**3GPP TSG-RAN WG2 Meeting #119-bis electronic R2-22xxxxx**

**e-Meeting, 10th October – 19th October 2022**

Source: vivo

Title: Summary of [Offline-417][POS] Calculation of TIR and provision of AL to UE

Agenda Item: 6.11.2.3

Document for: Discussion and Decision

# Introduction

This document summarizes the following email discussion:

* [AT119bis-e][417][POS] Calculation of TIR and provision of AL to UE (vivo)

Scope: Discuss the proposal from R2-2210606 and conclude on a way forward.

Intended outcome: Report to CB session

Deadline: Friday 2022-10-14 1000 UTC

## 1.1 Contact Points

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| Name | Company | Email Address |
| Xiang Pan | vivo | panxiang@vivo.com |
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# Background



**Figure 1: Relation of PL and TIR**

Figure 1 illustrates the relation of PL, TIR and error distribution. With the feared events, UE can generate the distribution of the position error based on implementation. One PL can be derived with a specific TIR for a certain error distribution, and vice versa.

In the LPP *ProvideLocationInformation* message, the achievableTargetIntegrityRisk-r17 is presented optionally along with PL.

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| IntegrityInfo-r17 ::= SEQUENCE {  horizontalProtectionLevel-r17 INTEGER (0..50000),  verticalProtectionLevel-r17 INTEGER (0..50000) OPTIONAL,  achievableTargetIntegrityRisk-r17 INTEGER (10..90) OPTIONAL,  ...  } |

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| ***integrityInfo***  This field provides the integrity result for the *locationEstimate.*  - ***horizontalProtectionLevel*** provides the HPL for the *locationEstimate* along the semi-major axis of the error ellipse. Scale factor 0.01 metre; range 0 – 500 metres.  - ***verticalProtectionLevel*** provides the VPL for the *locationEstimate*. Scale factor 0.01 metre; range 0 – 500 metres.  - ***achievableTargetIntegrityRisk*** indicates the achievable TIR for which the HPL and VPL are provided. The achievable TIR is given by *P*=10-0.1n [hour-1] where *n* is the value of *achievableTargetIntegrityRisk* and the range is 10-1 to 10-9 per hour. If this field is absent, the achievable TIR is the same as the *targetIntegrityRisk* in *CommonIEsRequestLocationInformation*. |

However, the definition/purpose of *achievableTargetIntegrityRisk* is not specified in the current spec. In the summary [2], it is assumed that the *achievableTargetIntegrityRisk* can be used for the following scenario:

- The UE may calculate the PL for the requested TIR (as normal). If the AL from the application is available at the UE, the UE could check whether the determined PL satisfies the AL requirement. If not, the UE may adjust the TIR in such a way that the determined PL satisfies the AL, and then reports the PL together with the 'new' TIR (achievableTargetIntegrityRisk). For example, the UE calculates a PL for the requested TIR of 10E-7. The UE then determines that this PL does not satisfy the required AL. The UE may then adjust the TIR until the computed PL satisfies the AL (e.g., a TIR of 10E-4 may satisfy the AL requirement). The UE then reports the PL with the achievableTargetIntegrityRisk of 10E-4.

The contribution [1] shares a similar view that *achievableTargetIntegrityRisk* is offered as a substitution, for the current situation cannot satisfy the client-required integrity risk, which is expected to be larger than TIR in terms of value. Knowledge of AL could offer UE a tuning boundary, with which the achievable TIR can be generated and then provided to the location server and LCS client for reference. Without AL, the UE may only feedback one random combination of PL and *achievableTargetIntegrityRisk*, which may be meaningless if both PL and TIR exceed the required bound.

The following Observations and Proposals are made based on the above understanding in [1]:

**Observation 1: The value of PL is obtained by the knowledge of TIR and the error probability distribution modeled by UE implementation.**

**Observation 2: UE would not intend to tune its implementation for other KPIs without the prior knowledge about the availability of positioning system (the relationship of AL and PL in terms of value).**

**Proposal: Alert Limit (AL) should be provided to UE in GNSS positioning integrity, in order to optionally obtain the achievable TIR.**

# Discussion

As described in the background, the purpose of *achievableTargetIntegrityRisk* is not clear in the current specification. To the understanding of [1], the *achievableTargetIntegrityRisk* is offered as a substitution when the available integrity risk cannot satisfy the client-required target integrity risk. The moderator thinks it may be due to limited UE capability and/or specific positioning error distribution.

**Question 1: Do companies agree with the above purpose of Achievable Target Integrity Risk?**

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| Company | Yes/No | Comments |
| vivo | Yes |  |
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As to how the UE compute the achievable TIR, one company figured out that the AL is not needed and it is also possible that the UE reports PL>AL. In this case, the reported AL and *achievableTargetIntegrityRisk* seem to be a random combination. Note that TIR shall be sent to the UE to derive PL, the moderator thinks it’s straightforward to provide the AL to UE to derive the *achievableTargetIntegrityRisk*.

**Question 2: As to how the UE compute the *achievableTargetIntegrityRisk*, which option do you prefer?**

* **Option 1: based on AL, e.g., PL is set equal to AL.**
* **Option 2: without AL, the combination of PL and achievable TIR is set up to UE implementation.**
* **Option 3: Others, please specify.**

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| Company | Option | Comments |
| vivo | Option 1 |  |
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For the definition of Achievable Target Integrity Risk, one initial version is formulated as follows:

**Achievable Target Integrity Risk**: A integrity risk that can be achieved with a specific protection level [(e.g., equal to AL)]. This parameter should be explicitly indicated when the required target integrity risk cannot be satisfied.

Note: whether the phrase [(e.g., equal to AL)] is needed relies on the conclusion of Q2.

**Question 3: Do companies agree to take the above definition of Achievable TIR as a baseline and capture it in stage 2 specification when available?**

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| Company | Yes/ No/  Yes with changes | Comments |
| vivo | Yes |  |
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During the online session, some companies thought that providing AL to UE to compute the achievable TIR was a new functionality and could be discussed in Rel-18. However, the *achievableTargetIntegrityRisk* was introduced in Rel-17 and the definition or how it works is not clear. So the moderator tends to clarify it as Rel-17 CR.

**Question 4: if the AL shall be provided to UE to compute the achievable TIR, which option do you prefer:**

* **Option 1: essential CR in Rel-17 to make how it works clear.**
* **Option 2: new functionality to be discussed in Rel-18.**
* **Option 3: Others, please specify.**

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| Company | Option | Comments |
| vivo | Option 1 |  |
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Besides, [2] also indicated that a new UE capability is required. After UE indicates the capability, the presence of AL in the CommonIEsRequestLocationInformation could be interpreted as the UE being requested to provide an achievableTargetIntegrityRisk if the requested TIR cannot be satisfied.

**Question 5: Do companies agree that a new UE capability is needed to enable the UE to feedback an *achievableTargetIntegrityRisk* based on the provided AL?**

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| Company | Yes/No | Comments |
| vivo | Yes |  |
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# Conclusion

To be populated.

# Reference

1. R2-2210606 Discussion on the provision of AL for achievable TIR calculation
2. R2-2210784 Summary of AI 6.11.2.3: LPP corrections