**3GPP TSG RAN WG2 Meeting #114-e R2-21xxxxx**

**Electronic meeting, 19th May - 27th May 2021**

**Source: ESA**

**Title: Email discussion on LS to RTCM for GNSS integrity**

**Agenda Item: 8.11.5**

**Document for: Discussion and Decision**

1. Introduction

During the online session it has been agreed to begin working towards an agreeable LS that could be send to RTCM to discuss the work carried out by 3GPP and RTCM on GNSS integrity.

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| * [AT114-e][624][POS] LS to RTCM on GNSS integrity (ESA)

      Scope: Draft an LS to RTCM informing them of our agreements on GNSS integrity and soliciting their input.      Intended outcome: Agreeable LS      Deadline:  Thursday 2021-05-27 0000 UTC |

Note, that RTCM was the first to reach to 3GPP by sending an LS to RAN at the RAN #88e meeting – see RP-200557 [1]. In this LS, RTCM asks for cooperation between the two organisation on high accuracy and integrity messages definition.

This contribution puts forward several considerations for a potential LS to RTCM.

1. Review of RP-200557 (LS from RTCM to 3GPP)

Besides providing an overview of its work over the last decades, RTCM asks 3GPP about the possibility to jointly develop the following points:

1. *Communication protocols and Compression*

*Design and development of advanced and efficient protocols for the broadcasting of GNSS augmentation data for high accuracy positioning in the framework of current and emerging mobile communication systems (e.g. 5G).*

*Analysis of compression means for big data transmission in an automotive V2I perspective*

1. *IoT protocols and data formats*

*Analysis and development of standards for high accuracy positioning metadata transmission and Edge computing developments, taking into account security threats and sensor agnostic solutions.*

1. *Security and Antispoofing*

*Analysis of protocols and messages for counteracting security threats and spoofing techniques through signal authentication*

1. *Integrity and Safety for emerging applications*

*Analysis of mobile communication network faults and relevant Integrity support messages transmission for guaranteeing safety in the merging transport applications (e.g. autonomous driving).*

Note, this LS has not been answer and is now approximately one year old. The initial list of items provided by RTCM may not be relevant anymore.

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| Q 1: Do RAN2 delegates consider we need to answer to the initial LS? If yes, do delegates have any considerations on the above list they would like to see included in the LS to be sent by RAN2 to RTCM? |
| Company | Agree/Disagree | Comments if any |
| ESA | Yes | Looking at the list of points mentioned by RTCM, if it´s to begin work with RTCM on all, we estimate that this would require several 3GPP releases. As a priority for Rel17, we would recommend to open a channel with RTCM integrity working group to collaborate **on item d**. although the scope of this collaboration needs clarifications from RTCM – this is addressed in more details in next section. We suggest to leave points a. to b. for future studies in next releases and to ask RTCM to further clarify the intention behind point c. |
| Hexagon | Yes | We agree with ESA that we should focus our collaboration on item d. We are interested to hear if RTCM SC-134 is able to share information on their progress on items a-c and whether there are specific topics related to these they like to collaborate on with 3GPP.Furthermore, we believe that we should work together with RTCM SC-134 on defining the integrity information that is applicable to emerging (transport) applications, i.e. the information that has to be relayed from the Correction Service infrastructure to the UE. It would be a very good outcome of 3GPP/RTCM collaboration if it ensures that the mapping of integrity information & message content between the two formats is understood, and ideally fully possible, so that integrity content initially encoded in RTCM SC-134 defined messages can be converted to 3GPP defined messages, or vice versa.We see it as very important that there is significant commonality in the integrity information content defined and encoded in both RTCM SC-134 and 3GPP messages, to enable maximum interoperability between Correction Services and UE’s irrespective of the communication infrastructure. If this is not achieved it will ultimately slow down adoption of either standard, and slow down the emergence of integrity applications in the market place. |
| Huawei, HiSIlicon | Yes | Agree with the companies above that we should focus on integrity aspects of the LS and consider for the others in the future releases. The scope of R17 pos has already been determined and would not be able to accommodate more objectives.  |
| MELCO | Yes | RTCM has a lot of experts on GNSS including integrity topics, we would recommend to communicate and collaborate on item d with RTCM SC-134 for the standardization on 3GPP.For item a-c, it includes the interesting topic, but,  we think that it is beyond the scope for the standardization of integrity in 3GPP. |
| Intel | Yes | We should focus on integrity since it is part of Rel-17 WI. Othesr are out of scope.  |
| CATT | Yes | Agree with above companies and we could clarify that we could not accommodate all these points in one release and may consider to support them in several releases. We also hope RTCM could provide and share more information and their progress on these points. |
| InterDigital | Yes | We have same understanding with ESA and MELCO to focus on point (d) in the LS to RTCM in order to accommodate any harmonization work on GNSS integrity in 3GPP.  |
| Qualcomm | Yes | Given the objectives of our Work Item, item d seem to have most overlap. Potential collaboration should focus on the integrity message definition. |
| Xiaomi | Yes | We share the same view with ESA that we should focus on item d. |
| Swift Navigation | Yes | Item d seems to have most overlap with the Release 17 work, specifically the GNSS integrity message definition. This in turn will allow us to identify which messages may be common between these standards and which messages may differ to satisfy the 3GPP functionality. We agree with ESA that the best way to clarify the scope of discussion with RTCM is by sending a list of questions to SC-134, as has been addressed in Q4 below. |
| ZTE | Yes | We share the same view with ESA.  |
| Nokia | Yes | Agree with ESA and several other companies, only item (d) is relevant to our current scope in 3GPP. |
| Ericsson | Yes | Same view as ESA.Further, It would be worth however to also refer our Rel-16 specification TS 37.355 where we have defined our SSR based upon QZSS and thus the RTCM SC 104 may take that into account while developing the SSR messages. |
| u-blox AG | Yes | Agree that item d) is relevant to the current WI in R17 and would support working with RTCM. We should ensure that they are aware of our time plan for R17. |
| ESA |  | We added a sentence clarifying that items a. to c. fall outside the scope of our work in Release 17 and cannot be pursue. In line with suggestions from Hexagon, QCOM, and Swift, a sentence has been included in the LS to clarify that our focus is on integrity message definition and exploit potential commonalities in the integrity information content. Following Ericsson’s comment, a reference to QZSS CLAS and 3GPP TS 37.355 has been included into the first paragraph of the LS |

*Q1 summary:*

14 out of 14 participants agreed to answer to the initial LS received from RTCM and indicate out priority for a potential collaboration with SC134 group: definition of GNSS integrity messages. Several participants suggested that commonality in the integrity information content is an important target.

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| Q 2: Do RAN2 delegates agree that we attached to the LS the TR of the NR Pos Enh study item? |
| Company | Agree/Disagree | Comments if any |
| ESA | Yes | We think the TR can help RTCM get up to speed with all the work carried out by RAN2 on the topic of GNSS integrity during the study item phase. |
| Hexagon | Yes | We agree; this will be an effective way of updating the RTCM SC-134 committee on the discussions and status within 3GPP and will help identify the areas where collaboration will be most needed |
| Huawei, HiSilicon | No strong view | If we can confirm the content of the TR as formal agreement for the group in the WI, they can be sent to RTCM. Otherwise, we should re-examine the progress we have in the TR and only send the agreements to RTCM when they are formally agreed.We think the current question 4 is sufficient already, i.e., asking RTCM to provide feedback to the chapter on integrity in the TR.  |
| MELCO | Yes | We agree that we attached to the LS the TR proposed by ESA because it is valuable to confirm the basic understanding between 3GPP and RTCM SC-134 committee. |
| Intel | Yes |  |
| CATT | Yes | And hope RTCM SC-134 committee could check and give further suggestions or comments to integrity part in the TR. |
| InterDigital | Yes | We think the TR can be included with the LS, with the intention of indicating to RTCM the scope of the topics on GNSS integrity discussed during the SI phase in 3GPP. The contents in the TR can at least be used as a starting point to motivate any feedback and inputs from RTCM on related topics.  |
| Qualcomm | No | We do not see the need to send them the TR since most of the terminology and content is 3GPP specific which would require quite a bit of explanation for someone not familiar with the 3GPP system and architecture. And the basics/background of GNSS integrity we would not need to explain to RTCM anyhow. However, if there is majority view that the TR should be attached, we would also be O.K. But then I think the rapporteur should be prepared to go to RTCM and explain the context/background of the TR, since I would expect many questions… |
| Xiaomi | Yes |  |
| Swift Navigation | Yes, with comments | We think it is generally useful to send the TR so long as we include specific questions on the feedback we are seeking in response to the TR – refer to Q4 and the track changes below.  |
| ZTE | Yes |  |
| Nokia | Yes, but | We should ask RTCM to focus on the GNSS integrity part – in particular the feared events that we have been considering. So in the LS we should explicitly indicate the relevant clause of feared events. |
| Ericsson | Yes, also reference to TS 37.355 for SSR for SC 104 | It could be good to let them know how we have defined the SSR in Rel-16 by citing our TS 37.355; so RTCM SC 104 also takes that into account. |
| u-blox AG | Yes | However we should be clear that only the chapter covering GNSS integrity is relevant for the current work effort. |
| ESA |  | Following concerns raised by some of the company a reference to section 9.3.1.1. We understand QCOM´s view but we think it´s more beneficial to help RTCM find quickly all the information related to GNSS integrity. A reference to TS 37.355 has been included as well. Track changes suggested by Swift looks fine to us.  |

*Q2 Summary*:

12 participants agreed to attach the TR of the NR Pos Enh study item to the LS. 1 participant stayed neutral and 1 suggested not to attach the TR.

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| Q 3: Do RAN2 delegates agree that we include in the LS the sentence from bellow which identifies our priorities when have to pick from the list of items suggested by RTCM?Out of the four topics, RAN2 puts priority on the Integrity and Safety for emerging applications as there are synergies with the scope of GNSS integrity as part of NR Positioning Enhancements work item.  |
| Company | Agree/Disagree | Comments if any |
| ESA | Yes | See answer to Q1 |
| Hexagon | Yes | Yes.  |
| Huawei,HiSIlicon | Yes |  |
| MELCO | Yes | See answer to Q1 |
| Intel | Yes |  |
| CATT | Yes |  |
| InterDigital | Yes |  |
| Qualcomm | Yes |  |
| Xiaomi | Yes |  |
| Swift Navigation | Yes | Refer to Q1 |
| ZTE | Yes |  |
| Nokia | Yes |  |
| Ericsson | Yes |  |
| u-blox | Yes |  |

*Q3 Summary*:

RAN2 delegates (14 out of 14) agree to include the sentence in the LS.

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| Q 4: Do RAN2 delegates agree with the 4 questions and their scope?  |
| Company | Agree/Disagree | Comments if any |
| ESA | Yes | We think these four questions are a good basis for an initial contact with RTCM SC134. Additional suggestions (both text rephrasing and/or new items) are very welcome. |
| Hexagon | Yes | It is worth adding to Question 3, specifically stating, that RAN2 will share its working documents, progress and timeline with RTCM SC134 prior to SC134 meetings |
| Huawei, HiSilicon | Yes |  |
| MELCO | Yes | We agree with 4 questions including scope.  RTCM SC-134 has the web meeting on May 26 and 27, the collaboration with 3GPP will also be discussed. |
| Intel | Yes |  |
| CATT | Yes | We would like to see more views from RTCM. |
| InterDigital | Yes |  |
| Qualcomm | No | On Q4, same as above. I.e., this would require some more background explanations to RTCM. For example, how HA-GNSS is supported in 3GPP, what MO-LR, MT-LR etc. means, what assistance data are, what UE-assisted and UE-based mode means, etc. Indeed, explaining how integrity is supposed to work for UE-assisted mode may be quite challenging.The focus of the collaboration should be to develop a common set of integrity messages (assistance data in our terminology); i.e., Q1.However, as said above, also fine to go with majority view. |
| Xiaomi | Yes |  |
| Swift Navigation | Yes, with comments | Please refer to the track changes. Further to our comments in Q1 and the comments from Qualcomm above, we think it is important to be more explicit about the specific content we are seeking feedback on (the GNSS integrity messages). |
| ZTE | Yes |  |
| Nokia | Yes but | We should stress that such cooperation is needed for assistance data relating to feared event. Ideally we should have a common set of feared event information between RTCM and 3GPP, it is not desirable to have fragmented solutions with similar objectives in the industry. |
| Ericsson | Yes |  |
| u-blox AG | Yes | However, we need to be clear that only Q4 (Integrity) is within scope of the current WI, so whilst the other questions are interesting we would not deal with them in the current RAN2 work plan. |
| ESA |  | Q3 has been reworked based on Hexagon suggestion. From our point of view Q1 to Q3 are more important for our work on Release 17 as it can help us decide how to progress with the GNSS integrity objective. We see no harm in including Q4 but we acknowledge the possible feedback may not be very useful to us. Swift´s addition to Q4 should be of help to RTCM in staying focus on what matters when reviewing the TR. We propose to remove the reference to section 10 and modify section 9 to section 9.3.1.1. |

*Q4 Summary*:

13 of the participants agree with the questions to be included in the LS. One participant objects to Q4. In reply to the objection, several clarifications have been added.

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| Q 5: If relevant, please provide any additional items you consider needs be included in the LS |
| Company | Additional items |
| Hexagon | See comment to Question 1 |
| InterDigital | We are not sure how familiar RTCM is with tasks of each working group in 3GPP but it may be helpful to mention that RAN2 is responsible for specification of radio interface architecture and protocols in 3GPP. |
| Swift Navigation | We have provided suggested edits as track changes below rather than trying to capture all of these suggestions in one comment. We propose to include these track changes. |
| Nokia | We should highlight in the LS that commonality of feared event related assistance data between 3GPP and RTCM is what we are after, in order to avoid solution fragmentation in the industry.  |
| Ericson | RTCM SC 104 can be cced and we can also let them know 3gpp has QZSS SSR based messages defined. If possible RTCM SC 104 can align with 3gpp solution.Pls check R2-21059733gpp RAN2 working group in the recently concluded Release 16 specification has specified QZSS based compact SSR [TS 37.355 v 16.4.0]. The Work Item objective was

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| * Define extensions of LPP protocol to support GNSS SSR (PPP-RTK support) based on the “Compact SSR” definitions specified for QZSS [RAN2]
	+ Note: Both, PPP and RTK, are already supported in Rel-15 LPP. The extensions are for PPP-RTK which requires additional info in Rel-16.
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3gpp RAN2 working group understands that RTCM 104 is working to define the SSR support. From 3gpp point of view, we see benefit if RTCM SC 104 considered adopting “Compact SSR” definitions specified for QZSS.We would like to thank you for your consideration, and we look forward to getting feedback on the RTCM SC 104 progress. |
| u-blox AG | Perhaps members common to RTCM and 3GPP RAN2 could sup0port mutual understanding.We should request that RTCM share as much of their present work with 3GPP as is acceptable to their members. |
| ESA | We tried to incorporate the various suggestions from above. In particular Q3 has been further improved based on u-blox´s recommendation. The item proposed by Ericsson is not directly related to GNSS integrity so we suggest to drop it from the LS as we have enough topics on the list as it.. |

*Q5 Summary*:

Some of the participants recommend to make the wording more clear in some instances of the draft LS. One participant suggests to request RTCM to consider adopting Compact SSR to finalize its work on SSR but we think this is not up to us suggest nor is related to GNSS integrity.

1. GNSS Integrity – tentative draft LS to RTCM

Title: LS on GNSS integrity assistance data

Release: Release 17

Work Item: NR\_pos\_enh

Source: RAN2

To: RTCM SC134

Cc: RTCM, RTCM SC104

**Contact Person:**

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**Send any reply LS to: 3GPP Liaisons Coordinator,** **mailto:3GPPLiaison@etsi.org**

Attachments: TR 38.857

**1. Overall Description:**

In the past, 3GPP has relied on RTCM specifications to carry out its work on RTK and SSR during Release 15. In Release 16, the SSR feature was further extended to support PPP-RTK based on the Compact SSR messages defined in the QZSS CLAS specification (see A-GNSS positioning in 3GPP TS 37.355). Most recently, as part of the NR Positioning Enhancements study item, RAN2, which is responsible for the specification of the radio interface, architecture and protocols in 3GPP, carried out an initial feasibility study on GNSS integrity in the context of mobile networks positioning architecture and protocols. The summary of this work is included 3GPP TR 38.857 Sections 9, in particular sub-section 9.3.1.1 which lists A-GNSS feared events, and 10.11 which lists the GNSS integrity objectives for the normative work.

The work on GNSS integrity has now moved to the normative phase which is due for completion in Q1 2022 as part of 3GPP Release 17. This work item takes place at the same time RTCM, through its SC-134 working group, works on a standard for GNSS integrity messages and the first specifications are expected in the 2021-2022 timeframe.

Through LS RP-200557 RTCM expressed interest in setting up a collaboration with 3GPP on the following topics: Communication protocols and Compression, IoT protocols and data formats, Security and Antispoofing, and Integrity and Safety for emerging applications.

Out of the four topics, RAN2 puts priority on the Integrity and Safety for emerging applications as there are synergies with the scope of GNSS integrity as part of NR Positioning Enhancements work item whereas the other items put forward by RTCM fall outside the scope of Release 17. The objective of the collaboration on this topic would be to have a significant commonality in the integrity information content defined and encoded in both, the RTCM SC-134 integrity messages and the 3GPP GNSS assistance data (integrity is part of the assistance data in 3GPP terminology), thus enabling the interoperability between both systems.

3GPP documents are publicly available whereas RTCM meetings and documents in between public releases of standards are less open and usually restricted to members only.

RAN2 would like to learn from RTCM (Radio Technical Commission for Maritime Services):

* **Question 1: RAN2 would like to ask RTCM SC134 whether the interest to collaborate on definition of GNSS integrity messages is still of interest.**
* **Question 2: RAN2 would like to ask RTCM SC134 to disclose the timeline and the scope of its work on a standard for GNSS integrity.**
* **Question 3: Should a collaboration between 3GPP and RTCM be established, RAN2 would like to ask RTCM SC134 to share with RAN2 as much of their present work as is acceptable to their members considering that 3GPP documents, progress, and timeline represent public information.**
* **Question 4: RAN2 would like to ask RTCM SC134 to provide feedback on the work carried out by RAN2 on GNSS integrity summarized in section 9.3.1.1 of TR 38.857. Specifically, what is RTCM’s view on the commonalities and differences between the scope of work being considered in SC134 and the scope of work being considered in 3GPP?**

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We would like to thank you for your consideration, and we look forward to getting feedback on the RTCM SC 134 progress.

**Actions:**

**To RTCM SC134.**

**ACTION:** RAN2 respectfully asks RTCM SC134 to provide feedback on the above questions.

**3. Date of Next RAN2 Meetings:**

RAN2#115-e 16th – 27th August 2021 Electronic meeting

RAN2#116-e 1-12 November 2021 Electronic meeting

1. References

[1] RP-200557, Cooperation on High Accuracy and Integrity Messages communication protocols definitions, RTCM

[2] R2-2006541, TP for Study on Positioning Integrity and Reliability, Swift Navigation, Deutsche Telekom, u-blox, Ericsson, Mitsubishi Electric, Intel Corporation, CATT, UIC

[3] R2-2006674, Discussion on error sources, threat models, occurrence rates and failure modes, CATT