**3GPP TSG-RAN WG4 Meeting #94-e R4-20xxxxx**

**Electronic Meeting, Feb.24th – Mar.6th 2020**

**Agenda item:** 9.18

**Source:** Moderator (CBN)

**Title:** Email discussion summary for RAN4#94e\_#31\_NR\_n28\_BW

**Document for:** Information

# Introduction

*Some important agreements in RAN4#93 are shown as below.*

* *UE part*
	+ *Agreement：Delta MPR will be introduced for band n28.*
	+ *To update spurious emission requirements for band n28 including TS 36.101, TS 38.101-1 and TS 38.101-3*
	+ *The specific Footnote for 30MHz Channel Bandwidth in Band n28 was approved.*
	+ *All of approved TPs in last meeting have been captured into R4-2000165.*
* *BS part*
	+ *BS-BS co-existence analysis was approved based on R4-1916064*
	+ *30MHz and 40MHz BS channel bandwidth for band n28 will be introduced into TS 38.104 based on R4-1916063*

*Some open issues are listed as below.*

* *UE part*
	+ *The specific value for n28 30MHz Delta MPR need to be specified.*
	+ *AMPR table for NS\_18 need to be generated based on companies’ inputs.*
	+ *REFSENS for n28 30MHz need to be specified based on RAN4’s consensus.*
* *BS part*
	+ *None*

*List of candidate target of email discussion for 1st round and 2nd round*

* 1st round: To make consensus for each open issue including Delta MPR\MPR, AMPR and REFSENS requirements and approve the relative TPs.
* 2nd round: To agree the final big CRs including TS 38.104, TS 36.101, TS 38.101-1 and TS 38.101-3.

# Topic #1: The updated TR 38.888 v0.1.0

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

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2000165 | CBN | Updated TR 38.888 v0.1.0 Adding wider channel bandwidths in NR band n28 based on approved TPs in last meeting. |

## Summary

*None*

## Companies views’ collection for 1st round

### Open issues

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

### TR 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.*

|  |  |
| --- | --- |
| **TR number** | **Comments collection** |
| R4-2000165 | 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:* |

### TR

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

|  |  |
| --- | --- |
| **TR number** | **TR Status update recommendation**  |
| R4-2000165 | *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)

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

# Topic #2: UE part for NR\_n28\_BW

*Main technical topic overview.*

*Sub-topic 2-1: MPR and delta MPR*

*Sub-topic 2-2: AMPR for NS\_18*

*Sub-topic 2-3: UE REFSENS*

*Sub-topic 2-4 Spurious emission requirements for band n28*

*Sub-topic 2-5 Big CR in TS 38.101-1 for band n28*

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| **Sub-topic 2-1: MPR and delta MPR****Sub-topic 2-2: AMPR for NS\_18** |
| R4-2000090 | Qualcomm Incorporated | Proposal: Define 30MHz n28 AMPR as shown in Table 2 and 3. Table 2: A-MPR regions for NS\_18

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Channel Bandwidth, MHz | Carrier Center Frequency, Fc, MHz | Regions | A-MPR | Meas.A-MPR DFT/CP |
| RBstart\*12\*SCSMHz | LCRB\*12\*SCSMHz |
| 30 | 718 | >11.7 | ≥max (0, 12\*SCS\*RBend – 1.8) | A1 |  |
| ≤11.7 | ≥6.3 | A2 | 7/8.5 |
| ≤7.92 | <6.3 | A3 | analysis |

Table 3: A-MPR for NS\_18

|  |  |  |  |
| --- | --- | --- | --- |
| Modulation/Waveform | A1 | A2 | A3 |
| Outer/Inner | Outer/Inner | Outer/Inner |
| DFT-s-OFDM  | PI/2 BPSK | [3] | [8] | [3] |
| QPSK | [3] | [8] | [3] |
| 16 QAM | [3] | [8] | [3] |
| 64 QAM | [3] | [8] | [4.5] |
| 256 QAM |  | [8] | [5.5] |
| CP-OFDM  | QPSK | [4.5] | [9.5] | [4.5] |
| 16 QAM | [4.5] | [9.5] | [4.5] |
| 64 QAM | [4.5] | [9.5] | [5.5] |
| 256QAM |  | [9.5] | [7.5] |

C:\Users\z00471447\AppData\Roaming\eSpace_Desktop\UserData\z00471447\imagefiles\1C5B94B6-4D5F-4F44-941A-54E4F310CDB9.png |
| R4-2001089 | Huawei, HiSilicon | Proposal: To specify the 30MHz n28 AMPR requirements for NS\_18 as shown in table 2-1 and 2-2. Table 2 1 A-MPR regions for NS\_18

|  |  |  |  |
| --- | --- | --- | --- |
| Channel Bandwidth, MHz | Frequency range of UL transmission bandwidth configuration, MHz | Regions | A-MPR |
| RBstart\*12\*SCSMHz | LCRB\*12\*SCSMHz |
| 30 | 703~733 | > LCRB\*12\*SCS+2.52 | ≥12\*SCS\*NRB – 1.8+ RBstart\*12\*SCS | B1 |
| ≤LCRB\*12\*SCS+2.52 | ≥5.4 | B2 |
| ≤7.92 | <5.4 | B3 |

Table 2 2 A-MPR for NS\_18

|  |  |  |  |
| --- | --- | --- | --- |
| Modulation/Waveform | B1 | B2 | B3 |
| Outer/Inner | Outer/Inner | Outer/Inner |
| DFT-s-OFDM  | PI/2 BPSK | [3] | [8] | [3] |
| QPSK | [3] | [8] | [3] |
| 16 QAM | [3] | [8] | [3] |
| 64 QAM | [3] | [8] | [4.5] |
| 256 QAM | [3] | [8] | [5.5] |
| CP-OFDM  | QPSK | [4] | [9.5] | [5] |
| 16 QAM | [4] | [9.5] | [5] |
| 64 QAM | [4] | [9.5] | [5.5] |
| 256QAM | [4] | [9.5] | [7.5] |

**EEC2EA4E-2DE0-48F1-8304-1A42FE02061C** |
| R4-2001088 | Huawei, HiSilicon, CBN | TP for Tx requirements1. Delta MPR

|  |  |
| --- | --- |
| Company | Huawei |
| The proposed delta MPR (dB) | 1 |

For band n28 30MHz, the allowed maximum power reduction (MPR) is defined in Table 5.1.2.1-2.**Table 5.1.2.1-2:** **The proposed delta MPR (dB)**

|  |  |  |
| --- | --- | --- |
| channel bandwidth Conditions | Power class | The allowed maximum power reduction (MPR) |
| Band n28 30MHz | Power class 3 | Table 6.2.2-1 from 38.101-1 + [1] dB |

2. AMPR for NS\_18The proposal can be referred to R4-2001089 |
| **Sub-topic 2-3: REFSENS** |
| R4-2000493 | ZTE Corporation | **Proposal: The REFSEN requirements for 30MHz in n28 are proposed highlighted as below:**REFSENS for band n28 for case 2

| **Operating Band** | **SCS kHz** | **30 MHz (dBm)** | **Duplex Mode** |
| --- | --- | --- | --- |
| n28 | 15 | -84.9 | FDD |
| 30 | -85.0 |
| 60 |  |

Where 25RB for 15kHz SCS, 10RB for 30kHz SCS are adopted in UL allocation assumption.  |
| R4-2001087 | Huawei, HiSilicon | **Discussion and TP for Rx requirements****Proposal 1: To consider the impact of Delta MPR for 30MHz n28 when RAN4 evaluate the REFSENS.****Proposal 2: REFSENS**REFSENS for band n28 for case 2

| **Operating Band** | **SCS kHz** | **30 MHz (dBm)** | **Duplex Mode** |
| --- | --- | --- | --- |
| n28 | 15 | -80.9 | FDD |
| 30 | -81.0 |
| 60 |  |

 |
| R4-2001226 | MediaTek Inc. | REFSENS for band n28 for case 1

| **Operating Band** | **SCS kHz** | **30 MHz (dBm)** | **Duplex Mode** |
| --- | --- | --- | --- |
| n28 | 15 | -88.2 | FDD |
| 30 | -88.3 |
| 60 |  |

REFSENS for band n28 for case 2

| **Operating Band** | **SCS kHz** | **30 MHz (dBm)** | **Duplex Mode** |
| --- | --- | --- | --- |
| n28 | 15 | -79.9 | FDD |
| 30 | -80 |
| 60 |  |

 |
| **Sub-topic 2-4: Spurious emission requirements for band n28** |
| R4-2001170 | CATT | TP for TR 38.888: Remove Band 39 from the protected bands of DC\_1-n28 combination. Band 39 is redundant since there is no DC\_1-28 combination in China and band 39 will not be used in the region where DC\_1-28 is applicable.Updated table 5.1.2.4-3 in TR 38.888. |
| R4-2000620 | CATT, CBN, ZTE, Huawei  | CR with the following changes for TS 36.101:Updated tables 6.6.3.2-1 and 6.6.3.2A-0.Note: Adding UE-UE co-existence requirements for band n28. |
| R4-2000622 | CATT, CBN, ZTE, Huawei  | CR with the following changes for TS 38.101-3:Updated tables 6.5B.3.3.2-1 .Note: Adding UE-UE co-existence requirements for band n28. |
| R4-2000621 | CATT, CBN, ZTE, Huawei  | CR with the following changes for TS 38.101-1:Updated tables 6.5.3.2-1 and 6.5A.3.2.3-1.Note: Protected bands are added for band n28. |
| **Sub-topic 2-5: Big CR in TS 38.101-1 for band n28** |
| R4-2001086 | Huawei, HiSilicon | CR with the following changes for TS 38.101-1:Updated tables 5.3.5-1, 6.2.2-0, 6.2.3.1-1, 6.2.3.13-2, 6.2.3.13-3, 6.5.3.2-1, 6.5A.3.2.3-1, 7.3.2-1, 7.3.2-3.Note: MPR, AMPR, spurious emissions for UE co-existence and REFSENS are specified for 30MHz band n28. |

## Open issues summary

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

### Sub-topic 2-1 MPR and delta MPR

*Sub-topic description: to specify MPR and delta MPR for n28 30MHz*

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

* Huawei’s Proposals
	+ 1dB delta MPR
	+ MPR for Band n28 30MHz: Table 6.2.2-1 from 38.101-1 + [1] dB

### Sub-topic 2-2 AMPR for NS\_18

*Sub-topic description: to specify AMPR for NS\_18 with 30MHz BW*

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

* Proposals
	+ Option 1: Qualcomm’s AMPR table based on R4-2000090
	+ Option 2: Huawei’s AMPR table based on R4-2001098

*Summary:*

1. *There are some slight difference for the AMPR region allocation between Qualcomm and Huawei’s proposals.*
2. *The values of A1\B1 for CP-OFDM are 4 and 4.5 respectively. Others are same.*
3. *The second column in AMPR region is different. (frequency center vs Frequency range of UL transmission bandwidth configuration, MHz)*

### Sub-topic 2-3 UE REFSENS

*Sub-topic description: to evaluate and specify REFSENS for n28 30MHz*

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

*Agreement: UL configuration*

Table n28 Uplink Configuration for Reference Sensitivity

| Operating band / SCS / Channel bandwidth / Duplex mode |
| --- |
| Operating Band | SCS kHz | 5MHz | 10MHz | 15MHz | 20MHz | 25 MHz | 30 MHz | 40MHz | 50MHz | 60MHz | 80MHz | 90MHz | 100 MHz | Duplex Mode |
| n28 | 15 | 25 | 251 | 251 | 251 |  | 251 |  |  |  |  |  |  | FDD |
| 30 |  | 101 | 101 | 101 |  | 101 |  |  |  |  |  |  |
| 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). |

* REFSENS for case 1

| **company** | **MTK** | **Skyworks** | **Average** |
| --- | --- | --- | --- |
| **Operating Band** | **SCS kHz** | **30MHz (dBm)** | **30 MHz (dBm)** | **30 MHz (dBm)** |
| n28 | 15 | -88.2 | -88.7 | -88.5 |
| 30 | -88.3 | -88.8 | -88.6 |
| 60 |  |  |  |

* REFSENS for case 2

| **company** | **ZTE** | **Huawei** | **MTK** | **Skyworks** | **Average** |
| --- | --- | --- | --- | --- | --- |
| **Operating Band** | **SCS kHz** | **30MHz (dBm)** | **30 MHz (dBm)** | **30MHz (dBm)** | **30 MHz (dBm)** | **30 MHz (dBm)** |
| n28 | 15 | -84.9 | -80.9 | -79.9 | -78.5 | -81.1 |
| 30 | -85.0 | -81.0 | -80 | -78.6 | -81.2 |
| 60 |  |  |  |  |  |

* Huawei’s proposal: To consider the impact of Delta MPR for 30MHz n28 when RAN4 evaluate the REFSENS.

### Sub-topic 2-4 Spurious emission requirements for band n28

*Sub-topic description: to specify Spurious emission requirements for band n28*

*Summary:*

1. It’s recommended that R4-2000621 can be merged into 38.101-1 big CR R4-2001086.
2. Companies are encouraged to carefully check R4-2001170 (updated TP), R4-2000620 (CR for 36.101) and R4-2000622 (CR for 38.101-3). If there is no comment, it’s recommended that these papers can be approved or agreed.

### Sub-topic 2-5 Big CR in TS 38.101-1 for band n28

*Sub-topic description: to specify UE core requirements in TS 38.101-1 for n28 30MHz*

*Summary:*

*Once RAN4 makes consensus on MPR, AMPR and REFSENS for n28 30MHz, R4-2001086 or the revision of R4-2001086 which capture RAN4’s consensus can be agreed in this meeting. Companies are encouraged to carefully check and comment it.*

## Companies views’ collection for 1st round

### Open issues

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Huawei | Sub topic 2-1: 1. MPR either for Band n28 30MHz or ‘Relative channel bandwidth > 3% for FDD band n28’: Table 6.2.2-1 from 38.101-1 + [1] dB.Sub topic 2-2: 1. The function limitation of A1 region is not correct for R4-2000090. It should be modified as ≥ 12\*SCS\*NRB - 1.8+ 12\*SCS\*RBstart2. For AMPR, we have a little different proposal comparing to Qualcomm’s proposal. We can merge the final table.3. The consensus can be reflected in the revision of R4-2001088Sub topic 2-3:  1. We propose to consider the impact of Delta MPR for 30MHz n28 when RAN4 evaluate the REFSENS.  2. As a compromise, we propose to use average value for case 2 REFSENS. Not to specify case 1 REFSENS in order to reduce test workload and spec complexity. Sub topic 2-4: Sub topic 2-5:  |
|  |  |

### 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** |
| R4-2001088TP for Tx requirements | [ZTE]: It is proposed to uses ‘Relative channel bandwidth > 3% for FDD band n28’ for channel bandwidth Conditions, rather than ‘Band n28 30MHz’. |
| [Huawei]: To ZTE, I’m open to use ‘Relative channel bandwidth > 3% for FDD band n28’ for channel bandwidth Conditions. |
|  |
| R4-2001087TP for Rx requirements | [ZTE]: More information shall be captured in the TP body, such as the values from the other companies, backgrounds, etc.. |
| [Huawei]: To ZTE, it’s OK to capture more information in the TP body. The most important thing is to reach a consensus to specify the case 2 REFSENS.  |
|  |
| R4-2001170Updated TP to remove band 39 for DC\_1\_n28 | Ericsson: This CR is not in the scope of this WI (adding channel BW to n28) and should be submitted in DC agenda items or TEI. |
| Company B |
|  |
| R4-2000620CR for 36.101 | [CATT]: An offline comments from Softbank was received that Protection of n78 and n79 from CA\_8-39, n78 and n79 should be moved to the next line (Band 22, 41...) which has Note 2 (Harmonic exception). A revision number is needed. |
| Ericsson: when adding new channel BW in a band, CRs to BS and UE shall be complete (big CR) and submitted at the same time/same meeting. This CR can’t be agreed as is. |
| R4-2000622CR for 38.101-3 | Ericsson: This CR is not in the scope of this WI, TS 38.101-3 is even not listed in the impacted TSs in the WI.  |
|  |
| R4-2000621CR for 38.101-1 (only spurious emission requirements) | [Huawei]: 1. It’s recommended that R4-2000621 can be merged into 38.101-1 big CR R4-2001086. |
| Ericsson: same remarks than for R4-2000620, we should only have big CR, and all big CRs submitted in same meeting for approval. Of course, it’s ok to work with partial draft CR in the meantime, but not CR. |
| R4-2001086big CR for 38.101-1 | [ZTE]: It is proposed to uses ‘Relative channel bandwidth > 3% for FDD band n28’ in second row in Table 6.2.2-0, rather than ‘Band n28 30MHz’. In addition, is it need to add asymmetric channel bandwidths for band n28 (clause 5.3.6) in the CR? |
| [Huawei]: To ZTE, I’m open to specify the asymmetric channel bandwidths. It depends on operators’ demand. |
| Ericsson:1. We don’t need table 6.2.2-0. This could be addressed just adding a note in existing table 6.2.2-1.
2. To keep consisten with other sections, better put table 6.2.3.13-2 before table 6.2.3.13-1 and change table’s number with “-0”.
3. Table 6.2.3.13-3 shall be merged with table6.2.3.13-1
 |

## 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 2-1** | *Tentative agreements:**Candidate options:**Recommendations for 2nd round:* |
| **Sub-topic 2-2** |  |
| **Sub-topic 2-3** |  |
| **Sub-topic 2-4** |  |
| **Sub-topic 2-5** |  |

*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*

|  |  |
| --- | --- |
| **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 #3: BS part for NR\_n28\_BW

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

*Sub-topic 3-1 CR to TS 38.104 for adding 30MHz and 40MHz BS channel bandwidth in band n28*

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2000623 | CATT, CBN, ZTE, Huawei | To introduce 30MHz and 40MHz BS channel bandwidth for band n28 |

## Summary

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

Summary:

Based on RAN4’s agreement, it’s recommended that this CR can be agreed. Companies are encouraged to carefully check it.

## Companies views’ collection for 1st round

### Open issues

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

### CRs/TPs comments collection

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

|  |  |
| --- | --- |
| **CR/TP number** | **Comments collection** |
| R4-2000623 | Ericsson: No issue with this CR but it could only be agreed if CR to TS 38.101-1 is also agreed at same time. |
| 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*

|  |  |
| --- | --- |
| **CR/TP number** | **CRs/TPs Status update recommendation**  |
| R4-2000623 | *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”* |