3GPP TSG-RAN WG4 Meeting #116bis R4-2514438

**Prague, Czech Republic, Oct. 13-17,** 2025

**Agenda item:** 6.14.1

**Source:** Moderator (CMCC)

**Title:** Topic summary for [116bis][315] A-IoT\_device

**Document for:** Information

# Introduction

This topic summary includes RRM performance requirements for device 1 (6.14.3), Demodulation performance requirements for device 1 (6.14.4) and Demodulation performance requirements for Ambient-IoT BS (6.14.5) for solutions for ambient IoT (Internet of Things) in NR.

*List of candidate target of discussions for this topic.*

* Mainly discuss on
	+ Issue 1-1-1, 1-1-2, 2-1-1, 3-1-1

# Topic #1: RRM performance requirements for device 1 (6.14.3)

## Companies’ contributions summary

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| **T-doc number** | **Company** | **Proposals / Observations** |
| **[R4-2513222](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_116bis/Docs/R4-2513222.zip)** | CATT | **Observation 1: It is reasonable to assume that UE meets RACH and UL timing requirements if UE passes RF and Demod tests.****Proposal 1: RAN4 do not define dedicated RRM test cases for A-IoT device 1.**  |
| **[R4-2513447](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_116bis/Docs/R4-2513447.zip)** | Xiaomi | **Observation 1: The performance impact due to D2R transmit timing error (e.g. SFO) can be reflected by the demod test.*****Proposal 1: RAN4 can define a single D2R transmit timing test cases for both demod and RRM .*****Observation 2: Whether the testing for AIoT random access is failure or not is upon the reader reception.*****Proposal 2: RAN4 can define the dedicated RRM test cases for AIoT random access.******Proposal 3: The common testing configuration for Rel19 AIoT RRM test cases can be defined as:**** ***SCS = 15KHz***
* ***BW =[180kHz]***
* ***Device 1 only***
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| **[R4-2513668](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_116bis/Docs/R4-2513668.zip)** | CMCC | ***Proposal 1: it is proposed to discuss whether to define test for TD2R\_min, which is about device processing time between D2R transmission and R2D reception.******Proposal 2: it is preferred to define dedicated RRM test to verify RRM requirements.******Proposal 3: For RACH, the transmit timing is verified by the device D2R transmission, and the test equipment will verify that the timing of the device is within a period of the end the corresponding R2D transmission triggering random access, where the period is related with*** $T\_{R\rightarrow D}$***and timing error due to SFO.*** |
| **[R4-2513709](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_116bis/Docs/R4-2513709.zip)** | vivo | **Proposal 1: RAN4 to define one test case for CBRA and the D2R timing error requirements are verified in the same test case.****Proposal 2: RRM test case is performed based on the test procedures for sensitivity, and the RRM test is only performed at peak direction.****Proposal 3: Take following test procedure and test requirements as baseline.*** **TE sends paging A-IoT Paging message with access type as CBRA, with Paging ID absence.**
	+ **Number of Access Occasions is configured as 2 or 4 to limit the test time.**
	+ **Time Resource Indication and Frequency Resource Indication is configured as 1.**
* **Device shall select one access occasion accordingly and transmit Access Random ID and the timing error shall be verified at the same time.**
* **TE monitors occasions whether there is Access Random ID reflected by device, and transmit Access trigger message is there is no Access Random ID detected, until and Access Random ID is detected or the all-access occasions has passed.**
* **If an Access Random ID is received, TE transmits Random ID Response which is identical to Access Random ID.**
* **Device shall transmit D2R Upper Layer Data Transfer and the timing error shall be verified at the same time.**
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| **[R4-2514058](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_116bis/Docs/R4-2514058.zip)** | Ericsson | **Proposal 1: RRM tests, if agreed, are performed in OTA.****Proposal 2: RAN4 to define dedicated RRM tests.****Proposal 3: Support Option 4:*** **For RACH, the transmit timing is verified by the device D2R transmission, and the test equipment will verify that the timing of the device is within a period of the end the corresponding R2D transmission triggering random access, where the period is related with Toffset1 /Toffset2/Toffset3/Toffset4 and timing error due to SFO.**
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| **[R4-2514094](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_116bis/Docs/R4-2514094.zip)** | ZTECorporation,Sanechips | **Proposal 1: For device transmit timing, the following test cases shall be considered:**1. **For CBRA:**

MSG1 X=1, Toffset1;MSG1 X=2. Toffset1+Toffset2.Except for MSG1 and MSG3, Toffset4.1. **For CFRA:**

First D2R transmission.1. **For TD2R\_min**

**Proposal 2: RAN4 shall define test cases one by one for the whole CBRA procedure and CFRA procedure.** |
| **[R4-2514177](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_116bis/Docs/R4-2514177.zip)** | Huawei, HiSilicon | **Proposal 1: RAN4 does not define dedicated RRM test case for random access.** **Proposal 2: RAN4 to define a dedicated RRM test case for transmit timing using CFA procedure. The FRCs from RF session for refsens test can be re-used as much as possible.** |

## Open issues summary

*Before f2f meeting, moderators shall summarize list of open issues, candidate options and possible WF (if applicable) based on companies’ contributions..*

###  Sub-topic 1-1: RRM performance requirements for device 1

*Open issues and candidate options before meeting:*

#### **Issue 1-1-1: Test case for TD2R\_min**

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| **Background****RAN1 agreements on TD2R\_min**AgreementA device is not required to monitor a corresponding R2D transmission earlier than TD2R\_min after the end of a D2R transmission from the device. It is up to RAN4 to define the value(s) for TD2R\_min.* Note: RAN1 expects that the value(s) for TD2R\_min will be defined in RAN4 specifications

**RAN4 agreements on TD2R\_min**Agreement:* The value of TD2R\_min is max {3\* TD2R\_chip, 10 us}, where TD2R\_chip is the chip length of D2R transmission
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* Proposals from companies:
	+ Option 1 (CMCC): it is proposed to discuss whether to define test for TD2R\_min, which is about device processing time between D2R transmission and R2D reception.
	+ Option 2 (ZTE): define test case for TD2R\_min.
* Recommended WF
	+ [Moderator]:
		- Discuss whether to define test case for TD2R\_min

#### **Issue 1-1-2: How to define RRM test cases**

* Proposals from companies:
	+ Option 1 (CATT): RAN4 do not define dedicated RRM test cases for A-IoT device 1
	+ Option 2 (ZTE, Xioami, CMCC, vivo, Ericsson, vivo, Huawei, HiSilicon): RAN4 define dedicated RRM test cases for A-IoT device 1
		- Option 2a (ZTE)
			* For device transmit timing, the following test cases shall be considered:

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| 1. **For CBRA:**

MSG1 X=1, Toffset1;MSG1 X=2. Toffset1+Toffset2.Except for MSG1 and MSG3, Toffset4.1. **For CFRA:**

First D2R transmission.1. **For TD2R\_min**
 |

* + - * RAN4 shall define test cases one by one for the whole CBRA procedure and CFRA procedure.
		- Option 2b (Xiaomi):
			* RAN4 can define a single D2R transmit timing test cases for both demod and RRM
			* RAN4 can define the dedicated RRM test cases for AIoT random access.
		- Option 2c (CMCC, Ericsson): For RACH, the transmit timing is verified by the device D2R transmission, and the test equipment will verify that the timing of the device is within a period of the end the corresponding R2D transmission triggering random access, where the period is related with Toffset1 /Toffset2/Toffset3/Toffset4 and timing error due to SFO
		- Option 2d (vivo): RAN4 to define one test case for CBRA and the D2R timing error requirements are verified in the same test case
		- Option 2f (Huawei, HiSilicon):
			* RAN4 does not define dedicated RRM test case for random access.
			* RAN4 to define a dedicated RRM test case for transmit timing using CFA procedure. The FRCs from RF session for refsens test can be re-used as much as possible.
* Recommended WF
	+ [Moderator]:
		- To check whether following suggestion is agreeable
			* RAN4 define dedicated RRM test cases for A-IoT device 1, but the number of test cases should be minimized to keep the low test cost
				+ Define a dedicated RRM test case, transmit timing requirements and RA procedure are tested in the same test

#### **Issue 1-1-3: Test configuration/procedure**

* Proposals from companies:
	+ Option 1 (Xiaomi)
		- The common testing configuration for Rel19 AIoT RRM test cases can be defined as:
		- SCS = 15KHz
		- BW =[180kHz]
		- Device 1 only
	+ Option 2 (CMCC, Ericsson):
		- For RACH, the transmit timing is verified by the device D2R transmission, and the test equipment will verify that the timing of the device is within a period of the end the corresponding R2D transmission triggering random access, where the period is related with Toffset1 /Toffset2/Toffset3/Toffset4 and timing error due to SFO
	+ Option 3 (vivo)
* RRM test case is performed based on the test procedures for sensitivity, and the RRM test is only performed at peak direction.
* Take following test procedure and test requirements as baseline.
* TE sends paging A-IoT Paging message with access type as CBRA, with Paging ID absence.
* Number of Access Occasions is configured as 2 or 4 to limit the test time.
* Time Resource Indication and Frequency Resource Indication is configured as 1.
* Device shall select one access occasion accordingly and transmit Access Random ID and the timing error shall be verified at the same time.
* TE monitors occasions whether there is Access Random ID reflected by device, and transmit Access trigger message is there is no Access Random ID detected, until and Access Random ID is detected or the all-access occasions has passed.
* If an Access Random ID is received, TE transmits Random ID Response which is identical to Access Random ID.
* Device shall transmit D2R Upper Layer Data Transfer and the timing error shall be verified at the same time.
	+ Option 4 (Huawei, HiSilicon)
		- RAN4 to define a dedicated RRM test case for transmit timing using CFA procedure. The FRCs from RF session for refsens test can be re-used as much as possible
* Recommended WF
	+ [Moderator]:
		- To check whether following suggestion is agreeable
			* In high level, take the test procedures/FRCs for sensitivity from RF session as baseline
			* FFS which RA procedure is in use
				+ CBRA
				+ CFRA

# Topic #2: Demodulation performance requirements for device 1 (6.14.4)

## Companies’ contributions summary

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| **T-doc number** | **Company** | **Proposals / Observations** |
| **[R4-2513398](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_116bis/Docs/R4-2513398.zip)** | Samsung | **FFS to define the PRDCH demodulation requirements** **Observation 1: From the test procedure and test metric perspective, the same test up was applied for both RF REFSENS testing and demodulation requirement testing.****Proposal 1: RAN4 can consider define PRDCH demodulation requirement targeting high data rates****Test Methodology****Proposal 2: RAN4 can consider the message 0 to test A-IoT device demodulation requirement****Specification structure****Proposal 3: RAN4 specifies the corresponding Ambient IoT device demodulation requirement into 38.191. And captured the demodulation requirements into the clause 10 of 38.191****M value** **Observation 2: The value of M will impact on the length of R2D chip duration, R2D postamble related operation, CP handling and minimum** Btx,R2D # of PRBs**Proposal 4: RAN4 can consider M as 24 for specifying PRDCH requirement. And the same M value is applied for CAP and PRDCH transmission** **TBS****Proposal 5: RAN4 should further discuss the number of TBS used for defining PRDCH demodulation requirement. The value of TBS as 96 can be considered as starting point** **Channel Bandwidth****Proposal 6: Considering the number of PRB as 3 for starting point when defining PRDCH requirement. FFS on other transmission bandwidth if other M-value will be considered****Channel Model** **Proposal 7: RAN4 can consider the TDLA30-10 channel for defining the A-IoT device demodulation requirement if the feasibility to emulated TDL channel in the chamber for Device 1 testing is confirmed from TE vendors** |
| **[R4-2513435](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_116bis/Docs/R4-2513435.zip)** | Huawei,HiSilicon | Proposal 1: RAN4 to not define PRDCH demodulation requirements for Ambient-IoT.If RAN4 agrees to define the related PRDCH demodulation requirements for device, we have the following considerations on the test setup: Proposal 2: RAN4 to consider message 2 and 3 and use following formular for test methodology $$BLER=1− \frac{Number of responsed Message 3}{Number of transmitted Message 2 }$$Proposal 3: RAN4 to consider 96 bits TBSProposal 4: Use M=24Proposal 5: Use TDLA30-10Proposal 6: RAN4 to choose 3PRBs. |
| **[R4-2513667](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_116bis/Docs/R4-2513667.zip)** | CMCC | ***Proposal 1: it is proposed to define PRDCH demodulation requirements for Ambient-IoT device to guarantee the performance.******Proposal 2: no need to consider both*** $BLER=1− \frac{Number of responsed Message 1}{Number of transmitted Message 0 }$ ***and*** $BLER=1− \frac{Number of responsed Message 3}{Number of transmitted Message 2 }$ ***, it is preferred to adopt*** $BLER=1− \frac{Number of responsed Message 1}{Number of transmitted Message 0 }$ ***.******Proposal 3: it is proposed to use M value of 24 to define PRDCH requirements.******Proposal 4: it is proposed to use 3 PRBs to define PRDCH requirements.******Proposal 5: it is proposed to adopt TDLA30-10 to define PRDCH requirements.*** ***Proposal 6: the demodulation requirements for A-IoT device is captured in clause 10 of TS 38.191.*** |
| **[R4-2513693](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_116bis/Docs/R4-2513693.zip)** | Qualcomm Incorporated | **Observation 1: The main difference between R2D reference sensitivity and demodulation requirements testing for PRDCH is whether fading channel, e.g., TDLA, is emulated.****Observation 2: With the current TRP and TRS test setup, it is challenging to add channel emulator to generate TDL-A fading channel.** **Observation 3: The fading channel condition could differ across devices. This inconsistency poses a challenge that must be addressed if the fading channel is to be used for PRDCH demodulation requirements testing.****Observation 4: Feasibility of applying ‘wireless cable’ approach to PRDCH demodulation testing is unclear and the test procedure would be very complicated including finding the proper test direction, calculating the feasible SNR range, etc., which is not proper for low-cost AIoT device testing.****Proposal 1: RAN4 do NOT specify PRDCH demodulation requirement for device 1 in Rel-19.** |
| **[R4-2513977](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_116bis/Docs/R4-2513977.zip)** | Ericsson | Observations:[Observation 1: A-IoT Device 1 RF Rx REFSENS requirement is set to achieve 10% BLER of PRDCH.](#_Toc210407931)[Observation 2: A-IoT Device 1 RF requirements are performed OTA.](#_Toc210407932)[Observation 3: Rel-19 A-IoT assumes Device 1 is used indoors with FR1 band n8.](#_Toc210407933)[Observation 4: Device 1 RF Rx REFSENS requirements can verify the functionality of PRDCH reception.](#_Toc210407934)Proposals:[Proposal 1: RAN4 does not define PRDCH demodulation requirements in Rel-19 Ambient-IoT WI.](#_Toc210407935) |

## Open issues summary

*Before f2f meeting, moderators shall summarize list of open issues, candidate options and possible WF (if applicable) based on companies’ contributions..*

###  Sub-topic 2-1: Whether to define PRDCH demodulation requirements for device 1

#### **Issue 2-1-1: Whether to define PRDCH demodulation requirements**

* Proposals from companies:
	+ Option 1 (Samsung, CMCC): RAN4 can consider define PRDCH demodulation requirement targeting high data rates
	+ Option 2 (Huawei, HiSilicon, Qualcomm, Ericsson): RAN4 to not define PRDCH demodulation requirements for Ambient-IoT.
* Recommended WF
	+ [Moderator]:
		- Further discuss above two options

###  Sub-topic 2-2: If it is agreed to define PRDCH demodulation requirements for device 1, how to define PRDCH demodulation requirements

#### **Issue 2-2-1: Test methodology**

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| **Agreements in last meeting (R4-2512603)****Issue 2-2: Test methodology*** Agreement
* 10% BLER with $BLER=1− \frac{Number of responsed Message 1}{Number of transmitted Message 0 }$ or $BLER=1− \frac{Number of responsed Message 3}{Number of transmitted Message 2 }$

for testing* + During countering the number of responded Message 1 or 3, the TE should check if the responded Message 1 or Message 3 is the correct response of Message 0 or Message 2 by checking the device ID
	+ Further discuss the message type to be tested
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* Proposals from companies:
	+ Option 1 (Samsung, CMCC):
		- RAN4 to consider the message 0 to test A-IoT device demodulation requirement

$$BLER=1− \frac{Number of responsed Message 1}{Number of transmitted Message 0 }$$

* + Option 2 (Huawei, HiSilicon):
		- RAN4 to consider message 2 and 3 and use following formular for test methodology

$$BLER=1− \frac{Number of responsed Message 3}{Number of transmitted Message 2 }$$

* Recommended WF
	+ [Moderator]:
		- If it is agreed to define PRDCH demodulation requirements for device 1, further discuss above two options

#### **Issue 2-2-2: TBS**

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| **Agreements in last meeting (R4-2512603)****Issue 2-7: TBS*** Way forward
* Option 1: 20 bits
* Option 2: 96 bits
* Other options are not precluded
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* Proposals from companies:
	+ Option 1 (Samsung, Huawei, HiSilicon): 96 bits TBS
* Recommended WF
	+ [Moderator]:
		- If it is agreed to define PRDCH demodulation requirements for device 1, use 96 bits TBS

#### **Issue 2-2-3: M value**

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| **Agreements in last meeting (R4-2512603)****Issue 2-10: M-chips for OOK*** Way forward
	+ Option 1: 6
	+ Option 2: 24
	+ Other options are not precluded
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* Proposals from companies:
	+ Option 1 (Samsung, Huawei, HiSilicon, CMCC): M=24
* Recommended WF
	+ [Moderator]:
		- If it is agreed to define PRDCH demodulation requirements for device 1, use M=24

#### **Issue 2-2-4: Channel Bandwidth**

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| **Agreements in last meeting (R4-2512603)****Issue 2-12: Channel Bandwidth*** Way forward
	+ Option 1: 2 PRBs
	+ Option 2: 3 PRBs
	+ Other options are not precluded
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* Proposals from companies:
	+ Option 1 (Samsung, Huawei, HiSilicon, CMCC): 3PRBs
* Recommended WF
	+ [Moderator]:
		- If it is agreed to define PRDCH demodulation requirements for device 1, use 3PRBs

#### **Issue 2-2-5: Channel model**

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| **Agreements in last meeting (R4-2512603)****Issue 2-13: Channel model*** Way forward
	+ Option 1: TDLA30-10
	+ Other options are not precluded
	+ TE vendors are encouraged to check the feasibility to emulate TDL channel in the chamber for Device 1 testing
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* Proposals from companies:
	+ Option 1 (Samsung, Huawei, HiSilicon, CMCC): RAN4 can consider the TDLA30-10 channel for defining the A-IoT device demodulation requirement if the feasibility to emulated TDL channel in the chamber for Device 1 testing is confirmed from TE vendors
* Recommended WF
	+ [Moderator]:
		- If it is agreed to define PRDCH demodulation requirements for device 1, RAN4 can consider the TDLA30-10 channel for defining the A-IoT device demodulation requirement if the feasibility to emulated TDL channel in the chamber for Device 1 testing is confirmed from TE vendors

#### **Issue 2-2-6: Specification structure**

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| **Agreements in last meeting (R4-2512603)****Issue 2-14: Specification structure (if specified)*** Way forward
	+ Option 1: RAN4 should specify the Ambient IoT device demodulation requirements in “Ambient IoT device radio transmission and reception”
	+ Option 2: The demodulation requirements can be captured in clause 10 of TS 38.191
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* Proposals from companies:
	+ Option 1 (Samsung, CMCC): RAN4 specifies the corresponding Ambient IoT device demodulation requirement into 38.191. And captured the demodulation requirements into the clause 10 of 38.191
* Recommended WF
	+ [Moderator]:
		- If it is agreed to define PRDCH demodulation requirements for device 1, the demodulation requirements for A-IoT device 1 are captured in clause 10 of TS 38.191.

# Topic #3: Demodulation performance requirements for Ambient-IoT BS (6.14.5)

## Companies’ contributions summary

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| **T-doc number** | **Company** | **Proposals / Observations** |
| **[R4-2513397](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_116bis/Docs/R4-2513397.zip)** | Samsung | **FFS to define PDRCH requirement** **Observation 1: From the test procedure perspective, CFA based random-access procedure was considered for testing with D2R message type as message 1****Observation 2: From the test configuration perspective, no repetition was configured.****Proposal 1: RAN4 could consider to define the PDRCH demodulation requirement** **Specification structure** **Proposal 2: RAN4 specifies the corresponding Ambient IoT BS demodulation requirement into 38.194 and Ambient IoT BS conformance testing into 38.195, separately. And captured the demodulation requirements into the clause of TS 38.194/195****Modulation** **Proposal 3: RAN4 should cover both BPSK and OOK modulation scheme when defining PDRCH requirement****Waveform****Proposal 4: Following the WID, RAN4 should consider the waveform with backscattering a carrier wave for defining PDRCH requirement, FFS on consider the unmodulated single tone CW for PDRCH requirement.****Block level Repetition****Proposal 5: RAN4 can consider block-level repetition at least as 2 when defining PDRCH requirement, FFS on considering block-level repetition as 1 for requirement** **D2R bandwidth****Observation 3: the D2R channel bandwidth is decided based on {Tb, Tc, R} and SFO assumption** **Proposal 6: Pending on the collusion of SFO assumption, RAN4 should further discuss how to select the proper CBW when defining PDRCH requirements****SFO assumption****Proposal 7: RAN4 can consider the SFO assumption with randomly selected a value from the range of [104 ppm~105 ppm] when defining PDRCH requirement** **Device sampling rate****Proposal 8: RAN4 could consider the device sampling rate as 1.92MHz for alignment, adding a note there is no restriction on AIoT device implementation.** **TBS****Proposal 9: RAN4 can consider the value of TBS as 96 as starting point when defining PDRCH requirement.****Channel Model** **Proposal 10: RAN4 consider TDLA30-10 channel for specifying PDRCH requirement.****Reader detection assumption** **Proposal 11: RAN4 consider the coherent receiver when specifying PDRCH requirement****D2R message type for testing****Proposal 12: RAN4 should consider the D2R message type as Message 3 for testing when defining the PDRCH requirement****D2R message structure for testing** **Proposal 13: RAN4 could consider long D2R transmission with midamble inserted with 31 bits Preamble and 31 bits Midamble when defining PDRCH requirements****Number of interval bits for D2R midamble insertion** **Proposal 14: RAN4 should discuss the value of interval bits for D2R midamble insertion. The value with 48 bits can be taken as starting point** |
| **[R4-2513434](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_116bis/Docs/R4-2513434.zip)** | Huawei,HiSilicon | Proposal 1: Define PDRCH demodulation requirementsProposal 2: RAN4 to configure 31 bits preamble and additional midamble **Proposal 3: The reader detection assumption should be up to BS implementation****Proposal 4: Consider OOK modulation** **Proposal 5: Prefer option 1, consider no repetition.****Proposal 6: Prefer 10% SFO and 1.92MHz device sampling rate.**Proposal 7: Define PDRCH demodulation requirements with message 3 reception.Proposal 8: Use TBS 96 bits.Proposal 9: Use TDLA30-10Proposal 10: Use ($T\_{chip}^{D2R}$, $T\_{bit}^{D2R}$,R=1)= ($133.33$, $66.67,$ R=1) as start point.Proposal 11: Don’t specify the test methodology for A-Iot BS demodulation test. |
| **[R4-2513666](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_116bis/Docs/R4-2513666.zip)** | CMCC | ***Proposal 1: it is proposed to define PDRCH demodulation requirements for Ambient-IoT BS to guarantee the performance.******Proposal 2: it is proposed to define PDRCH demodulation requirements with Message 1 reception. .******Proposal 3: for SFO assumption, it is proposed to use 104 ppm~105 ppm.******Proposal 4: it is proposed to adopt TDLA30-10 to define PDRCH requirements.*** ***Proposal 5: the demodulation requirements for Ambient IoT Base Station (BS) is captured in TS 38.194.*** |
| **[R4-2513978](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_116bis/Docs/R4-2513978.zip)** | Ericsson | Observations:[Observation 1: A-IoT BS RF Rx REFSENS requirement is set based on 10% BLER of PDRCH.](#_Toc210408122)[Observation 2: A-IoT Device 1 is stationary.](#_Toc210408123)Proposals:[Proposal 1: RAN4 does not define PDRCH demodulation requirements for Device 1 in Rel-19 Ambient-IoT WI.](#_Toc210408124) |
| **[R4-2514147](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_116bis/Docs/R4-2514147.zip)** | ZTE Corporation, Sanechips | ***Observation 1. The message 2 carries the data transmission from the device to the reader, including baseband processing functions, such as demodulation and decoding in reader side.*** ***Observation 2. A midamble is supported for clock synchronization and channel estimation.******Proposal 1. Propose to consider PDRCH demodulation requirements with message 3 reception.*** ***Propose 2. Propose to consider long D2R transmission with midamble inserted with 31 bits Preamble and 31 bits Midamble.******Propose 3. Propose to consider both BPSK and OOK modulation schemes.******Propose 4. Propose to consider unmodulated single tone waveform.*** ***Propose 5. Propose to consider 2 block level repetitions.******Propose 6. Propose to consider10^4 ppm~10^5 ppm for D2R link evaluation.*** |

## Open issues summary

*Before f2f meeting, moderators shall summarize list of open issues, candidate options and possible WF (if applicable) based on companies’ contributions..*

###  Sub-topic 3-1: Whether to define PDRCH demodulation requirements for Ambient-IoT BS

#### **Issue 3-1-1: Whether to define the PDRCH demodulation requirements**

* Proposals from companies:
	+ Option 1 (Samsung, Huawei, HiSilicon, CMCC): Define PDRCH demodulation requirements
	+ Option 2 (Ericsson): RAN4 does not define PDRCH demodulation requirements for Device 1 in Rel-19 Ambient-IoT WI.
* Recommended WF
	+ [Moderator]:
		- Further discuss above two options

###  Sub-topic 3-2: If it is agreed to define PDRCH demodulation requirements for Ambient-IoT BS, how to define PDRCH demodulation requirements

#### **Issue 3-2-0: Test methodology**

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| **Agreements in last meeting (R4-2512603)****Issue 3-16: Test methodology*** Agreement
* 10% BLER with $BLER=1− \frac{Number of responsed Message 2}{Number of transmitted Message 1 }$ for testing
	+ During countering the number of responded Message 2, the TE should check if the responded Message 2 is the correct response of Message 1.
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* Proposals from companies:
	+ Option 1 (Huawei, HiSilicon, ): Don’t specify the test methodology for A-Iot BS demodulation test.
* Recommended WF
	+ [Moderator]:
		- Check whether option 1 is agreeable

#### **Issue 3-2-1: D2R message type for testing**

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| **Agreements in last meeting (R4-2512603)****Issue 3-2: D2R message type for testing*** Way forward
	+ Option 1: Define PDRCH demodulation requirements with Message 1 reception
	+ Option 2: Define PDRCH demodulation requirements with Message 3 reception
 |

* Proposals from companies:
	+ Option 1 (Samsung, Huawei, HiSilicon, ZTE): Define PDRCH demodulation requirements with message 3 reception.
	+ Option 2 (CMCC): it is proposed to define PDRCH demodulation requirements with Message 1 reception
* Recommended WF
	+ [Moderator]:
		- Suggest to follow majority view to go with Option 1
			* Define PDRCH demodulation requirements with message 3 reception

#### **Issue 3-2-2: D2R message structure for testing**

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| **Agreements in last meeting (R4-2512603)****Issue 3-3: D2R message structure for testing*** Way forward
	+ Option 1: Short D2R transmission without midamble with 31 bits Preamble
	+ Option 2: Long D2R transmission with midamble inserted with 31 bits Preamble and 31 bits Midamble
	+ Other options are not precluded
 |

* Proposals from companies:
	+ Option 1 (Samsung, Huawei, HiSilicon, ZTE): RAN4 could consider long D2R transmission with midamble inserted with 31 bits Preamble and 31 bits Midamble when defining PDRCH requirements
* Recommended WF
	+ [Moderator]:
		- Companies’ views are aligned, to check whether following is agreeable
			* For PDRCH requirements definition, consider D2R transmission with midamble inserted, with 31 bits Preamble and 31 bits Midamble

#### **Issue 3-2-3: Reader detection assumption**

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| **Agreements in last meeting (R4-2512603)****Issue 3-4: Reader detection assumption*** Way forward
	+ Option 1: Coherence detection
	+ Other options are not precluded
 |

* Proposals from companies:
	+ Option 1 (Samsung): RAN4 consider the coherent receiver when specifying PDRCH requirement
	+ Option 2 (Huawei, HiSilicon): The reader detection assumption should be up to BS implementation
* Recommended WF
	+ [Moderator]:
		- For reader detection assumption, further discuss following options
			* Option 1: Coherent receiver
			* Option 2: Up to BS implementation

#### **Issue 3-2-3: Modulation**

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| **Agreements in last meeting (R4-2512603)****Issue 3-7: Modulation*** Way forward
	+ Option 1: Both BPSK and OOK modulation scheme
	+ Option 2: OOK modulation
 |

* Proposals from companies:
	+ Option 1 (Samsung): RAN4 should cover both BPSK and OOK modulation scheme when defining PDRCH requirement
	+ Option 2 (Huawei, HiSilicon): Consider OOK modulation
* Recommended WF
	+ [Moderator]:
		- For modulation, further discuss following options
			* Option 1: Consider both BPSK and OOK modulation
			* Option 2: Consider OOK modulation

#### **Issue 3-2-4: Waveform**

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| **Agreements in last meeting (R4-2512603)****Issue 3-8: Waveform*** Way forward
	+ Option 1: backscattering a carrier wave (CW)
	+ Option 2: Unmodulated single tone (CW)
 |

* Proposals from companies:
	+ Option 1 (Samsung): Following the WID, RAN4 should consider the waveform with backscattering a carrier wave for defining PDRCH requirement, FFS on consider the unmodulated single tone CW for PDRCH requirement.
	+ Option 2 (ZTE): Propose to consider unmodulated single tone waveform.
* Recommended WF
	+ [Moderator]:
		- Further discuss above two options

#### **Issue 3-2-6: Block level Repetition**

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| **Agreements in last meeting (R4-2512603)****Issue 3-10: Block level Repetition*** Way forward
	+ Option 1: 1
	+ Option 2: 2
 |

* Proposals from companies:
	+ Option 1 (Samsung): RAN4 can consider block-level repetition at least as 2 when defining PDRCH requirement, FFS on considering block-level repetition as 1 for requirement
	+ Option 2 (Huawei, HiSilicon): consider no repetition
	+ Option 3 (ZTE): Propose to consider 2 block level repetitions.
* Recommended WF
	+ [Moderator]:
		- For block-level repetition, further discuss following options
			* Option 1: Consider block-level repetition as 2
			* Option 2: Consider no repetition

#### **Issue 3-2-7: SFO assumption**

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| **Agreements in last meeting (R4-2512603)****Issue 3-11: SFO assumption*** Way forward
	+ Option 1: 104 ppm~105 ppm
	+ Other options
 |

* Proposals from companies:
	+ Option 1 (Samsung): RAN4 can consider the SFO assumption with randomly selected a value from the range of [104 ppm~105 ppm] when defining PDRCH requirement
	+ Option 2 (Huawei, HiSilicon): prefer 10% SFO, i,e, 105 ppm
	+ Option 3 (CMCC, ZTE): for SFO assumption, it is proposed to use 104 ppm~105 ppm
* Recommended WF
	+ [Moderator]:
		- to check whether following is agreeable
			* For PDRCH requirements definition, consider 10% SFO, i,e, 105 ppm

#### **Issue 3-2-8: Device sampling rate**

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| **Agreements in last meeting (R4-2512603)****Issue 3-12: Device sampling rate*** Way forward
	+ Option 1: 1.92MHz device sampling rate
	+ Other options
 |

* Proposals from companies:
	+ Option 1 (Samsung): RAN4 could consider the device sampling rate as 1.92MHz for alignment, adding a note there is no restriction on AIoT device implementation.
	+ Option 2 (Huawei, HiSilicon): 1.92MHz device sampling rate
* Recommended WF
	+ [Moderator]:
		- Consider 1.92MHz device sampling rate

#### **Issue 3-2-9: TBS**

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| **Agreements in last meeting (R4-2512603)****Issue 3-13: TBS*** Way forward
	+ Option 1: 96 bits
	+ Other options
 |

* Proposals from companies:
	+ Option 1 (Samsung, Huawei, HiSilicon): RAN4 consider the value of TBS as 96 bits when defining PDRCH requirement
* Recommended WF
	+ [Moderator]:
		- Consider TBS of 96 bits for PDRCH requirement definition

#### **Issue 3-2-10: CBW**

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| **Agreements in last meeting (R4-2512603)****Issue 3-14: CBW*** Way forward
	+ Option 1: further discuss how to select the proper CBW
	+ Option 2: postpone the channel bandwidth and (Tb, Tc, R) discussion until related core part is stable
 |

* Proposals from companies:
	+ Option 1 (Samsung): Pending on the collusion of SFO assumption, RAN4 should further discuss how to select the proper CBW when defining PDRCH requirements
	+ Option 2 (Huawei, HiSilicon): Use ($T\_{chip}^{D2R}$, $T\_{bit}^{D2R}$,R=1)= ($133.33$, $66.67,$ R=1) as start point
* Recommended WF
	+ [Moderator]:
		- To check whether option 2 is agreeable

#### **Issue 3-2-13: Number of interval bits for D2R midamble insertion**

* Proposals from companies:
	+ Option 1 (Samsung): RAN4 should discuss the value of interval bits for D2R midamble insertion. The value with 48 bits can be taken as starting point
* Recommended WF
	+ [Moderator]:
		- Discuss option 1

#### **Issue 3-2-11: Channel model**

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| **Agreements in last meeting (R4-2512603)****Issue 3-15: Channel model*** Way forward
	+ Option 1: TDL-A30-10
	+ Other options are precluded
 |

* Proposals from companies:
	+ Option 1 (Samsung, Huawei, HiSilicon, CMCC): use TDLA30-10 channel for specifying PDRCH requirement
* Recommended WF
	+ [Moderator]:
		- Use TDLA30-10 channel for specifying PDRCH requirement

#### **Issue 3-2-12: Specification structure**

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| **Agreements in last meeting (R4-2512603)****Issue 3-17: Specification structure*** **Way forward**
	+ Option 1: Specify the Ambient IoT BS demodulation requirements in “Ambient IoT Base Station (BS) and Carrier-Wave (CW) node radio transmission and reception” and “Ambient IoT Base Station (BS) and Carrier-Wave (CW) node conformance testing” if RAN4 agreed to define the Ambient IoT BS demodulation requirements.
	+ Option 2: The demodulation requirements can be captured in clause 10 of TS 38.194/195.
 |

* Proposals from companies:
	+ Option 1 (Samsung): RAN4 specifies the corresponding Ambient IoT BS demodulation requirement into 38.194 and Ambient IoT BS conformance testing into 38.195, separately. And captured the demodulation requirements into the clause 10 of TS 38.194/195
	+ Option 2 (CMCC): the demodulation requirements for Ambient IoT Base Station (BS) is captured in TS 38.194
* Recommended WF
	+ [Moderator]:
		- The demodulation requirements for Ambient IoT Base Station (BS) is captured in TS 38.194/195