**3GPP TSG-RAN WG4 Meeting # 96-e R4-2012541**

**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:

|  |  |
| --- | --- |
| **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

### 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”.  3. 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. |
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| R4-2010739  CR to 37.107 | ZTE:band n96 should be removed as I mentioned before. |
| Company B |
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| R4-2010962  CR to 36.104 | ZTE: okay for that |
| Company B |
|  |
| R4-2011409  CR to 36.104 | ZTE: band n96 should be removed |
| Company B |
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| 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? |
| Company B |
|  |
| R4-2011411  CR to 37.105 | ZTE: band n96 should be removed |
| Company B |
|  |
| 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? |
|  |

## 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** |
| 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)

## 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”* |

# 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

## Companies views’ collection for 1st round

### Open issues

|  |  |
| --- | --- |
| **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. |

### CRs/TPs comments collection

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

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

## Summary for 1st round

### Open issues

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

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

*Suggestion on WF/LS assignment*

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

### 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)

## 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*

|  |  |
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| **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”* |

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

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| --- | --- | --- |
| **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. |

* 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
    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
  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. |

* + 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.*

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

*Suggestion on WF/LS assignment*

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|  | **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*

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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”* |

* 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”* |