**3GPP TSG-RAN WG4 Meeting # 100-e R4-211XXX**

**Electronic Meeting, 16th – 27th August, 2021**

**Agenda item:** 5.1.10

**Source:** Moderator (Spirent)

**Title:** Email discussion summary for [100-e][203] NR\_NewRAT\_Positioning

**Document for:** Information

# Introduction

The document contains discussions for Rel-15 NR Positioning specs maintenance (36.171, 37.171 and 36.171)

The document contains the following two topics:

* Topic #1: Frequency Bands for testing of A-GNSS Sensitivity (AI 5.1.10.1)
* Topic #2: Others (AI 5.1.10.2)

# Topic #1: Frequency Bands for testing of A-GNSS Sensitivity (AI 5.1.10.1)

## Companies’ contributions summary

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| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2112138**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112138.zip) | Apple | Remaining issues on testing of A-GNSS Sensitivity requirements in NR and LTE (discussion) |
| [**R4-2113303**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113303.zip) | Xiaomi | Discussion on Frequency Bands for testing of A-GNSS Sensitivity requirements in NR and LTE (discussion) |
| [**R4-2114210**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2114210.zip) | Qualcomm Incorporated | Frequency bands for testing of A-GNSS sensitivity requirements (CR 36.171) |
| [**R4-2114208**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2114208.zip) | Qualcomm Incorporated | Frequency bands for testing of A-GNSS sensitivity requirements (CR 38.171) |

## Open issues summary

### Sub-topic 1-1: LTE and NR bands for testing

The WF from the previous meeting lists the following options:

*There are two options left for discussion:*

* + *Option 1: LTE Bands 13, 14, 24, 44 and NR Bands n13, n14, n24, n79 and n96. In case of the same LTE and NR band supported by a UE, e.g., 14/n14, it suffices to test either LTE band 14 or NR band n14 because of the same interference mechanism (Apple, Xiaomi, Qualcomm, vivo, OPPO)*
	+ *Option 2: all UE supported bands (Spirent, R&S)*
* Proposal:
	+ Apple: ***On LTE and NR bands for testing, select Option 1.***
	+ Xiaomi: **option 1 is preferred.**
* Recommended WF
	+ Discuss if Option 1 can be agreed.

### Sub-topic 1-2: EN-DC bands for testing

The follow agreement is reached in the WF in the previous meeting:

* + *When an EN-DC configuration generates second or third order intermodulation distortion (IMD) products falling into the following GNSS L1/E1/G1/B1 typical receiver bands (where supported by the UE), it shall be considered as a candidate for testing:*
	+ *GPS L1 C/A : 1574.3970 – 1576.4430 MHz*
	+ *Galileo E1 / GPS L1C: 1573.3740 – 1577.4660 MHz*
	+ *GLONASS G1: 1597.5515 – 1605.8860 MHz*
	+ *BDS B1I: 1559.0520 – 1563.1440 MHz*
	+ *To further reduce testing, all EN-DC configurations are divided into groups with similar IMD level and risks. For each group, only one of the EN-DC configurations supported by the UE in the group shall be tested. Details can be found at Annex B of reference [1].*
* New Proposal #1:
	+ Apple: ***Among the band combinations listed in Table 1 (see Tdoc*** [**R4-2112138**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112138.zip)***), prioritize those that generate both 2nd and 3rd IMDs and deprioritize those that only affect some (not all four) GNSS receiver bands for testing.***
* New Proposal #2:
	+ Xiaomi: Only specify the IMD order for each group in the RAN4 spec and the detail test configuration for each band combination can be left to RAN5 with the guideline: The carrier frequencies and bandwidths for LTE band and NR band are selected such that the interference falls into the Rx of GNSS band.
* Recommended WF
	+ Discuss if either or both New Proposal #1 and/or Proposal #2 should be added to the already agreed WF.

## Companies views’ collection for 1st round

### Open issues

**Sub-topic 1-1: LTE and NR bands for testing**

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| **Company** | **Comments** |
| AT&T | Option 2. The core requirements need to apply equally to all standalone operating bands. By selecting Option 2, we are not saying that devices will be tested in all UE supported bands. This is ultimately a decision for the certification bodies. We made very similar comments at RAN4 #99-e.RAN4 should only provide information concerning the harmonic cases and where they exist to RAN5 and should not conclude that testing is only required in specific bands with harmonics (this is a RAN5 decision). RAN4 should highlight these cases but let RAN5 decide concerning the bands for test since RAN5 needs to address the needs of the certification bodies which can include a wider set of operating bands. In addition, operators in some regions are bound by regulatory requirements concerning positioning accuracy and need to ensure that UEs are compliant. It is critical that the RAN4 core requirements and RAN5 test cases cover other regional/national requirements and regulatory requirements when operating in the corresponding NR and/or LTE bands. As such, other frequency bands may need to be specified for testing.Concerning the comment related to the case of the same LTE and NR band being supported by a UE, we believe that the RAN4 conclusion that the same interference mechanism exists can be communicated to RAN5. However, it is ultimately a RAN5 decision concerning test applicability in this case to decide if testing is done in LTE and/or NR. |
| DISH | Option 2. The core requirements need to apply, and equally as AT&T mentioned, to all SA bands. Why is RAN4 deciding on what to test? This is a RAN5 decision. RAN4 can provide RAN5 with information as to what AT&T stated above. To add on testing, RAN5 currently instruct only sensitivity tests to be tested on all bands. All the rest are sufficient with only one band supported by the UE. Single band testing, which much lower sensitivity requirements below -140dBm, is critical against some regulatory requirements, not to mention to verify the device RF performance against this low value. We don’t fully understand why SA bands are in question here to begin with. The original issue in testing has been raised from the complexity EN-DC comes with, which is 10x fold compared to the number of supported bands by the UE. And even in EN-DC case, single band performance should be the baseline (irrespective of the harmonics), which again, is RAN5 scope.  |
| Qualcomm | Option 1. We believe it is unnecessary to run the tests in a bearer band that is not affecting the GNSS reception bands.  |
| Xiaomi | Option 1. To Dish, from the RAN5 LS(R5-206900), it is clear that SA bands is involved.*RAN5 respectfully asks RAN 4 for guidance on the LTE and NR frequency bands, and band combinations, impacting the A-GNSS Sensitivity requirements in LTE and NR, and in particular in EN-DC, taking into account possible intermodulation and other interference mechanisms that may affect the GNSS bands.* |
| Spirent | Just some background:The original main issue in RAN 5 was indeed the bands for EN-DC. The issue of bands for SA was only raised during the editing of the LS to RAN 4 and was, I believe, of lower importance to RAN 5. |
| Apple | Option 1.First, regarding the applicability of core requirements in TS 38.171 as raised by AT&T and Dish, it is not clear from TS 38.171 that the core requirements apply to all the bands. If there is clear text about applicability in it, please let us know. Second, even if we assume for a moment that core requirements would apply to all LTE/NR bands, RAN4 still can discuss and decide if some verification exemption can be granted and share such decisions with RAN5 (as the case for FR-2 requirements in TS 38.101-2), knowing that the whole discussion on tests was triggered by RAN5 LS asking for RAN4 views. Based on the analysis in RAN4, clearly there is no good technical justification that all bands need to be tested. |
| DISH  | To Xiaomi. Yes, the ask is guidance on “*possible intermodulation and other interference mechanisms that may affect the GNSS bands.” and “In particular EN-DC”* So, let’s stick with the IMD and interference cases.To Apple. First, so you are saying these requirements do not apply across all bands? Further, this is exactly why RAN5 selects what testing should be done based on the minimum requirements. Second, can you elaborate why and which FR2 requirements are the same as this. We don’t understand this comment, does this mean Apple would like to take responsibility from RAN5 into RAN4. Can you please clarify? Third, on the last sentence. This exact sentence is what is being discussed in RAN5 and therefore, the exact reason why the discussion is and should be held in RAN5. We would like to understand why the testing selection should be done in RAN4 instead of RAN5. Given that this single band testing is this important, have you checked the test time impact of the (proposed solution vs. all bands) vs EN-DC complexity vs the entire positioning set? Or should this discussion be left for RAN5? Finally, we hope vendors also acknowledge that this “per band” requirement would end up in carrier acceptance plans if we are forced to change this (again, RAN5 discussion), given its importance to carriers. We are not sure that is the best way forward.  |
| R&S | Side question: How are devices supporting only GPS L5 considered in this discussion? |
| Rogers | Option 2.It is critical that the RAN4 core requirements and RAN5 test cases cover other regional/national requirements and regulatory requirements when operating in the corresponding NR and/or LTE bands. As such, other frequency bands may need to be specified for testing. |

**Sub-topic 1-2: EN-DC bands for testing**

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| **Company** | **Comments** |
| AT&T | Proposal #1: Do not agree. We do not see why testing would be limited to very special cases where multiple IMD products exist and affect all GNSS frequency ranges.Proposal #2: We agree in principle as it meets the goal of letting RAN5 make the test point decisions needed for the certification bodies. |
| Qualcomm | Proposal #1: This Proposal is not quite clear. This depends on the GNSS(s) and EN-DC configurations supported by the UE. If there is one EN-DC configuration impacting all supported GNSS bands, this single combination should be enough (if supported by the UE). Proposal #2: We understand this was the agreed Way Forward from last meeting:"For both LTE/NR bands and EN-DC band combinations, the following details are to be specified as well:E-UTRA / NR carrier frequenciesCarrier bandwidthother channel configurations if necessary".Therefore, we calculated the frequencies in our proposed CRs." |
| Xiaomi | Proposal #1: Share same view as QualcommProposal #2: The intention for this proposal is to reduce workload in RAN4 and avoid introducing a big table into the spec. Just showing exemplary test frequencies and RB setting for each frequency Group Combinations as listed in Qualcomm’s CR is also a good way. |
| Spirent | To confirm in the agreed WF in the last meeting we did agree that frequencies/bandwidths/other possible configurations would be specified by RAN 4. |
| Apple | Proposal #1: As the proponent of Proposal 1, let us share our original thinking in the following. In the last meeting, there was agreement:* + *To further reduce testing, all EN-DC configurations are divided into groups with similar IMD level and risks. For each group, only one of the EN-DC configurations supported by the UE in the group shall be tested. Details can be found at Annex B of reference [1].*

Since there may be multiple EN-DC band combinations falling into the same group, as only one is to be tested, it is proposed to prioritize those combinations that generate both 2nd and 3rd IMDs and deprioritize those that only affect some (not all four) GNSS receiver bands for testing.Proposal #2: We have similar view as Xiaomi, and the approach of providing some examples only, as shown in QC’s CR looks good. |
| R&S | Side question: How are devices supporting only GPS L5 considered in this discussion? |
| Rogers | Proposal #1: We do not agree with this proposal. Testing should not be limited to very special cases where multiple IMD products exist.Proposal #2: We agree, as it meets the goal of letting RAN5 make the test point decisions needed for the certification bodies. |

### CRs/TPs comments collection

* The two CRs below implement the following:
	+ LTE and NR bands for testing: Option 1 from the WF.
	+ EN-DC bands for testing: agreements from the WF without the new proposals above.
* Recommended WF:
	+ Discuss if CRs can be endorsed

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| **CR/TP number** | **Comments collection** |
| [**R4-2114210**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2114210.zip)(CR to 36.171)(Qualcomm)(LTE standalone) | AT&T: Cannot endorse based on feedback above. In addition, any use of NOTE outside of table notes is not considered as a normative requirement according to 3GPP drafting rules. |
| DISH: We cannot agree to this CR. |
| Qualcomm (proponent): We think this covers the agreements from last meeting with Option 1 with single carrier. |
| Spirent: we have some editorial and clarification concerns with this CR but will wait to see what the outcome will be before listing them here.Apple: we support using the CR, which resulted from the agreements at the last meeting, as a baseline for further discussion. |
| [**R4-2114208**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2114208.zip)(CR to 38.171)(Qualcomm)(NR standalone and EN-DC) | AT&T: Cannot endorse based on feedback above. In addition, any use of NOTE outside of table notes is not considered as a normative requirement according to 3GPP drafting rules. |
| DISH: We cannot agree to this CR. |
| Qualcomm (proponent): We think this covers the agreements from last meeting with Option 1 with single carrier. |
| Spirent: we have some editorial and clarification concerns with this CR but will wait to see what the outcome will be before listing them here.Apple: we support using the CR, which resulted from the agreements at the last meeting, as a baseline for further discussion. |

Above added for clarity

## Summary for 1st round

### Open issues

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|  | **Status summary**  |
| **Sub-topic 1-1** | **LTE and NR SA bands for testing** *Tentative agreements: no agreements.**Candidate options: Note this is the second meeting for this discussion. Suggest that we need to finalise the outcome at this meeting.****Option 1****: AT&T, Dish, Rogers want to retain some flexibility for RAN 5 to specify bands of interest (as well as bands with clear interference possibilities).* *Therefore, discuss compromise wording that would allow both specify bands of interest as well as bands with clear interference possibilities.****Option 2:*** *Accept that no agreement will be reached and stop the discussion. This will mean that “Option 2: all supported bands” will remain the RAN 5 requirement as that is the current text in RAN 5.**Recommendations for 2nd round:*Discuss Option 1 or Option 2 above. |
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|  | **Status summary**  |
| **Sub-topic 1-2** | **EN-DC bands for testing** *Tentative agreements:*Proposal #1: Majority of companies do not agree to this proposal. Do not discuss further.Proposal #2: (Xiaomi: Only specify the IMD order for each group in the RAN4 spec and the detail test configuration for each band combination can be left to RAN5 with the guideline)This is generally acceptable. No further discussion necessary.*Candidate options:**Recommendations for 2nd round:*Discuss proposed CR for EN-DC, taking into account Proposal #2 above. Remove parts of CR detailing LTE and NR SA bands which cannot be agreed. |
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### CRs/TPs

*Note: The tdoc decisions shall be provided in Section 3 and this table is optional in case moderators would like to provide additional information.*

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| **CR/TP number** | **CRs/TPs Status update recommendation**  |
| **R4-2114210**(Qualcomm Incorporated)(Frequency bands for testing of A-GNSS sensitivity requirements (CR 36.171)) | *Not currently acceptable* |
| **R4-2114208**(Qualcomm Incorporated)(Frequency bands for testing of A-GNSS sensitivity requirements (CR 38.171)) | *To be revised* |

## Discussion on 2nd round (if applicable)

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| **CR/TP number** | **CRs/TPs Status update recommendation**  |
| **R4-2114210**(Qualcomm Incorporated)(Frequency bands for testing of A-GNSS sensitivity requirements (CR 36.171)) | *Proposed discussion for 2nd round:**Discuss compromise wording that would allow both specify bands of interest as well as bands with clear interference possibilities.* |
| **R4-2114208**(Qualcomm Incorporated)(Frequency bands for testing of A-GNSS sensitivity requirements (CR 38.171)) | *Proposed discussion for 2nd round:*Discuss proposed CR for EN-DC, taking into account Proposal #2 above. Remove parts of CR detailing LTE and NR SA bands which cannot be agreed. |
| **Other** | *Spirent: to answer R&S “side question” from Round 1: in this discussion we decided to just concentrate on the “main” GNSS bands for now. So L5-only is not considered for the moment. Once we have agreed what to do for the “main” GNSS bands we can then extent it to cover other things like L5-only later.* |
| **Apple** | *For LTE/NR bands, thanks to the moderator for aiming to find a WF. Option 1 (Discuss compromise wording that would allow both specify bands of interest as well as bands with clear interference possibilities.) seems reasonable, but we would like to understand in detail how it works, in particular, how would operators specify their bands of interest? Is this done in RAN4 or RAN5?**In addition, we would like to respond to Dish’s comments in the first round.*1. *The whole discussion in RAN4 was triggered by RAN5 LS (*R5-206900*):*

***ACTION****: RAN5 respectfully asks RAN 4 for guidance on the LTE and NR frequency bands, and band combinations, impacting the A-GNSS Sensitivity requirements in LTE and NR, and in particular in EN-DC, taking into account possible intermodulation and other interference mechanisms that may affect the GNSS bands.**So we don’t quite understand the statement that Apple would like to take responsibility from RAN5 into RAN4. Perhaps you can clarify in this case, what RAN4 can and can’t discuss? If RAN5 thinks RAN4 should not discuss certain aspects after sending* R5-206900*, can RAN5 send RAN4 another LS clearly saying so?*1. *We are having technical discussions here. Dish and other companies mentioned core requirements apply to all bands. While this may be the case, out of curiosity we would like to confirm it in the specification. So can Dish or specification rapporteur (Spirent) point to the specification text so everyone has a common and clear understanding? In this way, clarity is provided and this issue is put to bed.*
2. *For FR2 testing issue, please refer to Topic #4: FR2 requirement applicability over ETC in email thread [100-e][149] NR\_reply\_LS\_UE\_RF at this meeting.*
3. *We certainly respect Operators’ interests/concerns on testing. That’s why we have submitted contributions and been working with interested companies in RAN4, striving to strike a good balance between having good test coverage and avoiding excessive/unnecessary testing.*

*For EN-DC combinations, we have some comments/edits on R4-2114208 at https://www.3gpp.org/ftp/tsg\_ran/WG4\_Radio/TSGR4\_100-e/Inbox/Drafts/%5B100-e%5D%5B203%5D%20NR\_NewRAT\_Positioning/Round%202/R4-2114208\_(CR%2038.171\_AGNSS%20Frequency%20Bands%20For%20Testing)\_Apple.docx.* |
| **Qualcomm** | *1. "Discuss compromise wording that would allow both specify bands of interest as well as bands with clear interference possibilities."**"specify bands of interest" does not look appropriate for a technical specification. This seems more an issue for e.g., GCF and others. A technical specification should list the bands which can affect the GNSS performance requirements, and Qualcomm spent quite some time and effort to analyse the issue. If there are bands missing, they can (and should) be added, but the "bands of interest" should have a technical justification. However, if there is no agreement that the currently listed bands can affect the GNSS performance, then it is better to remove the changes for LTE/NR single carrier and keep the requirements band independent. The conclusion from RAN4 should also be communicated to RAN5.**2.* *Discuss proposed CR for EN-DC**Thanks to Apple for the comments in the CR. However, I understand from the 1st round discussion, Proposal #2 is accepted:*"Proposal #2: (Xiaomi: Only specify the IMD order for each group in the RAN4 spec and the detail test configuration for each band combination can be left to RAN5 with the guideline)This is generally acceptable. No further discussion necessary.*"*Discuss proposed CR for EN-DC, taking into account Proposal #2 above. Remove parts of CR detailing LTE and NR SA bands which cannot be agreed." *Therefore, I removed the frequency details in updated CR in the drafts folder.* |
| **DISH** | *Sub-topic 1-1* *Option 2.* *We would appreciate if the discussion can be kept on what RAN4 would like to or should/will do.**Operators specify their Bands of interest in GCF/PTCRB as part of their WIs/RFTs, respectively. These follow the testing rules set by these organizations, following RAN5 guidance. RAN5 ask in the action from the LS, again, is asking guidance to requirements. Not to testing. If RAN4 states in the specification what is required to be tested, that changes the scope of RAN5. And in that case, also other interested parties from test industry should be involved in the discussion. This includes the discussion about testing time, which is not being discussed here now. Not to mention RAN5’s main interest, which is serving to the interests of certification forums. If RAN4 starts to discuss the testing requirements, then it should discuss them from all aspects.* *Perhaps it’s a good idea to discuss if such a text should be included in the specification about requirements applying across the bands / entire frequency range, etc. as in 38.101-1.**We don’t see the relevance to this discussion in the FR2 ETC topic, but even in that discussion also Qualcomm has stated RAN5 should decide whether they should be tested and “previous agreements in RAN4 to limit verification-testing may be an example of WG over-reach, in retrospect.”* *We really appreciate the efforts vendors have put into this, the findings are valuable to RAN5, and they should be sent to RAN5. But we can’t agree specifying these as directly testing requirements in RAN4.**In the conclusion what QC referred to, RAN4 could respond in an LS that these (x, y, z, etc) frequencies are impacting GNSS directly in per band performance via harmonic interference/other distortion, which RAN5 can take into account when deciding on potential test requirement changes to SA bands.* |
| **Spirent** | *1. "Discuss compromise wording that would allow both specify bands of interest as well as bands with clear interference possibilities."**Fully agree with Qualcomm that "specify bands of interest" does not look appropriate for a core technical specification. However, it is clear that there are concerns that go beyond just the purely technical and that these do have to be taken into account.* *One way would be to make the RAN 4 advice “Informative” and not “Normative” – so this might then say “The following Bands have clear technical mechanisms for creating interference in the GNSS bands. Other Bands may also affect the GNSS performance or may be required to be tested for other reasons.” This might be an approach for further discussion if companies wish to continue this topic beyond this meeting.* *Alternatively, I think Dish is suggesting that the information that RAN 4 has discussed should simply be put into an informative LS to RAN 5 which can then take it into account in its discussions and decisions. That would mean that the RAN 4 information would not be lost which will otherwise be the case if we simply ignore LTE and NR SA in this meeting. Also see my comments on the LS below.**To answer Apple:* *1. If we could agree some compromise wording (more like “advice”) in RAN 4 (perhaps just in an LS), then it would be for RAN 5 to discuss and agree which Bands should be tested. This would be done each time a new Band was introduced into RAN 5. It is also worth noting that the Certification Bodies GCF and PVG/PTCRB also “pick and choose” which Bands to test and they do not test in every Band, even though currently RAN 5 tells them that they should test in every Band.**2. Concerning the original LS: as everyone knows, the wording of LSs is normally “written by committee” and sometimes not perfectly clear so we should not argue too much about what exactly RAN 5 did or did not mean in the LS. But I do note that RAN 5 requested “guidance”, so perhaps that is all RAN 4 should provide and not a definitive/normative statement about what should or should not be tested …. So perhaps we are being too prescriptive in our proposals ….**3. Concerning the core requirements and Bands …. This goes back 15 years – at that time RAN 4 left the discussion/decision about which cellular bands to test to RAN 5 (in fact it was T1 before RAN 5 was formed). T1 (RAN 5) made the decision to test in each cellular Band and informed RAN 4 but this was only ever formalised in the RAN 5 specifications.* |
| AT&T | We support the views of DISH and Spirent. We think that RAN4 should focus on identifying the areas of concern to RAN5. The core requirements should apply in a band-agnostic way. |

# Topic #2: Others (AI 5.1.10.2)

## Companies’ contributions summary

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| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2112478**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112478.zip) | MediaTek Inc., Rohde & Schwarz | On the number of satellites for 3-GNSS scenarios (discussion) |
| [**R4-2112479**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112479.zip) | MediaTek Inc., Rohde & Schwarz | CR on satellite allocation (draftCR 36.171) (plus CAT A draftCR) |
| [**R4-2112481**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112481.zip) | MediaTek Inc., Rohde & Schwarz | CR on satellite allocation (draftCR 38.171) (plus CAT A draftCR) |
| [**R4-2113444**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113444.zip) | CATT | Draft CR on 36.171 requirements for support of A-GNSS (draftCR 36.171) |
| [**R4-2113443**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113443.zip) | CATT | Draft CR on 38.171 requirements for support of A-GNSS (draftCR 38.171) |

## Open issues summary

### Sub-topic 2-1: On the number of satellites for 3-GNSS scenarios

**Observation 1:** the way the GNSS scenarios are defined, the complexity of the test case increases with the number of constellations used.

**Observation 2:** this complexity increase is not consistent with the real field behavior: UEs supporting multiple constellations will generally see many more satellites.

**Proposal 1:** Increase the number of satellites to maintain always an overdetermined system with at least one equation more than unknowns, as shown (for example) in Table 1.

Table 1: Power level and satellite allocation

|  |  |
| --- | --- |
|  | Satellite allocation for each constellation |
| GNSS-1(1) | GNSS-2 | GNSS-3 |
| Single constellation | High signal level | 1 | - | - |
| Low signal level | 5 | - | - |
| Dual constellation | High signal level | 1 | - | - |
| Low signal level | 2 | 3 | - |
| Triple constellation | High signal level | 1 | - | - |
| Low signal level | 2 | 2 | 2 |
| Note 1:GNSS-1, i.e. the system having the satellite with high signal level, shall be selected by the device manufacturer. |

* Recommended WF:
	+ Discuss Observations and Proposal 1
	+ Discuss if draft CRs are able to be endorsed.

### Sub-topic 2-2: References updated (CATT)

* Recommended WF:
	+ Discuss if draft CRs are able to be endorsed.

## Companies views’ collection for 1st round

### CRs/TPs comments collection

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| **TP/draftCR number** | **Comments collection** |
| [**R4-2112478**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112478.zip)(discussion)(MediaTek Inc., Rohde & Schwarz) | Qualcomm: This requires more analysis. The requirement says: "In this test case 6 satellites are generated for the terminal". It seems the intention was that a UE is required to use SVs from all 2 or 3 constellations in order to pass the test. If we add one more SV to the 3-constellation scenario, then it seems using 2-constellations only may also result in a successful test outcome(?). In addition, there is the GNSS-GNSS Time Offset assistance data available, and therefore, the number of unknowns would be the same in all 3 cases (single, dual, triple constellation), since a UE would not necessarily need to solve for this time offset. However, assistance data are usually optional and the GNSS-GNSS time offset assistance data may not be provided in real deployments. In general Observation 2 seem correct - UEs supporting multiple constellations will generally see many more satellites, so the scenario(s) per se look unrealistic. |
| Spirent: I can confirm that the original intention, many years ago, was that the UE would be forced to use SVs from all 3 constellations and that is why the scenario(s) are “unrealistic”. However, if adding one more SV does not invalidate the purpose of the test, then we do not object. |
| MTK: @ Qualcomm: UE will not be able to pass the test case stably without one more degree of freedom. Furthermore, the rank could reduce from 6 to 5 if there is 4SV at the same plat. Even with the GNSS-GNSS Time Offset assistance, there is still the GNSS-GNSS measurement bias cause by the group delay of RF front end at different frequency such as GPS L1, BDS B1i, GLONASS G1. The bias could change phone-by-phone even with the same batch of RF component.@ Spirent: Based on the number of unknown parameters, UE should use all of 7 (3-2-2) measurements for passing this scenario stably. This proposal will not invalidate the purpose of the test, and UE will still use all 3 constellations. Otherwise, UE will lose 2 equations. This is why we did not purpose to add one more satellites to 8 SVs (3-3-2).  |
| Qualcomm-2: Thanks MTK for clarification. After further checking, we agree that the GNSS-GNSS Time Offset assistance would not help reducing the number of unknowns. Even the 7 measurement scenario will be quite challenging considering the signal levels and other test conditions. Therefore, we are O.K. with the proposal. We think even for a e.g. 3-3-2 case, it seems rather likely that all 3 constellations have to be used. |
| [**R4-2112479**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112479.zip)[**R4-2112481**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112481.zip)(draftCRs)(MediaTek Inc., Rohde & Schwarz) | Qualcomm: see above. |
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| [**R4-2113444**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113444.zip)[**R4-2113443**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113443.zip)(draft CRs)(CATT) | Qualcomm: Not needed. The guideline from the 3GPP specification manager was clear: Existing LPP references do not need to be updated, since 36.355 will exist also in future Releases. |
| (Comment sent before deadline for Round 1)CATT: Because in latest 38.171 and 36.171, BDS signal B1C is included. But the B1C was introduced from 37.355 and not included in 36.355. So if we refer to 36.355, we cannot find the information for B1C. And the IEs in 36.355 and 37.355 are different (for example **GNSS-IonosphericModel, GNSS-Almanac etc.**). We believe the reference should be based on the latest version i.e. 37.355. **So we suggest to keep the CR as return to, so that companies can further check in 2nd round. Thanks.**  |
| Qualcomm: 36.355 Rel-16 includes everything which is in 37.355 Rel-16, since 36.355 contains just a pointer to 37.355. As said, this has been done to avoid updating existing references in the various specifications.However, we have no problem with an editorial change. But the proposed CR is not a needed correction and the "Consequences if Not Approved" seem not correct. |
| CATT: Thanks for the clarification. After further check, we agree with QC’s explanation. Then this can be just an editorial change to make the reference more straightforward if companies are OK.  |

## Summary for 1st round

### Open issues

*No open issues*

### CRs/TPs

|  |  |
| --- | --- |
| **CR/TP number** | **CRs/TPs Status update recommendation**  |
| [**R4-2112479**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112479.zip)[**R4-2112481**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112481.zip)(MediaTek Inc., Rohde & Schwarz) | *Return to for further consideration* |
| [**R4-2113444**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113444.zip)[**R4-2113443**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113443.zip)(CATT) | *Return to for further consideration* |

## Discussion on 2nd round (if applicable)

*Moderator can provide summary of 2nd round here. Note that recommended decisions on tdocs should be provided in the section titled ”Recommendations for Tdocs”.*

|  |  |
| --- | --- |
| **CR/TP number** | **CRs/TPs Status update recommendation**  |
| **[R4-2112479](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112479.zip)****[R4-2112481](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112481.zip)**(MediaTek Inc., Rohde & Schwarz) | *Qualcomm (Spirent): Extra changes are required in a number of places in the text. Search for “*6 satellites” *and you will find all the places that need editing.* |
| *Spirent: Sorry, I just noticed that in every Table: “*Test Parameters”, *the number of satellites is listed so you also need to make this “6 or 7” and add a new note. Sorry for not noticing this before.**I will also ask for new Tdoc numbers.**MTK: Thank you for pointing out this. Additional edits are added around every Table and Annex B.15.2 in the revision.*  |
| **[R4-2113444](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113444.zip)****[R4-2113443](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113443.zip)**(CATT) | *Spirent: in R4-2113443 please add spaces in* 37.355[22] so that they are 37.355 [22]*Qualcomm: Seems I added my comment in the wrong Table (above)**36.355 Rel-16 includes everything which is in 37.355 Rel-16, since 36.355 contains just a pointer to 37.355. As said, this has been done to avoid updating existing references in the various specifications.**However, we have no problem with an editorial change. But the proposed CR is not a needed correction and the "Consequences if Not Approved" seem not correct.* |
| CATT: Thanks for the clarification. After further check, we agree with QC’s explanation. Then this can be just an editorial change to make the reference more straightforward if companies are OK. *OK with Sprint’s comments. The draft revision is uploaded to the second round folder. Can moderator help ask for a tdoc revision from session chair?* |
| Spirent (moderator): If we now say this is “editorial”, does RAN 4 use “Cat D”? I am not sure as normally I work in RAN 5. I will ask for guidance and a new Tdoc number. |

# Recommendations for Tdocs

## 1st round

**New tdocs**

|  |  |  |
| --- | --- | --- |
| **Title** | **Source** | **Comments** |
| WF on … | YYY |  |
| LS on … | ZZZ | To: RAN\_X; Cc: RAN\_Y |
|  |  |  |

**Existing tdocs**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Tdoc number** | **Title** | **Source** | **Recommendation**  | **Comments** |
| **R4-2112138** | Remaining issues on testing of A-GNSS Sensitivity requirements in NR and LTE | Apple | Noted |  |
| **R4-2113303** | Discussion on Frequency Bands for testing of A-GNSS Sensitivity requirements in NR and LTE | Xiaomi | Noted |  |
| **R4-2114210** | Frequency bands for testing of A-GNSS sensitivity requirements | Qualcomm Incorporated | Not Pursued | Not currently acceptable |
| **R4-2114208** | Frequency bands for testing of A-GNSS sensitivity requirements | Qualcomm Incorporated | Revised |  |
| **R4-2112478** | On the number of satellites for 3-GNSS scenarios | MediaTek Inc., Rohde & Schwarz | Noted |  |
| **R4-2112479** | CR on satellite allocation | MediaTek Inc., Rohde & Schwarz | *Return to for further consideration* | Found further changes needed |
| **R4-2112481** | CR on satellite allocation | MediaTek Inc., Rohde & Schwarz | *Return to for further consideration* | Found further changes needed |
| **R4-2113444** | Draft CR on 36.171 requirements for support of A-GNSS | CATT | Return to |  |
| **R4-2113443** | Draft CR on 38.171 requirements for support of A-GNSS | CATT | Return to |  |

Notes:

1. Please include the summary of recommendations for all tdocs across all sub-topics incl. existing and new tdocs.
2. For the Recommendation column please include one of the following:
	1. CRs/TPs: Agreeable, Revised, Merged, Postponed, Not Pursued
	2. Other documents: Agreeable, Revised, Noted
3. For new LS documents, please include information on To/Cc WGs in the comments column
4. Do not include hyper-links in the documents

## 2nd round

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Tdoc number** | **Title** | **Source** | **Recommendation**  | **Comments** |
| R4-210xxxx | CR on … | XXX | Agreeable, Revised, Merged, Postponed, Not Pursued |  |
| R4-210xxxx | WF on … | YYY | Agreeable, Revised, Noted |  |
| R4-210xxxx | LS on … | ZZZ | Agreeable, Revised, Noted |  |
|  |  |  |  |  |

Notes:

1. Please include the summary of recommendations for all tdocs across all sub-topics.
2. For the Recommendation column please include one of the following:
	1. CRs/TPs: Agreeable, Revised, Merged, Postponed, Not Pursued
	2. Other documents: Agreeable, Revised, Noted
3. Do not include hyper-links in the documents

# Annex

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Note:

1. Please add your contact information in above table once you make comments on this email thread.
2. If multiple delegates from the same company make comments on single email thread, please add you name as suffix after company name when make comments i.e. Company A (XX, XX)