**3GPP TSG-RAN WG4 Meeting # 109 R4-2318127**

**Chicago, USA, November 13 – November 17, 2023**

**Agenda item:** 9.4

**Source:** Moderator (MediaTek)

**Title:** Topic summary for [109][121] IoT\_NTN\_FDD\_LS\_band

**Document for:** Information

# Introduction

*Briefly introduce background, the scope of this email discussion (e.g. list of treated agenda items) and provide some guidelines for email discussion if necessary.*

*This summary treats the following tdocs submitted to RAN4#109 on B254 for IoT NTN operation:*

|  |  |  |  |
| --- | --- | --- | --- |
| **TDoc** | **Title** | **Source** | **Moderator’s remarks** |
| [**R4-2318363**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2318363.zip) | Analysis on ETSI emission requirement for NB-IoT in IoT NTN band b254 | Sony | Discussion paper on handling of ETSI emission requirements:  **Observation 1**: The ETSI unwanted emission requirements are much tighter than 3GPP SEMs for b254 at frequency offsets < ±100 kHz.  **Observation 2**: Significant A-MPR is needed to ensure a 3GPP NB-IoT device can meet the ETSI unwanted emission requirement in EN 301 411, which is not practical to use.  **Observation 3**: The A-MPR analysis above is confirmed with the measurement of NB-IoT emission with single-tone transmission.  **Observation 4**: A 100 kHz guard band/guard RB is needed to ensure a 3GPP NB-IoT device can meet the ETSI unwanted emission requirement in EN 301 411 but carrying the guard band/guard RB within the frequency band can jeopardize the spectrum efficiency.  **Observation 5**: It has been proposed to create a new work item (NWI) in ETSI in order to accommodate NTN requirements in harmonized standards based on ETSI replied information.  Observation 6: No simple solution (neither A-MPR nor guardband) can help NB-IoT devices meet those ETSI emission limits without severely impacting the linkbudget or spectrum efficiency of the IoT NTN system.  **Proposal 1**: 3GPP pending to capture the ETSI requirement in technical specification and waiting for progress in ETSI for b254.  Moderator’s remarks: the worst case mentioned in the tdoc is a single tone allocation at the edge, however, in Moderator’s understanding, the valid allocation in RAN4 specs is 3/6/12 tones only, such worst case does not exist in 3GPP. |
| [**R4-2318704**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2318704.zip) | Running draftCR to TS 36.102 on introducing L+S FDD band for IoT NTN operation | MediaTek Inc. | Running draft CR, to be revised according to discussion outcomes |
| R4-2318705 | CR to TS 36.102 on intrdoucing L+S FDD band for IoT NTN operation | MediaTek Inc. | Reserved for formal CR |
| [**R4-2318706**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2318706.zip) | DraftCR to TS 36.102 on A-MPR for B254 for IoT NTN operation | MediaTek Inc. | Draft CR for A-MPR |
| [**R4-2318707**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2318707.zip) | Draft TR 36.764 for IoT NTN bands v0.0.5 | MediaTek Inc. | Draft TR, to be revised according to discussion outcomes |
| [**R4-2318708**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2318708.zip) | Further discussion on UE RF requirements for B254 for IoT NTN operation | MediaTek Inc. | Discussion paper on the remaining UE RF requirements:  **Observation 1**: No more discussion is required for Rx RF requirements.  **Proposal 1a**: No A-MPR is specified for category NB1/NB2 for FCC regulations.  **Proposal 1b**: A-MPR is specified as Table 1 and 2 for category NB1/NB2 for ETSI regulations.  Table 1: A-MPR for NS\_04N   |  |  |  |  |  | | --- | --- | --- | --- | --- | | Modulation | QPSK | | | | | Tone positions for 3 Tones allocation | 0-2 | 3-5 and 6-8 | | 9-11 | | A-MPR | ≤ 0.7 dB | 0.2 dB | | ≤ 0.7 dB | | Tone positions for 6 Tones allocation | 0-5 and 6-11 | | | | | A-MPR | 0 dB | | 0 dB | | | Tone positions for 12 Tones allocation | 0-11 | | | | | A-MPR | 0 dB | | | |   Table 2: A-MPR for NS\_05N   |  |  |  |  |  | | --- | --- | --- | --- | --- | | Modulation | QPSK | | | | | Tone positions for 3 Tones allocation | 0-2 | 3-5 and 6-8 | | 9-11 | | A-MPR | ≤ 1.5 dB | 0.5 dB | | ≤ 1.5 dB | | Tone positions for 6 Tones allocation | 0-5 and 6-11 | | | | | A-MPR | ≤ 0.7 dB | | ≤ 0.7 dB | | | Tone positions for 12 Tones allocation | 0-11 | | | | | A-MPR | 0 dB | | | |     **Proposal 2**: RAN4 to introduce NS\_04N and NS\_05N for ETSI requirements for B254 category NB1/NB2, which is aligned with that for n254.  **Proposal 3**: RAN4 to introduce NS\_03N for FCC requirements for B254 category NB1/NB2, which is also aligned with that for n254.  **Proposal 4**: RAN4 to introduce NS\_03N for FCC requirements, and NS\_04N and NS\_05N for ETSI requirements for B254 category M1. |
| [**R4-2318709**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2318709.zip) | TP on A-MPR evaluation results for B254 for IoT NTN operation | MediaTek Inc. | TP to TR for A-MPR evaluation results. |
| [**R4-2319558**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2319558.zip) | Discussion on UE RF requirements for FDD band (L+S band) for IoT NTN operation | ZTE Corporation | Discussion paper on the remaining UE RF requirements:  **Proposal 1**: No A-MPR is needed for Cat. NB1/NB2 to meet both FCC and ETSI requirement.  **Proposal 2**: Two NS values should be introduced to support ETSI regulations for the new FDD frequency bands as shown in Table 1. |
| [**R4-2319559**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2319559.zip) | CR to TS36.108 Introduction of a new FDD band (L+S band) for IoT NTN operation | ZTE Corporation | Resubmission of the endorsed CR R4-2312047 |
| [**R4-2319560**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2319560.zip) | CR to TS36.133 Introduction of a new FDD band (L+S band) for IoT NTN operation | ZTE Corporation | Resubmission of the endorsed CR R4-2314715 |

# Topic #1: Title

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

## Companies’ contributions summary

|  |  |  |  |
| --- | --- | --- | --- |
| **TDoc** | **Title** | **Source** | **Moderator’s remarks** |
| [**R4-2318363**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2318363.zip) | Analysis on ETSI emission requirement for NB-IoT in IoT NTN band b254 | Sony | Discussion paper on handling of ETSI emission requirements:  **Observation 1**: The ETSI unwanted emission requirements are much tighter than 3GPP SEMs for b254 at frequency offsets < ±100 kHz.  **Observation 2**: Significant A-MPR is needed to ensure a 3GPP NB-IoT device can meet the ETSI unwanted emission requirement in EN 301 411, which is not practical to use.  **Observation 3**: The A-MPR analysis above is confirmed with the measurement of NB-IoT emission with single-tone transmission.  **Observation 4**: A 100 kHz guard band/guard RB is needed to ensure a 3GPP NB-IoT device can meet the ETSI unwanted emission requirement in EN 301 411 but carrying the guard band/guard RB within the frequency band can jeopardize the spectrum efficiency.  **Observation 5**: It has been proposed to create a new work item (NWI) in ETSI in order to accommodate NTN requirements in harmonized standards based on ETSI replied information.  Observation 6: No simple solution (neither A-MPR nor guardband) can help NB-IoT devices meet those ETSI emission limits without severely impacting the linkbudget or spectrum efficiency of the IoT NTN system.  **Proposal 1**: 3GPP pending to capture the ETSI requirement in technical specification and waiting for progress in ETSI for b254.  Moderator’s remarks: the worst case mentioned in the tdoc is a single tone allocation at the edge, however, in Moderator’s understanding, the valid allocation in RAN4 specs is 3/6/12 tones only, such worst case does not exist in 3GPP. |
| [**R4-2318708**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2318708.zip) | Further discussion on UE RF requirements for B254 for IoT NTN operation | MediaTek Inc. | Discussion paper on the remaining UE RF requirements:  **Observation 1**: No more discussion is required for Rx RF requirements.  **Proposal 1a**: No A-MPR is specified for category NB1/NB2 for FCC regulations.  **Proposal 1b**: A-MPR is specified as Table 1 and 2 for category NB1/NB2 for ETSI regulations.  Table 1: A-MPR for NS\_04N   |  |  |  |  |  | | --- | --- | --- | --- | --- | | Modulation | QPSK | | | | | Tone positions for 3 Tones allocation | 0-2 | 3-5 and 6-8 | | 9-11 | | A-MPR | ≤ 0.7 dB | 0.2 dB | | ≤ 0.7 dB | | Tone positions for 6 Tones allocation | 0-5 and 6-11 | | | | | A-MPR | 0 dB | | 0 dB | | | Tone positions for 12 Tones allocation | 0-11 | | | | | A-MPR | 0 dB | | | |   Table 2: A-MPR for NS\_05N   |  |  |  |  |  | | --- | --- | --- | --- | --- | | Modulation | QPSK | | | | | Tone positions for 3 Tones allocation | 0-2 | 3-5 and 6-8 | | 9-11 | | A-MPR | ≤ 1.5 dB | 0.5 dB | | ≤ 1.5 dB | | Tone positions for 6 Tones allocation | 0-5 and 6-11 | | | | | A-MPR | ≤ 0.7 dB | | ≤ 0.7 dB | | | Tone positions for 12 Tones allocation | 0-11 | | | | | A-MPR | 0 dB | | | |     **Proposal 2**: RAN4 to introduce NS\_04N and NS\_05N for ETSI requirements for B254 category NB1/NB2, which is aligned with that for n254.  **Proposal 3**: RAN4 to introduce NS\_03N for FCC requirements for B254 category NB1/NB2, which is also aligned with that for n254.  **Proposal 4**: RAN4 to introduce NS\_03N for FCC requirements, and NS\_04N and NS\_05N for ETSI requirements for B254 category M1. |
| [**R4-2319558**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2319558.zip) | Discussion on UE RF requirements for FDD band (L+S band) for IoT NTN operation | ZTE Corporation | Discussion paper on the remaining UE RF requirements:  **Proposal 1**: No A-MPR is needed for Cat. NB1/NB2 to meet both FCC and ETSI requirement.  **Proposal 2**: Two NS values should be introduced to support ETSI regulations for the new FDD frequency bands as shown in Table 1. |

## Open issues summary

*Before Meeting, moderators shall summarize list of open issues, candidate options and possible WF (if applicable) based on companies’ contributions.*

### Sub-topic 1-1

*Sub-topic description: The sub-topic discusses how to handle ETSI emission requirements for B254 for the time being, as ETSI is being expected to capture 3GPP requirements.*

*Open issues and candidate options before meeting:*

**Issue 1-1: How to handle ETSI emission requirements for B254 at this stage?**

* Proposals
  + Option 1: Hold on capturing ETSI regulatory requirements in RAN4 specs and wait for the progress in ETSI.
  + Option 2: Capture ETSI regulatory requirements based on inputs in RAN4 specs.
* Recommended WF
  + Option 2?

Sony: regarding the applicability of single tone, there is no agreement to preclude single tone for NTN. We have measured 12 tones. A-MPR values are not sufficient for us. The emission requirement is also coming from ETSI. In general, we propose to start the dedicated WI in the next release for ETSI requirements.

Apple: we are not going to define the requirements and there is no way to deploy the bands. Can we accept it?

Inmarsat: tend to agree with Apple. There is danger. If you want your device operating in ECC, you still need to specify the requirements. Even if it is not captured in RAN4, UE still needs pass the regulation requirements.

Mediatek: about 12 tones, we can capture 12 tones. For single tone allocation, we can still introduce and update the requirements after ETSI gives the feedback.

Hughes: In the latest ETSI related conference, we realized that the requirements do not consider 3GPP. We are considering whether to relax it from ETSI side or other solution.

Globalstar: operating in Region 1 is important for operator.

Sony: our concern is that test spec cannot be implemented.

Apple: If the device cannot fulfil the requirements, then the device cannot camp on the cell and later if it fulfil, it can.

Mediatek: Apple proposal could be a way out. Alternatively, for single tone, it is difficult to meet the requirement. We introduce 3, 6, and 12 tones requirements. We can meet the requirements. We can preclude single tone case.

Qualcomm: We are open to consider the option. But it conflicts 3GPP practice. It is mandatory for UE to meet all the NS requirements. Solution should be long-term solution. To Mediatek, this is regulatory requirement. It is not good way to ecosystem.

Inmarsat: we can postpone it and do not expect any different answer from ETSI for emission requirements.

Tentative agreement:

* Specify the emission requirements for 3, 6 and 12 tones
* Capture the ETSI emission requirement with single tone and clarify that there is no verification for it in TS.
  + Keep the requirements in [] if there is concern.

### Sub-topic 1-2

*Sub-topic description: This sub-topic addresses the remaining requirements based on inputs to this meeting.*

*Open issues and candidate options before meeting:*

**Issue 1-2-1: Whether to introduce NS\_03N for FCC requirements for B254 both for category M1 and NB1/NB2, which is also aligned with that for n254?**

* Proposals
  + Option 1: Yes
  + Option 2: No
* Recommended WF
  + Option 1?

Agreement: agree on Option 1.

**Issue 1-2-2: Whether to introduce NS\_04N and NS\_05N for ETSI requirements for B254 both for category M1 and NB1/NB2, which is aligned with that for n254?**

* Proposals
  + Option 1: Yes
  + Option 2: No
* Recommended WF
  + Option 1?

**Issue 1-2-3: Whether to specify A-MPR requirements for category NB1/NB2 for FCC regulations**

* Proposals
  + Option 1: No, A-MPR is not needed for FCC regulatory requirements.
  + Option 2: Yes, please elaborate.
* Recommended WF
  + Option 1?

Qualcomm: Agree A-MPR is not needed. The guard band is needed.

Sony: we have to specified guard band.

Apple: A-MPR+non-guard band is equivalent to guard band solution.

Ligado: B255, it is expected to impact the band at the edges. FCC mainly cares about the impact from one system on the other system.

Qualcomm: for B255, there is offset from edge of band.

Agreement:

* A-MPR is not needed for FCC regulatory requirements.
  + Guard band needs be specified.

**Issue 1-2-4: Whether to specify A-MPR requirements for category NB1/NB2 for ETSI regulations**

* Proposals
  + Option 1: No, A-MPR is not needed for ETSI regulatory requirements.
  + Option 2: Yes, as the below table for different tone allocations or frequency segments:

Table 1: A-MPR for NS\_04N

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Modulation | QPSK | | | |
| Tone positions for 3 Tones allocation | 0-2 | 3-5 and 6-8 | | 9-11 |
| A-MPR | ≤ 0.7 dB | 0.2 dB | | ≤ 0.7 dB |
| Tone positions for 6 Tones allocation | 0-5 and 6-11 | | | |
| A-MPR | 0 dB | | 0 dB | |
| Tone positions for 12 Tones allocation | 0-11 | | | |
| A-MPR | 0 dB | | | |

Table 2: A-MPR for NS\_05N

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Modulation | QPSK | | | |
| Tone positions for 3 Tones allocation | 0-2 | 3-5 and 6-8 | | 9-11 |
| A-MPR | ≤ 1.5 dB | 0.5 dB | | ≤ 1.5 dB |
| Tone positions for 6 Tones allocation | 0-5 and 6-11 | | | |
| A-MPR | ≤ 0.7 dB | | ≤ 0.7 dB | |
| Tone positions for 12 Tones allocation | 0-11 | | | |
| A-MPR | 0 dB | | | |

* + Option 3: others, please elaborate
* Recommended WF
  + Option 2?

# Topic #2: CRs and TPs

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

## Companies’ contributions summary

|  |  |  |  |
| --- | --- | --- | --- |
| **TDoc** | **Title** | **Source** | **Moderator’s remarks** |
| [**R4-2318704**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2318704.zip) | Running draftCR to TS 36.102 on introducing L+S FDD band for IoT NTN operation | MediaTek Inc. | Running draft CR, to be revised according to discussion outcomes |
| R4-2318705 | CR to TS 36.102 on intrdoucing L+S FDD band for IoT NTN operation | MediaTek Inc. | Reserved for formal CR |
| [**R4-2318706**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2318706.zip) | DraftCR to TS 36.102 on A-MPR for B254 for IoT NTN operation | MediaTek Inc. | Draft CR for A-MPR |
| [**R4-2318707**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2318707.zip) | Draft TR 36.764 for IoT NTN bands v0.0.5 | MediaTek Inc. | Draft TR, to be revised according to discussion outcomes |
| [**R4-2318709**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2318709.zip) | TP on A-MPR evaluation results for B254 for IoT NTN operation | MediaTek Inc. | TP to TR for A-MPR evaluation results. |
| [**R4-2319559**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2319559.zip) | CR to TS36.108 Introduction of a new FDD band (L+S band) for IoT NTN operation | ZTE Corporation | Resubmission of the endorsed CR R4-2312047 |
| [**R4-2319560**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2319560.zip) | CR to TS36.133 Introduction of a new FDD band (L+S band) for IoT NTN operation | ZTE Corporation | Resubmission of the endorsed CR R4-2314715 |

Moderator: CR and TPs are holding on until agreements have been reached on the remaining RF requirements.