**3GPP TSG-RAN WG4 Meeting # 104e R4-22XXXXX**

**Electronic Meeting, Aug 15 – Aug 26, 2022**

**Agenda item:** 12.3

**Source:** Moderator (Ligado Networks)

**Title:** Email discussion summary for [104-e][127] R18\_LTE\_TDD\_1.6GHz

**Document for:** Information

# Introduction

*Briefly introduce background, the scope of this email discussion and provide some guidelines for email discussion if necessary.*

Background:

In RAN#95e, a new work item (WI), Introduction of LTE TDD band in 1670 – 1675 MHz, was approved. WP for the WI was approved in RAN4#103-e; several agreements related to the expected changes to the BS specifications as well as CR work split was also approved at the meeting.

Scope:

This thread is to discuss the contributions submitted as part of agenda items 12.3 and associated sub-agenda items to further progress the work related to the WI.

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

* 1st round:

Discussion structure:

**Topic 1:** Band numbering and system parameters

Sub-topic: 1-1: Band numbering and operating band parameters

Sub-topic: 1-2: Expected Channel Bandwidth parameters

Sub-topic: 1-3: Expected EARFCN parameters

**Topic 2:** UE Tx Related

Sub-topic 2-1: A-MPR assessment for the new band

Sub-topic 2-2: Tx MOP for the new band

Sub-topic 2-3: Spurious emission limits for band UE co-existence

Issue 2-3-1: UE spurious emission co-existence limit for the new band to protect DL of legacy terrestrial bands in the US.

Issue 2-3-2: UE spurious emission co-existence limit for nearby legacy US bands, B24/n24/n99, B66/n66, B70/n70 and n255 to protect the DL of the new band

Issue 2-3-3: UE spurious emission co-existence limit for other legacy US bands to protect the DL of the new band

**Topic 3:** UE Rx Related

Sub-topic 3-1: Rx reference sensitivity power level for the new band

Sub-topic 3-2: Rx blocking requirements for the new band

**Topic 4:** Recommendations from Round 1 discussion

* 2nd round: TBA

# Topic #1: Band numbering and system parameters

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

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2212089 | Ligado Networks, Nokia, Nokia Shanghai Bell | **Operating Band**

|  |  |  |  |
| --- | --- | --- | --- |
| E‑UTRA Operating Band | Uplink (UL) operating bandBS receiveUE transmit | Downlink (DL) operating bandBS transmit UE receive | Duplex Mode |
| FUL\_low – FUL\_high | FDL\_low – FDL\_high |
| 54 or 105 | 1670 MHz | – | 1675 MHz | 1670 MHz | – | 1675 MHz | TDD |

**Channel Bandwidth**

|  |
| --- |
| E-UTRA band / Channel bandwidth |
| E-UTRA Band | 1.4 MHz | 3 MHz | 5 MHz | 10 MHz | 15 MHz | 20 MHz |
| 54 or 105 | Yes | Yes | Yes |  |  |  |

**EARFCN****Option 1:**

|  |  |  |
| --- | --- | --- |
| E-UTRA OperatingBand | Downlink | Uplink |
| FDL\_low (MHz) | NOffs-DL | Range of NDL | FUL\_low (MHz) | NOffs-UL | Range of NUL |
| 103 | 757 | 70646 | 70646 – 70655 | 787 | 134282 | 134282 – 134291 |
| 105 | 1670 | 70656 | 70656 – 70705 | 1670 | 70656 | 70656 – 70705 |

**Option 2:**

|  |  |  |
| --- | --- | --- |
| E-UTRA OperatingBand | Downlink | Uplink |
| FDL\_low (MHz) | NOffs-DL | Range of NDL | FUL\_low (MHz) | NOffs-UL | Range of NUL |
| 53 | 2483.5 | 60140 | 60140 - 60254 | 2483.5 | 60140 | 60140 - 60254 |
| 54 | 1670 | 60255 | 60255 – 60304 | 1670 | 60255 | 60255 – 60304 |

**Proposal 1: Approve the proposed system parameters for operating band and channel bandwidths for the new LTE TDD band in 1670 – 1675 MHz so that draft CR(s) can be submitted at the RAN4#104-bis-e meeting for endorsement.****Proposal 2: Select and agree to either Option 1 (Table 3) or Option 2 (Table 4) for the EARFCN range for the new LTE TDD Band in 1670 – 1675 MHz so that draft CR(s) can be submitted at the RAN4#104-bis-e meeting for endorsement.** |
| R4-2213581 | Nokia, Nokia Shanghai Bell | It is proposed to revisit previous RAN4 agreement and allocate Band 54 to LTE TDD band in 1670-1675 MHz. |

## Open Issues summary

### Sub-topic 1-1: Band Numbering and Operating Band Parameters

*Sub-topic description:* In RAN4 #103-e, it was agreed to assign number 105 to the new LTE TDD Band in 1670 – 1675 MHz. There are proposals to assign instead the number 54 given that TDD band numbers between 0 – 63 have not yet been exhausted

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

**Issue 1-1-1:** Band number allocation for the new band

There is a proposal to assign #54 to the new band instead of #105 that was agreed to in RAN4#103-e

* Proposals
	+ Option 1: Change the assigned band number to 54 for the new band and draft CR to add the highlighted text below to clause 5.5 of TS 36.101 (Table 5.5-1)

|  |  |  |  |
| --- | --- | --- | --- |
| E‑UTRA Operating Band | Uplink (UL) operating bandBS receiveUE transmit | Downlink (DL) operating bandBS transmit UE receive | Duplex Mode |
| FUL\_low – FUL\_high | FDL\_low – FDL\_high |
| 54  | 1670 MHz | – | 1675 MHz | 1670 MHz | – | 1675 MHz | TDD |

* + Option 2: Keep Band number 105 for the new band and draft CR to add the highlighted text below to clause 5.5 of TS 36.101 (Table 5.5-1)

|  |  |  |  |
| --- | --- | --- | --- |
| E‑UTRA Operating Band | Uplink (UL) operating bandBS receiveUE transmit | Downlink (DL) operating bandBS transmit UE receive | Duplex Mode |
| FUL\_low – FUL\_high | FDL\_low – FDL\_high |
| 105 | 1670 MHz | – | 1675 MHz | 1670 MHz | – | 1675 MHz | TDD |

* Recommended WF
	+ Companies are encouraged to review the proposal for any issues/concerns. While expressing a view, it is suggested that each company provide a brief summary/reason for the expressed view.

Agreement:

* Option 1.

### Sub-topic 1-2: Expected Channel Bandwidth parameters

*Sub-topic description:* This sub-topic is related to reaching agreement related to expected changes to the channel bandwidth parameters in TS 36.101 for the new band.

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

**Issue 1-2-1:** Proposed Channel Bandwidth parameters for the new band for the Draft CR for TS 36.101

* Proposals
	+ Option 1: Draft CR to add the highlighted text below to clause 5.6 of TS 36.101 (Table 5.6.1-1). The Band number to be populated based on agreement related to Issue 1-1-1.

|  |
| --- |
| E-UTRA band / Channel bandwidth |
| E-UTRA Band | 1.4 MHz | 3 MHz | 5 MHz | 10 MHz | 15 MHz | 20 MHz |
| [TBD] | Yes | Yes | Yes |  |  |  |

* + Option 2: TBA
* Recommended WF
	+ Companies are encouraged to review the proposal for any issues/concerns. While expressing a view, it is suggested that each company provide a brief summary/reason for the expressed view.

### Sub-topic 1-3: Expected EARFCN parameters

*Sub-topic description:* Per the proposed work plan, one of the objectives for this meeting is to assign the CR work split amongst companies.

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

**Issue 1-3-1:** Proposed EARFCN parameters for the new band for the Draft CR for TS 36.101

* Proposals
	+ Option 1: Proposed parameters if band number 105 is agreed to for the new band and draft CR to add the highlighted text below to clause 5.7 of TS 36.101 (Table 5.7.3-1).

|  |  |  |
| --- | --- | --- |
| E-UTRA OperatingBand | Downlink | Uplink |
| FDL\_low (MHz) | NOffs-DL | Range of NDL | FUL\_low (MHz) | NOffs-UL | Range of NUL |
| 103 | 757 | 70646 | 70646 – 70655 | 787 | 134282 | 134282 – 134291 |
| 105 | 1670 | 70656 | 70656 – 70705 | 1670 | 70656 | 70656 – 70705 |

* + Option 2: Proposed parameters if band number 54 is agreed to for the new band and draft CR to add the highlighted text below to clause 5.7 of TS 36.101 (Table 5.7.3-1).

|  |  |  |
| --- | --- | --- |
| E-UTRA OperatingBand | Downlink | Uplink |
| FDL\_low (MHz) | NOffs-DL | Range of NDL | FUL\_low (MHz) | NOffs-UL | Range of NUL |
| 53 | 2483.5 | 60140 | 60140 - 60254 | 2483.5 | 60140 | 60140 - 60254 |
| 54 | 1670 | 60255 | 60255 – 60304 | 1670 | 60255 | 60255 – 60304 |

* Recommended WF
	+ Companies are encouraged to review the proposal for any issues/concerns. While expressing a view, it is suggested that each company provide a brief summary/reason for the expressed view.

## Companies views’ collection for 1st round

### Open Issues

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Skyworks | Sub-topic 1-1, Issue 1-1-1: Option 1 It makes sense to use band 54Sub-topic 1-2, Issue 1-2-1: Option1 with band 54 CBW of 1.4, 3 and 5MHz are agreableSub-topic 1-3, Issue 1-3-1: Option 2 with band 54 |
| Ligado Networks | Sub-topic 1-1, Issue 1-1-1: We are ok with use of Band number 54 for the new bandSub-topic 1-2, Issue 1-2-1: We are ok with use of Band number 54 for the new bandSub-topic 1-3, Issue 1-3-1:We are ok with Option 2 assuming Band number 54 is used for the new band. |
|  |  |
|  |  |

### 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.*

|  |  |
| --- | --- |
| **Number** | **Comments collection** |
|  | Company A |
| Company B |
|  |
|  | 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:* |

*Recommendations 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 provides recommendation on CRs/TPs Status update*

|  |  |
| --- | --- |
| **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: UE Tx Related

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

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2212090 | Ligado Networks | **Observation 1: Filter simulations show the average maximum insertion loss to be 2.2 dB.****Observation 2: Filter simulations show the average minimum rejection between 1541 – 1620 MHz to be 40 dB or more.****Observation 3: Filter simulations show the average minimum rejection between 1620 – 1626 MHz to be 36 dB or more.****Observation 4: Filter rejection is required to meet the additional spurious emissions requirements below 1615 MHz****Observation 5: All filter vendors have adequate minimum rejection to meet the additional spurious emissions requirements without additional maximum power reduction.****Proposal 1: No A-MPR needs to be specified for the new band in 1670 – 1675 MHz to meet the additional spurious emissions associated with the new band [2].****Proposal 2: Collect additional B24 duplexer rejection data as well measurements to finalize exception/relaxation, if any, for the UE coexistence spurious emission limit for protection of the new band by B24/n24 at the next meeting.****Proposal 3: Collect additional B70 duplexer data as well measurements to finalize exception/relaxation, if any, for the UE coexistence spurious emission limit for protection of the new band by B70/n70 at the next meeting.****Proposal 5: It is proposed that the maximum output power be specified as 23 dBm +/- 2 dB for the LTE TDD Band in 1670 – 1675 MHz.** |
| R4-2212164 | Skyworks Solutions, Inc. | **Proposal on protection of legacy bands by the new 1670-1675MHz TDD band: given the distance to US legacy DL bands and the fact that H2 falls outside the n77 US range, -50dBm/MHz protection can be granted for all US bands.****Proposal on protection of the new 1670-1675MHz TDD band by legacy bands:*** **-50dBm/MHz protection level by band n24/n99, n70 and n66 is not specified**
* **Relaxed protection can be specified but must account for legacy devices:**
	+ **Band n24 UL filter is focussed on the critical protection of the GNSS bands on the lower frequency side which is regulatory and thus provides only a small rejection at the new band frequencies at the higher frequency side**
	+ **Band n70 and n66 UL use a consolidated UL filter, which only provides moderate rejection at the new band frequencies**
	+ **The relaxation could be limited to UL BW above a given value and/or at a given position**
	+ **For some cases, it may be feasible to provide the -50dBm/MHz protection level but only up to a given channel bandwidth, while not specifying protection for a higher CBW (for n66 for example)**
 |

## Open issues summary

### Sub-topic 2-1: A-MPR assessment for the new band

*Sub-topic description:* Assessing whether A-MPR needs to be specified or not for the new band to be included in the draft CR for the TS 36.101 at this meeting. R4-2212090 presents PAout measurements and filter data for the proposed new band to facilitate the assessment.

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

**Issue 2-1-1:** UE transmission in 1670 – 1675 MHz is required to meet certain OOBE limits in the 1541 – 1625 MHz frequency range. The frequency range 1541 – 1625 MHz falls in the spurious region and the general spurious emission limits specified in Clause 6.5.3.1 of TS 36.101 will not be adequate to meet the required OOBE limits. It was agreed in RAN4#103-e meeting to evaluate if A-MPR will be required to meet these additional requirements.

* Proposals
	+ Option 1: No A-MPR needs to be specified for the new band in 1670 – 1675 MHz to meet the additional spurious emissions associated with the new band.
	+ Option 2: TBA
* Recommended WF
	+ Companies are encouraged to review the data presented and the proposal for any issues/concerns. Companies should also review Issue 2-3-1 to assess if A-MPR may be required to meet the spurious emission co-existence requirement for protecting the DL of legacy E-UTRA/NR bands. While expressing a view, it is suggested that each company provide a brief summary/reason for the expressed view.

**Discussion:**

Skyworks: we do have an issue. The evaluation is done by doing average. It would be good to cross check the worst case.

Ligado: we provide the analysis for worst case. There are enough margin.

Skyworks: I would like to cross check. One unclear part is how the PA is calibrated 30dB ACLR.

Ligado: Yes.

### Sub-topic 2-2: Tx MOP for the new band

*Sub-topic description:* Proposed Tx MOP requirement in the Draft CR for TS 36.101 for the new band. The filter data from 4 different vendors is presented to evaluate the UE Tx MOP requirements for the new band. Table 1 from R4-2212090 is copied below:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Freq Range (MHz) | Vendor 1  | Vendor 2  | Vendor 3  | Vendor 4  | Average |
| Max IL | 1670 - 1675 | 3 | 2.3 | 2.0 | 1.6 | 2.2 |
| Min Rejection between 1541 to 1626 MHz | 1620 – 1626 | 16 | 41 | 35 | >50 | >35.5 |
| 1610 - 1620 | 40 | 40 | 35 | >50 | >41 |
| 1608 – 1610 | 40 | 38 | 35 | >50 | >40.7 |
| 1559 - 1608 | 45 | 38 | 35 | >50 | >42 |
| 1541 - 1559 | 45 | 37 | 35 | >50 | >41.7 |

The following reference data for B66/B70 duplexers was also used to determine the proposed requirements for the new band.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Band | Tx IL | Rx IL | Tx Isolation | Rx Isolation | Source |
| 66 | 2.4 | 3.0 | 53 | 52 | Table 8.1.A-3, TR 36.869 |
| 70 | 1.7 | 2.1 | 56 | 55 | Table 8.1-1, TR 36.749 |

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

**Issue 2-2-1:** Proposed Tx MOP requirement in the Draft CR for TS 36.101 for the new band.

* Proposals
	+ Option 1: It is proposed that the maximum output power be specified as 23 dBm +/- 2 dB for the LTE TDD Band in 1670 – 1675 MHz and to draft CR for clause 6.2 of TS 36.101 (Table 6.2.2-1) accordingly.
	+ Option 2: TBA
* Recommended WF
	+ Companies are encouraged to review the filter data and the proposal for any issues/concerns. While expressing a view, it is suggested that each company provide a brief summary/reason for the expressed view.

### Sub-topic 2-3: Spurious emission limits for band UE co-existence

*Sub-topic description:* Assessing the spurious emission limits for UE co-existence for the new band as well as legacy US bands. The E-UTRA/NR bands with either DL or UL operations in proximity of the new band are depicted below in blue:



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

**Issue 2-3-1:** UE spurious emission co-existence limit for the new band to protect DL of legacy E-UTRA/NR bands in the US.

* Proposals
	+ Option 1: Given the distance to US legacy DL bands and the fact that H2 falls outside the n77 US range, -50dBm/MHz protection can be granted for all US bands. Draft CR forTS 36.101 be prepared accordingly.
	+ Option 2: TBA
* Recommended WF
	+ Companies are encouraged to review the proposal for any issues/concerns. While expressing a view, it is suggested that each company provide a brief summary/reason for the expressed view.

Agreement:

* Option 1: Given the distance to US legacy DL bands and the fact that H2 falls outside the n77 US range, -50dBm/MHz protection can be granted for all US bands. Draft CR forTS 36.101 be prepared accordingly.

**Issue 2-3-2:** UE spurious emission co-existence limit for nearby legacy US E-UTRA/NR bands, B24/n24/n99, B66/n66, B70/n70 and n255 to protect the DL of the new band

Proposals

* + Option 1:
		- -50dBm/MHz protection level by band n24/n99, n70 and n66 is not specified
		- Relaxed protection can be specified but must account for legacy devices:
			* Band n24 UL filter is focussed on the critical protection of the GNSS bands on the lower frequency side which is regulatory and thus provides only a small rejection at the new band frequencies at the higher frequency side
			* Band n70 and n66 UL use a consolidated UL filter, which only provides moderate rejection at the new band frequencies
			* The relaxation could be limited to UL BW above a given value and/or at a given position
			* For some cases, it may be feasible to provide the -50dBm/MHz protection level but only up to a given channel bandwidth, while not specifying protection for a higher CBW (for n66 for example)
	+ Option 2:
		- Collect additional B24 duplexer rejection data as well measurements to finalize exception/relaxation, if any, for the UE coexistence spurious emission limit for protection of the new band by B24/n24 at the next meeting.
		- Collect additional B70 duplexer data as well measurements to finalize exception/relaxation, if any, for the UE coexistence spurious emission limit for protection of the new band by B70/n70 at the next meeting.
	+ Option 3:
		- Collect duplexer rejection data as well as measurements for different channel bandwidths for legacy bands B24/n24/n99, B66/n66, B70/n70 and n255 and finalize exception/relaxation for the UE coexistence spurious emission limits for these legacy bands for protection of the new band at the next meeting.
* Recommended WF
	+ Companies are encouraged to review the proposal for any issues/concerns. While expressing a view, it is suggested that each company provide a brief summary/reason for the expressed view.

**Discussions:**

Skyworks: For collecting data, we have the devices, which do not look into this protection. We may have issue for legacy. If we collect data, we should consider the existing devices.

Qualcomm: we agree with Skyworks. The bands are closed. In addition to that for band 66, the range is extended over the entire spectrum. More work is needed on it. Making the emission requirement based on filter rejection is some kind of frustructing

**Chair =>** when collecting data, take the comments from Skyworks and Qualcomm into account.

**Agreement:**

* **Option 3**

**Issue 2-3-3:** UE spurious emission co-existence limit for other legacy US E-UTRA/NR bands to protect the DL of the new band

Moderator Proposal

* + Option 1:
		- -50dBm/MHz protection level can be specified for other legacy US bands (B2/n2, B5/n5/n89, B12/n12, B13/n13, B14/n14, B17, B25/n25, B26/n26, B29/n29, B30/n30, B41/n41, B48/n48, B53/n53, B71/n71, B77/n77, B85/n85, n86) to protect the new band. Draft CR for TSs 36.101, 38.101-1 and 38.101-5 be prepared accordingly.
	+ Option 2:
		- TBA
* Recommended WF
	+ Companies are encouraged to review the proposal for any issues/concerns. While expressing a view, it is suggested that each company provide a brief summary/reason for the expressed view.

Discussion:

Verizon: for n5, should we consider both 5 and n5?

Skyworks: n255.

T-mobile USA: why n66 and B66 not included?

Ligado: n66 is with larger channel bandwidth. The first ACLR falls. There may be more work.

Skyworks: when 35Mhz CBW is used for n66, filter does not help too much. It is not feasible to guarantee -50dBm.

Agreement:

* -50dBm/MHz protection level can be specified for other legacy US bands (B2/n2, B5/n5/n89, B12/n12, B13/n13, B14/n14, B17, B25/n25, B26/n26, B29/n29, B30/n30, B41/n41, B48/n48, B53/n53, B71/n71, B77/n77, B85/n85, n86) to protect the new band. Draft CR for TSs 36.101, 38.101-1 and 38.101-5 be prepared accordingly.

## Companies views’ collection for 1st round

### Open issues

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Skyworks | Sub-topic 2-1, Issue 2-1-1: In general, we do not think that taking averages for filter performance is necessarily valid as different technology performances/price points exists (even within one vendor). So if there are large differences, more discussion may be needed. Especially, in the proposed values there are significant differences between vendors on IL and attenuation in the 1620 – 1626 MHz range rejection. More discussion is needed to agree on target filter performance for AMPR and REFSENS. At least it would be worth assessing if no A-MPR needed even with the worst data from filter.Sub-topic 2-2, Issue 2-2-1: MOP can be defined at 23dBm +/-2dB but is anyhow not depending on filter IL.Sub-topic 2-3, Issue 2-3-1:Sub-topic 2-3, Issue 2-3-2: Sub-topic 2-3, Issue 2-3-3: |
| Ligado Networks | Sub-topic 2-1, Issue 2-1-1: As requested by Skyworks, after assessing the minimum rejection for each frequency range across all vendors (16 dB between 1626 and 1620 MHz and 35 dB between 1541 - 1620 MHz), based on the measurement data, this is adequate margin to meet the emission requirements. Therefore, no A-MPR is required even when considering the worst data from the filters. The last column (highlighted in green) in the table (Table 2 of R4-2212090) below reviews the worst case filter attenuation vs what is required to meet additional spurious emissions requirements for a 5 MHz channel.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Mark Freq(MHz)** |  | **Spec.(dBm)** | **Margin against emission specs** | **Avg of 1670 – 1675 MHz Filter Simulations** | **Worst data across all filter data** |
|  | **50RB0** | **1RB0** |
|  | **RBW2 kHz** | **RBW1MHz** | **RBW2 kHz** | **RBW1MHz** | **RBW2 kHz** | **RBW1MHz** |
| 1541 |  | -102 |  | -27.0 |  | -25.9 |  | >40 | >35 |
| 1543 |  | -102 |  | -27.2 |  | -26.5 |  | >40 | >35 |
| 1545 |  | -102 |  | -27.9 |  | -27.6 |  | >40 | >35 |
| 1547 |  | -102 |  | -27.2 |  | -25.4 |  | >40 | >35 |
| 1549 |  | -102 |  | -27.3 |  | -26.1 |  | >40 | >35 |
| 1551 |  | -102 |  | -25.6 |  | -25.2 |  | >40 | >35 |
| 1553 |  | -102 |  | -26.3 |  | -26.5 |  | >40 | >35 |
| 1555 |  | -102 |  | -27.4 |  | -27.0 |  | >40 | >35 |
| 1557 |  | -102 |  | -28.0 |  | -27.9 |  | >40 | >35 |
| 1559 |  |  | -75 |  | -23.0 |  | -22.2 | >40 | >35 |
| 1569 |  |  | -75 |  | -22.2 |  | -22.3 | >40 | >35 |
| 1579 |  |  | -75 |  | -22.6 |  | -22.6 | >40 | >35 |
| 1589 |  |  | -75 |  | -22.6 |  | -22.6 | >40 | >35 |
| 1599 |  |  | -75 |  | -22.8 |  | -22.9 | >40 | >35 |
| 1608 |  |  | -75 |  | -23.1 |  | -23.1 | >40 | >35 |
| 1609 |  |  | -72.5 |  | -20.4 |  | -20.5 | >40 | >35 |
| 1610 |  |  | -70 |  | -18.1 |  | -18.0 | >40 | >35 |
| 1611 |  |  | -65.6 |  | -13.6 |  | -13.6 | >40 | >35 |
| 1612 |  |  | -61.2 |  | -9.9 |  | -10.0 | >40 | >35 |
| 1613 |  |  | -56.8 |  | -7.6 |  | -8.0 | >40 | >35 |
| 1614 |  |  | -52.4 |  | -0.7 |  | -0.6 | >40 | >35 |
| 1615 |  |  | -48.0 |  | 3.7 |  | 3.9 | >40 | >35 |
| 1616 |  |  | -43.6 |  | 8.2 |  | 8.2 | >40 | >35 |
| 1617 |  |  | -39.2 |  | 12.6 |  | 12.7 | >40 | >35 |
| 1618 |  |  | -34.8 |  | 17.2 |  | 17.0 | >40 | >35 |
| 1619 |  |  | -30.4 |  | 21.5 |  | 21.3 | >40 | >35 |
| 1620 |  |  | -26.0 |  | 25.9 |  | 25.7 | >35 | >16 |
| 1621 |  |  | -21.6 |  | 30.3 |  | 30.1 | >35 | >16 |
| 1622 |  |  | -17.2 |  | 34.5 |  | 34.3 | >35 | >16 |
| 1623 |  |  | -12.8 |  | 38.9 |  | 38.8 | >35 | >16 |
| 1624 |  |  | -8.4 |  | 43.4 |  | 43.1 | >35 | >16 |
| 1625 |  |  | -4 |  | 47.8 |  | 47.5 | >35 | >16 |

Sub-topic 2-2, Issue 2-2-1:Sub-topic 2-3, Issue 2-3-1:Sub-topic 2-3, Issue 2-3-2:Sub-topic 2-3, Issue 2-3-3: |
| Murata | Sub-topic 2-3, Issue 2-3-2: Option 1. Some agreement is required in the (n24/n255 and n70/n66 consolidated) filter rejection level in 1670-1675 region before deciding on any coexistence relaxation. Legacy filtering must be considered. |

### 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*

|  |  |
| --- | --- |
| **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: UE Rx Related

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

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2212090 | Ligado Networks | **Observation 1: Filter simulations show the average maximum insertion loss to be 2.2 dB.****Proposal 4: The following reference sensitivity table for the new band is proposed**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **E-UTRA Band** | **1.4 MHz** | **3 MHz** | **5 MHz** | **10 MHz** | **15 MHz** | **20 MHz** | **Duplex** **Mode** |
| **(dBm)** | **(dBm)** | **(dBm)** | **(dBm)** | **(dBm)** | **(dBm)** |
| 54 or 105 | -106.2 | -102.2 | -100 |  |  |  | TDD |

**Proposal 6: It is proposed that the current specifications for in-band and out of band blocking be used for the new LTE TDD band in 1670 – 1675 MHz.** |

## Open issues summary

### Sub-topic 3-1: Rx reference sensitivity power level for the new band

*Sub-topic description:* Expected changes to key band specific Rx requirements to be included in the draft CR for the TS 36.101.

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

**Issue 3-1-1:** The highlighted text is proposed to be introduced for Rx reference sensitivity power level requirement in the Draft CR for TS 36.101, Clause 7.3, Table 7.3.1-1. The band number to be populated will be based on agreement reached for Issue 1.1.1.

* Proposals
	+ Option 1: The following reference sensitivity table for the new band Clause is proposed

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **E-UTRA Band** | **1.4 MHz** | **3 MHz** | **5 MHz** | **10 MHz** | **15 MHz** | **20 MHz** | **Duplex** **Mode** |
| **(dBm)** | **(dBm)** | **(dBm)** | **(dBm)** | **(dBm)** | **(dBm)** |
| 54 or 105 | -106.2 | -102.2 | -100 |  |  |  | TDD |

* + Option 2: TBA
* Recommended WF
	+ Companies are encouraged to review the proposal for any issues/concerns. While expressing a view, it is suggested that each company provide a brief summary/reason for the expressed view.

Discussion:

Huawei: refsens should be based on the whole noise figure rather than only insertion loss.

Mediatek: we agree with Huawei comment.

Agreement:

* Option 1: The following reference sensitivity table for the new band Clause is proposed

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **E-UTRA Band** | **1.4 MHz** | **3 MHz** | **5 MHz** | **10 MHz** | **15 MHz** | **20 MHz** | **Duplex** **Mode** |
| **(dBm)** | **(dBm)** | **(dBm)** | **(dBm)** | **(dBm)** | **(dBm)** |
| 54 | -106.2 | -102.2 | -100 |  |  |  | TDD |

### Sub-topic 3-2: Rx blocking requirements for the new band

*Sub-topic description:* Expected changes to the Blocking requirements Tables 7.6.1.1-2 and 7.6.2.1-2 are proposed for the new band.

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

**Issue 3-2-1:** The highlighted text is proposed to be introduced for in-band and out of band blocking requirements in the Draft CR for TS 36.101, Clauses 7.6.1 and 7.6.2. The band number to be populated will be based on agreement reached for Issue 1.1.1.

* Proposals
	+ Option 1: It is proposed that the current specifications for in-band and out of band blocking be used for the new LTE TDD band in 1670 – 1675 MHz. Draft CR submission to add the highlighted texts below to TS 36.101, Clause 7.6.1 and 7.6.2.

Table 7.6.1.1-2: In-band blocking

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| E-UTRA band | Parameter | Unit | Case 1 | Case 2 | Case 3 | Case 4 | Case 5 | Case 6 |
| PInterferer | dBm | -56 | -44 | Void | Void | -38 | -15 |
| FInterferer (offset) | MHz | =-BW/2 – FIoffset,case 1&=+BW/2 + FIoffset,case 1 | ≤-BW/2 – FIoffset,case 2&≥+BW/2 + FIoffset,case 2 | -BW/2 - 11 |  |
| 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 17, 18, 19, 20, 21, 22, 23,25, 26, 27, 28, 31, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 48, 50, 51, 52, 53, 65, 66, 68, 70, 72, 73, 74, 85, 87, 88, 54 or 105 | FInterferer | MHz | (NOTE 2) | FDL\_low – 15toFDL\_high + 15 |  |  |
| 30 | FInterferer | MHz | (NOTE 2) | FDL\_low – 15toFDL\_high + 15 | FDL\_low – 11 |  |
| 71 | FInterferer | MHz | (NOTE 2) | FDL\_low – 12 to FDL\_high + 15 |  |  |  | FDL-low - 12 |
| NOTE 1: For certain bands, the unwanted modulated interfering signal may not fall inside the UE receive band, but within the first 15 MHz below or above the UE receive bandNOTE 2: For each carrier frequency the requirement is valid for two frequencies:a. the carrier frequency -BW/2 - FIoffset, case 1 andb. the carrier frequency +BW/2 + FIoffset, case 1NOTE 3: FInterferer range values for unwanted modulated interfering signal are interferer center frequencies  |  |

Table 7.6.2.1-2: Out of band blocking

|  |  |  |  |
| --- | --- | --- | --- |
| E-UTRA band | Parameter | Units  | Frequency  |
| Range 1 | Range 2 | Range 3 | Range 4 |
| PInterferer | dBm | -44 | -30 | -15 | -15 |
| 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 30, 31, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42 (NOTE 2), 43 (NOTE 2), 44, 45, 48 (NOTE 2), 50, 51, 52 (NOTE 6), 539, 65, 66, 68, 70, 71, 72, 73, 74, 85, 87, 88, 54 or 105 | FInterferer (CW) | MHz | FDL\_low -15 toFDL\_low -60  | FDL\_low -60 toFDL\_low -85  | FDL\_low -85 to1 MHz | - |
| FDL\_high +15 toFDL\_high + 60  | FDL\_high +60 toFDL\_high +85  | FDL\_high +85 to+12750 MHz | - |
| 2, 5, 12, 17, 85 | FInterferer | MHz | - | - | - | FUL\_low**-** FUL\_high(NOTE 5) |
| NOTE 1: For the UE which supports both Band 11 and Band 21 the out of blocking is FFS.NOTE 2: The power level of the interferer (PInterferer) for Range 3 shall be modified to -20 dBm for FInterferer > 2800 MHz and FInterferer < 4400 MHz. The power level of the interferer (PInterferer) for Range 3 shall be modified to -20 dBm for FInterferer > 2800 MHz and FInterferer < 4800 MHz when UE supports both E-UTRA band B42 and NR bands n77, n78.NOTE 3: For the UE that supports both Band 4 and Band 66, the out-of-blocking frequency range for Band 4 is defined relative to FDL\_low and FDL\_high of Band 66.NOTE 4: For a UE supporting CA\_20A-28A, CA\_1A-3A-7A-20A-28A, CA\_1A-3A-20A-28A, CA\_1A-3A-3A-20A-28A, CA\_1A-7A-20A-28A, CA\_1A-20A-28A, CA\_3A-7A-20A-28A, CA\_3A-20A-28A or CA\_7A-20A-28A the requirements for Band 20 and Band 28 apply with FDL\_low given by the lower limit of the restricted operating frequency range in Band 28 and FDL\_high by Band 20 (Table 5.5A-2).NOTE 5: Range 4 requirement does not apply to category M1 and M2.NOTE 6: The power level of the interferer (PInterferer) for Range 3 shall be modified to -20 dBm for FInterferer > 2700 MHz and FInterferer < 4000 MHz.NOTE 7: For band 51 the FDL\_high of band 50 is applied as FDL\_high for band 51.NOTE 8: For UEs supporting both bands 38 and 41, the FDL\_high and FDL\_low of band 41 is applied as FDL\_high and FDL\_low for band 38.NOTE 9: The power level of the interferer (PInterferer) for Range 3 shall be modified to [-20 dBm] for FInterferer > [2580 MHz] and FInterferer < [2775 MHz]. |

* + Option 2: TBA
* Recommended WF
	+ Companies are encouraged to review the proposal for any issues/concerns. While expressing a view, it is suggested that each company provide a brief summary/reason for the expressed view.

Discussions:

## Companies views’ collection for 1st round

### Open issues

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Skyworks | Sub topic 3-1, Issue 3-1-1: Based on n66 and n70 comparison the proposed REFSENS is acceptableSub topic 3-2, Issue 3-2-1: Given the rejection of one filter vendor at 1620-1626MHz, it is unclear what rejection is provided in band n24UL (10MHz distance) and band n70UL (20MHz distance). It may be worth checking further. But in principle general blocking requirement should apply, may be some exception should be analyzed. |
| Ligado Networks | Sub topic 3-1, Issue 3-1-1:Sub topic 3-2, Issue 3-2-1: Is further check on filter data necessary given that the same blocker levels are specified for in-band blocking (Case 2) and out of band blocking (Range 1)? Isn’t the filter attenuation taken to be zero for Range 1 for out of band blocking since the blocker level is the same as in band blocking? Note that there have been bands specified that have DL and UL in proximity of each other (e.g., B14 DL is 9 MHz from B13 UL, separation between B41 and B53 is 1 MHz; for B41/B53 there is no note indicating the frame configuration will be synchronized) |

### 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*

|  |  |
| --- | --- |
| **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”* |

# Recommendations for Tdocs

## 1st round

**New tdocs**

|  |  |  |  |
| --- | --- | --- | --- |
| **New Tdoc number** | **Title** | **Source** | **Comments** |
|  | WF on … | YYY |  |
|  | LS on … | ZZZ | To: RAN\_X; Cc: RAN\_Y |
|  |  |  |  |

**Existing tdocs**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Tdoc number** | **Revised to** | **Title** | **Source** | **Recommendation**  | **Comments** |
| R4-22xxxxx |  | CR on … | XXX | Agreeable, Revised, Merged, Postponed, Not Pursued |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |

Notes:

1. Please include the summary of recommendations for all tdocs across all sub-topics incl. existing and new tdocs.
2. For the Recommendation column please include one of the following:
	1. CRs/TPs: Agreeable, Revised, Merged, Postponed, Not Pursued
	2. Other documents: Agreeable, Revised, Noted
3. For new LS documents, please include information on To/Cc WGs in the comments column
4. Do not include hyper-links in the documents

## 2nd round

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Tdoc number** | **Revised to** | **Title** | **Source** | **Recommendation**  | **Comments** |
| R4-22xxxxx |  | CR on … | XXX | Agreeable, Revised, Merged, Postponed, Not Pursued |  |
| R4-22xxxxx |  | WF on … | YYY | Agreeable, Revised, Noted |  |
| R4-22xxxxx |  | LS on … | ZZZ | Agreeable, Revised, Noted |  |
|  |  |  |  |  |  |

Notes:

1. Please include the summary of recommendations for all tdocs across all sub-topics.
2. For the Recommendation column please include one of the following:
	1. CRs/TPs: Agreeable, Revised, Merged, Postponed, Not Pursued
	2. Other documents: Agreeable, Revised, Noted
3. Do not include hyper-links in the documents

# Annex

Contact information

|  |  |  |
| --- | --- | --- |
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Note:

1. Please add your contact information in above table once you make comments on this email thread.
2. If multiple delegates from the same company make comments on single email thread, please add you name as suffix after company name when make comments i.e. Company A (XX, XX)