**3GPP TSG-RAN WG4 Meeting # 106bis R4-2514447**

**Prague, Czech Republic, Oct 13th‒ 17th, 2025**

**Agenda item:** 10.2, 10.3, 10.4

**Source:** Moderator (CATT)

**Title:** Topic summary for [116bis][324] LS\_BDaT

**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 is about to treat all tdocs related to NR LSs in BDaT session.*

# Topic #1: Reply LS on beam correspondence

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

*This topic discusses the reply LS to RAN5 (R4-2509022/R5-253653) on beam correspondence Initial Access.*

## Companies’ contributions summary

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| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2513625R4-2513626 | Apple | Proposal 1: To provide the following clarification to RAN5: |
| R4-2514421 | Qualcomm, Sony, Ericsson, Lenovo | Observation 1: There is no mandate from RAN4 for the UE to implement a test function like beam lock for compliance. Proposal 1: RAN4 to clarify whether the wording in any normative document pertaining to Rel-18 initial access beam correspondence requirement carries a mandate to implement the beam lock test function as precondition for compliance.Observation 2: In RAN4, the beam correspondence requirement is based on maximum UL EIRP in the direction of the DL during the time interval when that UL is expected.Observation 3: The Rel-18 initial access beam correspondence requirements apply to a UE’s MSG1 EIRP during RACH occasions in each direction of test, and for each tested direction there is no implied requirement on the EIRP in other directions.Observation 4: The wording in the RAN4 core requirement is consistent with ensuring a certain expectation in field operation, and no new behaviour like beam lock is needed to guarantee good field performance.Observation 5: If RAN4 ties compliance with core requirements to implementation of a test function, a worrisome implication for the future of RAN4 is that ‘Even if a UE that can meet core requirements without an available test function, it is non-compliant.’ Proposal 2: Discuss if OK for RAN4 to enforce ‘Even if a UE that can meet core requirements without an available test function, it is non-compliant.’Proposal 3: RAN4 confirm that the Rel-18 initial access beam correspondence core requirements apply to the max msg1 EIRP in the direction of test over all available RACH occasions and does not include implementation of a test function. |

## 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: In Moderator’s view, there are even different understandings on RAN4 agreements made on specifying beam correspondence requirements for initial access shown in R4-2317764:*

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| *RAN4 has agreed on the PRACH EIRP spherical coverage requirement based on working assumptions of test condition as below. RAN4 respectfully asks RAN5 to evaluate following working assumptions and provide feedback if RAN5 identifies any issue related to the working assumptions.** *RAN4 has agreed to inform RAN5 to develop the beamlock function in initial access.*
* *UE locks the beam direction after requested by test equipment*
* *UE is kept in RRC\_IDLE state to ensure at least 1ms EIRP measurement period for PRACH.*
* *Enable multiple PRACH transmissions in testing mode, including holding RAR.*
* *UE transmits with the optimal Tx beam that is autonomously selected by UE.*
* *UE achieves Pcmax before PRACH EIRP measurement.*
* *UE transmits PRACH with gap <=20ms.*
* *To accelerate the testing, it’s recommended to use the longest applicable PRACH preamble format and minimum gap between PRACH transmission.*
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*And furthermore, the CR of introducing the beam correspondence requirements for initial access and RRC\_INACTIVE can be found in R4-2321984.*

*Open issues and candidate options before meeting:*

**Issue 1-1-1: For the introduction of beam correspondence requirements for initial access and RRC\_INACTIVE as approved in the CR R4-2321984, is it specified under the working assumptions as agreed in R4-2317764? In other words, does it reflect the agreements in R4-2317764?**

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

**Issue 1-1-2: For a UE meeting beam correspondence coverage requirements for initial access and RRC\_INACTIVE, shall it have beam lock function which is only for testing purpose, i.e., not a real-field behaviour?**

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

**Issue 1-1-3: Can RAN4 confirm that the Rel-18 initial access beam correspondence core requirements apply to the max msg1 EIRP in the direction of test over all available RACH occasions and does not include implementation of a test function?**

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

### Sub-topic 1-2

*Sub-topic description: detailed answers to the three questions in the RAN5 LS.*

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| *-Q1: RAN5 is looking to develop test procedure with and without UE Beamlock test function, can either procedure be used to verify RAN4 core requirements?**-Q2: Regarding the verification of spherical coverage requirement for initial access and RRC\_INACTIVE using UE Beamlock test function in the IDLE mode, will it prevent UE to not autonomously choose Uplink beams? Will using beam lock prevent UE from autonomously choosing other beams even if UE’s behaviour is such?**-Q3: Regarding the verification of spherical coverage requirement for initial access and RRC\_INACTIVE without using UE Beamlock test function in the IDLE mode, would this be aligned to verifying RAN4 core requirements when the requirements were defined?* |

*Open issues and candidate options before meeting:*

**Issue 1-2-1: Answer to Q1**

* Proposals
	+ Option 1: Yes, either procedure can be used, since the Rel-18 initial access beam correspondence core requirements apply to the max msg1 EIRP only in the direction of test over all evaluated RACH occasions. RAN4 confirm that core requirements do not mandate a UE to implement an IABC-specific BL function for compliance with the IABC requirements. (As in R4-2514421)
	+ Option 2: RAN4 core requirements were derived under the assumption that UE beamlock function is used. During the RAN4 discussion of deriving the core requirements, the working assumptions were shared with RAN5 in LS R4-2317764.

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| **Answer**: RAN4 has agreed on the PRACH EIRP spherical coverage requirement based on working assumptions of test condition as below. RAN4 respectfully asks RAN5 to evaluate following working assumptions and provide feedback if RAN5 identifies any issue related to the working assumptions.* RAN4 has agreed to inform RAN5 to develop the beamlock function in initial access.
* UE locks the beam direction after requested by test equipment
* UE is kept in RRC\_IDLE state to ensure at least 1ms EIRP measurement period for PRACH.
* Enable multiple PRACH transmissions in testing mode, including holding RAR.
* UE transmits with the optimal Tx beam that is autonomously selected by UE.
* UE achieves Pcmax before PRACH EIRP measurement.
* UE transmits PRACH with gap <=20ms.

To accelerate the testing, it’s recommended to use the longest applicable PRACH preamble format and minimum gap between PRACH transmission. |

RAN4 requests RAN5 to consider the above-mentioned assumption in developing their test procedures (As in R4-2513626)

* Recommended WF
	+ To be further discussed.

**Issue 1-2-2: Answer to Q2**

* Proposals
	+ Option 1: Yes, BL can prevent a UE from autonomously choosing other beams if UE’s behaviour is such. (As in R4-2514421)
	+ Option 2: RAN4 is of the following view:
		- Using beamlock function in testing does not prevent UE from choosing UL beams in the real field.
		- In the beamlock function based test, UE should still be able to autonomously choose the UL beams based on DL measurement before the beamlock function is activated.
		- RAN4’s understanding is that beamlock function should be activated after the UL beam is autonomously chosen.
		- Once the beam is locked, UE cannot autonomously change the UL beams.
		- The exact test setup should be decided by RAN5.

(As in R4-2513626)

* Recommended WF
	+ To be further discussed.

**Issue 1-2-3: Answer to Q3**

* Proposals
	+ Option 1: Yes. There is no RAN4 mandate for a UE to use IABC BL for IABC core requirement compliance. From a RAN4 perspective, there is no conflict if a UE chooses to meet core requirements without a test mode. It is up to RAN5 to develop the requisite test procedures. (As in R4-2514421)
	+ Option 2: Please refer to the answer to Q1 above (As in R4-2513626)
* Recommended WF
	+ To be further discussed.

# Topic #2: Reply LS on AAS BS operation in low frequency bands below 1 GHz

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

*This topic discusses the reply LS to ECC PT on parameters for AAS BS operating in bands below 1 GHz (R4-2513058), where three questions are launched:*

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| 1. *Unwanted emissions characteristics of AAS BSs operating in the 700 MHz, 800 MHz and 900 MHz bands.*
2. *Whether 3GPP TS 37.105 and TS 38.104 BS RF requirements are also applicable for AAS BS operation in bands below 1 GHz under consideration.*
3. *A model and associated parameters for modelling AAS BS antenna arrays in frequencies below 1 GHz, both in-band and out of band for frequency bands under consideration.*
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*According to the inputs, Moderator does not see that a reply LS could be ready in this meeting, hence issues are created with a focus on the workplan to conduct the necessary evaluation/measurements, not the reply LS itself.*

## Companies’ contributions summary

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| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2513944 | Ericsson | **Observation 1:** The RAN4 AAS BS requirements are applicable for all bands. However, RAN4 currently do not have recent information regarding relevant spatial unwanted emission for AAS BS operating below 1 GHz. If needed and AAS sub-GHz products are deployed, RAN4 need to initiate a study to collect measurement data for unwanted emission relevant for AAS BS operating below 1 GHz. **Observation 2:** Requirement levels for unwanted emissions in TS 38.104 and TS 37.105 are derived based on legacy non-AAS requirement levels. Before we provide response to ECC PT1 there may be a need to re-evaluate and check that requirements are sufficient to guarantee adjacent channel co-existence and protection of other 3GPP bands used in the same geographical area. **Observation 3:** RAN4 need to establish AAS array parameters for the frequency range below 1 GHz, following structure used for previous frequency ranges. **Observation 4:** RAN4 need to establish relevant parameters for correlation roll-off outside the carrier for the frequency range 700 to 900 MHz (including adjacent channels, harmonics and other spectral regions). It is obvious that RAN4 need to do work before answering questions from ECC PT1. To speed up interaction between the groups it is essential to ask RAN for mandate to send information directly to ECC PT1 according to approved time schedule. **Proposal:** Use the information in this contribution and attached draft LS to further discuss on how to proceed in RAN4. |
| R4-2514466R4-2514467 | Huawei, HiSilicon | **Proposal 1**: Clarify in the LS reply to CEPT ECC PT1, that the RF characteristics of AAS BS in operating bands below 1 GHz, in particular the unwanted emissions limits of AAS BS operating in the 700 MHz, 800 MHz and 900 MHz bands, are already captured since Rel‑15 in AAS BS specifications (TS 37.105, TS 37.145-1, TS 37.145-2), and NR BS specifications (TS 38.104, TS 38.141-1, TS 38.141-2).**Proposal 2**: Clarify in the LS reply to CEPT ECC PT1, that the antenna model in section 7.1 of TR 38.922 can be used in 700 MHz, 800 MHz and 900 MHz operating bands, with the following set of parameters to be used in the model:

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| **Parameter** | **Value** |
| Antenna pattern model | Extended AAS subarray model |
| Element gain (dBi) | 5.5 (with 2dB Ohmic loss) |
| Horizontal/vertical 3 dB beam width of single element (degree)  | 90º for H90º for V |
| Horizontal/vertical front‑to‑back ratio (dB) | 30 for both H/V |
| Antenna polarization  | Linear ±45º polarized sub-array |
| Antenna array configuration (Row × Column)  | 2×4 |
| Horizontal/Vertical radiating sub-array or element spacing | 0.5 of wavelength for H, 2.8 of wavelength for V |
| Number of element rows in sub-array | 4 |
| Vertical element separation in sub-array  | 0.7 of wavelength for V |
| Pre-set sub-array down-tilt (degrees) | 3 |
| Mechanical down-tilt (degrees) | 6 for urban/suburban, 3 for rural |
| Base station horizontal coverage range (degrees) | ±60 |
| Vertical steering range (degree) | 90-100 |

**Proposal 3**: Companies are encouraged to provide their views on the following items at the RAN4#117: * Out of band array response for operation in the 700 MHz, 800 MHz and 900 MHz bands,
* Potential technical solution(s) to address the out of band antenna gain modelling for 700/800/900 MHz operating bands. Band agnostic solution are not precluded.
* Possible handling to formally capture the above technical work in RAN4 (e.g., SI/WI approach, RAN task, etc.).
* Envisioned timeline required.

**Proposal 4**: RAN4 to send LS reply to CEPT ECC PT1 on questions covered in R4-2513058 during RAN4#117 the latest.Related Draft CR was provided in [5]. |

## 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 2-1

*Sub-topic description: Time line to reply ECC PT1.*

*Open issues and candidate options before meeting:*

**Issue 2-1: Which of the following two options is agreeable to proceed with the reply LS to ECC PT1?**

* Proposals
	+ Option 1: Two-step replies, the first to inform the workplan, and the second to answer all three questions by Nov 2026 (As in R4-2513944)

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| * Simulation parameters (in-band): Estimated date for completion: May 2026 (RAN WG4#119)
* • Re-evaluation of unwanted emission requirements: Estimated date for completion: August 2026 (RAN WG4#120)
* • Unwanted emission characteristics (out-of-band): Estimated date for completion: November 2026 (RAN WG4#121)
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* + Option 2: One-step reply in RAN4#117 with the following plans (As in R4-2514466)

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| * Companies are encouraged to provide their views on the following items at the RAN4#117:
	+ Out of band array response for operation in the 700 MHz, 800 MHz and 900 MHz bands,
	+ Potential technical solution(s) to address the out of band antenna gain modelling for 700/800/900 MHz operating bands. Band agnostic solution are not precluded.
	+ Possible handling to formally capture the above technical work in RAN4 (e.g., SI/WI approach, RAN task, etc.).
	+ Envisioned timeline required.
* RAN4 to send LS reply to CEPT ECC PT1 on questions covered in R4-2513058 during RAN4#117 the latest.
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* Recommended WF
	+ TBA

### Sub-topic 2-2

*Sub-topic description: Candidate answers or discussions on the three questions.*

*Open issues and candidate options before meeting:*

**Issue 2-2-1: For unwanted emissions characteristics of AAS BSs operating in the 700 MHz, 800 MHz and 900 MHz bands, have RAN4 specs already specified?**

* Proposals
	+ Option 1: Yes (As in R4-2514466)

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| Clarify in the LS reply to CEPT ECC PT1, that the RF characteristics of AAS BS in operating bands below 1 GHz, in particular the unwanted emissions limits of AAS BS operating in the 700 MHz, 800 MHz and 900 MHz bands, are already captured since Rel 15 in AAS BS specifications (TS 37.105, TS 37.145-1, TS 37.145-2), and NR BS specifications (TS 38.104, TS 38.141-1, TS 38.141-2) |

* + Option 2: No, measurement data is required (As in R4-2513944)

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| The RAN4 AAS BS requirements are applicable for all bands. However, RAN4 currently does not have recent information regarding relevant spatial unwanted emission for AAS BS operating below 1 GHz. If needed and AAS sub-GHz products are deployed, RAN4 needs to initiate a study to collect measurement data for unwanted emission relevant for AAS BS operating below 1 GHz. |

* Recommended WF
	+ TBA

**Issue 2-2-2: 2Whether 3GPP TS 37.105 and TS 38.104 BS RF requirements are also applicable for AAS BS operation in bands below 1 GHz under consideration?**

* Proposals
	+ Option 1: Yes (As in R4-2514467)

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| BS RF requirements and their limits for AAS BS operating in the 700 MHz, 800 MHz and 900 MHz bands, are already captured since Rel 15 in AAS BS specifications (TS 37.105, TS 37.145-1, TS 37.145-2), and NR BS specifications (TS 38.104, TS 38.141-1, TS 38.141-2. |

* + Option 2: No, re-evaluation is required (As in R4-2513944)

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| Requirement levels for unwanted emissions in TS 38.104 and TS 37.105 are derived based on legacy non-AAS requirement levels. Before we provide response to ECC PT1 there may be a need to re-evaluate and check that requirements are sufficient to guarantee adjacent channel co-existence and protection of other 3GPP bands used in the same geographical area. |

* Recommended WF
	+ TBA

**Issue 2-2-3: What are the model and associated parameters for modelling AAS BS antenna arrays in frequencies below 1 GHz, both in-band and out of band for frequency bands under consideration**

* Proposals
	+ Option 1: As in R4-2514466

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| * More inputs required in the next meeting in addition to the antenna model.
* Antenna model in section 7.1 of TR 38.922 can be used in 700 MHz, 800 MHz and 900 MHz operating bands, with the following set of parameters to be used in the model:

|  |  |
| --- | --- |
| **Parameter** | **Value** |
| Antenna pattern model | Extended AAS subarray model |
| Element gain (dBi) | 5.5 (with 2dB Ohmic loss) |
| Horizontal/vertical 3 dB beam width of single element (degree)  | 90º for H90º for V |
| Horizontal/vertical front‑to‑back ratio (dB) | 30 for both H/V |
| Antenna polarization  | Linear ±45º polarized sub-array |
| Antenna array configuration (Row × Column)  | 2×4 |
| Horizontal/Vertical radiating sub-array or element spacing | 0.5 of wavelength for H, 2.8 of wavelength for V |
| Number of element rows in sub-array | 4 |
| Vertical element separation in sub-array  | 0.7 of wavelength for V |
| Pre-set sub-array down-tilt (degrees) | 3 |
| Mechanical down-tilt (degrees) | 6 for urban/suburban, 3 for rural |
| Base station horizontal coverage range (degrees) | ±60 |
| Vertical steering range (degree) | 90-100 |

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* + Option 2: As in R4-2513944

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| --- |
| * RAN4 need to establish AAS array parameters for the frequency range below 1 GHz, following structure used for previous frequency ranges
* RAN4 need to establish relevant parameters for correlation roll-off outside the carrier for the frequency range 700 to 900 MHz (including adjacent channels, harmonics and other spectral regions)
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* Recommended WF
	+ TBA