3GPP TSG-RAN WG4 Meeting #112 R4-2414280

Maastricht, Netherlands,19 – 23 Aug, 2024

**Agenda item:** 8.20.4

**Source:** Moderator (CMCC)

**Title:** Adhoc minutes for ambient IOT

**Document for:** Information

# Introduction

The adhoc session discussed some issues for the following topics:

[131] topic#4 evaluation parameters

[131] topic 3-3 CW considerations

[132] topic#1 AIOT system parameters

[132] topic#2 AIOT BS

The summary for [131] is in R4-2412833, the summary for [132] is in R4-2412834.

# [131] Topic#3 Evaluation methodology and cases

## Topic 3-3: CW considerations

**Issue 3-3-1: Layout of CW for outside topology**

* Option 1 (Huawei): assume that CW node is co-located with the neighbouring A-IoT Reader.
* Option 2 (vivo):



* Option 3 (Ericsson): Model a dedicated CWT node layer with a grid shift to the network layer.

**Tentative agreement:**

Simulate CW outside topology case, FFS on the layout of CW

For the CW outside topology layout:

* For every reader, the outside topology CW node is always located at the nearest neighboring reader location. If the CW node is co-located with other readers, CW node and reader are not transmitted simultaneously.
* Note: This proposal is based on some further offline discussion. Companies please further check

**Issue 3-3-2: CW cancellation capability**

|  |
| --- |
| **Agreement in RAN4#111:**  Do not consider CW interference for calibration purpose for D1T1-A2 and D2T2-A2  FFS on how to consider CW cancellation capability in formal simulation |

* Proposal 1 (CMCC): we have following suggestions for self-interference if finally approve to simulate self-interference in final simulation
  + Total interference cancellation capability is based on companies report. Companies are also encouraged to show detailed analysis of each part of self-interference cancellation aspects, i.e. total interference cancellation capability = spatial isolation + RF cancellation + digital cancellation
* Proposal 2 (Spreadtrum): Refer to RAN1’s CW cancellation capability. Use formula as follow in formal simulation.
  + Remaining CW interference = CW Tx Power (dBm)+CW TX antenna gain(dBi)-Cabel,connector,combiner,body losses,(dB)+Receiver antenna gain (dBi)- Cabel,connector,combiner,body losses,(dB)-CW cancellation capability(dB)
* Proposal 3 (Qualcomm): The reader receiver sensitivity is essential for a reasonable D2R performance evaluation. This sensitivity is related to the reader’s CW cancellation capability. RAN1 and RAN4 should study the CW cancellation capability and provide the values for coexistence study.
* Proposal 4 (Huawei):
  + For monostatic (-A2), assume: [140dB for BS] and [120dB for UE]
  + For bistatic (-A1 and B), assuming CW has no impact to the receiver sensitivity loss.

**Tentative agreements:**

For the CW cancellation capability, companies to report the CW cancellation capability used for co-existence evaluation, CW cancellation capability for inside topology and outside topology can be different.

* + total interference cancellation capability = spatial isolation + RF cancellation + digital cancellation
  + CW transmission impact on the received SINR, e.g. degradation

**Issue 3-3-3: CW unwanted emissions**

* Proposal 1 (vivo): To avoid the impact from CW, an isolation distance between activated CW node and indoor NR UE can be defined. For D2T2, 41m can be the starting point, For D1T1, further discuss whether it is feasible to allow NR UEs locate inside factory.
* Proposal 2 (Huawei): Simulation is not needed for interference from CW to NR/A-IOT.
  + The reasons are as follows: The remaining interference after CW cancellation/suppression can be calculated, and the suppressed CW is used as the system's floor noise. CW deployment reuses Reader sites, and the interference path is similar to that of Reader. The CW output power does not exceed the Reader output power, and since CW is a single tone, interference from CW is no greater than that from Reader.
* Proposal 3 (Ericsson):
  + Use the ACLR for interference modelling for coexisting study.
  + Use the same ACLR characteristic of the device 1/2a for the CW transmission.

**Recommended WF:**

Discuss whether and how to model the CW unwanted emission.

# [131] Topic#4 Evaluation parameters

## Topic 4-1: Adjacent RB Tx and Rx characteristics

**Issue 4-1-1: A-IOT reader and NR BS**

**Agreement in RAN4#111:**

For calibration purpose, use 0RB guard band between AIOT and NR for in-band spectrum deployment mode

|  |  |  |  |
| --- | --- | --- | --- |
|  |  | In-band | |
|  | Tx | Rx |
| NR UE/A-IOT Intermediate UE | For calibration purpose | Legacy UE IBE | ACS |
| NR BS | For calibration purpose | ACLR of legacy gNB | ACS of legacy gNB |
| A-IOT BS | For calibration purpose | ACLR of legacy gNB (i.e. 45) | ACS of legacy gNB |

**Proposals in RAN4#112:**

Proposal 1 (Huawei): A-IoT micro-BS ACLR (dB): ACLR1:40dB，ACLR2:50dB

Proposal 2 (Ericsson): Interference for case 6 and 12: NR BS IBE factor: 17 dBc relative to to the average NR transmission power.

图表

描述已自动生成

**Tentative agreement:**

Following values are used for formal simulation. More discussion is required for NR BS.

|  |  |  |
| --- | --- | --- |
|  | In-band | |
| Tx | Rx |
| NR UE/A-IOT Intermediate UE | Legacy UE IBE | ACS |
| NR BS | Option 1: ACLR of legacy gNB (45dB)  Option 2: 40dB  Option 3: 17dB or other values | ACS of legacy gNB |
| A-IOT BS | ACLR of legacy NB -IOT gNB  (i.e. ACLR1:40dB，ACLR2:50dB) | ACS of legacy gNB |

**Issue 4-1-2: Tx for device 1 and 2a**

|  |
| --- |
| **Agreement in RAN4#111:**  For device 1 and 2a, 25dBc is used for calibration purposes  **图表, 直方图  描述已自动生成** |

Proposal 1(CMCC): for device 1 and 2a, it’s suggested to use following value for IBE with assuming 7kbps D2R date rate, Manchester code, 1/3 code rate convolution code, BPSK modulation scheme. Following assumes that Tx signal is at frequency center

• 16dBc at the edge of center 1PRB, i.e. 90kHz offset from frequency center

**Tentative agreement:**

* Discuss which one or both should be used for formal simulation
  + Option 1: 25dBc (based on 5kbps, Manchester code)
  + Option 2: 16dBc (based on 7kbps, Manchester code, 1/3 code rate convolution code)

**Issue 4-1-3: Rx for device 1 and 2a**

|  |
| --- |
| **Agreement in RAN4#111:**  Assume no frequency selectivity for co-existence evaluation for calibration purposes for device 1 and 2a. |

**Proposals in RAN4#112:**

Proposal 1 (Samsung): By adopting LPF for R2D, the frequency selectivity on interference and noise can be applied to the SINR. Where the attenuation for received NR interference by the tag can be at least 4.3 dB and the noise can be reduced for SINR calculation of R2D.

|  |  |  |
| --- | --- | --- |
| SINR | R2D with LPF | R2D without LPF |
| Interference from NR | Frequency selectivity: > 4.3 dB | No frequency selectivity |
| Noise bandwidth | 180kHz | 10MHz |

Proposal 2 (Spreadtrum): We need to consider BB LPF in formal simulation.

Proposal 3 (CMCC): it’s suggested to assume there is no in-band selectivity for RF-ED based device for formal simulation, which is the worst assumption. If final simulation show interference occurs, RAN4 can further focus on BB LPF performance analysis and conclude certain RF requirements if necessary to avoid interference.

**Tentative agreement:**

* Use R2D without LPF as baseline for co-existence evaluation
* R2D with LPF as optional. FFS on the values (More offline this week).

**Issue 4-1-4: Scaling factor**

Proposal (Ericsson):

Interference for case 1 and 7: CW node aggressor ACLR scaling factor: ACLR\_e\_AIOT\_xx = ACLR – 10\*log10((9MHz/(# of NR users))/180kHz)

Interference for case 3 and 9: AIoT-BS aggressor ACLR scaling factor: tACLR\_e\_AIOT\_BS = ACLR – 10\*log10((9MHz/(# of NR users))/180kHz)

**Tentative agreement:**

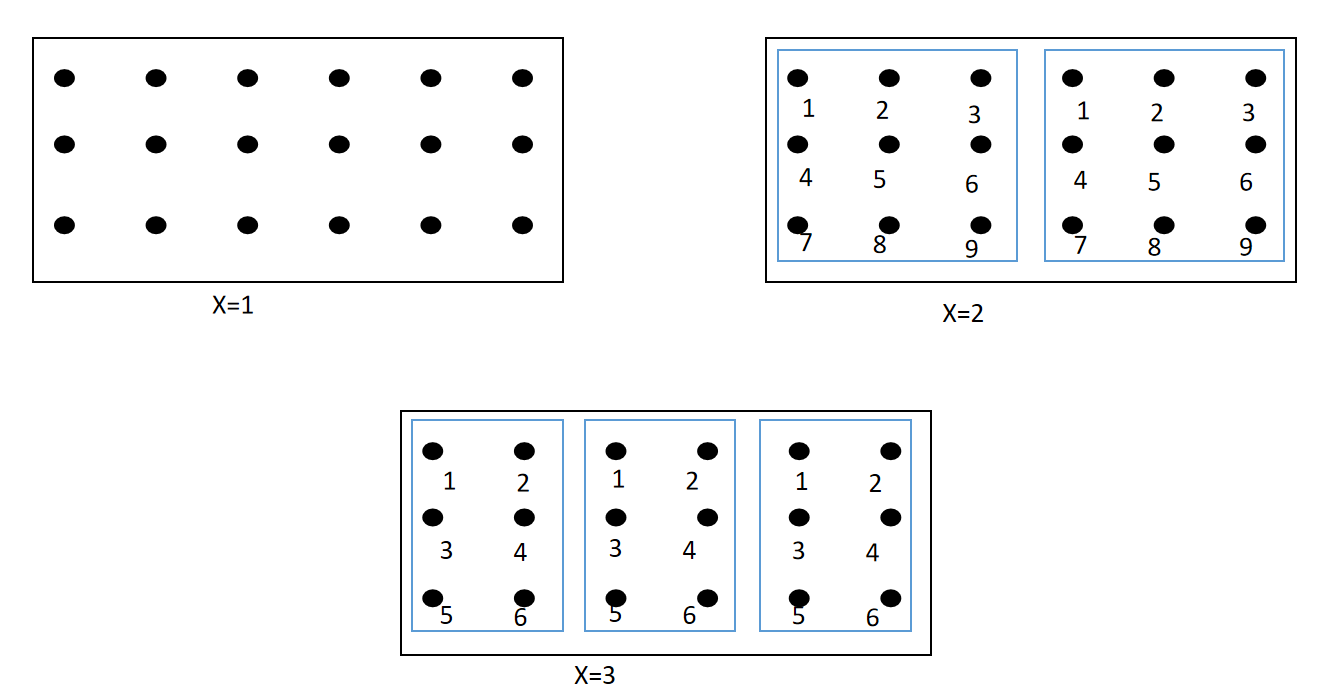
* when A-IoT reader as victim, the scaling factor is suggested as below to compensate different aggressor and victim bandwidth when calculating inter-system interference.
* Scaling factor =
* FFS on whether to evaluate individual RB. (check whether this bullet can be removed).

## Topic 4-2: General parameters and layout

**Issue 4-2-1: Active rate of reader for D1T1**

It has been observed that the intra-system interference is very high for the 18 BS layout of D1T1. Some companies propose to reduce the number of active BS and the proposals are:

* Proposal 1 (Qualcomm): 50% active rate (9 reader)
* Proposal 2 (Huawei): For D1T1, Readers transmit round-robin as the baseline, and concurrent transmission is not considered for co-existence simulation. (1 reader)
* Proposal 3 (ZTE): further study the assumption of A-IoT BS activation within the indoor factory in D1T1 scenario.
* Proposal 4 (vivo): For D1T1, at least 1/3 readers are activated in one snapshot is assumed. (6 reader)
* Proposal 5 (Xiaomi): For D1T1, adopting 2 readers are activated in one drop as the starting point to reduce the inter-system interference due to all reader are activated. (2 reader)
* Proposal 6 (CMCC): the activation ratio of topology 1 reader is suggested as below:
  + Divide all 18 readers into X blocks, 1 reader per block are activated simultaneously. Noted: we need to order the reader in each block, the reader that is located in the same relative location in each block would be blocked as the same index. only the reader with the same order index will be activated simultaneously.
  + X could be 1, 2, 3, if there is no consensus of X value, X could be based on companies report.

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**Issue 4-2-2: Active rate of reader for D2T2**

The similar observation of intra-system interference as issue X-X-X is also observed for D2T2. The proposed active rate for intermediate UE for D2T2 are:

* Proposal 1 (Qualcomm): 1 or 2 UE at each drop should be used for the D2T2 coexistence study.
* Proposal 2 (Xiaomi, vivo, CMCC): For D2T2, adopting Option 1 (2 UE at one drop) as the starting point for the later simulation.

**Recommended WF:**

It is recommended that:

* Randomly choose 2 intermediate UEs simultaneously for D2T2 for formal simulation.

**Tentative agreement for active rate of readers for D1T1 and D2T2:**

* ~~1 reader is activated in one drop~~
* ~~2 readers are activated in one drop, 1 reader per block are activated simultaneously~~
* ~~Active reader number depending on minimum distance between active readers~~
* Minimum distance between active readers: 60m, other values can be reported by other companies.

- 2 readers are activated in one drop, companies can use larger values

**Issue 4-2-3: Indoor UE percentage for scenario option 1-2**

**Agreements in RAN4#111:**

For scenario option 1-2, uniformly distributed, 80% indoor, 20% outdoor

**Proposals in RAN4#112:**

Proposal 1 (CMCC): for calibration purpose, 80% legacy indoor UE are unifrom distributed in the same factory/office as A-IoT system, i.e. there is no penetration loss between A-IoT system and legacy indoor UE.

Proposal 2 (vivo): it is suggested to modify the NR UE indoor ratio from 80% to 10%

Proposal 3 (Spreadtrum): 20% legacy indoor UE and 80% legacy outdoor UE in formal simulation.

Proposal 4 (Qualcomm): uniformly distributed, 100% indoor.

**Tentative agreement:**

* Choose two options for co-existence evaluation for NR UE indoor ratio:
  + Option 1: 10%
  + Option 2: 100%

**Issue 4-2-4: transmission bandwidth of R2D**

**Agreements in RAN4#111:**

|  |  |
| --- | --- |
| Channel BW for AIOT | DL: 180kHz with 15KHz SCS  UL: 15KHz or 180KHz |

**Proposals in RAN4#112:**

Proposal 1 (Huawei): 180KHz

Proposal 2 (ZTE): for the transmission bandwidth of R2D signal, propose to use 720KHz transmission bandwidth for formal evaluation.

**Tentative agreement:**

R2D: 180KHz for formal simulation.

**Issue 4-2-5: Minimum NR BS-NR UE distance (2D)**

**Agreements in RAN4#111:**

Minimum NR BS – NR UE distance (2D): 35 m

**Proposal in RAN4#112:**

Proposal (Ericsson): Use MCL of 70 dB for Minimum NR BS – NR UE distance setting in coexisting simulation.

**Tentative agreement:**

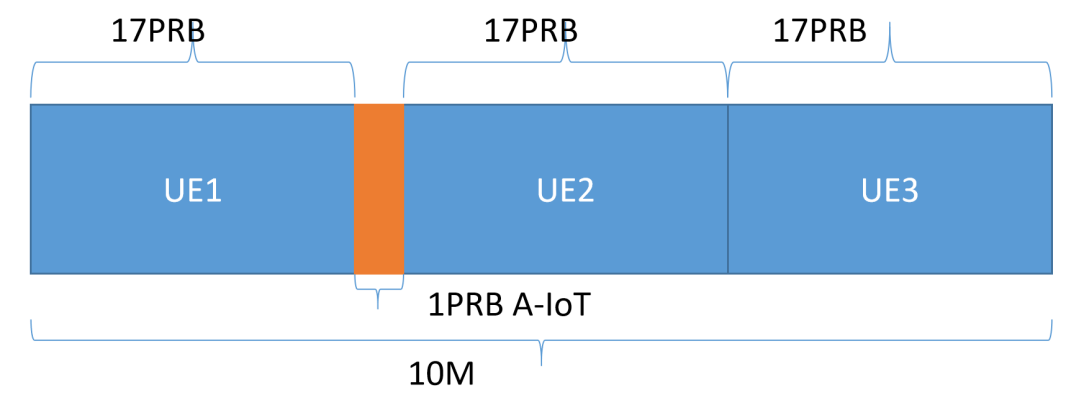
For formal simulation:

* Use MCL of 70 dB for Minimum NR BS – NR UE distance

**Issue 4-2-6: NR RB allocation**

|  |
| --- |
| **Agreements in RAN4#111:**  NR UE number:  - DL active UE: 1 UE per cell  - UL active UE: 3UE per cell |

* **Tentative agreement:**
* For RB allocation, each UE is scheduled with 17PRB and A-IoT using 1PRB is located between the most two UEs. Detailed illustration is listed as below:



**Issue 4-2-7: Penetration loss for O2I**

Following is already used for calibration:

* Use the equation of 7.4-2 in 38.901
* PLin = 0.5 \* d2D-in where d2D-in is the distance to nearest factory/office boundary on the line between Tx and Rx point.

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In this meeting, CMCC propose to set the max value of d2D-in as 25m, since if there is no upper bound limitation of d2D-in, the received power from NR macro gNB to existing UE would be low

**Tentative agreement:**

* Use the equation of 7.4-2 in 38.901
* PLin = 0.5 \* d2D-in where d2D-in is the distance to nearest factory/office boundary on the line between Tx and Rx point.
* Check whether to set maximum value of d2D-in as [25m]

**Issue 4-2-8: Pathloss**

**Tentative agreement:** Following pathloss is used for calibration. It is recommended to reuse for formal simulation

|  |  |  |
| --- | --- | --- |
|  | **D1T1** | **D2T2** |
| Indoor legacy UE <-> indoor device | Indoor office | |
|  |  | |
| Indoor legacy UE <-> indoor reader | Indoor factory DH | Indoor office |
| Outdoor macro gNB <-> indoor device/indoor reader | PLb: Uma | |
| Outdoor UE <-> indoor device/ D2T2 UE, i.e. UE<->UE | PLb: Umi | |
| Outdoor UE <-> indoor D1T1 reader, i.e. UE<-> reader | PLb: UMi | |
| Note: For other indoor factory related parameters that are not listed, it’s suggested to refer to 7.8.4 of TR 38.901. | | |

## Topic 4-3: Parameters for AIOT BS/intermedaite UE and device

**Issue 4-3-1: AIOT micro-BS parameters for D1T1**

**Tentative agreement:**Following parameters are used for calibration. It is recommended to reuse for formal simulation

|  |  |
| --- | --- |
| **A-IoT micro BS parameters** | **Values for calibration purposes** |
| A-IoT micro-BS total Tx power | 33dBm |
| A-IoT micro-BS receiver Noise Figure（dB） | 10 |
| A-IoT micro-BS antenna gain (dBi) | 6 dBi |
| Antenna pattern | Antenna Array Geometry：   * 1\*1\*1 antenna element * equals to omni-directional antenna pattern in GCG in horizontal   图示, 示意图  描述已自动生成   |  |  | | --- | --- | | **Parameter** | **Assumption** | | Antenna pattern (horizontal) | ,  = 90°, *Am* = 15 dB | | Antenna pattern (vertical) | ,  = 90°, *SLAv* = 15 dB | | Combining method in 3D antenna pattern |  | | BS antenna gain (dBi) (including feeder loss) | 6 | |

**Issue 4-3-2: Intermediate UE parameters for D2T2**

**Tentative agreement:**Following parameters are used for calibration. It is recommended to reuse for formal simulation.

|  |  |
| --- | --- |
| **intermediate UE parameters** | **Values for calibration purposes** |
| intermediate UE total Tx power（dBm） | 23dBm |
| gain of antenna intermediate UE (dBi) | 0 |
| intermediate UE receiver Noise Figure（dB） | 9 |
| Antenna configuration | Omni direction antenna |

## Topic 4-4: Paramters for legacy NR

**Issue 4-4-1: NR macro BS parameters**

**Tentative agreement:** Following pathloss is used for calibration. It is recommended to reuse for formal simulation

|  |  |
| --- | --- |
| **NR macro-BS Parameter** | **Values for calibration purposes** |
| Macro-BS Tx power (dBm) | 46 |
| BS antenna gain (dBi) and antenna pattern | Antenna Array Geometry：   * 1\*1\*1 antenna element * BS point at fixed beam direction   + vertical: θtilt + 90°   + horizontal: 0, 120, 240 °      |  |  | | --- | --- | | **Parameter** | **Assumption** | | Antenna pattern (horizontal)  (For 3-sector cell sites with fixed antenna patterns) | = 65 degrees, *Am* = 25 dB | | | Antenna pattern (vertical)  (For 3-sector cell sites with fixed antenna patterns) | = 10 degrees, *SLAv* = 25 dB, = 9 degrees | | | Combining method in 3D antenna pattern |  | | | BS antenna gain (dBi) (including feeder loss) | 15 | | |
| Height of macro NR BS (m) | 25 |
| NR Macro-BS Noise Figure(dB) | 5 |
| Network location | outdoor |

**Issue 4-4-2: NR UE parameters**

**Tentative agreement:** Following parameters are used for calibration. It is recommended to reuse for formal simulation

|  |  |
| --- | --- |
| **NR UE Parameter** | **Values for calibration purposes** |
| UE TX power in dBm | -40 to 23 |
| NR UE Antenna gain (dBi) | 0 |
| Height of UE antenna (m) | 1.5 |
| NR UE ACLR（dB） | 30 |
| NR UE Noise Figure（dB） | 9 |
| Antenna configuration | Omni direction antenna |

## Topic 4-5: Paramters for CW

**Issue 4-5-1: Other CW parameters**

**Tentative agreement:**Following parameters are used for formal simulation.

|  |  |  |
| --- | --- | --- |
| **CW parameters** | **D1T1** | **D2T2** |
| Tx power（dBm） | If UL spectrum is used, UE Tx power is assumed, i.e. 23dB  If DL spectrum is used, AIOT micro-BS Tx power is assumed. | Inter-mediate UE Tx power is assumed. |
| Antenna gain | Same as AIOT reader | Same as inter-mediate UE |

# [132] Topic #1: A-IoT System Parameters

### Issue 1-1: System parameter

Agreement in RAN4#111

* RAN4 will define the D2R and/or R2D channel bandwidth and operating bands for A-IoT
  + Wait for the conclusions from other WGs to discuss the detailed parameters.
  + FFS on whether to have the same or different channel bandwidths for devices, BS and intermediate node
* Proposals:
  + define one unified set of system parameter for A-IoT BS, A-IoT intermediate UE and devices. (R4-2411768, CMCC)
* **Tentative agreement:**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **System parameter for A-IoT** | | | | **Whether requirements are needed or not** |
| System parameter | Operating band | | Band n8 as example band |  |
| Channel bandwidth | Transmission bandwidth configuration | NA (R4-2411768, CMCC) | FFS |
| channel bandwidth | Standalone: 5MHz bandwidth is enough based on current assumed data rate and modulation scheme.  In-band/ guard-band: may be needed. | Yes |
| Channel arrangement | Channel spacing | Standalone： Applicable  In-band/ Guard-band：NA | FFS |
| Channel raster | Standalone/ In-band：Applicable (R4-2411768, CMCC)  Guard-band：NA （R4-2411768, CMCC)  If needed, reuse the enhanced channel raster (i.e. 10 kHz)（R4-2413282, Huawei） | FFS |
| Synchronization raster | NA | NA |
| ~~Minimum receiver bandwidth~~ | | ~~Discuss whether needed considering the spectrum of backscattering signal（R4-2408093, vivo）~~ |  |
| Guard band/Guard RB | | discuss whether any guard band is needed or not (R4-2411768, CMCC) | NA  Note: Guard band/RB can be considered as part of RF requirements and/or test cases |

# [132] Topic #2: A-IoT BS

### Issue 2-2: A-IoT BS class and BS type

* Proposals:
  + Proposal 1: Use micro cell type/MR BS as baseline but further discuss whether reader could support other BS class besides MR. (R4-2411769, CMCC)
  + Proposal 2: 1/C and 1/H
    - Option 1: focus on 1-C reader BS type at first and further discuss the necessity of 1-H reader BS type. (R4-2411769, CMCC)
    - Option 2: define BS type 1-C for Ambient-IoT indoor scenarios. （R4-2413282, Huawei）
* **Tentative agreement:** 
  + BS class: Use Micro-BS as baseline in SI stage (reference to SID RP-240826).
  + BS type: Priority A-IoT BS type 1-C, FFS for 1-H.

### Issue 2-4: TX

Agreement in RAN4#111:

* Use the following table as starting point for RF requirements impact study. The table is for information.

|  |  |  |  |
| --- | --- | --- | --- |
| **RF Requirement for A-IoT BS- TX part** | | | |
| TX requirement | Transmit output power | Maximum output power |  |
| Output power dynamic | |  |
| Transmit ON/OFF power | |  |
| Transmission times | |  |
| Transmit signal quality | Frequency error |  |
| EVM |  |
| TAE |  |
| Unwanted emissions | Occupied bandwidth |  |
| SEM |  |
| ACLR |  |
| Operating band unwanted emissions |  |
| Transmitter spurious emissions |  |
| Transmitter intermodulation | |  |

* Proposals:
  + OFDM based transmitter should be baseline for R2D. (R4-2412968, Ericsson)
* **Tentative agreement:**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **RF Requirement for A-IoT BS- TX part** | | | | | **Whether requirements are needed or not?** |
| TX requirement | Base station output power | | | Option 1: MR A-IoT BS reuse current transmit output power and max output power of 1-C MR BS. (R4-2411769, CMCC; R4-2413282, Huawei)  Option 2: To follow the FR1 MR and LA BS output power limitation and power accuracy requirement; (R4-2412698, ZTE)  Requirement necessary（R4-2411084, CATT） | YES |
| Output power dynamic | | RE power control dynamic range | Option 1: NA. The power boosting for BS support both Ambient IOT and NR can be discussed in future release. (R4-2413282, Huawei）  Option 2: define power boosting for OOK signal might be needed for in-band/guard band operation for hardware share; (R4-2412698, ZTE; R4-2412065, vivo; R4-2411769, CMCC) | FFS |
| Total power dynamic range | need to be updated accordingly based on conclusion of channel bandwidth and SCS. (R4-2411769, CMCC)  FFS（R4-2411084，CATT） | FFS |
| Some requirements like Transmit ON/OFF power | | | Option1: some transition period might be needed for the switch between R2D signal transmission and CW transmission in D1T1-A1 and D1T1-A2. (R4-2412698, ZTE)  Option 2: It is a TDD requirements and not applicable to Ambient IOT BS. (R4-2413282, Huawei） | FFS |
| Transmitter transient period | | | Requirement necessary（R4-2411084, CATT）  define transient period related requirements for A-IoT reader. Details value can refer to RFID rise/fall time. (R4-2411769, CMCC)  RAN4 further discuss whether settling time as defined in RFID spec is needed or not to evaluate RF envelop ripple characteristics. (R4-2411769, CMCC) | FFS |
| Transmission times (requirements from RF ID reader) | | | Not applicable. (R4-2413282, Huawei） | NA |
| ~~Transmit signal quality~~ | | | ~~define RF envelope mask as the transmit signal quality requirement. (R4-2413282, Huawei）~~ | ~~YES~~ |
| Transmit signal quality | Frequency error | | Requirement necessary（R4-2411084, CATT）  Reused from NR BS (R4-2413282, Huawei; R4-2412698, ZTE, R4-2411769, CMCC） | YES |
| Some requirements like EVM | | Requirement necessary（R4-2411084, CATT）  refer to RFID RF envelop related parameters to define signal transmission quality requirement, such as:   1. modulation depth, RF envelop ripple, RF plusewidth. (R4-2411769, CMCC) 2. RF envelope mask (R4-2413282, Huawei） 3. power stability or power accuracy for OOK ON signal and OOK OFF signal, power difference between OOK ON and OOK OFF (R4-2412698, ZTE) | YES |
| TAE | | Not needed for R2D signal transmission or CW signal transmission. （R4-2411084,CATT; R4-2412698, ZTE, R4-2413282, Huawei; R4-2411085, CATT） | NA |
| Unwanted emissions | Occupied bandwidth | | Requirement necessary（R4-2411084, CATT）  The legacy OBW requirement could be reused for A-IoT BS (R4-2412698, ZTE) | YES |
| ACLR | | Depends on co-existence study (R4-2412698, ZTE; R4-2413282, Huawei ; R4-2412968, Ericsson; R4-2411084, CATT) | YES |
| IBE | | if finally approve that A-IoT reader support multiple-RAT, IBE equivalent requirement needs to be defined. (R4-2411769, CMCC) | FFS |
| Operating band unwanted emissions | | depends on coexistence study (R4-2412698, ZTE; R4-2411769, CMCC; R4-2411084, CATT; R4-2413282, Huawei) | YES |
| Transmitter spurious emissions | | Requirement necessary（R4-2411084, CATT）  Existing spurious emission requirement is applicable (R4-2413282, Huawei; R4-2412698, ZTE; R4-2411769, CMCC） | YES |
| Transmitter intermodulation | | | For 900M: not needed (R4-2413282, Huawei; R4-2412698, ZTE）  For 2GHz: FFS (R4-2412698, ZTE)  FFS（R4-2411084，CATT） | FFS |