**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 | Company A |
| Company B |
|  |
| R4-2000620CR for 36.101 |  |
|  |
| R4-2000622CR for 38.101-3 |  |
|  |
| 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. |
|  |
| 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. |

## 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 | 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*

|  |  |
| --- | --- |
| **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”* |