**3GPP TSG-RAN WG4 Meeting #95-e  *Revision of* R4-2007174**

**Electronic Meeting, 25th May. 2020 – 5th June. 2020**

**Source:** Nokia, Nokia Shanghai Bell

**Title: NR-U – Capturing Spectral Emission Mask in Specification**

**Agenda item:** 6.1.1 System Parameters [NR\_unlic-Core]

**Document for:** Discussion and Approval

# Introduction

The definition of spectrum emission requirements applicable for NR-U wideband operation have been discussed since the start of the work item [1]. These discussions has resulted in three WFs [2], [3] and [4] on the basis on multiple sessions.

At RAN4#94-e meeting, it was agreed [5] that the Nokia was to provide draftCRs to reflect how the agreements from [4] could be captured in the specification. These draftCRs have been provided at RAN4#94bis-e as [13] for 38.101-1 and [14] for 38.104. These draftCRs was not agreed as the questions on the specification structure was raised. As a result, revised versions of the draftCRs are provided at this meeting along with this discussion.

In parallel to the discussions in RAN4 discussions are ongoing in ETSI TC BRAN in relation to the harmonized standard for 5GHz (ETSI EN 301 893 [7]). This discussion was initiated by an LS send from RAN4 [6]. An update of these discussions is found in [15].

The application of the agreed mask for different LBT outcomes and channel bandwidths is illustrated in the Appendix of this contribution.

# Capturing SEM in TS

During the RAN#94-e meeting, it was agreed that the Nokia was to provide draftCRs for the SEM for the RAN#94bis-e meeting. The draftCR for TS 38.101-1 proposed that the addition of the SEM applicable for NR-U is done by adding a suffix (No preference on a letter, just needed to be unused) to section 6.5 Output RF spectrum emissions. Even though the agreements, as of now, are only related to band n46 this option means the suffix can be reused and contain all emission requirements specific for NR-U. Also, its seen beneficial as some of the agreements are expected reuse e.g. for a new band in the 6 GHz spectrum. Further, the suffix approach can be reused in section 5.3 UE channel bandwidth for capturing the GB design, as agreed in [8], Maximum transmission bandwidth configuration and other NR-U specific agreements relevant for section 5.3. However, no agreement to include such suffix for NR-U could be reached. Further, there were objections to refer to NR-U deployed in band n46 as NR-U operation.

For the naming in specification some options are given below:

Option 1: RAN4 introduces the acronym ‘NR-U’ to 3.3 Abbreviations of 38.101-1 and uses this as a general term for all unlicensed operation.

Option 2: As option 1 but with the explicit mentioning of LBT, as ‘NR-U with LBT’, when operating in bands with requirement of this. LBT should be included in 3.1 Definitions with the reference to the RAN1 definition of shared spectrum channel access.

Option 3: As option 1 but with the explicit mentioning of the operation band as ‘NR-U operation in band n46’.

Option 4: RAN4 align to the RAN1 naming being “operation with shared spectrum channel access” as specified in 37.213

**Proposal 1: Adopt one of the proposed options for naming of NR-U in specification.**

As it seems the basis for not agreeing the proposed draftCRs for the SEM was also related to specification structure. Therefore, the text related directly to the SEM is included herein section 3 as a text proposal such that the wording either can be agreed or the basis for discussion and thereby separated from the specification structure discussion.

**Proposal 2: Introduce the SEM for NR-U based on the text proposal in section 3. (Note naming option can be exchanged pending proposal 1)**

# Text Proposal

Text proposal for TS 38.101-1. The section numbering is made generic to make it applicable for placement either in general section or suffix section.

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* Start of TP \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

#### X Spectrum emission mask for operation with shared spectrum channel access

When operating with shared spectrum channel access the relative power of any UE emission shall not exceed the levels specified in Table X-1 for the specified channel bandwidth or -30 dBm/MHz whichever is the greatest. The spectrum emission mask for operation with shared spectrum channel access is defined relative to the maximum power density in a 1 MHz measurement bandwidth within the channel bandwidth.

The spectrum emission mask for operation with shared spectrum channel access applies to frequencies (ΔfOOB) starting from the ± edge of the assigned channel bandwidth. For frequencies offset greater than ΔfOOB, the spurious requirements in clause 6.5.3 are applicable.

Table X-1: Spectrum emission mask for operation with shared spectrum channel access

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Spectrum emission limit (dBr) / Channel bandwidth | | | | | | | | | |
| ΔfOOB  (MHz) | 10 MHz | | 20 MHz | | 40 MHz | | 60 MHz | 80 MHz | Measurement bandwidth (MBW) |
| ± 0-1 |  | | | | | | | | [100kHz]3 |
| ± 1-5 | NOTE 1 | NOTE 1 | | NOTE 1 | | NOTE 1 | | NOTE 1 | 1 MHz |
| ± 5-10 | NOTE 2 |
| ± 10-20 | -40 | NOTE 2 | |
| ± 20-30 |  | -40 | | NOTE 2 | |
| ± 30-40 |  |  | | NOTE 2 | |
| ± 40-50 |  |  | | -40 | | NOTE 2 |
| ± 50-60 |  |  | |  | |
| ± 60-70 |  |  | |  | | -40 | |
| ± 70-80 |  |  | |  | |  | |
| ± 80-100 |  |  | |  | |  | | -40 |
| NOTE 1: Given as: where  NOTE 2: Given as: where  NOTE 3: The measured value shall be scaled by a factor equal to the ratio of the reference bandwidth (1 MHz) to the measurement bandwidth before the emission limit (dBr) is applied. | | | | | | | | | |

For measurement conditions at the edge of each frequency range, the lowest frequency of the measurement position in each frequency range should be set at the lowest boundary of the frequency range plus MBW/2. The highest frequency of the measurement position in each frequency range should be set at the highest boundary of the frequency range minus MBW/2.

#### X-1 Spectrum emission mask for non-transmitted channels

In the case of non-transmitted 20 MHz channel(s) on the edges of an assigned channel bandwidth the spectrum emission mask for operation with shared spectrum channel access, specified in Table X-1, is applied by using the total bandwidth of the remaining transmitted channels. The spectrum emission mask for non-transmitted channels is floored at -28dBr.

The relative power of any UE emission shall not exceed the most stringent levels given by the spectrum emission mask for operation with shared spectrum channel access with full channel bandwidth and the spectrum emission mask for non-transmitted channels with the channel bandwidth of the transmitted channels in the case of non-transmitted channels at the edge of an assigned channel bandwidth.

An exception to the spectrum emission mask for non-transmitted channels allows a single [2] MHz bandwidth to extend to [-28] dBc relative to total transmit power, or [-20] dBm, whichever is the greatest.

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* End of TP \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

# Conclusion

This contribution presents a method for implementing the SEM to 38.101-1

**Proposal 1: Adopt one of the proposed options for naming of NR-U in specification.**

**Proposal 2: Introduce the SEM for NR-U based on the text proposal in section 3. (Note naming option can be exchanged pending proposal 1)**

# References

1. RP-182878 New WID on NR-based Access to Unlicensed Spectrum, Qualcomm
2. R4-1910535, WF on Emission Requirements for NR-U, Nokia
3. R4-1913059, WF on punctured channel, Charter
4. R4-1915979, WF on NR-U spectral emission mask, Nokia
5. R4-2002879, Email discussion summary RAN4#94e\_#9\_NR\_unlic\_SysParameters, Moderator (Ericsson)
6. R4-1907850, LS to ETSI TC BRAN on Interpretations of EN 301 893, Nokia
7. ETSI EN 301 893, 5 GHz RLAN; Harmonised Standard covering the essential requirements of article 3.2 of Directive 2014/53/EU
8. R4-1916160, WF on Guardbands for NR-U, Nokia
9. BRAN(20)104a002r3, Revised clause 4.2.4.2 in EN 301 893 - Spectrum Mask, Rapporteur (Cisco)
10. BRAN(20)105041r3, Chairman’s welcome and notes of the week, Chair (Ericsson)
11. BRAN(20)104g007, EN 301 893 - Spectrum mask proposals A and B after G2M of 11 March, Rapporteur (Cisco)
12. BRAN(20)104g003, On the extension of transmit mask for large channel bandwidths, Qualcomm
13. R4-2004233, draft CR to introduce SEM and ACLR for NR-U to TS 38.101-1, Nokia
14. R4-2004811, draft CR to introduce SEM and ACLR for NR-U to TS 38.104, Nokia
15. R4-2004232, NR-U - Capturing the Spectral Emission Mask, Nokia

# Appendix

The following shows how the proposed mask will present itself for different transmit scenarios for channel/carrier bandwidths of 40, 60 and 80 MHz. Note that the LO exception have not been illustrated in these figures.







