and BS type 1-H. |

* + 1. CRs/TPs comments collection

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

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

* 1. Summary for 1st round
     1. Open issues

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

|  |  |
| --- | --- |
|  | **Status summary** |
| **Sub-topic#1** | *Tdoc R4-2010743 can be approved as below proposal is agreed and is only one proposal from that Tdoc.*  *Following proposal is agreed:*  *Option 1: To agree option 1 for introduction of 60 kHz SCS Rx requirements that are based on legacy NR FRCs i.e. Option 1) Have NR-U Rx 60 kHz requirements in 2 places in specification (once in nominal NR tables and once in NR-U tables).*  *Recommendations for 2nd round:*  Take above agreement when drafting revision of big CR to 38.104. |
| **Sub-topic#2** | *Following proposals are agreed:*  *Proposal 1: to use the following frequency offset for ACS interfering signal in Table 7.4.1.2-2a;*  *Proposal 4: to use the following frequency offset for RX IMD interfering signal in Table 7.7.2-2a;*  *Recommendations for 2nd round:*  *FFS for NR-U BS type 1-C for below issues:*  *- IBB interference signal power levels*  *- Frequency offset for OOBB requirements*  *Option 1: Align with NR BS OOBB requirements*  *Option2: Reusing LAA approach.*  *- FFS for NR-U BS type 1-H: Frequency offset for OOBB requirements* |

*Suggestion on WF/LS assignment*

|  |  |  |
| --- | --- | --- |
|  | **WF/LS t-doc Title** | **Assigned Company,**  **WF or LS lead** |
| #1 |  |  |

* + 1. CRs/TPs

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

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

* 1. Discussion on 2nd round (if applicable)
  2. Summary on 2nd round (if applicable)

*Moderator tries to summarize discussion status for 2nd round and provided recommendation on CRs/TPs/WFs/LSs Status update suggestion*

|  |  |
| --- | --- |
| **CR/TP/LS/WF number** | **T-doc Status update recommendation** |
| XXX | *Based on 2nd round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |