3GPP TSG-RAN WG2 Meeting #126 R2-24xxxxx

Fukuoka, Japan, May 20th -24th, 2024

Agenda Item: 8.1.4

Source: Mediatek Inc.

Title: Report of [POST125bis][020][AI/ML PHY] UE side data collection

Document for: Discussion, Decision

# Introduction

This contribution is aimed at reporting the discussion and results of the following post email discussion:

* [POST125bis][020][AI/ML PHY] UE side data collection (Mediatek)

Intended outcome: Discuss new table capturing solution details and discussion fon control and visibility, privacy.

Deadline: two weeks (Deadline May 3rd, 10:00 UTC)

Companies providing input to this email discussion are requested to leave contact information below.

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| **Company** | **Name** | **Email Address** |
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# 2 Discussion

The following proposals were identified during the Rel-18 SI on AI/ML for NR Air Interface:

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| 1. UE collects and directly transfers training data to the Over-The-Top (OTT) server;   1a) OTT (3GPP transparent)  1b) OTT (non-3GPP transparent)   1. UE collects training data and transfers it to Core Network. Core Network transfers the training data to the OTT server. 2. UE collects training data and transfers it to OAM. OAM transfers the needed data to the OTT server.   RAN2 did not study or analyse these proposals and did not agree to requirements or recommendations. | |
| 1a) | 1b) |
| 2. Data collection via CN | 3. Data collection via OAM |

According to the consensus made during the online discussion in RAN2#125bis meeting,

=> need to better define what is control of data collection in MNO and visibility of data content in MNO.

=> understanding is that OTT is outside of MNO

We will clarify these methods in the following aspects:

* Inside/outside MNO’s network
* Termination Entity
* Controllability of data collection in MNO
* Visibility of data content in MNO
* Protocol layer for data transfer
* Privacy concerns

## 2.1 Terminology

According to the common understanding made in RAN2 that OTT is outside of MNO, it is inappropriate to refer to the term OTT in the context of solutions 1b, 2, and 3. To avoid confusion and enhance clarity, we propose replacing the term ' OTT server' with 'server for UE-side data collection' in these solutions. The term "UE-side data collection" refers to the data collection intended for use in UE-side model training. Please note that the term 'training' is omitted from the terminology to prevent confusion or debate regarding whether the locations for data storage and model training are identical or separate.

**Q1:** **Do companies agree to replace the term ‘OTT server’ with ‘server for UE-side data collection’ in the definitions/descriptions of different solutions?**

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| Company | Yes/No (Comment) |
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## 2.2 Inside/outside MNO’s network

One point that requires clarification is the location of the server for UE-side data collection relative to the MNO’s network. In solution 1a, the UE directly communicates with the server for UE-side model collection, typically via the application layer, without any interaction with the MNO's network infrastructure. Consequently, in this scenario, the server for UE-side data collection operates outside of the MNO's network, functioning as an OTT server. However, for solutions 1b, 2, and 3, the server for UE-side data collection has the flexibility to be positioned either inside or outside the MNO's network. It is noted that in solution 2, the server for UE-side data collection can be a NF in CN.

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| **Solutions** | **Inside/outside MNO’s network** |
| **1a** | OTT server, i.e., outside MNO’s network |
| **1b** | Inside/outside MNO’s network |
| **2** | Inside/outside MNO’s network  Note: The server for UE-side data collection can be a NF in CN. |
| **3** | Inside/outside MNO’s network |

**Q2.1:** **Do companies agree that for solution 1a the server for UE-side data collection is outside of MNO’s network and is therefore classified as an OTT server?**

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| Company | Yes/No (Comment) |
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**Q2.2:** **Do companies agree that for solutions 1b, 2 and 3, the server for UE-side data collection can be either inside or outside MNO’s network?**

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| Company | Yes/No (Comment) |
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## 2.3 Termination Entity

The "(First)termination entity" refers to the entity that receives and stores data transmitted from the UE, **which possesses the authority to oversee the subsequent handling of this data**, such as data cleaning, forwarding, sharing, and analysis, among others, in compliance with privacy policies, security protocols, and any regulatory compliance requirements. The purpose of introducing the term ‘(first) termination entity’ is to emphasize the entity’s role in management and possession of the collected data.

According to the responsibility of the termination entity as define above, the termination entity for solution 1a) is the OTT server. The termination entity for solution 1b is the server for UE-side data collection. The termination entity for solution 2 is the CN. The termination entity for solution 3 is the OAM.

**Q3.1: Do companies agree that for solutions 1a the termination entity of UE-side data collection is the OTT server?**

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| Company | Yes/No (Comment) |
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**Q3.2: Do companies agree that for solutions 1b the termination entity is the server for UE-side data collection?**

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| Company | Yes/No (Comment) |
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**Q3.3: Do companies agree that for solutions 2 the termination entity of UE-side data collection is the CN?**

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| Company | Yes/No (Comment) |
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**Q3.4: Do companies agree that for solutions 3 the termination entity of UE-side data collection is the OAM?**

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| Company | Yes/No (Comment) |
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## 2.4 Controllability for transfer of the collected data in MNO

To begin, we focus on the aspect of data transfer to address controllability.  Once these aspects are clearly understood, we can delve into more intricate details, such as how the MNO might configure measurement and reporting for the UE, among other considerations.

We define the controllability of data transfer for UE-side data collection within an MNO in the following dimensions:

* The capability of the MNO to control the data transfer to the server for UE-side data collection.
* The specific entity within the MNO to control the data transfer.
* The protocols or methods utilized by the MNO to control the data transfer.
* The MNO's ability to manage (e.g., allow/disallow, initiate/terminate, prioritize/de-prioritize, etc.) the data transfer.

Companies are invited to discussion on whether it is appropriate to start discussions on the controllability of data transfer, as outlined in the preceding four bullet points. Additionally, companies are requested to provide any definitions of controllability that may encompass critical aspects not already covered.

**Q4.1** **Do companies agree to start controllability discussion on data transfer as defined with the above four bullets? Please provide/clarify the definition on controllability if there are any important aspects missing.**

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| Company | Yes/No (Comment) |
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For solution 1a), the MNO has no specific controllability for transfer of the collected data for UE-side data collection. For example, the collected data might be transferred together with other UE traffic without differentiation.

**Q4.2:** **Do companies agree that in solution 1a) MNO has no specific controllability for transfer of the collected data for UE-side data collection? Otherwise,** **please clarify any controllability that the MNOs have.**

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| Company | Yes/No (Comment) |
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In solution 1b, it is recognized that the MNO retains a certain level of control over the data transfer to the server for UE-side data collection. The entity within the MNO responsible for this control might be a NF in the CN, such as the DCAF. The MNO exercises this control at the granularity of the PDU session, as governed by the SLA. However, since the initiation of the data collection procedure is triggered by the server as specific types of services, the MNO may not have the authority to directly control and manage the data transfer process.

**Q4.3: Related to solution 1b, can the MNO have control/management over the data collection for UE-side data collection, given that it may be managed by a NF within the CN, with control granularity at the level of the PDU session per SLA? Please clarify any other controllability that the MNOs might have in solution 1b.**

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| Company | Yes/No (Comment) |
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For solution 2, it is recognized that the MNO has full level of control over the data collection process. The entity within the MNO responsible for this control is a NF in the CN, such as NWDAF, LMF (for positioning), or other relevant NFs. There are two potential control methods:

* Option 1: The MNO may manage data collection through NAS signaling (or LPP for positioning).
* Option 2: Alternatively, the MNO may manage the data collection process from the CN to the UE via RAN nodes, utilizing RRC signaling.

This level of control enables the MNO to directly manage the data collection process as required.

**Q4.4:** **Do the companies agree that in solution 2, the MNO’s control over the data collection for UE-side data collection is characterized by full controllability? Please clarify whether it is managed by a NF within the CN through NAS signaling directly (option 1) or through RRC signaling via RAN node (option 2), or others?**

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| Company | Yes/No (Comment) |
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For solution 3, it is recognized that the MNO has full level of control over the data collection process. The entity within the MNO responsible for this control is OAM. The MNO controls the data collection process through RRC signaling via RAN node. This level of control enables the MNO to directly initiate and terminate the data collection process as required.

**Q4.5: Do the companies agree that in solution 3, the MNO’s control over the data collection for UE-side data collection is characterized by full controllability, managed by OAM through RRC signaling via RAN node, and with the ability to directly manage the data collection procedure?**

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| Company | Yes/No (Comment) |
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## 2.5 Visibility of data content in MNO

As a preliminary measure, the nature of the data content can be described by its format, type, value and others. Visibility refers to the extent to which the MNO is able to aware, access or even comprehend this data content.

Companies are invited to provide the definition on visibility and to what extent (aware, access or comprehend) the visibility is preferred.

**Q5.1 Companies are invited to clarify their understanding of data content visibility and specify their preferred level of visibility.**

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As an initial step, we define the levels of data content visibility within the MNO as follows:

* No visibility: MNO is not aware of the collected data and cannot access the data content.
* Partial visibility: The MNO is aware of the collected data, has limited access/comprehension to some elements of the data content, allowing for limited access.
* Full visibility: The MNO is aware of the collected data, has complete access to all aspects of the data content, enabling thorough comprehension if needed.

For solution 1a), the MNO has no visibility of data content. For solution 1b), the MNO has no or partial visibility of data content depending on the SLA. For solution 2 and 3, the MNO is able to have full visibility of the data content.

**Q5.2: Do companies agree that in solution 1a) MNO has no visibility of data content for UE-side data collection?**

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| Company | Yes/No (Comment) |
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**Q5.3: Do companies agree that in solution 1b) MNO has no or partial visibility of data content for UE-side data collection depending on SLA?**

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| Company | Yes/No (Comment) |
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**Q5.4: Do companies agree that in solution 2 and 3 MNO is able to have full visibility of data content for UE-side data collection?**

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| Company | Yes/No (Comment) |
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## 2.6 Protocol layer for Data Transfer

For solution 1a and 1b, the server for UE-side data collection receives data from the UE through the application layer, utilizing a UP tunnel for transmission. It should be noted that from user’s perspective, the data transfer from the UE to the server via UP tunnel is consider as traffic and is subject to data usage charges.

**Q6.1: Do companies agree that in solution 1a) and 1b) the data transfer from the UE to the server for UE-side data collection is through the application layer, utilizing a UP tunnel for transmission?**

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| Company | Yes/No (Comment) |
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For solution 2, the UE collects training data and transfers it to the CN, which then forwards the data to the UE-side server. As a basic approach, the data transfer from the UE to the CN can be conducted through the NAS layer using CP tunnel. The necessity for a UP tunnel to facilitate data transfer from the UE to the CN depends on the data volume, which is based on the requirements provided by RAN1. The feasibility of support a UP tunnel falls under the purview of SA2.

**Q6.2:** **Do companies agree that in solution 2, the baseline method for data transfer from the UE to the CN, is through the NAS layer, utilizing a CP tunnel for transmission?**

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| Company | Yes/No (Comment) |
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For solution 3, the UE collects training data and transfers it to the OAM, which then forwards the data to the UE-side server. As a basic approach, the data transfer from the UE to the OAM via RAN node can be conducted through the RRC layer using CP tunnel. The necessity for a UP tunnel to facilitate data transfer from the UE to the OAM depends on the data volume, which is based on the requirements provided by RAN1. The feasibility of support a UP tunnel falls under the purview of SA5.

**Q6.3:** **Do companies agree that in solution 3, the baseline method for data transfer from the UE to OAM via RAN node is through the RRC layer, utilizing a CP tunnel for transmission?**

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| Company | Yes/No (Comment) |
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**Q6.4: For solution 2 and 3, interested company please share their view on solution details of UP tunnel solutions.**

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| Company | Yes/No (Comment) |
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## 2.7 Privacy Concerns

Privacy concerns in the communications ecosystem can vary significantly among different stakeholders, such as MNOs, network vendors, OEMs, and chipset vendors. Each entity has its own set of sensitive information that needs to be protected from unauthorized disclosure. Here are more detailed examples of privacy concerns for each stakeholder:

MNO Privacy Concerns:

* Network Information Disclosure: MNOs may inadvertently disclose sensitive network information, such as deployment strategies, network configurations, and performance metrics, to servers outside their network.
* Data Transfer Risks: When transferring data to external servers, there is a risk that the data may contain undisclosed information about the network or its users/customers. This could include subscriber identities, locations, website visited, phone calls, etc and other proprietary information that MNOs are obligated to protect.

Network Vendor Privacy Concerns:

* Sensitive Information Leakage: Network vendors may possess proprietary algorithms, system designs, and other intellectual property that are integral to their competitive edge. Unintentional disclosure of such information to third parties could undermine their market position and lead to potential legal issues.
* Implementation Details Exposure: The specific details of how network equipment is implemented, including software and hardware design, are crucial for maintaining the security and integrity of the network. If such information is disclosed, it could be exploited for malicious purposes or used by competitors to gain insights into the vendor's technology.

Chipset Vendor Privacy Concerns:

* Proprietary Technology Exposure: Chipset vendors develop specialized hardware and software that may contain trade secrets or patented technologies. here is a risk that shared information could be unintentionally disclosed to unauthorized parties, leading to privacy breaches.

OEM Privacy Concerns:

* User Information Disclosure: OEMs handle a vast amount of user data, including personal information, usage habits, and location data. There is a significant privacy concern if this information is disclosed to external entities without user consent, potentially violating privacy laws and damaging the OEM's reputation.

For all stakeholders, it is essential to implement robust data protection measures, such as encryption, access controls, and privacy policies, to mitigate these privacy concerns. Additionally, compliance with regulations like the General Data Protection Regulation (GDPR) and other local privacy laws is crucial for maintaining trust and legal standing in the market.

Companies are encouraged to clearly define and express their privacy concerns, even if these concerns may not be the primary focus of RAN2. There is a prevailing sentiment that companies have underlying fears that they have not been able to precisely define. This ambiguity regarding the specific nature of their concerns is not conducive to advancing our collective work on data collection. A well-defined awareness of the privacy issues at stake is important for facilitating meaningful progress in our study.

**Q7: What’s your privacy concerns on the data collection?**

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# 3 Appendix

**Table 1 Comparative analysis among different data collection approaches**

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| **Aspects** | **1a) OTT (3GPP Transparent)** | **1b) OTT (Non-3GPP Transparent)** | **2. Transfer via Core Network** | **3. Transfer via OAM** |
| **Termination Entity** | UE-side OTT server | UE-side OTT server | CN | OAM |
| **Inside/outside MNO’s network** | Outside | Inside/Outside | Inside/outside | Inside/outside |
| **Transport Tunnel** | UP tunnel (Note: data collection may be charged as normal traffic.) | UP tunnel (Note: data collection may be charged as normal traffic.) | CP tunnel (FFS: UP tunnel) | CP tunnel (FFS: UP tunnel) |
| **Protocol layer for data transfer** | Application layer | Application layer | NAS or RRC layer (FFS: transport layer of UP tunnel) | RRC layer (FFS: transport layer of UP tunnel) |
| **Data Collection Controller** | UE-side OTT server | CN (certain NF, e.g., DCAF) | CN | OAM/RAN |
| **Control Granularity by NW** | NA, the OTT server can directly request data from the UE. | Coarse e.g., based on SLA | Finer (e.g., per NAS procedure) | Finer (e.g., per RRC procedure) |
| **RAN Intervene** | No | No | Possible | Yes |
| **Radio Resource Efficiency** | Low, as the network cannot optimize radio resource usage for data transfer | Low, as the network cannot optimize radio resource usage for data transfer | Higher, due to the possibility of RAN intervene | Maximum |
| **Data format** | Non-standardized | Non-standardized | Standardized/non-standardized | Standardized/non-standardized |
| **Network Awareness of the data Content** | No | No | Yes, if the data content is standardized or disclosed to MNO. | Yes, if the data content is standardized or disclosed to MNO. |
| **RAN configuration/condition acquisition** | Unclear whether the RAN configuration/condition acquired by the UE can be transferred to the UE-side OTT server. | Unclear whether the RAN configuration/condition acquired by the UE can be transferred to the UE-side OTT server and how the CN can control it with limited intervene. | Controlled by MNO | Controlled by MNO |
| **Spec Impact** | No | Limited | High | High |
| **Security and Privacy Risk** | High, managed by the OTT application, with potential risks if not 3GPP compliant | Lower, managed by the OTT application and NF based on SLA. | Minimum, NW can enforce security and privacy protection. | Minimum, NW can enforce security and privacy protection. |
| **Involved WGs** | No | SA2 | RAN2, SA2 | RAN2, SA2, SA5 |

# 4 Conclusion



# 5 Reference

1. [R2-2403967](file:///C:\Users\panidx\OneDrive%20-%20InterDigital%20Communications,%20Inc\Documents\3GPP%20RAN\TSGR2_125bis\Docs\R2-2403967.zip) Discussion on Definition of Different UE Side Data Collection Solutions
2. [R2-2402364](file:///C:\Users\panidx\OneDrive%20-%20InterDigital%20Communications,%20Inc\Documents\3GPP%20RAN\TSGR2_125bis\Docs\R2-2402364.zip) Data Collection for UE Side Model Training MediaTek Inc.
3. [R2-2403235](file:///C:\Users\panidx\OneDrive%20-%20InterDigital%20Communications,%20Inc\Documents\3GPP%20RAN\TSGR2_125bis\Docs\R2-2403235.zip) Data Collection for UE-Side Model Training Interdigital Inc.
4. [R2-2403473](file:///C:\Users\panidx\OneDrive%20-%20InterDigital%20Communications,%20Inc\Documents\3GPP%20RAN\TSGR2_125bis\Docs\R2-2403473.zip) Discussion on Data Collection for UE-side Model Training Futurewei Technologies
5. [R2-2403378](file:///C:\Users\panidx\OneDrive%20-%20InterDigital%20Communications,%20Inc\Documents\3GPP%20RAN\TSGR2_125bis\Docs\R2-2403378.zip) Consideration on UE Side Data Colection ZTE Corporation,Sanechips
6. [R2-2403492](file:///C:\Users\panidx\OneDrive%20-%20InterDigital%20Communications,%20Inc\Documents\3GPP%20RAN\TSGR2_125bis\Docs\R2-2403492.zip) AI/ML Data Collection Requirements T-Mobile USA, Verizon, Charter, NTT DOCOMO, Deutsche Telekom, Turkcell, BT, AT&T, Nokia, Telecom Italia, CMCC
7. [R2-2403230](file:///C:\Users\panidx\OneDrive%20-%20InterDigital%20Communications,%20Inc\Documents\3GPP%20RAN\TSGR2_125bis\Docs\R2-2403230.zip) Discussion on UE Side Data Collection Qualcomm Incorporated
8. [R2-2402375](file:///C:\Users\panidx\OneDrive%20-%20InterDigital%20Communications,%20Inc\Documents\3GPP%20RAN\TSGR2_125bis\Docs\R2-2402375.zip) Data collection for UE-side model training Samsung
9. [R2-2402962](file:///C:\Users\panidx\OneDrive%20-%20InterDigital%20Communications,%20Inc\Documents\3GPP%20RAN\TSGR2_125bis\Docs\R2-2402962.zip) Data Collection for Training of UE-side AI/ML Models Nokia
10. [R2-2403567](file:///C:\Users\panidx\OneDrive%20-%20InterDigital%20Communications,%20Inc\Documents\3GPP%20RAN\TSGR2_125bis\Docs\R2-2403567.zip) Discussion on UE side data collection China Unicom
11. [R2-2402171](file:///C:\Users\panidx\OneDrive%20-%20InterDigital%20Communications,%20Inc\Documents\3GPP%20RAN\TSGR2_125bis\Docs\R2-2402171.zip) Data Collection for UE Side Model Training OPPO
12. [R2-2402302](file:///C:\Users\panidx\OneDrive%20-%20InterDigital%20Communications,%20Inc\Documents\3GPP%20RAN\TSGR2_125bis\Docs\R2-2402302.zip) Consideration on UE side data collection CATT
13. [R2-2402316](file:///C:\Users\panidx\OneDrive%20-%20InterDigital%20Communications,%20Inc\Documents\3GPP%20RAN\TSGR2_125bis\Docs\R2-2402316.zip) Data collection for UE side model training Xiaomi
14. [R2-2402342](file:///C:\Users\panidx\OneDrive%20-%20InterDigital%20Communications,%20Inc\Documents\3GPP%20RAN\TSGR2_125bis\Docs\R2-2402342.zip) Discussion on UE side data collection Spreadtrum Communications
15. [R2-2402375](file:///C:\Users\panidx\OneDrive%20-%20InterDigital%20Communications,%20Inc\Documents\3GPP%20RAN\TSGR2_125bis\Docs\R2-2402375.zip) Data collection for UE-side model training Samsung discussion
16. [R2-2402478](file:///C:\Users\panidx\OneDrive%20-%20InterDigital%20Communications,%20Inc\Documents\3GPP%20RAN\TSGR2_125bis\Docs\R2-2402478.zip) Label Dataset Transfer for Positioning UE-sided model training Intel Corporation
17. [R2-2402489](file:///C:\Users\panidx\OneDrive%20-%20InterDigital%20Communications,%20Inc\Documents\3GPP%20RAN\TSGR2_125bis\Docs\R2-2402489.zip) Discussion on UE side data collection vivo
18. [R2-2402669](file:///C:\Users\panidx\OneDrive%20-%20InterDigital%20Communications,%20Inc\Documents\3GPP%20RAN\TSGR2_125bis\Docs\R2-2402669.zip) Data Collection for UE side Model training NEC
19. [R2-2402732](file:///C:\Users\panidx\OneDrive%20-%20InterDigital%20Communications,%20Inc\Documents\3GPP%20RAN\TSGR2_125bis\Docs\R2-2402732.zip) Discussion on data collection for UE-sided model Lenovo
20. [R2-2402864](file:///C:\Users\panidx\OneDrive%20-%20InterDigital%20Communications,%20Inc\Documents\3GPP%20RAN\TSGR2_125bis\Docs\R2-2402864.zip) Discussion on UE-sided data collection Apple
21. [R2-2403022](file:///C:\Users\panidx\OneDrive%20-%20InterDigital%20Communications,%20Inc\Documents\3GPP%20RAN\TSGR2_125bis\Docs\R2-2403022.zip) Discussion on data collection for UE-sided model training CMCC
22. [R2-2403122](file:///C:\Users\panidx\OneDrive%20-%20InterDigital%20Communications,%20Inc\Documents\3GPP%20RAN\TSGR2_125bis\Docs\R2-2403122.zip) UE-side data collection Fraunhofer HHI, Fraunhofer IIS
23. [R2-2403163](file:///C:\Users\panidx\OneDrive%20-%20InterDigital%20Communications,%20Inc\Documents\3GPP%20RAN\TSGR2_125bis\Docs\R2-2403163.zip) Discussion on UE-sided data collection for training Huawei, HiSilicon
24. [R2-2403230](file:///C:\Users\panidx\OneDrive%20-%20InterDigital%20Communications,%20Inc\Documents\3GPP%20RAN\TSGR2_125bis\Docs\R2-2403230.zip) Discussion on UE Side Data Collection Qualcomm Incorporated
25. [R2-2403567](file:///C:\Users\panidx\OneDrive%20-%20InterDigital%20Communications,%20Inc\Documents\3GPP%20RAN\TSGR2_125bis\Docs\R2-2403567.zip) Discussion on UE side data collection China Unicom discussion
26. [R2-2403573](file:///C:\Users\panidx\OneDrive%20-%20InterDigital%20Communications,%20Inc\Documents\3GPP%20RAN\TSGR2_125bis\Docs\R2-2403573.zip) UE side data collection LG Electronics discussion
27. [R2-2403658](file:///C:\Users\panidx\OneDrive%20-%20InterDigital%20Communications,%20Inc\Documents\3GPP%20RAN\TSGR2_125bis\Docs\R2-2403658.zip) Discussion on UE side data collection Indian Institute of Tech (M), IIT Kanpur
28. [R2-2403661](file:///C:\Users\panidx\OneDrive%20-%20InterDigital%20Communications,%20Inc\Documents\3GPP%20RAN\TSGR2_125bis\Docs\R2-2403661.zip) UE-side Data Collection Ericsson