**3GPP TSG-RAN2 Meeting #124 R2-23xx**

**Chicago, USA, Nov 13-17 2023**

**Agenda Item:** 7.8.1

**Release:** Rel-18

**Work Item:** NR\_UAV-Core

**Source:** Qualcomm Incorporated

**Title:**  Report of [POST123bis][025][UAV] 38.331 Running CR (Qualcomm)

**Document for:**Discussion/Decision

# Introduction

As the outcome of the email discussion “[POST123][311][UAV] Running CR 38.331 (Qualcomm)”, the latest version of RRC running CR is available in [R2-2309611](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_123bis/Docs/R2-2309611.zip). There are several Editor’s Notes and FFSes in the running CR. Based on various company contributions, RAN2#123bis made several agreements.

Following email discussion was setup to discuss further on the running CR and remaining RRC open issues:

* [POST123bis][025][UAV] 38.331 Running CR (Qualcomm)

Scope:

- Review running CR

- Identify open issues

- Get inputs for subset of open issues (focus on more detailed open issues that would help with CR finalisation.

      Deadline: long

The running CR is being updated as part of the email discussion. However, there are still some open items. This document is the report of the email discussion on open issues.

**Deadline for feedback (please provide your comments in tables below): Friday, October 27, 1000 UTC.**

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|  |  |  |
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# Measurement/Reporting

## UE behaviour when the altitude range ranges

There was a brief discussion on the UE behavior regarding the existing measurements when the applicable configuration changes due to the UE’s entering or leaving another altitude range. Following shows the chair’s notes:

|  |
| --- |
| - Apple explains that the UE already clears stored measurements. Samsung has a different understanding as we agreed already that it is up to implementation. We should have a note that the UE can reset the filtered measurements but it is up to UE implementation. QC has already implemented the notes. Apple asks about the cell list, whether the UE removes the cell list. Samsung understands but if height range changes it is up to UE implementation.  => The rapporteur will discuss what the UE behaviour when the height range ranges in the rapporteur CR review. |

In addition, RAN2#123bis also captured the following in agreements:

* FFS UE behavior with respect to cell list is already clear when it switches to a new height range in either SSB to Measure or in eventAxHy (in rapporteur CR email discussion)

Based on the above and the changes captures in the latest/updated running CR (part of the post meeting email discussion), companies are invited to comment on whether anything else needs to be captured.

**Q1: Please comment whether anything else needs to be captured for UE behavior regarding the existing measurements when the applicable configuration changes due to the UE’s entering or leaving another altitude range.**

|  |  |
| --- | --- |
| **Company** | **Comment** |
| Ericsson | For measurement samples we agree it should be left to UE implementation. However, what does “**UE behavior regarding the existing measurements**” consist of? Do we discuss here the cell list as well? |
| Xiaomi | No spec change is needed.  For the height based SSB to Measure, it is up to UE implementation whether to keep measurement samples when the UE switches to a new height range. For event AxHy, when the UE switches to a new height range, it means the leaving condition of event AxHy is fulfilled and current UE behaviours can cover the case. Hence, no spec change is needed. |
| ZTE | No, smililar view as Xiaomi |
| Lenovo | No spec change is needed. Agree with Xiaomi |
| Huawei, HiSilicon | OK to leave it to UE implementation.  Regarding the event AxHy, there is no need to introduce additional spec changes. |
| Nokia | In our opinion, leaving this up to the UE implementation is the worst option, as the NW will never know if certain UE reports just those currently applicable cells or also the old ones. So clarity in the specification is preferable – the UE either keeps the old measurements or releases them. |

**Summary:** TBD

## Altitude based triggers H1/H2/AxHy: UE altitude ‘is higher/lower than’ vs ‘becomes higher/lower than’ a threshold

This issue was raised during last CR review and also during the meeting. The rapporteur had unified the terms to ‘becomes higher/lower than’ to be consistent with the other NR event triggers. However, there is still one issue that was raised which is not clear: at the time of configuration, if the UE is *already* in the specified altitude range, does that trigger a measurement report?

**Take an example:** at the time of RRC Reconfiguration, the UE is already at 52m. The new configuration includes an H1 event with threshold = 50m, Hyst = 1m, TTT = 100ms. In such case, does the UE trigger a measurement reporting event after say 100ms, i.e. TTT expiry due to the event H1 (assuming the altitude does not go below 49m)?

**If yes:** then ‘is higher/lower than’ seems more accurate.

**If no:** then the network may not get the measurement result along with the UE altitude, even after configuring the H1 event in anticipation of getting the report when UE is above 50m. Then we may need to consider adding altitude reporting even in *PeriodicalReportConfig*?

**Q2: If the UE is already in the corresponding altitude range at the time of configuration, does the UE trigger measurement reporting based on the configured event after the TTT expiry (assuming everything else remaining the same)? See example above.**

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| --- | --- | --- |
| **Company** | **Yes/No** | **Comment** |
| Ericsson | yes | Event is triggered when the condition is fulfilled(H and RSRP). UE did not track the time how long it was above 50m before the configuration, so TTT would naturally start upon configuration. |
| LGE | Yes | In the case of the other events related to radio quality, the same term of “becomes” is used, but there is no issue for understanding. We can understand the same way with the radio quality. That is, UE could send MR if the height satisfied the height condition at the initial setup as well. There is no need for spec change. |
| Xiaomi | Yes | Generally, when UE is configured with a measId associated with the event, UE will start the evaluation. Hence, before the reception of the configuration, UE can not track whether the event is fulfilled before the configuration. Similar to legacy event Ax, for the evaluation, UE doesn’t mind the measurement results/height before the configuration. |
| ZTE | Yes | We think this is common understanding. “become” is also used for existing event triggers. With the help of entering/leaving conditions, the event will be triggered if entering condition is fulfilled upon configuration. We don’t think there is chance for misunderstanding. |
| Lenovo | Yes | Similar understanding as other companies. UE only evaluate whether height is larger or smaller than the threshold but not consider the height before the configuration. |
| NEC | Yes | UE need to check *VarMeasReportList* and only trigger measurement reporting when *VarMeasReportList* does not include a measurement reporting entry for this *measId*, to avoid continuously reporting.  UE also need to remove the measurement reporting entry within the *VarMeasReportList* for this *measId* upon leaving the altitude range.  From above, we think initial reporting will be triggered when UE is already in the specified altitude range while subsequent reporting will only be triggered when UE ascends above a threshold or UE descends below a threshold. (This is aligned with LTE and CR R2-2002078 was captured for this issue) |
| Huawei, HiSilicon | Yes | The UE should send the MR once the events H1/H2/AxHy are configured or re-configured when the UE is already in the specified altitude range. We are not sure that the word “becomes” can cover this. Do we need a NOTE to explain this case? |
| Nokia | Yes | Same understanding as Ericsson. |

**Q2a: If the answer to question 2 is ‘yes’, is any change needed in running CR (e.g. change ‘becomes higher/lower than’ to ‘is higher/lower than’)?**

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| --- | --- | --- |
| **Company** | **Yes/No** | **Comment** |
| Ericsson | No strong view |  |
| LGE | No | See the Q2 answer |
| Xiaomi | No strong view | Both ‘is higher/lower than’ and ‘becomes higher/lower than’ are ok for us. There may be no issues for the understanding about ‘becomes higher/lower than’. |
| ZTE | No | We think this is common understanding. “Become” is also used for legacy event triggers.. |
| Lenovo | No strong view |  |
| NEC | No |  |
| Huawei, HiSilicon | Maybe | Maybe adding a NOTE can avoid the possible confusion. |
| Nokia | No strong view | The ‘becomes’ terminology is already aligned with the other events and the reporting situation/condition is the same as for the other non-UAV triggers |

**Q2b: If the answer to question 2 is ‘no’, is any change needed in running CR (e.g. add altitude reporting in *PeriodicalReportConfig*)?**

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| **Company** | **Yes/No** | **Comment** |
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**Summary:** TBD

## Granularity for UE Altitude configuration and reporting

RAN2#123 agreed: **Signalling should allow the network to simultaneously configure height-based event thresholds for the whole range of possible UE heights.**

Note that UE height parameter in LTE is defined as follows (see TS 36.331):

heightUE-r15                      INTEGER (-400..8880)       OPTIONAL

***heightUE***

Indicates height of the UE in meters relative to the sea level. Value 0 corresponds to sea level (i.e., negative value indicates depth of the UE below sea level). Value -400 corresponds to -400 m, value -399 corresponds to -399 m and so on.

**Observation: In LTE, the granularity of UE altitude for reporting is 1m.**

RAN2#123bis made the following agreement.

**Agreements:**

- The altitude from -420m to 1k above mt. Everest (i.e. ~10km) with 2m granularity.

Although the proposal was to have granularity of 1m, the main argument for this agreement (to have a 2m granularity) was to make it ‘same as LTE’, as shown in the following snippet.

Discussion on granularity

- Qualcomm thinks it should be 1m. Samsung wonders why as in LTE is 2m. Ericsson thinks that this would require more bits to signal. Samsung is not convinced that even if we change height range it doesn’t mean we need to change granularity. 2m is enough as we can configure hysteresis with 1m granularity at least in LTE.

As described above, in LTE, the granularity of UE height *reporting* is 1m. On the other hand, for the *configuration* such as H1/H2, the granularity is 2m. As in NR RAN2#123 agreed to support the signalling to allow *configuration of the whole range of possible UE heights*, the running CR uses the single IE for Altitude-r18 to be used both in confugration and reporting, with granularity of 1m, as shown below.

|  |
| --- |
| – *Altitude*  The IE *Altitude* is used to indicate altitude relative to sea level. The actual value is the field value in meters.  ***Altitude* information element**  -- ASN1START  -- TAG-ALTITUDE-START  Altitude-r18 ::= INTEGER (-420..10000)  -- TAG-ALTITUDE-STOP  -- ASN1STOP |

Companies are requested to provide their comments if they prefer to:

* + As currently captured, use single IE (Altitude-r18) for both configuration and reporting inline with agreement from RAN2#123 (granularity for both reporting and configuration is 1m)
  + Create separate IE to be used only for configuration with 2m granularity. Keep 1m granularity for reporting as in LTE.

**Q3: Please comment Con your preference regarding granularity of altitude reporting and configuration.**

* 1. **As currently captured in the running CR: Use single IE (Altitude-r18) for both configuration and reporting inline with agreement from RAN2#123. Granularity for both reporting and configuration would be 1m.**
  2. **Create separate IE to be used for configuration with 2m granularity for Altitude. (Keep 1m granularity for reporting as in LTE.)**

|  |  |  |
| --- | --- | --- |
| **Company** | **Preference** | **Comment** |
| Ericsson | No strong view |  |
| LGE | No strong view | We prefer the current agreement (as LTE). Altitude(2m granularity) can be adjusted in 1m granularity using hysteresis(1m granularity). |
| Xiaomi | No strong view | Slightly prefere option a), which may be simpler. |
| ZTE | No strong view |  |
| Lenovo | No strong view |  |
| NEC | a) | This is a cleaner option. |
| Huawei, HiSilicon | a | The granularity of reporting and configuration should be same. |
| Nokia | a) | Simplifies the specs. |

**Summary:** TBD

## Avoiding duplicate cells in cellsTriggeredList

In section 5.5.4.1, an Editor’s Note is captured based on company comments during the email discussion.

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| 2> if the *reportType* is set to *eventTriggered*, and if the corresponding *reportConfig* includes *numberOfTriggeringCells*, and if the entry condition applicable for this event, i.e. the event corresponding with the *eventId* of the corresponding *reportConfig* within *VarMeasConfig*, is fulfilled for one or more applicable cells for all measurements after layer 3 filtering taken during *timeToTrigger* defined for this event within the *VarMeasConfig*:  3> if the *VarMeasReportList* does not include a measurement reporting entry for this *measId* (a first cell triggers the event):  4> include a measurement reporting entry within the *VarMeasReportList* for this *measId*;  3> if the number of cell(s) in the *cellsTriggeredList* is larger than or equal to *numberOfTriggeringCells*:  4> include the concerned cell(s) in the *cellsTriggeredList* defined within the *VarMeasReportList* for this *measId*;  3> else:  4> include the concerned cell(s) in the *cellsTriggeredList* defined within the *VarMeasReportList* for this *measId*;  4> if the number of cell(s) in the *cellsTriggeredList* is larger than or equal to *numberOfTriggeringCells*:  5> set the *numberOfReportsSent* defined within the *VarMeasReportList* for this *measId* to 0;  5> initiate the measurement reporting procedure, as specified in 5.5.5;  Editor’s Note: To be checked further whether additional conditions are needed to avoid the existing cells in *cellsTriggeredList* to be added again to the list (i.e. both instances of “4> include the concerned cell(s) in the *cellsTriggeredList* defined within the *VarMeasReportList* for this *measId*;” above). This applies to LTE spec also. |

There can be multiple ways to interpret the statement “include the concerned cell(s) in the *cellsTriggeredList…*”. One way to interpret is that ‘include the concerned cell(s)’ is not same as ‘append’, so this should mean only add if not already there in the list. Other way to interpret could be that there is no restriction on duplicate entries, so the list can grow due to duplicate entries.

So far, the *size* of *cellsTriggeredList* was not a determining factor (other than when it is empty) in the procedural texts. The *risk* of duplicate entries was not there in the existing procedures since ‘remove the concerned cell(s) in the *cellsTriggeredList*’ procedure would anyway remove the duplicates, if any.

Now the new procedural text relies on the “number of cell(s) in the *cellsTriggeredList*”. This is a new behaviour. So, it is worth discussing whether there is a risk of adding the same cells again to the *cellsTriggeredList*, thereby reaching the *number* prematurely by counting duplicate entries.

From rapporteur point of view, there are following alternatives: a) Confirm RAN2 understanding of existing procedure: “include the concerned cell(s) in the cellsTriggeredList” means adding only the cells not already in the list; or b) Add conditions to clarify that only the cells not already in the cellsTriggeredList are added. In case of b), further comment on what to for LTE.

**Q4: What is your view regarding Editor’s Note in section 5.5.4.1 (whether additional conditions are needed to avoid the existing cells in cellsTriggeredList to be added again)?**

1. Confirm RAN2 understanding of existing procedure: “include the concerned cell(s) in the *cellsTriggeredList*” means adding only the cells not already in the list. In case of a) further comment on whether any spec change is needed.
2. Add conditions to clarify that only the cells not already in the *cellsTriggeredList* are added. In case of b), further comment on what to for LTE.
3. Any other suggestion.

|  |  |  |
| --- | --- | --- |
| **Company** | **Answer option a/b/c** | **Comment** |
| Ericsson | a | Is there any other option to interpret this? |
| LGE | a | We believe a smart UE does not add the cell already included in the list. Also, further comment is not necessary. |
| Xiaomi | a | We think a) is a common understanding and share the same view LGE the smart UE will not add the duplicate cell in the cellsTriggeredList. Hence, no spec change is needed. |
| ZTE | a | A reasonable implementation will not add again the cells already into the list. Option a) is enough. |
| Lenovo | a |  |
| NEC | a |  |
| Huawei, HiSilicon | a | We think the “include the concerned cell(s) in the *cellsTriggeredList*” means adding only the cells not already in the list. But do we need to add a NOTE to clarify this and avoid possible confusion? |
| Nokia | a) | This is the only option which is technically coherent with the expected usage of the report information. |

**Summary:** TBD

# Flight Path Reporting

## Forwarding flight path by source gNB during HO

RAN2#121 agreed:

1. Flightpath information should be forwarded from source gNB to target gNB during handover. Send LS to RAN3 to check for feasibility

An LS was sent to RAN3 in R2-2304474. RAN3 replied in R2-2307034/R3-233493 with the following:

RAN3 agreed adding the UAV flight path information into RAN3 specifications for NGAP (TS 38.413), and XNAP (TS 38.423). The agreed TP capturing the UAV flight path information are attached, while the referred IE to RRC is FFS to wait until RAN2 finalization of the definition of UAV fight path information.

In other words, RAN3 has already agreed on baseline CRs. From RAN2 side, the flight path information IE could be included in *AS-Context* within *HandoverPreparationInformation* such that it can be transferred between the RAN nodes during the HO preparation. This has been captured in the running CR, however there was a comment that the change in the CR may not be needed.

**Q5: Do you agree, during HO preparation, source gNB includes *FlightPathInfoReport* in *AS-Context* within *HandoverPreparationInformation* (as already captured in the running CR)? If not, please explain alternatives.**

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| --- | --- | --- |
| **Company** | **Agree/Disagree** | **Comment** |
| ericsson | yes |  |
| LGE | Agree | It is useful for reducing the transmission process of flight path information after a handover |
| Xiaomi | Yes |  |
| ZTE | Yes | To include *flightPathInfoReport* in *AS-Context* is also useful for other cases, e.g. RRC re-establishment.  If RAN2 reach this agreement, we need to inform RAN3 considering that the explicit IEs introduced in NGAP and XNAP messages shall not be required any more. As the contact company of RAN3 LS, we volunteer to prepare a draft reply LS to RAN3. |
| Lenovo | Yes |  |
| NEC | Agree |  |
| Huawei, HiSilicon | Disagree | It has been agreed in RAN3 baseline CRs, there is no reason to change the baseline RAN3 CRs. Nevertheless not strong opinion, as long as we let RAN3 know. |
| Nokia | Disagree | As explained in the background to this question, we have asked RAN3 to do the job. Thus, we should not try now to invalidate their decisions. |

**Summary:** TBD

# Aerial-specific Emission (RAN4 LS)

## NS values for EUTRA bands in NR SIB

In the current running CR, the aerial specific NS values are captured in SIB1, SIB2 and SIB4. However, they are not added in SIB5.

SIB5 in NR contains information relevant only for inter-RAT cell re-selection i.e. information about E-UTRA frequencies and E-UTRAs neighbouring cells relevant for cell re-selection.

SIB5 -> carrierFreqListEUTRA -> CarrierFreqEUTRA -> EUTRA-MultiBandInfoList -> EUTRA-NS-PmaxList indicates the list of frequency bands in addition to the band represented by *CarrierFreq* for which cell reselection parameters are common, and a list of *additionalPmax* and *additionalSpectrumEmission*.

Now, the question: should NR SIB5 also be updated to include aerial specific EUTRA NS values?

**Q6: Should NR SIB5 be updated to include aerial specific EUTRA NS values?**

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| --- | --- | --- |
| **Company** | **Yes/No/FFS** | **Comment** |
| Huawei, HiSilicon | Yes | No strong opinion, but NS values should be considered for EUTRA because the OOBE requirements is also applicable for inter-RAT scenario. |
| Nokia | Yes | SIB5 contains EUTRA-MultiBandInfoList which comprises eutra-NS-PmaxList. So a corresponding change for Aerial UEs can be added. |
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**Summary:** TBD

## Capability to indicatate support of Aerial-specific emission list

One of the items that is still open is UAV capability indication which is also related to RAN4 LS question that RAN2 has not replied to yet.

For OOB emission parameters/NS values in RAN4 specifications, RAN4 would like to refer to the *aerial* *capabilities* in RAN2 specs, however it is not clear which one (or multiple) they should refer to.

The OOB emissions requirements are generally governed by regional regulations. For example, the current RAN4 work is needed due to European requirements on some specific bands, while such requirements are not known to be present in other jurisdictions.

Therefore, for the Aerial UE, one could argue it should be optional to support the procedure of acquiring and applying the Aerial-specific emission list. (Of course, that is not to say it should be optional for the UE to comply with the regional requirements.) Aerial UEs need to implement the feature if they are to be operated in the jurisdiction where such requirements exist, but should not be forced to implement the feature if they are only intended to operate outside of such regions.

**Q7: Do you agree to introduce optional UE capability with indication to indicate support of the mechanisms defined for cells broadcasting Aerial-specific emission list? (Applicable to both LTE and NR)**

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| --- | --- | --- |
| **Company** | **Yes/No** | **Comment** |
| Ericsson | no | Seems there is no need for extra capability for the NS value. Hoevere, this discussion could be postponed until we have decided all aerial UE capabilities. |
| LGE | Yes | If the aerial-specific emission operation isn't a mandatory feature, the network should manage the aerial UE based on whether it supports it to prevent regulatory violations. Seperate capability can be beneficial. |
| ZTE |  | Can postpone this until the capability discussions for all aerial UE capabilities. |
| Huawei, HiSilicon | No | Similar opinion as Ericsson. We can discuss in the context of UE capability discussion first. The addition of a separate capability for this use needs to be clearly justified. |
| Nokia | No | The same UE can be operated in different regions, and therefore different requirements would need to be supported, but the UE capabiltity should not be optional. Simply, in the regions where this requirement is not needed, the network would not be broadcasting the aerial specficic emission list. |
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**Summary:** TBD

# Misc/Other

**Q8: Please list below if there are other open issues which should be addressed in this email discussion.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Issue/Question** | **Comment/Details** |
| Ericsson | FlightPathUpdateDistanceThr-r18 ::= FFS  flightPathUpdateTimeThr-r18 ::= FFS | Discuss the FFS  And change IE to start with capital letter |
| ZTE | How to apply hysteresis for altitude-based SSB-ToMeasure configuration. | In current running CR, the hystersis is used as following (field description of IE *ssb-ToMeasureAltitudeBasedList)*  when *altitudeHyst* is configured for an altitude range, the UE considers itself to be in the range while (*altitudeMin – altitudeHyst*) ≤ UE altitude ≤ (*altitudeMax + altitudeHyst*).  However, the *altitudeHyst* acts only as an extension of the altitude range of (altitudeMin, altitudeMax), but not acts as ‘hysteresis’.  In our understanding, the entering and leaving condition for event H1 and H2 can be reused.  Thus following formula can be used as the entering condition:  (*altitudeMin* + *altitudeHysts*) ≤ UE altitude ≤ (*altitudeMax* - *altitudeHyst*).  Following conditions can be used as leaving condition:  UE altitude ≤ (*altitudeMin* - *altitudeHysts*) , or (*altitudeMax* + *altitudeHyst*) ≤ UE altitude |
| NEC | The expected UE behavior of providing UAI for flightpath availability notification upon handover. | RAN2 to confirm for the UAI providing flightpath availability notification, UE follow the legacy “last 1 second” rule: UE initiate transmission of UAI again to the target cell if a UAI transmission was initiated during the last 1 second before receiving the reconfigurationWithSync. |
| Huawei, Hisilicon | Clarification on the use of “normal” respurce pool for A2X. | In the last meeting, RAN2 agreed to introduce a dedicated resource pool for BRID and DAA broadcasts of UAV. If the NW does not configure the dedicated resource pool for UAV, whether the UAV can use the “normal” resource pool needs to be confirmed. In Rel-17, sidelink relay discovery resource pool was introduced for relay discovery. The UE uses the sidelink relay discovery resource pool to send discovery message when the discovery resource pool is configured. Otherwise, the UE can use the sidelink “normal” resource pool for discovery message.  We think the A2X dedicate resource pool can follow the mechanism of sidelink relay discovery resource pool. The UAV uses the dedicated resource pool for A2X service if the A2X dedicated resource pool is configured. Otherwise, the UAV can use the normal resource pool for A2X service. |
| Nokia | 1) Add ‘Aerial UE’ in the list of terms in Section 3.1  2) Use consistently ‘Aerial UE’ when needed to differentiate from ‘UE’  3) In 5.7.4.2 “A UE capable of indicating the availability of flight path information…”  4) “Planned location coordinates”  5) “UE for Aerial UE operation” | We have raised many things in the CR directly. Here we repeat just some of these.  3) Simplify the “A UE capable of indicating the availability of flight path information” to “A UE capable of indicating the flight path information”. The UE which has FPP reporting should also have the capabiltity to report its availability.  4) The ‘planned’ aspect is totally irrelevant for 3GPP. The waypoints and timestamps are defined as “flight path plan” already, and some of the reported waypoints might be in the past already at the time of reporting.  5) The “operation” word is unnecessary. |
| Nokia | New IE *frequencyBandListAerial* | This modification is not in line with the RAN2 previous agreement (we have agreed to introduce a list of NS values, not a list of aerial bands). Such change as currently suggested in the CR will cause more work to RAN4 (and they need to also finalize all during the upcoming November’s meeting). In R2-2311287, RAN2 has indicated a different IE would be provided: “and will add a new field additionalSpectrumEmissionUAV which shall be applied by the UAV UE”. Thus, it is expected that RAN4 contributions for this meeting will be prepared assuming such type of modification. Introducing a new IE *frequencyBandListAerial* is a different level of modification and will trigger RAN4 work to create new tables to define the applicable bands for UAV UEs. This is a significant undertaking that might take several meetings (which we do not have). Please note that the introduction of “aerial” bands was actually even discussed by RAN4, but this option was not selected due to the complications it would cause. |

**Summary:** TBD

# Summary

TBD