3GPP TSG-RAN WG4 (Radio) Meeting #95-e R4-2008919

Electronic Meeting, 25 May – 5 June 2020

**Agenda Item:** **9.2.6.3**

**Source:** **Nokia, Nokia Shanghai Bell**

**Title:** **TP to TR 38.820: Summary Tables for Receiver Requirements**

**Document for:** **Approval**

**1. Introduction**

There are some unfilled entries in the summary tables for receiver requirements in TR 38.820 [2] for 7 - 24 GHz even though the related discussion sections have been completed.

This contribution provides a TP to fill those entries in the summary tables for receiver requirements in the TR, according to the contents in the related discussion sections.

**2. Text proposal**

**<Start of change>**

#### 7.4.2.1 Rx requirements overview

Summary of the conducted and radiated Rx requirements specified in Rel-15 for the NR BS is presented in this clause. More detailed elaboration on the motivation on selected requirements is provided in dedicated clauses below.

All the findings captured for the conducted requirements in table 7.4.2.1-1 and related clauses below are considered to be applicable to the (sub)-range of the 7 – 24 GHz for which the conducted requirements will be found to be feasible during related WI.

While radiated requirements are considered to be applicable to the whole 7 – 24 GHz range, their definitions, values and levels may differ across the 7 – 24 GHz range.

Table 7.4.2.1-1: Overview of conducted Rx requirements for NR BS in 7 – 24 GHz range

|  |  |  |  |
| --- | --- | --- | --- |
| Rx requirement | | Conclusions from SI | Items to be completed in related WI |
| Reference sensitivity level | | Based on BW of FRC and NF assumptions.  Indicative noise figure values were concluded in the SI where for 10, 15 and 20 GHz example frequencies, the NF value of 7, 8 and 9 dB respectively. | CBW and reference measurement channels to be confirmed.  Frequency specific NF assumptions to be confirmed. |
| Dynamic range | | Requirement will have to be re-calculated to account for an updated NF, IM and the supported set of NRB and SCS. Required SNR for the wanted signal to be re-simulated.  For the derivation of the requirement: reuse the 95% throughput threshold, reuse the 16QAM-based FRC (if possible). | Value(s) of the NF, IM and required SNR. Consider capturing this aspect by demodulation requirements as for FR2. |
| In-band selectivity and blocking | ACS | ACS requirements defined with the BS class specific values of the interfering signal mean power. | The ACS requirement to be decided based on co-existence simulations during the follow-up WI. |
| In-band blocking | As the 7 to 24 GHz specification has to deal with all the BS types and implementation architectures the in-band blocking level should be set based on the difference between the wanted signal to interferer signal power levels in the same way as the FR2 levels. The conducted requirement can then be extracted by using the same delta on the conducted REFSENS value. As there are no existing conducted requirements to maintain equivalence to and the 7 to 24 GHz range will primarily consider beam forming systems it is suitable to derive the OTA requirements 1st and then apply the same methodology to the conducted. | Over the 7 to 24 GHz range it is possible there are multiple in-band blocking deltas covering different bands |
| Out-of-band blocking | General out-of-band blocking | The interferer level is -15 dBm below 7.125 GHz. | Range above 7.125 GHz to be concluded in the WI. |
| Co-location | The necessity of the co-location blocking requirement can be analysed by understanding the isolation, the aggressor power, as frequency increases. As none of these parameters could be agreed in the SI the need for co-location blocking requirement cannot be accurately analysed. | Need to establish antenna port isolation for specific band in WI. |
| Receiver spurious emissions | | For FDD systems, the receiver spurious emissions are not expected to increase the total spurious emission level. The receiver spurious emission limit is therefore lower than the transmitter spurious emission limit, so the total is approximately equal to the transmitter spurious emission level. For TDD systems, the receiver spurious emission requirements are the same as the transmitter spurious emission requirements. | In certain regions, receiver spurious emission limit will be specified during the WI based on applicable regional regulations. |
| Receiver intermodulation | | For conducted RX IMD levels were reused from E-UTRA.  The RX IMD requirement for 7 - 24 GHz must be consistent with the methodology used for sensitivity.  The blocking interferer levels (and hence RX IMD interferer levels) are absolute power levels. | Requirement to be concluded in the WI. |
| In-channel selectivity | | BS class specific requirements will have to be re-calculated to account for an updated NF and the supported set of NRB and SCS. Required SNR for the wanted signal to be re-simulated.  For the derivation of the requirement: reuse the 95% throughput threshold, reuse the QPSK-based FRC. | BS class specific conducted requirements to be considered in the WI phase: Value(s) of the NF, required SNR for wanted signal. ICS for the interferer to be verified. |

Table 7.4.2.1-2: Overview of radiated Rx requirements for NR BS in 7 – 24 GHz range

|  |  |  |  |
| --- | --- | --- | --- |
| OTA Rx requirement | | Conclusions from SI | Items to be completed in related WI |
| OTA sensitivity | | The OTA sensitivity requirement is a minimum sensitivity requirement for FR1 and ensures correct operation of the receiver including the integral antenna. OTA sensitivity is a declared parameter, the minimum sensitivity over an associated range of angle of arrivals (RoAoA) are declared (the declaration also allows for the RoAoA to be redirected by non-real time means but this distinction is not needed for simple analysis). | Confirm if minimum sensitivity can be supplied by OTA REFSENS requirement. |
| OTA reference sensitivity level | | The 7 to 24GHz BS is expected to require beam forming and whilst there may be conducted requirements there is no legacy so there is no need to provide equivalence between OTA and conducted requirements. As such the FR2 type of OTA REFSENS requirement may be used even if conducted specifications are specified.  Indicative noise figure values were concluded in the SI where for 10, 15 and 20 GHz example frequencies, the NF value of 7, 8 and 9 dB respectively. | The appropriate NF and ranges of expected antenna gain can be agreed when the exact operating bands are known. |
| OTA dynamic range | | For FR1-like (sub)-range: reuse FR1 approach of deriving the OTA requirement.  For FR2-like (sub)-range: further investigation will be required to decide if the OTA dynamic range requirement in the FR2-like (sub)-range of 7 – 24 GHz range can be skipped.  Value(s) of the NF, IM and required SNR to be reused from the conducted requirement for 7 – 24 GHz.  For the derivation of the requirement: reuse the 95% throughput threshold, reuse the 16QAM-based FRC (if possible). | Evaluations for the FR2-like (sub)-range. |
| OTA in-band selectivity and blocking | OTA ACS | Frequency range specific requirements defined for OTA ACS, with the BS class specific values of the interfering signal mean power. | The OTA ACS requirement to be decided based on co-existence simulations during the follow-up WI. |
| OTA in-band blocking | In-band requirements dependent on the sensitivity requirements, as the sensitivity is used as a metric of the receiver performance under interference conditions. The in-band blocking requirement for 7 to 24 GHz must therefore be consistent worth the methodology used for sensitivity.  The delta value for the 7 to 24 GHz range would be expected to be between the FR1 and FR2 values (52.7 to 27 dB), however the precise values would have to be found by blocking simulation once the operating frequencies are known and co-existence simulation parameters have been defined. | Over the 7 to 24 GHz range it is possible there are multiple in-band blocking deltas covering different frequency ranges.  To be concluded in WI when system scenarios, specific frequency bands are defined, and proper co-existence studies are performed. |
| OTA out-of-band blocking | General out-of-band blocking | The interferer level is 0.36 V/m below 7.125 GHz and 0.1 V/m above 24.125 GHz. | The interferer signal within the range 7.125 to 24.125 GHz is defined in the WI. |
| Co-location | As the frequency increases the need for an out-of-band co-location receiver blocking requirements reduces. If an out-of-band co-location receiver blocking requirement is needed in the 7 - 24 GHz region then it will be a co-location requirement. Co-location in the 7 - 24 GHz region has a number of implementation issues, which may require a new method of injecting the interfering signal. | Need to establish antenna port isolation for specific band in WI. A new concept of injecting the interferer signal is required. |
| OTA receiver spurious emissions | | The RX IMD requirement for 7 - 24 GHz must be consistent with the methodology used for sensitivity.  The RX IMD is closely related to the in-band blocking, for both FR1 and FR2 the RX IMD levels have been between 8 to 9 dB lower than the in-band blocking levels. It is likely that the same will be found in the 7 - 24 GHz frequency range once operating frequencies are known and co-existence simulation parameters have been defined. | In certain regions, receiver spurious emission limit will be specified during the WI based on applicable regional regulations. |
| OTA receiver intermodulation | | The RX IMD is closely related to the in-band blocking, for both FR1 and FR2 the RX IMD levels have been between 8 to 9 dB lower than the in-band blocking levels. It is likely that the same will be found in the 7 - 24 GHz frequency range once operating bands are known and co-existence simulation parameters have been defined. | Requirement to be concluded in WI. |
| OTA in-channel selectivity | | For FR1-like sub-range: reuse FR1 approach for deriving the BS class specific OTA requirement, based on offsetting the conducted requirement.  For FR2-like sub-range: reuse FR2 approach for deriving wanted and interferer levels based on offsetting the declared sensitivity EISREFSENS\_50M.  For the derivation of the requirement: reuse the 95% throughput threshold, reuse the QPSK-based FRC. | BS class specific radiated requirements to be considered in the WI phase: Required ICS level for FR2-like interferer. |

**<Next change>**

7.4.2.6 Receiver spurious emissions

For conducted systems, receiver spurious emissions are specified separately for FDD and TDD systems.

For conducted FDD systems, as the transmitter and the receiver are both on at the same time and can be specified on separate connectors, the receiver spurious emissions are not expected to increase the total spurious emission level. The receiver spurious emission limit is therefore lower than the transmitter spurious emission limit, so the total is approximately equal to the transmitter spurious emission level.

For OTA FDD systems, the requirement is over the air and hence the transmitter and receiver cannot be separated, so there are no receiver spurious emission requirements needed.

For OTA TDD systems in applicable regions, the receiver spurious emission requirements are the same as the Category B transmitter spurious emission requirements as discussed in clause 7.4.1.8.

In certain regions, receiver spurious emission limit will be specified during the WI based on applicable regional regulations.

**<End of change>**

**References**

[1] R4-2005740, “TR 38.820 v1.3.0”, Huawei.