**3GPP TSG RAN WG2 Meeting #111-e R2-200xxxx**

**Electronic meeting, August 17th - 28th, 2020**

**Source: Huawei, HiSilicon**

**Title: [AT111-e][613][POS] Integrity Error Sources (Huawei)**

**Agenda item: 8.11.3.2**

**Document for:** **Discussion and Decision**

Introduction

This document provides the summary of the following email discussion and its outcome.

* [AT111-e][613][POS] Integrity error sources (Huawei)

Scope: Categorise the identified error sources and develop a way forward, considering RAT-dependent and RAT-independent methods, with the understanding that the use of specific positioning methods may be use-case-dependent.

Intended outcome: Summary in R2-2008263

Deadline: Thursday 2020-08-27 1200 UTC

The intention of this offline discussion is to reach a common understanding on the error sources for positioning integrity. The tdocs under the scope of this discussion are:

[1] R2-2006580 Discussion on positioning integrity validation and reporting Huawei, HiSilicon discussion Rel-17 FS\_NR\_pos\_enh

[2] R2-2006674 Discussion on error sources, threat models, occurrence rates and failure modes CATT discussion Rel-17 FS\_NR\_pos\_enh

[3] R2-2006565 Identify Error sources for positioning integrity vivo discussion FS\_NR\_pos\_enh

[4] R2-2006955 Factors impacting positioning integrity Ericsson discussion Rel-17

[5] R2-2007647 Discussion on GNSS position integrity error sources ESA discussion Rel-17 FS\_NR\_pos\_enh

[6] R2-2007938 Discussion of the positioning error sources, threat models and failure modes ZTE Corporation, Sanechips discussion Rel-17 FS\_NR\_pos\_enh

# Discussion

General view

According to the online discussion, the identification of error sources can be considered as a starting point of integrity validation and reporting. Regarding the methodology to study the integrity error sources, relevant proposals have been excerpted from [1], [2] and [4] as follows:

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| Tdoc | Source | Relevant proposals |
| [1] R2-2006580 | Huawei, HiSilicon | *Proposal 1 Study the potential error sources for each positioning method of RAT-dependent and RAT-independent positioning separately.* |
| [2] R2-2006674 | CATT | *Proposal 1 RAN2 should discuss what kind of integrity monitors are required in RAT-Independent system and in RAT-Dependent separately.* |
| [4] R2-2006955 | Ericsson | *Proposal 1 The attributes impacting integrity are classified as static, semi-static and dynamic factors and shall be captured in the TR.* |

* **Q1: Please kindly provide your views on the following options:** 
  + - **If you prefer option 1, please provide your further comments on Q3 and Q4；**
    - **If you prefer option 2, comments are also welcome for Q3 and Q4.**
* ***Option 1: Study the potential error sources for each positioning methods for RAT-dependent and RAT-independent positioning separately.***
* ***Option 2: Study the potential error sources by categorizing the attributes into static, semi-static and dynamic factors.***

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| **Company** | **Comments** |
| Huawei, HiSilicon | Go for Option 1.  Considering different positioning methods and scenarios, the error sources may be different. As a starting point, the analysis of error sources should be conducted separately for each positioning methods of RAT-dependent and RAT-independent positioning systems considering the huge difference between cellular networks and satellite networks. |
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Additionally, as mentioned by CATT in [2], RAN2 doesn’t know the priorities of these errors and hard to make decision which error should be reported and which should not without RAN1 suggestions. Same concerns have been raised in [1].

* **Q2: Please kindly provide your views on the following proposal if we can propose an LS to RAN1**
* ***Proposal #1: LS to RAN1 to study the error sources that influence the positioning accuracy for RAT-dependent and RAT-independent positioning methods for the study of integrity.***

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| **Company** | **Y/N** | **Comments** |
| Huawei, HiSilicon | Y | We agree that the error sources and the corresponding impacts on the positioning integrity should be studied with the inputs from RAN1. |
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Error Sources for RAT-dependent Positioning

Concerning the error sources for RAT-dependent positioning, only two companies provide their views, which is summarized as follows:

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| Tdoc | Source | Relevant proposals |
| [3] R2-2006565 | vivo | *Proposal 2: Source of error include below factors at least*   * *The DOP of TRPs* * *The SNR and RSRP of receiving PRS* * *Synchro error of TRPs* * *Multi-path and NLOS of receiving PRS.* |
| [1] R2-2006580 | Huawei, HiSilicon | *Proposal 2 The error sources for RAT-dependent positioning can be studied separately for timing-based positioning methods (e.g. DL-TDOA, UL-TDOA, Multi-RTT), and angle-based positioning methods (e.g. DL-AoD, UL-AoA).* |

* **Q3: Please kindly provide your views on the following proposal:**
* ***Proposal #2: Study the potential error sources for timing-based positioning methods and angle-based positioning methods separately. For instance,***
  + ***For timing based positioning, the error sources may include time measurement error, UE clock drifting within and across PRS occasions, reference station/TRP synchronization, radio environment, measurement geometry, cell data base accuracy, etc.***
  + ***For angle measurements based positioning, the error sources may include angle measurement error, gNB antenna calibration, radio environment, measurement geometry, cell data base accuracy, etc.***

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| **Company** | **Comments** |
| Huawei, HiSilicon | Due to different positioning mechanisms, the error sources may vary for different RAT-dependent positioning methods. AS of now, for RAT-dependent positioning, there are two types of measurements, namely, timing-based measurement and angle-based measurement. At least for timing-based positioning methods (e.g. DL-TDOA, UL-TDOA, Multi-RTT) and angle-based positioning methods (e.g. DL-AoD, UL-AoA), the error sources should be identified and analyzed separately in terms of types of measurements. |
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Error Sources for RAT-independent Positioning

Concerning the error sources for RAT-independent positioning, a comprehensive analysis has been provide in [5] provided by ESA, which also indicates the following observation:

*Observation 2: For an assisted positioning with GNSS there are three major factors in determining overall position accuracy: the quality of the range measurements, the quality of the satellite geometry, and the quality of the GNSS assistance data.*

* **Q4: Please kindly provide your views on the following proposal:**
* ***Proposal #3: Categorize the error sources for RAT-independent positioning into different factors: Range measurements, Satellite geometry, GNSS assistance data, etc. The error sources for different factors are FFS.***

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| **Company** | **Comments** |
| Huawei, HiSilicon | As a starting point for the error sources identification for RAT-independent positioning, we may first reach a consensus on the taxonomy for all the potential error resources, and then discuss the specific ones for each category. |
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Conclusions

To be seen.