**3GPP TSG RAN meeting #91e RP-21xxxx**

**Electronic Meeting, March 16-26, 2020**

## Status Report to TSG

**Agenda item:** 9.7.3

|  |  |
| --- | --- |
| **WI / SI Name** | NR Positioning Enhancements |
| included in this status report | Study Item: Yes | Core part: No | Performance part:No | Testing part:No |
| **Acronym** | FS\_NR\_Pos\_Enh |
| **Unique ID** | 860034 |
| **TSG Tdoc of latest approved WI/SI description (if any)** | RP-202094 |
| **Target Completion Date****(indicate if changed)** | Study Item: 03/2021(changed from 12/2020)  | Core part: NA | Performance part: NA | Testing part: NA |
| **Overall Completion level** | Study Item: 100% | Core part: NA | Performance Part: NA | Testing part: NA |

Note: Overall completion level percentage numbers should use one of the colors below:

* xx%: Normal progress, no RAN plenary action needed
* xx%: Progress behind schedule, may need RAN plenary intervention. If so, SR should clearly define requested action
* xx%: Progress critically behind, RAN plenary shall intervene. SR should define requested action

**Source:**

|  |  |
| --- | --- |
| **Leading WG** | RAN1 |
| **Rapporteur** | **Name** | Ren DA |
| **Company** | CATT |
| **Email** | renda@catt.cn |
| **Rapporteur** | **Name** | Yi GUO |
| **Company** | Intel Corporation |
| **Email** | yi.guo@intel.com |

## 1 Work plan related evaluation

|  |  |
| --- | --- |
| **Do you want to modify the time budget for this WI/SI compared to what was endorsed at the last RAN meeting?** | No |

*If you answered No: Then please remove the Excel file from the zip file of this status report.*

*If you answered Yes: Then please fill out the attached Excel template to request a modification of the time budgets for your WI /SI. The Excel table has to be filled out for all affected RAN WGs and up to the target date of the WI/SI. The basis are the endorsed time budgets of the last RAN meeting. Please highlight all changes of the values.
 One time unit (TU) corresponds to ~ 2 hours in the meeting.
 If this status report covers a WI with Core and Performance part, then please have one line for each in the attached Excel table.
 Note: If no Excel table is attached, then this means no time budget change.*

**Additional explanations/motivations for the time budget changes in the attached Excel table:**

## 2. Detailed progress in RAN WGs since last TSG meeting (for all involved WGs)

 NOTE: Agreements and Open issues impacted cross-TSG aspects shall be explicitly highlighted

## 2.1 RAN1

#### 2.1.1 Agreements

Agreements (RAN1#104-e)

The following revision of TR 38.857 was endorsed, which captures the TPs in RAN2 LS (R2-2102114, R2-2102125)

R1-2102267        TR 38.857 v110: Study on NR positioning enhancements, Ericsson

#### 2.1.2 Remaining Open issues

None

## 2.2 RAN2

#### 2.2.1 Agreements

Agreements (RAN2#113-e)

Study item is concluded from RAN2 perspective

**Two LSs have been sent to RAN1 to capture Text proposals for TR 38.837**

R2-2102114 LS to capture Text Proposal for TR 38.857 Ericsson LS out Rel-17 To:RAN1

R2-2102125 LS to capture Text Proposal for TR 38.857 Ericsson LS out Rel-17 To:RAN1

**Regarding RAN3 LS in** R2-2102277, RAN2 agreed:

* After further discussion, RAN2 understand that RAN1 can incorporate this material directly since they also received the LS.

**Enhancements for commercial use cases- Latency reduction-Analysis:**

Agreement:

Agreements:

- To capture the procedure, assumptions and evaluation results for rel-16 in clause 8.1.3 as “Higher layer latency analysis for Rel-16”

- To capture the evaluation results for enhancements if any in clause 8.2.3 as “Higher layer latency analysis for NR positioning enhancements”

 o Note: This is related to email discussion [Post112-e][617][POS] Evaluation of latency enhancement solutions (CATT);

- To capture the summary for Rel-16 existing solutions from higher layer perspective in clause 8.4;

- To capture the recommendation from higher layer perspective in clause 10.8 for latency reduction;

for DL-TDOA/DL AoD, only capture baseline results in the TR and use 88.5ms as minimum DL PRS measurement time based on conclusion in RAN1.

for UL-TDOA/UL AoA, only capture baseline results in the TR and use 12ms as minimum SRS measurement time based on conclusion in RAN1.

for Multi-RTT, only capture baseline results in the TR and use 88.5ms as minimum DL PRS measurement time and 12ms as minimum SRS measurement time based on conclusion in RAN1.

for Downlink E-CID, only capture baseline results in the TR.

for Uplink E-CID, only capture baseline results in the TR.

For the latency analysis, stick to values endorsed in last RAN2 meeting although some companies in RAN3 have different view, considering RAN3 is unable to provide feedback before the completion of the SI. This does not preclude future changes to the values when RAN3 provide input (e.g. in WI phase).

**Corresponding TP R2-2102095 has been endorsed.**

**Enhancements for commercial use cases- Latency reduction-Solutions:**

Agreement:

Agreements:

The following TPs are endorsed, with an indication of which items originate from RAN2:

--------------------------------Text Proposal #1-----------------------------------------------------------------------------------

The following enhancements of signaling & procedures for reducing NR positioning latency are recommended for normative work, including DL and DL+UL positioning methods

 The details of the solutions are left for further discussion in normative work, which may include the following aspects:

 Latency reduction related to the measurement gap

 Latency reduction related to the reporting and request of the measurement (e.g., via RRC signaling, MAC-CE and/or physical layer procedure, and/or priority rules)

 Latency reduction related to measurements

 Latency reduction related to the reporting and request of positioning assistance data (e.g., via location scheduling in advance of the time of when the location is needed)

----------------------------End of Text Proposal #1--------------------------------------------------------------------------

--------------------------------Text Proposal #2-----------------------------------------------------------------------------------

The following enhancements of signaling & procedures for reducing NR positioning latency can be studied and specified, if needed

 Latency reduction related to the request and response of positioning assistance data (e.g., via RRC signaling, MAC-CE and/or physical layer procedure)

 Latency reduction related to the reception of DL PRS (e.g., priority rules for the reception of DL PRS)

 Latency reduction related to the reporting of the measurements (e.g., CG-based transmission)

 Latency reduction related to the request and response of UE positioning capabilities (e.g., via storing UE capabilities in the network) [RAN2].

----------------------------End of Text Proposal #2--------------------------------------------------------------------------

[R2-2102124](file:///C%3A%5CUsers%5Cmtk16923%5CDocuments%5C3GPP%20Meetings%5C202101-02%20-%20RAN2_113-e%2C%20Online%5CExtracts%5CR2-2102124%20Text%20proposals%20of%20latency%20enhancement.docx) Text Proposals of latency enhancements CATT discussion Rel-17 FS\_NR\_pos\_enh

* Endorsed

**Enhancements for commercial use cases- positioning in idle/inactive:**

Agreement:

Agreements:

Proposal 1a: RAN2 confirms on the following recommendation of TSG RAN (17/17)

 Positioning in RRC\_INACTIVE

 DL, UL and DL+UL positioning methods

 UE-based and UE-assisted positioning solutions

 Support of UE positioning measurements for UEs in RRC\_INACTIVE state

 Options that can be considered include DL-PRS or DL-PRS and SSB

 Support of gNB positioning measurements for UEs in RRC\_INACTIVE state

Proposal 1b: RAN2 confirms on the following (17/17)

 Positioning in RRC\_IDLE

 It is feasible for a UE to perform DL positioning measurement in RRC\_IDLE state

 It is up to RAN2 to decide whether to support the enhancements of NR positioning reporting of DL positioning measurements and/or positioning estimates for RRC\_IDLE UEs.

Proposal2: RAN2 recommends the following for normative work for DL positioning

 The report of PRS measurement performed in RRC\_IDLE/INACTIVE when the UE is in RRC\_INACTIVE is supported (10/12)

 PRS measurement report and/or location estimate are sent from the UE to the gNB in RRC\_INACTIVE. RAN2 generally agree to do this by enhancing small data transmission in RRC\_INACTIVE (details of the use of SDT to be studied in the WI phase) (15/16)

Proposal4: For DL positioning in IDLE/INACTIVE, the followings are already supported for the current spec and can be reused:

 Current stage3 spec has already supported assistance data delivery for DL positioning during RRC\_CONNECTED and on-demand SI request in RRC\_IDLE/ INACITVE for IDLE/INACTIVE positioning. (14/14)

 Current stage3 spec already supports the transfer of RequestLocationInformation in RRC\_CONNECTED for PRS measurement in IDLE/INACTIVE. (14/14)

Proposal5: Support RAT-Independent positioning in RRC\_IDLE/INACTIVE. FFS the procedures that can be supported. (13/14)

[R2-2102121](file:///C%3A%5CUsers%5Cmtk16923%5CDocuments%5C3GPP%20Meetings%5C202101-02%20-%20RAN2_113-e%2C%20Online%5CExtracts%5CR2-2102121%20TP%20for%20IDLE%20and%20INACTIVE%20postioning.docx) Text proposal for IDLE and INACTIVE positioning Huawei, HiSilicon discussion Rel-17 FS\_NR\_pos\_enh

* Endorsed

**Enhancements for commercial use cases- On-demand PRS transmission;:**

Agreement:

From Upper layers perspective the below conclusions have been made for on demand PRS functionality.

* UE-initiated request of on-demand DL-PRS transmission is recommended for normative work; the details will be decided during WI phase.
* LMF Initiated on-demand control of DL-PRS transmission is recommended for normative work; the details will be decided during WI phase.
* The exact parameters that can be dynamically changed and necessary measurement and/or assistance information for LMF/UE initiated on demand PRS are expected to be decided by RAN1 and RAN2 during WI phase.

[R2-2102096](file:///C%3A%5CUsers%5Cmtk16923%5CDocuments%5C3GPP%20Meetings%5C202101-02%20-%20RAN2_113-e%2C%20Online%5CExtracts%5CR2-2102096.docx) Text Proposal for on-demand PRS Ericsson report Rel-17

* Endorsed

**Integrity:**

Agreement:

Agreements:

Include the additional references (as proposed by ESA) in the list of references for the TR, and integrate the italicised text from the email into section 9.4.1.1.2.

Recommendation text to be updated as proposed by Qualcomm in email.

Signalling and procedures to support GNSS positioning integrity determination are recommended for normative work. The details of the solutions are left for further discussion in normative work, which may include the following aspects:

* + The assistance information that will be used to support integrity determination;
	+ The information that will be used to provide the positioning integrity KPIs and integrity results.
	+ Support of integrity for UE-Based and UE-Assisted A-GNSS positioning.

[R2-2102113](file:///C%3A%5CUsers%5Cmtk16923%5CDocuments%5C3GPP%20Meetings%5C202101-02%20-%20RAN2_113-e%2C%20Online%5CDocs%5CR2-2102113.zip) [AT113-e][601][POS] – Integrity Text Proposal Swift Navigation discussion Rel-17 FS\_NR\_pos\_enh

* Endorsed

#### 2.2.2 Remaining Open issues

None

## 2.3 RAN3

#### 2.3.1 Agreements

#### 2.3.2 Remaining Open issues

## 2.4 RAN4

#### 2.4.1 Agreements

#### 2.4.2 Remaining Open issues

## 2.5 RAN5

#### 2.5.1 Agreements

#### 2.5.2 Remaining Open issues

#### 2.5.3 Remaining Open issues with cross-WG dependencies

## 2.6 RAN6

#### 2.6.1 Agreements

#### 2.6.2 Remaining Open issues

## 3. Detailed progress in SA/CT WGs since last TSG meeting (for all involved WGs)

NOTE: This section only needs to be filled in for WI/SIs where there is a corresponding relevant WI/SI in SA/CT.

## 3.1 SAx/CTs

#### 3.1.1 Agreements with cross-TSG impacts

#### 3.1.2 Remaining Open issues with cross-TSG impacts

NOTE: This section should also flag any critical dependencies that need TSG attention.

## 4. References

NOTE: This can be e.g. a list of all related Tdocs in the affected WGs since last TSG, references to LSs, produced TRs/TSs, the work/study item description or status reports of previous TSGs.

1. R2-2100649 Consideration on R17 positioning WI Scope Intel Corporation
2. R2-2101387 draft LS to capture Text Proposal for TR 38.857 Ericsson
3. R2-2102103 draft LS to capture Text Proposal for TR 38.857 Ericsson
4. R2-2102114 LS to capture Text Proposal for TR 38.857 RAN2
5. R2-2102122 draft LS to capture Text Proposal for TR 38.857 Ericsson
6. R2-2102125 LS to capture Text Proposal for TR 38.857 RAN2
7. R2-2101388 Report on TR 38.857 Ericsson
8. R2-2102277 Reply LS on Latency of NR Positioning Protocols (R3-211121; contact: Ericsson) RAN3
9. R2-2100648 Report of [Post112-e][616][POS] TP for latency analysis results (Intel) Intel Corporation
10. R2-2100653 TP of [Post112-e][616][POS] TP for latency analysis results (Intel) Intel Corporation
11. R2-2102094 TP of [Post112-e][616][POS] TP for latency analysis results (Intel) Intel Corporation
12. R2-2102095 TP of [Post112-e][616][POS] TP for latency analysis results (Intel) Intel Corporation
13. R2-2100407 Summary of [Post112-e][617][POS] Evaluation of latency enhancement solutions (CATT) CATT
14. R2-2102304 Report of [AT113-e][608][POS] Continue discussion of latency enhancements CATT
15. R2-2102305 Text Proposals of latency enhancements CATT discussion
16. R2-2102117 Report of [AT113-e][608][POS] Continue discussion of latency enhancements CATT
17. R2-2102120 Text Proposals of latency enhancements CATT
18. R2-2102124 Text Proposals of latency enhancements CATT
19. R2-2101950 Summary of AI 8.11.2.1 Latency analysis and latency enhancements CATT
20. R2-2100373 Discussion on Enhancements for Latency Reduction InterDigital, Inc.
21. R2-2100683 Discussion on A-PRS and semi-persistent PRS vivo
22. R2-2100685 Discussion on latency enhancement for R17 positioning vivo
23. R2-2100814 Positioning enhancements on latency reduction Xiaomi
24. R2-2100869 Discussion on latency reduction for NR positioning enhancements Apple
25. R2-2100933 On Positioning Latency Reduction Solutions Lenovo, Motorola Mobility
26. R2-2101227 Discussion on positioning latency Huawei, HiSilicon
27. R2-2101392 Discussion on Latency Aspects Ericsson
28. R2-2101469 Positioning Latency Reduction Qualcomm Incorporated
29. R2-2101870 Discussion on latency reduction solutions Nokia, Nokia Shanghai Bell
30. R2-2101906 Latency reduction via configured grant for positioning Samsung R&D Institute UK
31. R2-2101907 Latency reduction via measurement gap signalling optimization Samsung R&D Institute UK
32. R2-2101921 Discussion on local LMF ZTE Corporation, Sanechips
33. R2-2101922 Discussion on latency reduction of NR positioning ZTE Corporation, Sanechips
34. R2-2101923 Discussion on latency reduction of MO-LR ZTE Corporation, Sanechips
35. R2-2101230 [Post112-e][609][POS] Positioning support in RRC\_IDLE and INACTIVE (Huawei) Huawei, HiSilicon
36. R2-2102336 [AT113-e][609][POS] Continued discussion of positioning in idle/inactive (Huawei) Huawei, HiSilicon
37. R2-2102431 Text proposal for IDLE and INACTIVE positioning-Ph2 Huawei, HiSilicon
38. R2-2102100 Text proposal for IDLE and INACTIVE positioning Huawei, HiSilicon
39. R2-2102121 Text proposal for IDLE and INACTIVE positioning Huawei, HiSilicon
40. R2-2101229 TP for IDLE and INACTIVE postiioning Huawei, HiSilicon
41. R2-2101389 Report on [Post112-e][608][POS] Support of on-demand PRS Ericsson
42. R2-2102096 Text Proposal for on-demand PRS Ericsson
43. R2-2102369 Summary of Email Discussion [AT113-e][610][POS] Continue discussion of on-demand PRS (Ericsson) Ericsson
44. R2-2101545 Summary for AI 8.11.2.2 on the accuracy and efficiency enhancements Intel Corporation
45. R2-2100107 Discussion on on-demand DL-PRS OPPO
46. R2-2100108 Positioning in RRC\_IDLE and RRC\_INACTIVE state OPPO
47. R2-2100374 Discussion on Positioning in RRC Idle/Inactive mode InterDigital, Inc.
48. R2-2100375 Discussion on On-demand reference signals for positioning InterDigital, Inc.
49. R2-2100408 Further considerations on on-demand PRS CATT
50. R2-2100409 Further considerations on positioning in RRC\_IDLE/RRC\_INACTIVE CATT
51. R2-2100650 Support of positioning in idle/inactive mode Intel Corporation
52. R2-2100651 Support of on demand PRS Intel Corporation
53. R2-2100673 Discussion on positioning support in RRC\_IDLE and INACTIVE Spreadtrum Communications
54. R2-2100813 Discussion on PRS enhancements Xiaomi
55. R2-2100815 Positioning enhancements on RRC idle inactive UE Xiaomi
56. R2-2100866 Discussion on positioning accuracy and efficiency enhancements Apple
57. R2-2100934 Positioning in RRC\_INACTIVE and RRC\_IDLE state Lenovo, Motorola Mobility
58. R2-2100935 On-Demand PRS Support Lenovo, Motorola Mobility
59. R2-2101225 Discussion on IDLE and INACTIVE positioning Huawei, HiSilicon
60. R2-2101226 Discussion on-demand PRS Huawei, HiSilicon
61. R2-2101393 SDT, UL Positioning and On Demand PRS Aspects Ericsson
62. R2-2101470 Positioning of UEs in RRC Idle/Inactive State Qualcomm Incorporated
63. R2-2101471 On-Demand PRS Qualcomm Incorporated
64. R2-2101868 Enhancements on on-demand PRS transmissions Nokia, Nokia Shanghai Bell
65. R2-2101908 support of positioning in idle/inactive mode UE Samsung R&D Institute UK
66. R2-2101909 Support of on-demand PRS Samsung R&D Institute UK
67. R2-2101920 Discussion on IDLE/INACTIVE mode positioning ZTE Corporation, Sanechips
68. R2-2100916 Considerations on potential positioning enhancements Sony
69. R2-2100684 Discussion on positioning support in RRC\_IDLE and RRC\_INACTIVE states vivo
70. R2-2100596 [Post112-e][618][POS] Finalise integrity text proposals Swift Navigation
71. R2-2102092 [AT113-e][601][POS] – Integrity Text Proposal Swift Navigation
72. R2-2102113 [AT113-e][601][POS] – Integrity Text Proposal Swift Navigation
73. R2-2100719 Text Proposals of Definitions Relating to Positioning Integrity Modes Nokia, Nokia Shanghai Bell
74. R2-2101390 On RAT-dependent integrity use cases and error categories Ericsson
75. R2-2101504 Recommendations for the Integrity Text Proposal Swift Navigation, Intel Corporation
76. R2-2101436 Summary of AI 8.11.3.2 Methodologies for network-assisted and UE-assisted integrity ESA
77. R2-2100106 Discussion on Methodology for Integrity OPPO
78. R2-2100376 Discussion on Methodologies for network-assisted & UE-assisted integrity InterDigital, Inc.
79. R2-2100674 Discussion on the methodologies for network-assisted and UE-assisted integrity Spreadtrum Communications
80. R2-2100686 Discussion on methodologies for network-assisted and UE-assisted integrity vivo
81. R2-2100720 Positioning Integrity Result Reporting Nokia, Nokia Shanghai Bell
82. R2-2100812 Discussion on methodologies for positioning integrity Xiaomi
83. R2-2101087 UE Detection and Signalling of Percieved Threats to GNSS systems Fraunhofer IIS, Fraunhofer HHI
84. R2-2101228 Discussion of network-assisted and UE-assisted integrity Huawei, HiSilicon
85. R2-2101391 GNSS Integrity Methodologies Ericsson
86. R2-2101437 Text Proposal to methodologies for GNSS position integrity ESA
87. R1-2102262, TR 38.857 v110: Study on NR positioning enhancements, Ericsson
88. R1-2102267, TR 38.857 v110: Study on NR positioning enhancements, Ericsson

 09.11.2020 minor adaptations for RAN #90e

31.08.2020 minor adaptations for RAN #89e

 20.04.2020 minor adaptations for RAN #88e

 18.02.2020 minor adaptations for RAN #87e

 14.11.2019 minor adaptations for RAN #86

 18.08.2019 minor adaptations for RAN #85

 12.05.2019 minor adaptations for RAN #84

 27.02.2019 minor adaptations for RAN #83

 21.11.2018 completion levels with colours added (for RAN #82)

v04.81 31.07.2018 simplification of template and addition of cross-TSG aspects (for RAN #81)

v04.80 21.05.2018 minor adaptations for RAN #80

v04.79 26.02.2018 minor adaptations for RAN #79

v04.78 18.11.2017 minor adaptations for RAN #78

v04.77 06.08.2017 minor adaptations for RAN #77

v04.76 15.05.2017 minor adaptations for RAN #76

v04.75 31.01.2017 minor adaptations for RAN #75

v04.74 28.10.2016 minor adaptations for RAN #74

v04.73 01.09.2016 adaptations for RAN #73 (time units in extra Excel table, RAN6 reporting included)

v04.72 26.05.2016 adaptations for RAN #72 (introduction of NR & GERAN TUs)

v04.71 10.02.2016 minor adaptations for RAN #71

v04.70 30.10.2015 minor adaptations for RAN #70

v04.69 12.08.2015 minor adaptations for RAN #69

v04.68 21.05.2015 minor adaptations for RAN #68

v04.67 01.02.2015 minor adaptations for RAN #67

v04.66 16.11.2014 minor adaptations for RAN #66

v04.65 16.08.2014 minor adaptations for RAN #65

v04.64 22.05.2014 minor adaptations for RAN #64

v04.63 24.01.2014 restructuring for RAN #63 to cover Core & Perf. in one doc file

v03.62 11.11.2013 section 1.2.3 adapted for RAN #62

v03 11.08.2013 section 1.2.3 added on time budget

v02 07.05.2010 history added, some spelling corrections

v01 13.11.2009 First version of the template