**3GPP TSG-RAN WG4 Meeting # 97-e R4-201xxxx**

Electronic Meeting, 2-13 Nov., 2020

**Agenda item:** 10.22

**Source:** Moderator (Huawei)

**Title:** Email discussion summary for [97e][125] NR\_FR1\_35MHz\_45MHz\_BW

**Document for:** Information

# Introduction

The scope of this email discussion is to discuss the contributions submitted at agenda 10.22 on introduction of channel bandwidths 35MHz and 45MHz for NR. The following topics are discussed in the email discussion.

* Topic#1: General part
	+ Sub-topic 1-1: Release independence
* Topic#2: Spectrum utilization
* Topic#3: UE RF requirements
	+ Sub-topic 3-1: Expanding Specification Tables
	+ Sub-topic 3-2: UL BW limitation
	+ Sub-topic 3-3: new BW handling
	+ Sub-topic 3-4: n3 35MHz and 45MHz REFSENS
	+ Sub-topic 3-5: n8 35MHz REFSENS
	+ Sub-topic 3-6: n25 35MHz and 45 MHz REFSENS
	+ Sub-topic 3-7: n71 35MHz REFSENS
	+ Sub-topic 3-8: n7 35 MHz A-MPR
	+ Sub-topic 3-9: n25 and n66 A-MPR
	+ Sub-topic 3-10: n71 35 MHz A-MPR
* Topic #4: UE draft CRs
* Topic#5: BS draft CRs

# Topic #1: General part

## Companies’ contributions summary

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| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2015351 | OPPO | Proposal 1: Option 3: Release independence shall be discussed cases by case per band and bandwidths |
| R4-2015701 | Huawei, HiSilicon | The paper provide the needed changes to TS 38.307 for the options.  |
| R4-2016113 | ZTE Corporation | Observation: if 35MHz/45MHz is introduced in release independent way from earlier release, there might be potential NBC issues if the existing maximum supported channel bandwidth is less than 35MHz/45MHz.Proposal 1: sent LS to RAN2 to inform the introduction of 35MHz and 45MHz from Rel-17 onwards.Proposal 2: to explicit inform RAN2 that 35MHz/45MHz might be maximum channel bandwidth in certain bands; |
| R4-2016452 | T-Mobile USA, TELUS, Bell Mobility, AT&T | Observation 1: RAN2 has allocated spare bits in Rel-15 for adding new channel BWs to UE capabilities. Observation 2: A RAN2 CR shows how to add 35 and 45 MHz UE capability signalling to Rel-15. Observation 3: There is no protocol reason to not make 35 and 45 MHz release independent to Rel-15.Observation 4: Having the new Channel BWs release independent to RTel-15 won’t cause any backward compatibility issues. Proposal 1: RAN4 should agree to make the new 35 and 45 MHz channel BWs release independent to Rel-15, and leave the topic of release implementation to commercial rather than standards discussions. |
| R4-2015800 (Proposal 3) | Skyworks Solutions Inc. | • Release independence for band/band combination should be agreed case by case. |

## Open issues summary

### Sub-topic 1-1

**Issue 1-1: Release independence**

* Proposals
	+ Option 1: The support of 35 MHz and 45 MHz is from Rel-17 onwards
	+ Option 2: 35 MHz and 45 MHz is optional support from Rel-15
	+ Option 3: Release independence shall be discussed cases by case per band and bandwidths.
* Recommended WF
	+ It is proposed to continuously discuss the 3 options and make a decision this meeting, considering the following aspects,
		- UE signaling
		- UE hardware capability
		- backward compatibility issues
		- band specific work

## Companies views’ collection for 1st round

### Open issues

**Comments on Release independence**

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| **Company** | **Comments** |
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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**  |
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*Recommendations on WF/LS assignment*

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|  | **WF/LS t-doc Title**  | **Assigned Company,****WF or LS lead** |
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### 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**  |
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## Discussion on 2nd round (if applicable)

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| **WF number** | **Comments collection** |
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## 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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# Topic #2: Spectrum utilization

## Companies’ contributions summary

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| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2015043 | ZTE Corporation | Remove [] for the SU values for 35MHz and 45MHz in the table.

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| --- | --- | --- |
| SCS (kHz) | 35MHz | 45MHz |
| NRB | NRB |
| 15 | 188 | 243 |
| 30 | 92 | 119 |
| 60 | 44 | 58 |

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## Open issues summary

### Sub-topic 2-1

**Issue 2-1: Spectrum utilization**

* Proposals
	+ Remove [] for the SU values for 35MHz and 45MHz
* Recommended WF
	+ Approve the proposal to remove [].

## Companies views’ collection for 1st round

### Open issues

**Comments on spectrum utilization**

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| **Company** | **Comments** |
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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**  |
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## Discussion on 2nd round (if applicable)

## Summary on 2nd round (if applicable)

# Topic #3: UE RF requirements

## Companies’ contributions

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| --- | --- | --- |
| **T-doc number** | **Company** | **Title** |
| R4-2014173 revised to R4-2016600 | Qualcomm Incorporated | 35M\_45M AMPR, MPR, REFSENS |
| R4-2015432 | Murata Manufacturing Co Ltd. | REFSENS of n3, n8, n25 and n71 for new channel bandwidth |
| R4-2015800 | Skyworks Solutions Inc. | Specification impact of additional 35&45MHz channel bandwidths |
| R4-2016010 | Skyworks Solutions Inc. | n71 35MHz AMPR and MSD Measurements |
| R4-2016011 | Skyworks Solutions Inc. | n8 35MHz AMPR and MSD Measurements |
| R4-2016027 | Skyworks Solutions Inc. | n7 35MHz AMPR and MSD Measurements |
| R4-2016060 | Ericsson | Introduction of 35MHz and 45MHz regarding CA, DC, V2x combinations |
| R4-2016295 | Apple Inc. | Introduction of 35 MHz for n8, n66, n71 and 45 MHz for n66 |
| R4-2014186 | MediaTek Inc. | REFSENS of n8 and n71 for 35MHz channel bandwidth |
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## Open issues summary

### Sub-topic 3-1

**Issue 3-1: Expanding Specification Tables**

* Proposals

**Proposal 1:** SEM, ACS, In-band and Narrow band blocking, Spurious response, Intermodulation tables use equations proportional to channel BW instead of one column per channel BW.

**Observation:** There are many other specification tables that have one column per channel BW such as channel configurations for single CC and band combinations and the related REFSENS and RFSENS exceptions. Simplification or a separate table may be needed.

* Recommended WF
	+ Check whether proposal 1 above is agreeable

### Sub-topic 3-2

**Issue 3-2: UL BW limitation**

* Proposals
* UL BW limitation to 20 MHz for n8 and n71 should seriously be considered as default operation to guarantee the best DL operation in 35 MHz and reduce spec/test impact.
* UL BW limitation to 40 MHz for n25 could be further studied if justified from an MSD point of view
* Recommended WF
	+ To discuss whether UL BW limitation is adopted for the case with high MSD in DL

### Sub-topic 3-3

**Issue 3-3: new BW handling**

* Proposals

In R4-2015800

* Support of 35 and 45 MHz Channel bandwidth should be optional for bands and should use separate table for band and band specific requirements. This should apply to any new FR1 channel BW beyond Release 16.
* The introduction of new “regular” channel bandwidth or new bands using these channel bandwidths, should not be treated with a basket approach including for band combinations.

 In R4-2016060

* Proposal 1: RAN4 shall avoid adding new BCSs when introducing new bandwidths to band combinations, if really needed it should be done on a case by case basis.
* Recommended WF
	+ Comments on the proposals

### Sub-topic 3-4

**Issue 3-4: n3 35MHz and 45MHz REFSENS**

* Proposals summary

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Operating Band** | **SCS kHz** | **35 MHz (dBm)**  | **45 MHz (dBm)** | **Duplex Mode** |
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|
|  |  | **Murata** | **Qualcomm** |  | **Murata** | **Qualcomm** |  |  |
| n3 | 15 | -86 | -85.2 | 　 | -84.2 | -80.2 | 　 | FDD |
| 30 | -86.1 | 　 | 　 | -84.3 | 　 | 　 |
| 60 | -86.2 | 　 | 　 | -84.4 | 　 | 　 |
|  |  |  |  |  |  |  |  |  |
| **Operating Band** | **SCS kHz** | **35 MHz (dBm)** | **45 MHz (dBm)** | **Duplex Mode** |
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|
|  |  | **Murata** | **Qualcomm** |  | **Murata** | **Qualcomm** |  |  |
| n3 | 15 | 50 | 50 | 　 | 50 | 50 | 　 | FDD |
| 30 | 24 | 　 | 　 | 24 | 　 | 　 |
| 60 | 10 | 　 | 　 | 10 | 　 | 　 |

* Tentative agreements
	+ For n3 35MHz and 45MHz UL configuration, 50RB is used for 15 KHz SCS, 24RB is used for 30 KHz SCS, and10RB is used for 60 KHz SCS
* Recommended WF
	+ Agree on the UL configuration and check if companies can agree on the MSD

### Sub-topic 3-5

**Issue 3-5: n8 35MHz REFSENS**

* Proposals summary

|  |  |  |  |
| --- | --- | --- | --- |
| **Operating Band** | **SCS kHz** | **35 MHz (dBm)**  | **Duplex Mode** |
|
|
| n8 |  | **Murata R4-2015432** | **QualcommR4-2014173** | **SkyworksR4-2016011** | **AppleR4-2016295** | **MediaTek R4-2014186** |  |
| 15 | -62.2 | -69.9 (Rbend =187)-84.0 (Rbend =143)-87.9 (Rbend =123) | -66.3 | -62.3 | -69.2 | FDD |
| 30 | -62.3 | 　 | -66.4 | -63,7 | -69.5 |
| 60 | 　 | 　 | 　 | 　 | 　 |
|  |  |  |  |  |  |  |  |
| **Operating Band** | **SCS kHz** | **35 MHz (dBm)** | **Duplex Mode** |
|
|
| n8 |  | **Murata R4-2015432** | **QualcommR4-2014173** | **SkyworksR4-2016011** | **AppleR4-2016295** | **MediaTek R4-2014186** |  |
| 15 | 20 | 16 | 25 | 8 | 20 | FDD |
| 30 | 10 | 　 | 10 | 4 | 10 |
| 60 | 　 | 　 | 　 | 　 | 　 |

* Tentative agreements
* Recommended WF
	+ Agree on UL configuration firstly and check if companies can get agreement on MSD

### Sub-topic 3-6

**Issue 3-6: n25 35MHz and 45 MHz REFSENS**

* Proposals summary

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Operating Band** | **SCS kHz** | **35 MHz (dBm)**  | **45 MHz (dBm)** | **Duplex Mode** |
|
|
|  |  | **Murata R4-2015432** | **QualcommR4-2014173** |  | **Murata R4-2015432** | **Qualcomm****R4-2016600** |  |  |
| n25 | 15 | -85.4 | -81.7 | 　 | -70.7 | -68. | 　 | FDD |
| 30 | -85.5 | 　 | 　 | -70.8 | 　 | 　 |
| 60 | -85.6 | 　 | 　 | -70.9 | 　 | 　 |
|  |  |  |  |  |  |  |  |  |
| **Operating Band** | **SCS kHz** | **35 MHz (dBm)** | **45 MHz (dBm)** | **Duplex Mode** |
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|  |  | **Murata R4-2015432** | **QualcommR4-2014173** |  | **Murata R4-2015432** | **QualcommR4-2016600** |  |  |
| n25 | 15 | 40 | 45 | 　 | 40 | 40 | 　 | FDD |
| 30 | 20 | 　 | 　 | 20 | 　 | 　 |
| 60 | 10 | 　 | 　 | 10 | 　 | 　 |

* Tentative agreements
* Recommended WF
	+ Agree on UL configuration firstly and check if companies can get agreement on MSD

### Sub-topic 3-7

**Issue 3-7: n71 35MHz REFSENS**

* Proposals summary

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| --- | --- | --- | --- |
| **Operating Band** | **SCS kHz** | **35 MHz (dBm)**  | **Duplex Mode** |
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|
|  |  | **Murata R4-2015432** | **QualcommR4-2014173** | **Skyworks R4-2016010**  | **AppleR4-2016295** | **MediaTek R4-2014186** |  |
| n71 | 15 | -67.6 | 69.9 | -66.5 | -62.5 | -70.5 | FDD |
| 30 | -67.7 | 　 | -66.6 | -63.9 | -70.8 |
| 60 | 　 | 　 | 　 | 　 | 　 |
|  |  |  |  |  |  |  |  |
| **Operating Band** | **SCS kHz** | **35 MHz**  | **Duplex Mode** |
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|
|  |  | **Murata R4-2015432** | **QualcommR4-2014173** | **Skyworks R4-2016010** | **AppleR4-2016295** | **MediaTek R4-2014186** |  |
| n71 | 15 | 20 | 16 | 25 | 8 | 20 | FDD |
| 30 | 10 | 　 | 10 | 4 | 10 |
| 60 | 　 | 　 | 　 | 　 | 　 |

* Tentative agreements
* Recommended WF
	+ Agree on UL configuration firstly and check if companies can get agreement on MSD

### Sub-topic 3-8

**Issue 3-8: n7 35 MHz A-MPR**

* Proposals
* A-MPR regions for in R4-2014173,

|  |  |  |  |
| --- | --- | --- | --- |
| **Channel Bandwidth, MHz** | **Carrier Center Frequency, Fc, MHz** | **Regions** | **A-MPR** |
| **RBend\*12\*SCS** | **LCRB\*12\*SCS** |
| **MHz** | **MHz** |
| 35 MHz | 2517.5 ≤ FC ≤ 2552.5 | ≥0, <2.7 | >0 | A4 |
| ≥2.7, <13.5 | >max (0, 12\*SCS\*RBend –2.7) | A5 |
| ≥13.5, <23.76 | >9.0 | A6 |
| ≥23.76, <29.52 | >9.0 | A7 |
| ≥29.52 | >0 | A8 |

* A-MPR regions for in R4-2016027,

|  |  |  |  |
| --- | --- | --- | --- |
| Channel Bandwidth, MHz | Carrier Center Frequency, Fc, MHz | Regions | A-MPR |
| RBend\*12\*SCSMHz | LCRB\*12\*SCSMHz |
| 35 MHz | 2517.5 ≤ FC ≤ 2552.5 | ≥0, <[2.7] | >0 | A4 |
| ≥[2.7], <[15.84] | >max (0, 12\*SCS\*RBend –[3.06]) | A5 |
| ≥[15.84], <[22.68] | >[12.6] | A6 |
| ≥[22.68], <[28.8] | >[9.36] | A7 |
| ≥[28.8] | >0 | A8 |

* Recommended WF
	+ The A-MPR value for NS\_46 can be reused and check if companies can get agreement on A-MPR regions.

### Sub-topic 3-9

**Issue 3-9: n25 and n66 A-MPR**

* Proposals
* in R4-2014173,

Updated NS\_03 requirement below:

|  |  |  |
| --- | --- | --- |
| **ΔfOOB** **MHz**  | **Channel bandwidth (MHz) / Spectrum emission limit (dBm)**  | **Measurement bandwidth**  |
| **5**  | **10**  | **15**  | **20**  | **25**  | **30**  | **35**  | **40**  | **45**  |
|  0-1  | -13   | -13   | -13  | -13   | -13   | -13   | -13  | -13  | -13  | 1 % of channel BW   |
|  1-6  | -13  | -13  | -13  | -13  | -13  | -13  | -13  | -13  | -13  | 1 MHz  |
|  6-10  | -25  | -13  | -13  | -13  | -13  | -13  | -13  | -13  | -13  | 1 MHz  |
|  10-15  |   | -25  | -13  | -13  | -13  | -13  | -13  | -13  | -13  | 1 MHz  |
|  15-20  |   |   | -25  | -13  | -13  | -13  | -13  | -13  | -13  | 1 MHz  |
|  20-25  |   |   |   | -25  | -13  | -13  | -13  | -13  | -13  | 1 MHz  |
|  25-30  |   |   |   |   | -25  | -13  | -13  | -13  | -13  | 1 MHz  |
|  30-35  |   |   |   |   |   | -25  | -13  | -13  | -13  | 1 MHz  |
|  35-40  |   |   |   |   |   |   | -25  | -13  | -13  | 1 MHz  |
|  40-45  |   |   |   |   |   |   |  | -25  | -13  | 1 MHz  |
|  45-50  |  |  |  |  |  |  |  |  | -25 | 1 MHz  |

**Proposal 2**: Use same NS\_03 AMPR for 35MHz and 45MHz as specified in TS38.101-1.

* in R4-2016295,

**Observation 4**: Band n66 Tx with 45MHz CBW and NS\_43&NS\_43U does not seem to require additional power reduction for CP-OFDM QPSK to comply with emission requirements.

* Recommended WF
	+ Agree on the updated NS\_03 requirement for 35MHz and 45MHz
	+ Agree to use same NS\_03 AMPR for 35MHz and 45MHz as specified in TS38.101-1

### Sub-topic 3-10

**Issue 3-10: n71 35 MHz A-MPR**

* Proposals
* in R4-2014173,

SEM requirements for NS\_35

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| --- | --- | --- |
| **ΔfOOB (MHz)** | **Channel bandwidth (MHz) / Spectrum emission limit (dBm)** | **Measurement bandwidth** |
| **5** | **10** | **15** | **20** | **35** |
|  0-0.1  | -15   | -18   | -20  | -21  | -23.5  | 30 kHz   |
|  0.1-6  | -13  | -13  | -13  | -13  | -13  | 100 kHz  |
|  6-10  | -251   | -13  | -13  | -13  | -13  | 100 kHz  |
|  10-15  |   | -251  | -13  | -13  | -13  | 100 kHz  |
|  15-20  |   |   | -251   | -13   | -13   | 100 kHz  |
|  20-25  |   |   |   | -251   | -13 | 100 kHz  |
|  25-35  |  |  |  |  | -13 | 100 kHz  |
|  35-40 |  |  |  |  | -25 | 1 MHz |
|  | NOTE 1: The measurement bandwidth shall be 1 MHz  |

**Observation 1**: Further measurement study is required to determine the 35MHz NS\_35 AMPR impact.

* In R4-2016295,

**Observation 3**: Band n71 Tx with 35MHz CBW and filter rejection of 9dB in protected region requires additional power reduction of roughly 10dB for CP-OFDM QPSK to comply with coexistence requirements.

**Proposal 5:** RAN4 needs to consider either introducing additional power back off for n71 with 35MHz or the usage of asymmetric UL/DL.

* Recommended WF
	+ Agree on the SEM requirements for NS\_35
	+ Further discussion on the approach for protection close 3GPP bands
	+ Further study on the required A-MPR for NS\_35

## Companies views’ collection for 1st round

### Open issues

**Issue 3-1: Expanding Specification Tables**

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| **Company** | **Comments** |
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**Issue 3-2: UL BW limitation**

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| **Company** | **Comments** |
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**Issue 3-3: new BW handling**

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| **Company** | **Comments** |
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**Issue 3-4: n3 35MHz and 45MHz REFSENS**

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| **Company** | **Comments** |
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**Issue 3-5: n8 35MHz REFSENS**

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| **Company** | **Comments** |
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**Issue 3-6: n25 35MHz and 45 MHz REFSENS**

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| **Company** | **Comments** |
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**Issue 3-7: n71 35MHz REFSENS**

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| **Company** | **Comments** |
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**Issue 3-8: n7 35 MHz A-MPR**

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| **Company** | **Comments** |
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**Issue 3-9: n25 and n66 A-MPR**

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| **Company** | **Comments** |
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**Issue 3-10: n71 35 MHz A-MPR**

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| **Company** | **Comments** |
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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**  |
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*Suggestion on WF/LS assignment*

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|  | **WF/LS t-doc Title**  | **Assigned Company,****WF or LS lead** |
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## Discussion on 2nd round (if applicable)

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| **WF number** | **Comments collection** |
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## 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**  |
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# Topic #4: UE draft CRs

## Companies’ contributions summary

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| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2015044 | ZTE Corporation | On UE RF requirement for new channel bandwidth of 35MHz and 45MHz |
| R4-2015702 | Huawei, HiSilicon | Draft CR for TS 38.101: introduction of channel bandwidths 35MHz and 45MHz for general part |
| R4-2016059 | Ericsson | Draft CR to add 35MHz and 45 MHz Bandwidth to TS38.101-1 |
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## Companies views’ collection for 1st round

### CRs/TPs comments collection

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| --- | --- |
| **CR/TP number** | **Comments collection** |
| R4-2015044 |  |
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| R4-2015702 |  |
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| R4-2016059 |  |
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## Summary for 1st round

### 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**  |
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## Discussion on 2nd round (if applicable)

# Topic #4: BS draft CRs

## Companies’ contributions summary

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| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2015703 | Huawei, HiSilicon | draft CR on introduction of channel bandwidths 35MHz and 45MHz for BS TX |
| R4-2015718 | Ericsson | Draft CR to TS 38.104: Introduction of CBWs 35 MHz and 45 MHz |
| R4-2015719 | Ericsson | Draft CR to TS 38.141-1: Introduction of CBWs 35 MHz and 45 MHz |
| R4-2015720 | Ericsson | Draft CR to TS 38.141-2: Introduction of CBWs 35 MHz and 45 MHz |
| R4-2016114 | ZTE Corporation | Discussion on BS RF requirement for new channel bandwidth of 35MHz and 45MHz |
| R4-2016115 | ZTE Corporation | Draft CR to TS 38.104: Introduction of 35MHz and 45MHz |
| R4-2016116 | ZTE Corporation | Draft CR to TS 38.141-1: Introduction of 35MHz and 45MHz |
| R4-2016117 | ZTE Corporation | Draft CR to TS 38.141-2: Introduction of 35MHz and 45MHz |
| R4-2016118 | ZTE Corporation | Draft CR to TS 37.104: Introduction of 35MHz and 45MHz |
| R4-2016119 | ZTE Corporation | Draft CR to 37.141: Introduction of 35MHz and 45MHz |
| R4-2016120 | ZTE Corporation | Draft CR to TS 37.105: Introduction of 35MHz and 45MHz |
| R4-2016121 | ZTE Corporation | Draft CR to 37.145-1: Introduction of 35MHz and 45MHz |
| R4-2016122 | ZTE Corporation | Draft CR to 37.145-2: Introduction of 35MHz and 45MHz |

## Companies views’ collection for 1st round

### CRs/TPs comments collection

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| --- | --- |
| **CR/TP number** | **Comments collection** |
| R4-2015703 |  |
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| R4-2015718 |  |
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| R4-2015719 |  |
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| R4-2015720 |  |
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| R4-2016115 |  |
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| R4-2016116 |  |
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| R4-2016117 |  |
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| R4-2016118 |  |
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| R4-2016119 |  |
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| R4-2016120 |  |
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| R4-2016121 |  |
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| R4-2016122 |  |
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## Summary for 1st round

### 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**  |
|  |  |
|  |  |

## Discussion on 2nd round (if applicable)