**3GPP TSG-RAN WG4 Meeting # 114 draft R4-2500687**

Athens, GR, 17th – 21st February, 2025

**Agenda item:** 7.21.4

**Source:** Moderator (Huawei)

**Title:** Topic summary for [114][135] A-IoT\_BSCW

**Document for:** Information

# Introduction

The thread [114][135] A-IoT\_BSCW is on Rel-19 WI on solutions for Ambient IoT in NR (RP-243326).

The summary covers contributions submitted under the agenda items including:

7.24.2.1 RF requirements for Type 1-C Ambient-IoT BS

7.24.2.3 RF requirements for CW

For 7.24.2.1, companies’ contributions are as follows:

|  |  |  |  |
| --- | --- | --- | --- |
| **Index No.** | **TDoc** | **Title** | **Source** |
| 1 | [**R4-2500877**](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_114/Docs/R4-2500877.zip) | Discussion on BS RF requirements for A-IOT | CMCC |
| 2 | [**R4-2500782**](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_114/Docs/R4-2500782.zip) | RF requirements for A-IoT BS | Huawei, HiSilicon |
| 3 | [**R4-2501029**](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_114/Docs/R4-2501029.zip) | Discussion on A-IoT BS requirements | CATT |
| 4 | [**R4-2501868**](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_114/Docs/R4-2501868.zip) | Discussions on RF requirements for A-IoT BS | ZTE Corporation, Sanechips |
| 5 | [**R4-2500744**](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_114/Docs/R4-2500744.zip) | Discussion on the RF requirement for AIoT BS | vivo |
| 6 | [**R4-2502098**](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_114/Docs/R4-2502098.zip) | A-IoT BS RF impact overview | Ericsson |
| 7 | [**R4-2500489**](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_114/Docs/R4-2500489.zip) | Ambient IoT reader ACS requirements with external CW | Qualcomm Incorporated |
| 8 | [**R4-2502253**](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_114/Docs/R4-2502253.zip) | Discussion on RF requirement for Type 1-C Ambient-IoT BS | LG Electronics UK |

For 7.24.2.3, companies’ contributions are as follows:

|  |  |  |  |
| --- | --- | --- | --- |
| **Index No.** | **TDoc** | **Title** | **Source** |
| 9 | [**R4-2500879**](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_114/Docs/R4-2500879.zip) | Discussion on CW requirements | CMCC |
| 10 | [**R4-2500615**](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_114/Docs/R4-2500615.zip) | Discussion on RF requirements for CW | Spreadtrum,UNISOC |
| 11 | [**R4-2501794**](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_114/Docs/R4-2501794.zip) | RF requirements for CW | OPPO |
| 12 | [**R4-2501030**](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_114/Docs/R4-2501030.zip) | Discussion on RF requirements for CW for D1T1 | CATT |
| 13 | [**R4-2500641**](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_114/Docs/R4-2500641.zip) | Discussion on AIoT CW RF requirements | Xiaomi |
| 14 | [**R4-2501870**](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_114/Docs/R4-2501870.zip) | Discussion on RF requirement for CW node | ZTE Corporation, Sanechips |
| 15 | [**R4-2500746**](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_114/Docs/R4-2500746.zip) | Discussion on the RF requirement for CW | vivo |
| 16 | [**R4-2501863**](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_114/Docs/R4-2501863.zip) | RF requirements for CW | Huawei, HiSilicon |
| 17 | [**R4-2502101**](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_114/Docs/R4-2502101.zip) | CW node RF impact overview | Ericsson |
| 18 | [**R4-2502256**](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_114/Docs/R4-2502256.zip) | CW phase noise requirement | Qualcomm Incorporated |
| 19 | [**R4-2502270**](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_114/Docs/R4-2502270.zip) | Discussion on RF requirement for CW | LG Electronics UK |
| 20 | [**R4-2502099**](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_114/Docs/R4-2502099.zip) | A-IoT general overview | Ericsson |
| 21 | [**R4-2501867**](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_114/Docs/R4-2501867.zip) | Discussions on General aspect for A-IoT | ZTE Corporation, Sanechips |

Note：

1. BS and CW output power related proposals of [R4-2502099](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_114/Docs/R4-2502099.zip) and R4-2501867, which submitted in 7.24.1, are also included.
2. Proposal on which specification will contain the RF requirements for CW in R4-2501863 is moved to the thread [114][135]

# Topic #1: A-IoT BS TX

*Background:*

*Following is the SI conclusions on A-IoT BS TX requirements*

|  |  |
| --- | --- |
| **RF Requirement for A-IoT BS- TX requirements** | **Potentially needed or not**  |
| Base station output power | YES |
| Output power dynamic | RE power control dynamic range | TBD |
| Total power dynamic range | TBD |
| Some requirements like Transmit ON/OFF power | Transmitter OFF power | TBD |
| Transmitter transient period | TBD |
| Transmit signal quality | Frequency error | YES |
| Some requirements like EVM (Modulation quality) | YES |
| Unwanted emissions | Occupied bandwidth | YES |
| ACLR | YES |
| Operating band unwanted emissions | YES |
| Transmitter spurious emissions | YES |
| Transmitter intermodulation | TBD |

### Issue 1-1: Base station output power

* Proposals:
	+ Proposal 1: A-IoT BS output power, Prated,c,AC≤ 38 dBm (CMCC, R4-2500877; HW, R4-2500782; CATT, R4-2501029; ZTE, R4-2501867）
	+ Proposal 2: 33dBm (CATT, R4-2501029)
	+ Proposal 3: A-IoT BS output power, Prated\_c\_IoT≤ 38 dBm or 31dBm (LGE, R4-2502253)
	+ Proposal 4: The number of RBs of R2D signal and the number of RBs corresponding to the BS output power need to be clarified in the WID (CATT, R4-2501029)
* Recommended WF
	+ Proposal 1 aligns with the Micro BS output power and does not conflict with the SI coexistence assumptions.
	+ Discuss whether Proposal 1 can be agreed.

### Issue 1-2-1: RE power control dynamic range

* Proposals:
	+ Option 1: NO (HW, R4-2500782; ZTE, R4-2501868)
	+ Option 2: The necessity of RE power control dynamic range can be decided after RAN1 have a conclusion on whether A-IoT BS supports RE power boosting. (CATT, R4-2501029）
	+ Option 3: Update according to the modulation scheme and bandwidths（CMCC, R4-2500877）
* Recommended WF
	+ Discuss whether Proposal 1 can be agreed.

### Issue 1-2-2: Total power dynamic range

* Proposals:
	+ Option 1: NO (HW, R4-2500782；ZTE, R4-2501868)
	+ Option 2: Update according to the modulation scheme and bandwidths（CMCC, R4-2500877）
	+ Option 3: Needed if signal resource of R2D is several RBs.（CATT, R4-2501029; ZTE, R4-2501868）
* Recommended WF
	+ Discuss whether option 1 is acceptable, as the R2D carrier (even with multiple RBs) is handled as a whole.

### Issue 1-3-1: Transmitter OFF power

* Proposals:
	+ **Option 1**: Define Transmitter OFF power
		- Specify the ON/OFF requirement for A-IoT BS for HD-FDD operation. (E, R4-2502098)
		- Transmitter OFF power spectral density shall be less than -85 dBm/MHz per antenna connector.（HW, R4-2500782）
	+ **Option 2**: Not needed when the frequency spectrums of R2D and D2R/CW are different.（CATT, R4-2501029）
* Recommended WF
	+ Define Transmitter OFF power.
	+ Discuss whether the TDD NR BS requirements can be reused.

### Issue 1-3-2: Transmitter transient period

* Proposals:
	+ **Option 1**: Need to define.
		- **Proposal 1**: Reuse the NR BS type 1-C NR requirements for Transmitter transient period,10µs（HW, R4-2500782）
		- **Proposal 2**: Propose RAN4 to discuss both ON-OFF/OFF-ON transition time (e.g. 10us transition time) and also the decoding time (e.g. 400us or 500us decoding time) for R2D reception at device side for the appropriate guard period configuration. (ZTE, R4-2501868)
		- **Proposal 3**: Define transient period related requirements for A-IoT reader. Details value can refer to RFID rise/fall time (R4-2418726, CMCC)
	+ **Option 2**: No need to define (CATT, R4-2501029; vivo, R4-2500744)
* Recommended WF
	+ Option 1.
	+ FFS values.

### Issue 1-4-1: Frequency error

* Proposal:
	+ Reuse the NR micro BS requirements（±0.1 ppm）（CMCC, R4-2500877,;HW, R4-2500782; CATT, R4-2501029; ZTE, R4-2501868; LGE, R4-2502253）
* Recommended WF
	+ Reuse the NR micro BS requirements（±0.1 ppm）for A-IoT BS.

### Issue 1-4-2: Modulation quality

* Proposals:
	+ **Option 1**:Define RF envelop requirements
		- **Proposal 1-1**：Define RF envelop requirements, including modulation Depth, RF Envelope Ripple, RF Envelope Rise Time, RF Envelope Fall Time and RF Pulse width for A-IoT BS. (HW, R4-2500782, ZTE, R4-2501868; CMCC, R4-2500877)
		- **Proposal 1-2**：The RF envelope requirements primarily depend on the baseband waveform but also need to consider additional factors like CP effects, varying chip lengths, digital filtering, and RF impairments. (HW, R4-2500782）
		- **Proposal 1-3**：Further consider whether settling time as defined in RFID spec is needed or not to evaluate RF envelop ripple characteristics.( CMCC, R4-2500877)
		- **Proposal 1-4**：Power ratio between ON chip and OFF chip. (vivo, R4-2500744)
	+ **Option 2:** Define EVM requirements
		- **Proposal 2-1**：Specify the OOK-M signal quality requirement with equivalent EVM requirement better than 64QAM. (E, R4-2502098)
		- **Proposal 2-2**：The EVM of OOK is defined as the average amplitude difference between normalized transmitted signal and the ideal 1&0 reference signal. (vivo, R4-2500744)
	+ **Option 3:** Others
		- **Proposal 3-1**：The transmit signal quality requirements apply during the transmitter ON period. (CATT, R4-2501029)
		- **Proposal 3-2**：New requirements for EVM is needed for A-IoT. (LGE, R4-2502253)
		- **Proposal 3-4**：Wait RAN1 further progress on the R2D signal design (E, R4-2502098; CATT, R4-2501029)
		- **Proposal 3-5**：Wait for the conclusion of LP-WUS. (vivo, R4-2500744)
* Moderator note:
	+ A-IoT shares similar technology with RFID, it makes sense to reference the RFID Interrogator-to-Tag (R=>T) RF envelope parameters. However, due to differences in modulation and encoding, values can be FFS.
* Recommended WF
	+ Consider to define parameters like RFID RF envelop, such as modulation Depth, RF Envelope Ripple, RF Envelope Rise Time, RF Envelope Fall Time and RF Pulse width for A-IoT BS.
	+ FFS for values.

### Issue 1-5-1: Occupied bandwidth

* Proposals:
	+ **Proposal 1:** Reuse the legacy OBW requirement for A-IoT BS R2D transmission. (ZTE, R4-2501868; LGE, R4-2502253; CATT, R4-2501029)
	+ **Proposal 2:** Larger occupied bandwidth may be needed for OOK-4 modulation due to its wider side lobes compared to a legacy NR carrier. (HW, R4-2500782)
* Recommended WF
	+ Discuss the issue together with channel BW in thread [114][134]

### Issue 1-5-2: ACLR

* Proposals:
	+ **Proposal 1**: Define ACLR requirement up to the coexistence study (e.g. 38dBm A-IoT BS transmission power (ZTE, R4-2501868)
	+ **Proposal 2**: Specify 1RB transmission bandwidth A-IoT carrier ACLR, Other transmission bandwidths are FFS (HW, R4-2500782)
		- **Option 1**: ACLR1 is 30dB and ACLR2 is 40dB (HW, R4-2500782)
		- **Option 2**: ACLR1 is 40dB and ACLR2 is 50dB. (CMCC, R4-2500877; CATT, R4-2501029; E, R4-2502098)
* Recommended WF
	+ Considering no indoor legacy NR UE, ACLR assumptions can be checke
	+ ACLR value is FFS.

### Issue 1-5-3: OBUE

* Proposals:
	+ **Proposal 1:** OBUE requirement for standalone NB-IoT MR BS can be reused for A-IoT BS. (CATT, R4-2501029; CMCC, R4-2500877)
	+ **Proposal 2:** Define OBUE requirement up to the ACLR requirement and carrier bandwidth requirement. (ZTE, R4-2501868)
	+ **Proposal 3:** Consider the absence of indoor NR UEs and the large side lobes produced by OOK-4 modulation, OBUE can be further investigated. (HW, R4-2500782)
* Recommended WF
	+ TBA

### Issue 1-5-4: Transmitter spurious emissions

* Proposals:
	+ **Proposal 1:** Reuse the FR1 NR BS transmitter spurious emission requirement for A-IoT BS (ZTE, R4-2501868; HW, R4-2500782; CMCC, R4-2500877; CATT, R4-2501029)
	+ **Proposal 2:** The unwanted emissions requirements apply during the transmitter ON period. (CATT, R4-2501029)
	+ **Proposal 3:** No need to specify protection of the own receiver if TX ON/OFF would be specified. (E, R4-2502098)
	+ **Proposal 4:** Specify the co-location requirement if the deployment of A-IoT BS with other co-located BS is not excluded. (E, R4-2502098)
* Recommended WF
	+ Agree Proposal 1, 2 and 4
	+ Check whether proposal 3 can be revised to no need to specify protection of the own receiver

### Issue 1-6: Transmitter intermodulation

* Proposals:
	+ **Option 1:** The A-IoT BS and NR BS are not co-located, so the transmitter intermodulation requirement is not necessary. (CATT, R4-2501029)
	+ **Option 2:** Tx intermodulation should be defined for A-IoT BS. (E, R4-2502098; ZTE, R4-2501868)
		- Reuse the FR1 MR Tx intermodulation requirement for A-IoT BS. (ZTE, R4-2501868)
* Recommended WF
	+ TBA

# Topic #2: A-IoT BS RX

*Background:*

*Following is the SI conclusions on A-IoT BS RX requirements*

|  |  |
| --- | --- |
| **A-IoT BS- RX RF Requirement** | **Potentially needed or not**  |
| Reference sensitivity level | YES |
| Dynamic range  | TBD |
| Adjacent Channel Selectivity | YES |
| In-band blocking | general blocking | YES |
| narrowband blocking | YES |
| Out-of-band blocking | YES |
| Receiver spurious emission | YES |
| Receiver intermodulation | General intermodulation | TBD |
| Narrowband intermodulation | YES |
| In-channel selectivity  | TBD |

### Issue 2-1-1: Reference sensitivity level

*Background:*

*Following conclusion* *of reference sensitivity level for A-IoT BS was captured in TR38.769*

Copied from TR38.769:

Regarding the reference sensitivity level for A-IoT BS, RAN4 reached the following consensus:

* For BS type 1-C,

- BW is the transmission bandwidth for D2R.

- NF is the noise figure of A-IoT BS, equal to 10 dB for Medium Range BS.

- IM is the implementation margin, equal to 2dB.

- SNR is the SNR value for D2R decoding, the detailed metrics would be discussed in the WI phase.

- Desens target is considered for CW signal interference cancellation in D1T1 scenario. The desens level for CW signal cancellation might be different for D1T1-A1/D1T1-A2 and D1T1-B. For D1T1-A2, CW signal interference is coming from self-interference and also potential CW interference from other nodes transmitting CW signal. For D1T1-A1, the CW signal interference is coming from other nodes transmitting CW inside the topology. For D1T1-B, the CW signal interference is coming from CW nodes transmitting outside topology.

* Proposals:
	+ **Proposal 1:** Define the reference sensitivity level specifically for 15 kHz D2R channel BW at least. (HW, R4-2500782)
	+ **Proposal 2:** Use the 10dB noise figure for the REFSENS specification. (HW, R4-2500782, CMCC, R4-2500877)
	+ **Proposal 3:** SNR target
		- **Option 1:** SNR targets for 10% BLER for PRDCH, RAN4 will discuss the simulation assumption to derive target SNR (CMCC, R4-2500877)
		- **Option 2:** Rx requirement of AIoT BS is defined based on miss detection rate. (vivo, R4-2500744)
	+ **Proposal 4:** Postpone the REFSENS requirement discussion until RAN1 reach the consensus.( ZTE, R4-2501868; E, R4-2502098)
	+ **Proposal 5-1:** Further discuss the maximum input power for CW signal in D1T1-B scenario and potential maximum desens due to the CW reception.（ZTE, R4-2501868）
	+ **Proposal 5-2:** Define reader receiver selectivity test with CW as jammer for the BS reader to stress the CW cancellation capability. (QC, R4-2500489)
* Recommended WF
	+ Discuss whether proposal 1, 2 can be agreed
	+ For Proposal 3, discuss whether option 1 is acceptable

### Issue 2-1-2: LLS assumptions and parameters for SNR

* Proposals:
	+ **Proposal 1:** (HW, R4-2500782)

|  |  |
| --- | --- |
| **Parameter** | **Value** |
| Channel Model | AWGN |
| SFO | [104 ppm~105 ppm] |
| Transmission bandwidth (double sideband) | 15kHz |
| TBS | 96 bits |
| FEC | 1/3 Convolutional Code |
| Line code | Manchester |
| Repetition | None |
| Carrier-wave waveform | Unmodulated single tone |

* + **Proposal 2:**：（Vivo, R4-2500744）

|  |  |
| --- | --- |
| **Parameters** | **Assumptions** |
| Carrier frequency | 900 MHz |
| SCS | 15 kHz as baseline |
| Block structure | Depend on RAN1 |
| Channel model | AWGN |
| Device velocity | 3 km/h |
| Number of Tx/Rx chains for Ambient IoT device | 1 |
| Number of BS antenna elements  | 2 |
| Reference data rate | 1 kbps (M)5 - 7 kbps (M) |
| Message size | {20 bits, 96 bits, 400 bits} are considered for message size.Note 1: companies to report the M value and chip length used for each message sizeNote 2: CRC is not included for the message size |
| BLER target | 10% |
| Sampling frequency | Randomly select a value from the range of [0.1 ~ 1] \* 10^5 ppm for device 1 |
| Transmission bandwidth | DSBX kHz is considered for D2R transmission bandwidth. The value is for two sidebands, i.e., the total transmission bandwidth for DSB is X kHzX = {[15 (M)], [180 (O)]} |
| [OOK/BPSK chip rate]  | Companies to report  |
| Receiver bandwidth | FFS |
| Waveform (CW) | unmodulated single tone |
| Modulation | OOK |
| Line code | Manchester encoding |
| FEC | No FEC |
| ADC bit width | Ideal |
| D2R receiver  | coherent receiver |

* Recommended WF
	+ Take the following table as a start point

|  |  |
| --- | --- |
| **Parameters** | **Assumptions** |
| Carrier frequency | 900 MHz |
| SCS | 15 kHz as baseline |
| Block structure | Depend on RAN1 |
| Channel model | AWGN |
| Device velocity | 3 km/h |
| Number of Tx/Rx chains for Ambient IoT device | 1 |
| Number of BS antenna elements  | 2 |
| Reference data rate | 1 kbps (M)5 - 7 kbps (M) |
| Message size | **Option 1**：{20 bits, 96 bits, 400 bits} are considered for message size.Note 1: companies to report the M value and chip length used for each message sizeNote 2: CRC is not included for the message size**Option 2**：96 bits |
| BLER target | 10% |
| Sampling frequency（SFO） | Randomly select a value from the range of [104 ppm~105 ppm] for device 1 |
| Transmission bandwidth（DSB） | **Option 1：**X kHz is considered for D2R transmission bandwidth. The value is for two sidebands, i.e., the total transmission bandwidth for DSB is X kHzX = {[15 (M)], [180 (O)]}**Option 2:** 15kHz |
| [OOK/BPSK chip rate]  | Companies to report  |
| Receiver bandwidth | FFS |
| Waveform (CW) | unmodulated single tone |
| Modulation | OOK |
| Line code | Manchester encoding |
| FEC | **Option 1**：No FEC**Option 2**：1/3 Convolutional Code |
| ADC bit width | Ideal |
| D2R receiver  | coherent receiver |
| Repetition | None |

### Issue 2-2: Dynamic range

* Proposals:
	+ **Proposal 1:** After obtaining the D2R SNR through LLS simulation, the dynamic range can be calculated accordingly.( (HW, R4-2500782)
	+ **Proposal 2:** Further discuss the co-channel interference coming from co-channel device transmission and CW interference for dynamic range requirement in D1T1-B scenario (ZTE, R4-2501868)
* Recommended WF
	+ TBA

### Issue 2-3: ACS

* Proposals:
	+ **Proposal 1:** Further discuss ACS requirement up to the coexistence study. NR UE UL interference in the indoor case is not concerning one if NR UE could cell re-select to other freq or Redirecton to other frequency.（ZTE, R4-2501868）
	+ **Proposal 2:** No ACS requirement for A-IoT BS. (HW, R4-2500782)
	+ **Proposal 3:** For ACS requirements, reuse legacy NB-IOT requirements.（CMCC, R4-2500877）
	+ **Proposal 4:** Coexisting simulation will be needed to study the ACS requirement for D1T1-B.（E, R4-2502098）
* Moderator note:
	+ Coexisting simulation is not within the WI objective
	+ Considering no indoor NR UE, no multi-device scenario, proposal 2 can be proper.
	+ However, due to differences in modulation and encoding, values can be FFS.
* Recommended WF
	+ Discuss whether Proposal 2 can be agreed

### Issue 2-4-1: general blocking

* Proposals:
	+ **Proposal 1:** Reuse the in-band blocking requirement from NB-IoT standalone Medium Range BS for A-IoT BS. (HW, R4-2500782)
	+ **Proposal 2:** Coexisting simulation will be needed to study the inband blocking requirement for D1T1-B.（E, R4-2502098; ZTE, R4-2501868）
* Recommended WF
	+ Discuss whether Proposal 1 can be agreed

### Issue 2-4-2: narrowband blocking

* Proposal:
	+ For D1T1-B scenario and NR UEs only distributed outdoor, the narrowband blocking requirement is not necessary.( CATT, R4-2501029)
* Recommended WF
	+ Narrowband blocking is not needed.

### Issue 2-5: Out-of-band blocking

* Proposals:
	+ **Proposal:** Reuse the out-of-band blocking requirement from NB-IoT standalone Medium Range BS for A-IoT BS. (HW, R4-2500782；CATT, R4-2501029；ZTE, R4-2501868)
* Recommended WF
	+ Reuse the out-of-band blocking requirement from NB-IoT standalone Medium Range BS for A-IoT BS

### Issue 2-6: Receiver spurious emission

* Proposals:
	+ **Proposal:** The receiver spurious emissions for A-IoT BS can reuse the NR BS requirements specified in Table 7.6.2-1 of TS 38.104. (HW, R4-2500782; ZTE, R4-2501868; CATT, R4-2501029)
* Recommended WF
	+ Reuse the NR BS Receiver spurious emission requirements for A-IoT BS

### Issue 2-7-1: General intermodulation

* Proposals:
	+ **Option 1:** No need to define general intermodulation for A-IoT BS. (HW, R4-2500782; CATT, R4-2501029)
	+ **Option 2:** Reuse FR1 MR BS Rx IMD requirement in the licensed band for A-IoT BS Rx IMD requirement. (ZTE, R4-2501868)
* Recommended WF
	+ Check whether Option 1 can be agreed

### Issue 2-7-2: Narrowband intermodulation

* Proposals:
	+ **Proposal 1:** Reuse the Medium Range BS for NB-IoT standalone requirements specified in Table 7.8.1-6c of TS 36.104. (HW, R4-2500782)
	+ **Proposal 2:** For D1T1-B scenario and NR UEs only distributed outdoor, the narrowband intermodulation requirement is not necessary.( CATT, R4-2501029)
* Recommended WF
	+ Check whether Proposal 2 can be agreed

### Issue 2-8: ICS

* Proposals:
	+ **Option 1:** No need. (HW, R4-2500782；ZTE, R4-2501868)
	+ **Option 2:** Wait RAN1 progress on FDMA of D2R before RAN4 study the receiver intermodulation and ICS requirement.( E, R4-2502098)
* Recommended WF
	+ TBA

### Issue 2-9: A-IoT BS others

* Proposals:
	+ **Proposal 1:** Clarify the mitigation scheme in TR 38.769 on whether a NR cell to be configured at the same A-IoT BS. (E, R4-2502098)
	+ **Proposal 2:** most of the legacy BS TX requirement could be kept (E, R4-2502098)
	+ **Proposal 3:** The RF impact on the CW transmission by A-IoT BS could be evaluated if this is also a valid scenario to consider for Rel-19 work item. (E, R4-2502098)
	+ **Proposal 5:** Define selectivity test for the reader with more than 70 dBc CW to D2R signal level ratio. (QC, R4-2500489)
* Recommended WF
	+ No need to discuss Proposal 2 because it have been addressed case by case in separate issues.
	+ Other proposals TBA

# Topic #3: CW

*Background:*

*Following is the SI conclusions on CW RF requirements*

|  |  |
| --- | --- |
| **CW RF Requirement** | **Potentially needed or not**  |
| Output power | YES |
| ON/OFF power | TBD |
| Frequency error | YES |
| Phase noise | TBD in WI phase for outside topology |
| Unwanted emission | YES |
| Spurious emissions | YES |
| Intermodulation | TBD |

### Issue 3-1: CW Output power

* Proposals:
	+ **Option 1**: Study a reasonable CW output power to meet the 15 meter design target, e.g 33 dBm. （E, R4-2502101）
		- Adding a coexisting simulation case for a CW output power larger than 23 dBm to meet the design target. （E, R4-2502101）
	+ **Option 2**: 33dBm (HW, R4-2501863; CMCC, R4-2500879; Spreadtrum, R4-2500615; ZTE，R4-2501867）
	+ **Option 3**: 23dBm（CATT，R4-2501030; Vivo, R4-2500746; Xiaomi, R4-2500641）
* Recommended WF
	+ CW output power 33dBm
	+ Discuss whether simulation is needed.

### Issue 3-2: ON/OFF power

* Proposals:
	+ **Option 1**: No needed（HW, R4-2501863; CATT, R4-2501030; Xiaomi, R4-2500641; Spreadtrum, R4-2500615）
	+ **Option 2**: Need to be specified (E, R4-2502101)
* Recommended WF
	+ Discuss whether option 1 is agreeable

### Issue 3-3: Frequency error

* Proposals:
	+ **Proposal 1:** ±0.1 ppm. （HW, R4-2501863; CATT, R4-2501030；Spreadtrum, R4-2500615; Xiaomi, R4-2500641）
	+ **Proposal 2:** Take RFID ±10ppm as the starting point for CW frequency error. (Vivo, R4-2500746)
	+ **Proposal 3:** To define frequency accuracy requirement for CW. (OPPO, R4-2501794)
	+ **Proposal 4:** For in-band operation, the frequency of CW should align with the NR channel raster. (vivo, R4-2500746)
* Recommended WF
	+ Reuse Micro BS frequency error ±0.1 ppm for A-IoT BS.
	+ Proposal 4 may be discussed together with system parameters

### Issue 3-4: Phase noise

* Proposals:
	+ **Option 1**: No need（HW, R4-2501863; Vivo, R4-2500746; Spreadtrum, R4-2500615; Xiaomi, R4-2500641）
	+ **Option 2**: Define phase noise requirement for the CW at least when it is coming from outside of the topology.( QC, R4-2502256)
	+ **Option 3**: Wait for RAN1’s conclusions on occupied bandwidth and encoding gain of D2R signal to analyse CW signal cancellation ability of the digital unit. （CATT，R4-2501030）
* Recommended WF
	+ Phase noise can be discussed together with the Issue 3-5

### Issue 3-5: Unwanted emission

* Proposals:
	+ **Proposal 1**：The boundary between spectrum emission mask domain and spurious emission domain for CW node is specified as FOBUE = 10 MHz（HW, R4-2501863）
	+ **Proposal 2:** CW node spectrum emission mask
	+ **Option 1:** CW node spectrum emission mask is defined as in Table 2.2-2. （HW, R4-2501863）
* **Table 2.2-2: CW node spectrum emission mask**

|  |  |  |
| --- | --- | --- |
| **Δf (kHz)** | **Emission limit (dBm)** | **Measurement bandwidth** |
| ± 0-90 | N/A |  |
| ± 90-270 | -15 | 30 kHz |
| ± 270-450 | -20 | 30 kHz |
| ± 450- Δfmax | -27 | 30 kHz |

* + **Option 2-1:** The Unwanted emission requirements for NB-IoT BS can be reused for CW signal. （CATT，R4-2501030）
	+ **Option 2-2:** For emission requirements, use NB-IOT requirements as baseline and adjust the offsets.( CMCC, R4-2500879)
	+ **Option 3:** CW unwanted emission can be modeled with 37 dBc for ACLR1 and 47 dBc for ACLR2.（E, R4-2502101）
* Recommended WF
	+ Discuss whether proposal 1 can be agreed
	+ Proposal 2 TBA

### Issue 3-6: Spurious emissions

* Proposals:
	+ **Option 1**: NR spurious emission requirement can be considered for R19 AIoT CW node. (Xiaomi, R4-2500641; HW, R4-2501863)
	+ **Option 2**: Not necessary for scenario D1T1-B. （CATT，R4-2501030）
* Recommended WF
	+ Option 1

### Issue 3-7: Intermodulation

* Proposals:
	+ **Option 1:** No（HW, R4-2501863; CATT，R4-2501030）
	+ **Option 2:** Yes (Spreadtrum, R4-2500615）
	+ **Option 3:** Discuss if the co-location with other BS is a valid scenario before discussing the inter-modulation requirement. （E, R4-2502101）
* Recommended WF
	+ TBA

### Issue 3-8: CW others

* Proposals:
	+ **Proposal 1**: Consider the following RF requirement for CW node: Potential DC leakage related requirements. （ZTE，R4-2501870）
	+ **Proposal 2**: A bandwidth should be defined together with CW output power so that the power can be measured with OCC bandwidth. （E, R4-2502101
* Recommended WF
	+ TBA