**3GPP TSG-RAN WG2 Meeting #130 *R2-25xxxx***

**St Julian, Malta, 19th – 23rd May, 2025**

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| *CR-Form-v12.3* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
|  | | | | | | | | |
|  | **38.300** | **CR** | **-** | **rev** | **-** | **Current version:** | **18.5.0** |  |
|  | | | | | | | | |
| *For* [***HE******LP***](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* | | | | | | | | |
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| ***Proposed change affects:*** | UICC apps |  | ME | **x** | Radio Access Network | **x** | Core Network | **x** |

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| ***Title:*** | Introduction of AI/ML for NR Air interface feature in TS38.300 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | vivo | | | | | | | | | |
| ***Source to TSG:*** | R2 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | NR\_AIML\_air-Core | | | | |  | ***Date:*** | | | 2025-05-09 |
|  |  | | | |  | |  | | |  |
| ***Category:*** | **B** |  | | | | | ***Release:*** | | | Rel-19 |
|  | *Use one of the following categories:* ***F*** *(correction)* ***A*** *(mirror corresponding to a change in an earlier release)* ***B*** *(addition of feature),* ***C*** *(functional modification of feature)* ***D*** *(editorial modification)*  Detailed explanations of the above categories can be found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | | | | | | | | *Use one of the following releases: Rel-8 (Release 8) Rel-9 (Release 9) Rel-10 (Release 10) Rel-11 (Release 11) … Rel-17 (Release 17) Rel-18 (Release 18) Rel-19 (Release 19)  Rel-20 (Release 20)* | |
|  |  | | | | | | | | | |
| ***Reason for change:*** | | Introduction of AI/ML for NR Air interface feature in Rel-19. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | Capture RAN2 agreements up to RAN2#129bis. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | Stage 2 specification TS38.300 does not include the AI/ML for NR Air interface feature in Rel-19. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | 3.2, 7.9, X.Y | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | | **X** |  | Other core specifications | | | | TS38.331 … CR …  TS38.305 ... CR ...  TS37.355 ... CR | | |
| ***affected:*** | |  | **x** | Test specifications | | | | TS/TR ... CR ... | | |
| ***(show related CRs)*** | |  | **x** | O&M Specifications | | | | TS/TR ... CR ... | | |
|  | |  | | | | | | | | |
| ***Other comments:*** | |  | | | | | | | | |
|  | |  | | | | | | | | |
| ***This CR's revision history:*** | |  | | | | | | | | |

*START OF CHANGES*

## 3.2 Definitions

For the purposes of the present document, the terms and definitions given in TR 21.905 [1], in TS 36.300 [2] and the following apply. A term defined in the present document takes precedence over the definition of the same term, if any, in TR 21.905 [1] and TS 36.300 [2].

**2Rx XR UE**: two antenna port XR UE as specified in TS 38.101-1 [18].

**A2X communication**: A communication to support A2X services leveraging PC5 reference points. A2X services are realized by various types of A2X applications, i.e. BRID or DAA.

**Activated AI/ML functionality:** AI/ML functionality that is already enabled for performing inference.

Editor's Note: FFS how to update the definition, e.g., replace 'functionality'.

**Aerial UE communication:** functionality enabling Aerial UE function, as defined in 16.18.

**AI/ML Model:** A data driven algorithm that applies AI/ML techniques to generate a set of outputs based on a set of inputs.

**Air to Ground network:** An NG-RAN consisting of ground-based gNBs, which provide cell towers that send signals up to an aircraft's antenna(s) of onboard ATG terminal, with typical vertical altitude of around 10,000m and take-off/landing altitudes down to 3000m.

**Applicable AI/ML functionality:** AI/ML functionality for which the UE is able to perform and report inference according to an inference configuration.

Editor's Note: FFS how to update the definition, e.g., replace 'functionality'.

**BH RLC channel**: an RLC channel between two nodes, which is used to transport backhaul packets**.**

**Boundary IAB-node:** as defined in TS 38.401 [4].

**Broadcast MRB**:A radio bearer configured for MBS broadcast delivery.

**CAG Cell**:a PLMN cell broadcasting at least one Closed Access Group identity.

**CAG Member Cell**:for a UE, a CAG cell broadcasting the identity of the selected PLMN, registered PLMN or equivalent PLMN, and for that PLMN, a CAG identifier belonging to the Allowed CAG list of the UE for that PLMN.

**CAG-only cell**: a CAG cell that is only available for normal service for CAG UEs.

**Cell-Defining SSB**: an SSB with an RMSI associated.

**Child node**: IAB-DU's and IAB-donor-DU's next hop neighbour node; the child node is also an IAB-node.

**Conditional Handover (CHO**): a handover procedure that is executed only when execution condition(s) are met.

**CORESET#0**: the control resource set for at least SIB1 scheduling, can be configured either via MIB or via dedicated RRC signalling.

**DAPS Handover**: a handover procedure that maintains the source gNB connection after reception of RRC message for handover and until releasing the source cell after successful random access to the target gNB.

**Data Burst:** A set of multiple PDUs generated and sent by the application in a short period of time, as defined in TS 23.501 [3].

**Direct Path**: a type of UE-to-Network transmission path, where data is transmitted between a UE and the network without sidelink relaying.

**Downstream**: direction toward child node or UE in IAB-topology.

**Early Data Forwarding**: data forwarding that is initiated before the UE executes the handover.

**Earth-centered, earth-fixed**: a global geodetic reference system for the Earth intended for practical applications of mapping, charting, geopositioning and navigation, as specified in NIMA TR 8350.2 [51].

**eRedCap UE**: a UE with enhanced reduced capabilities as specified in clause 4.2.22.1 in TS 38.306 [11].

**Feeder link**: wireless link between the NTN Gateway and the NTN payload.

**Geosynchronous Orbit**: earth-centered orbit at approximately 35786 kilometres above Earth's surface and synchronised with Earth's rotation. A geostationary orbit is a non-inclined geosynchronous orbit, i.e. in the Earth's equator plane.

**Group ID for Network Selection**: an identifier used during SNPN selection to enhance the likelihood of selecting a preferred SNPN that supports a Default Credentials Server or a Credentials Holder, as specified in TS 23.501 [3].

**gNB**: node providing NR user plane and control plane protocol terminations towards the UE, and connected via the NG interface to the 5GC.

**High Altitude Platform Station**: airborne vehicle embarking the NTN payload placed at an altitude between 8 and 50 km.

**IAB-donor**:gNB that provides network access to UEs via a network of backhaul and access links.

**IAB-donor-CU**: as defined in TS 38.401 [4].

**IAB-donor-DU**:as defined in TS 38.401 [4].

**IAB-DU**: gNB-DU functionality supported by the IAB-node to terminate the NR access interface to UEs and next-hop IAB-nodes, and to terminate the F1 protocol to the gNB-CU functionality, as defined in TS 38.401 [4], on the IAB-donor.

**IAB-MT**: IAB-node function that terminates the Uu interface to the parent node using the procedures and behaviours specified for UEs unless stated otherwise. IAB-MT function used in 38-series of 3GPP Specifications corresponds to IAB-UE function defined in TS 23.501 [3].

**IAB-node**: RAN node that supports NR access links to UEs and NR backhaul links to parent nodes and child nodes. The IAB-node does not support backhauling via LTE.

**IAB topology**: the unison of all IAB-nodes and IAB-donor-DUs whose F1 and/or RRC connections are terminated at the same IAB-donor-CU.

**Indirect Path**: a type of UE-to-Network transmission path, where data is forwarded via a U2N Relay UE between a U2N Remote UE and the network.

**Inter-donor partial migration:** migration of an IAB-MT to a parent node underneath a different IAB-donor-CU while the collocated IAB-DU and its descendant IAB-node(s), if any, are terminated at the initial IAB-donor-CU. The procedure renders the said IAB-node as a boundary IAB-node.

**Intra-system Handover**:handover that does not involve a CN change (EPC or 5GC).

**Inter-system Handover**:handover that involves a CN change (EPC or 5GC).

**Late Data Forwarding**: data forwarding that is initiated after the source NG-RAN node knows that the UE has successfully accessed a target NG-RAN node.

**L1/L2 Triggered Mobility**: a cell switch procedure that the network triggers via MAC CE based on L1 or L3 measurement report.

**Mapped Cell ID**: in NTN, it corresponds to a fixed geographical area.

**MBS Radio Bearer**: A radio bearer configured for MBS delivery.

**Mobile-IAB cell**: a cell of a mobile IAB-DU.

**Mobile IAB-DU**: gNB-DU functionality supported by the mobile IAB-node to terminate the NR access interface to UEs, and to terminate the F1 protocol to the gNB-CU functionality on the IAB-donor, as defined in TS 38.401 [4].

**Mobile IAB-DU migration**: procedure for a mobile IAB-node as defined in TS 38.401 [4].

**Mobile IAB-MT**: mobile IAB-node function that terminates the Uu interface to the parent node using the procedures and behaviours specified for UEs unless stated otherwise.

**Mobile IAB-MT migration**: procedure for a mobile IAB-MT as defined in TS 38.401 [4].

**Mobile IAB-node**: RAN node that supports NR access links to UEs and an NR backhaul link to a parent node, and that can conduct physical mobility across the RAN area. The mobile IAB-node function used in 38-series of 3GPP Specifications corresponds to the MBSR function defined in TS 23.501 [3].

**MP Relay UE**: a UE that provides functionality to support connectivity to the network for MP Remote UE(s).

**MP Remote UE**: a UE that communicates with the network via a direct Uu link and a MP Relay UE.

**MSG1**: preamble transmission of the random access procedure for 4-step random access (RA) type.

**MSG3**: first scheduled transmission of the random access procedure.

**MSGA**:preamble and payload transmissions of the random access procedure for 2-step RA type.

**MSGB**:response to MSGA in the 2-step random access procedure. MSGB may consist of response(s) for contention resolution, fallback indication(s), and backoff indication.

**Multicast/Broadcast Service**: A point-to-multipoint service as defined in TS 23.247 [45].

**Multicast MRB**:A radio bearer configured for MBS multicast delivery.

**Multi-hop backhauling**: using a chain of NR backhaul links between an IAB-node and an IAB-donor.

**NCR-Fwd**: Network-Controlled Repeater node function, which performs amplifying-and-forwarding of UL/DL RF signals between gNB and UE. The behaviour of the NCR-Fwd is controlled according to the side control information received by the NCR-MT from a gNB.

**NCR-Fwd access link**: link used for transmissions between the NCR-Fwd and UEs.

**NCR-Fwd backhaul link**: link used for backhauling between the NCR-Fwd and gNB.

**NCR-MT**: NCR-node entity which communicates with a gNB via a control link to receive side control information. The control link is based on NR Uu interface.

**NCR-node**: RAN node comprising NCR-MT and NCR-Fwd.

**Network-side (AI/ML) model:** An AI/ML Model whose inference is performed entirely at the network.

**ng-eNB**: node providing E-UTRA user plane and control plane protocol terminations towards the UE, and connected via the NG interface to the 5GC.

**NG-C**: control plane interface between NG-RAN and 5GC.

**NG-U**: user plane interface between NG-RAN and 5GC.

**NG-RAN node**: either a gNB or an ng-eNB.

**Non-CAG Cell**: a PLMN cell which does not broadcast any Closed Access Group identity.

**Non-Cell Defining SSB**: an SSB without an RMSI associated.

**Non-Geosynchronous orbit**: earth-centered orbit with an orbital period that does not match Earth's rotation on its axis. This includes Low and Medium Earth Orbit (LEO and MEO). LEO operates at altitudes between 300 km and 1500 km and MEO at altitudes between 7000 km and 25000 km, approximately.

**Non-terrestrial network**: an NG-RAN consisting of gNBs, which provide non-terrestrial NR access to UEs by means of an NTN payload embarked on an airborne or space-borne NTN vehicle and an NTN Gateway.

**NR backhaul link**: NR link used for backhauling between an IAB-node and an IAB-donor, and between IAB-nodes in case of a multi-hop backhauling.

**NR sidelink communication**: AS functionality enabling at least V2X communication as defined in TS 23.287 [40] and/or A2X communication as defined in TS 23.256 [60] and/or the ProSe communication (including ProSe non-Relay and UE-to-Network Relay communication) as defined in TS 23.304 [48], between two or more nearby UEs, using NR technology but not traversing any network node.

**NR sidelink discovery**: AS functionality enabling ProSe non-Relay Discovery and ProSe UE-to-Network Relay discovery for Proximity based Services as defined in TS 23.304 [48] between two or more nearby UEs, using NR technology but not traversing any network node.

**NTN Gateway**: an earth station located at the surface of the earth, providing connectivity to the NTN payload using the feeder link. An NTN Gateway is a TNL node.

**NTN payload**: a network node, embarked on board a satellite or high altitude platform station, providing connectivity functions, between the service link and the feeder link. In the current version of this specification, the NTN payload is a TNL node.

**Numerology**: corresponds to one subcarrier spacing in the frequency domain. By scaling a reference subcarrier spacing by an integer *N*, different numerologies can be defined.

**Parent node**: IAB-MT's or mobile IAB-MT's next hop neighbour node; the parent node can be an IAB-node or IAB-donor-DU

**PC5 Relay RLC channel**: an RLC channel between L2 U2N Remote UE and L2 U2N Relay UE, or between L2 U2U Remote UE and L2 U2U Relay UE, which is used to transport packets over PC5 for L2 UE-to-Network/UE-to-UE Relay**.**

**PDU Set**: one or more PDUs carrying the payload of one unit of information generated at the application level (e.g. frame(s) or video slice(s) for XR Services), as defined in TS 23.501 [3].

**PLMN Cell**: a cell of the PLMN.

**RACH-less LTM**: an LTM cell switch procedure where UE skips the random access procedure.

**RedCap UE**: a UE with reduced capabilities as specified in clause 4.2.21.1 in TS 38.306 [11].

**Relay discovery**: AS functionality enabling 5G ProSe UE-to-Network Relay Discovery as defined in TS 23.304 [48], using NR technology but not traversing any network node.

**Satellite**:a space-borne vehicle orbiting the Earth embarking the NTN payload.

**Service link**:wireless link between the NTN payload and UE.

**Sidelink Discovery RSRP:** RSRP measurements on PC5 link related to NR sidelink discovery.

**Sidelink RSRP:** RSRP measurements on PC5 link related to NR sidelink communication.

**SNPN Access Mode**: mode of operation whereby a UE only accesses SNPNs.

**SNPN-only cell**: a cell that is only available for normal service for SNPN subscribers.

**SNPN Identity**: the identity of Stand-alone NPN defined by the pair (PLMN ID, NID).**Supported AI/ML functionality:** AI/ML functionality for which the UE can indicate by using UE capability information.

Editor's Note: FFS how to update the definition, e.g., replace 'functionality'.

**Transmit/Receive Point**:part of the gNB transmitting and receiving radio signals to/from UE according to physical layer properties and parameters inherent to that element.

**U2N Relay UE**: a UE that provides functionality to support connectivity to the network for U2N Remote UE(s).

**U2N Remote UE**: a UE that communicates with the network via a U2N Relay UE.

**U2U Relay UE**: a UE that provides functionality to support connectivity between two U2U Remote UEs.

**U2U Remote UE**: a UE that communicates with other UE(s) via a U2U Relay UE.

**UE-side (AI/ML) model:** An AI/ML Model whose inference is performed entirely at the UE.

**Upstream**: direction toward parent node in IAB-topology.

**Uu Relay RLC channel**: an RLC channel between L2 U2N Relay UE or MP Relay UE and gNB, which is used to transport packets over Uu for L2 UE-to-Network Relay or for indirect path in case of MP.

**V2X sidelink communication**: AS functionality enabling V2X communication as defined in TS 23.285 [41], between nearby UEs, using E-UTRA technology but not traversing any network node.

**Xn**: network interface between NG-RAN nodes.

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## 7.9 UE Assistance Information

When configured to do so, the UE can signal the network through *UEAssistanceInformation*:

- If it prefers an adjustment in the connected mode DRX cycle length, for the purpose of delay budget reporting;

- If it is experiencing internal overheating;

- If it prefers certain DRX parameter values, and/or a reduced maximum number of secondary component carriers, and/or a reduced maximum aggregated bandwidth and/or a reduced maximum number of MIMO layers and/or minimum scheduling offsets K0 and K2 for power saving purpose;

- If it expects not to send or receive any more data in the near future, and in this case, it can provide its preference to transition out of RRC\_CONNECTED where this indication may express its preferred RRC state, or alternately, it may cancel an earlier indicated preference to transition out of RRC\_CONNECTED;

- If it prefers (not) to be provisioned with reference time information;

- If it prefers to transition out of RRC\_CONNECTED state for MUSIM operation and its preferred RRC state after transition;

- If it wants to include assistance information for setup or release of MUSIM gaps, and/or for setup the priority of periodic MUSIM gaps, and/or for keeping the colliding MUSIM gaps;

- If it prefers to restrict UE capability temporarily or remove the restriction for MUSIM operation;

- When affected by IDC problems that it cannot solve by itself:

- The list of frequencies affected by IDC problems (see clause 23.4 of TS 36.300 [2]);

- The list of frequency ranges/frequency range combinations affected by the IDC problems;

- DRX based TDM assistance information (see clause 23.4.2 of TS 36.300 [2]);

- Its RRM measurement relaxation status indicating whether RRM measurement relaxation criteria are met or not;

- Its RLM measurement relaxation status indicating whether the UE is applying RLM measurements relaxation;

- Its BFD measurement relaxation status indicating whether the UE is applying BFD measurements relaxation;

- If it prefers not operating on multi-Rx (i.e. not supporting simultaneous reception with different QCL-typeD) for FR2;

- If it prefers to stop data collection for model training for power saving purpose;

- If it has available logged data;

- Its preferred data collection configuration;

- Its updated applicability of AI/ML functionalities.

NOTE: The requirements on RRM/RLM/CSI measurements in different phases of IDC interference defined in TS 36.300 [2] are applicable except that for NR serving cell, the requirements in TS 38.133 [13] and TS 38.101-1 [18], TS 38.101-2 [35], TS 38.101-3 [36] apply.

In the second case, the UE can express a preference for temporarily reducing the number of maximum secondary component carriers, the maximum aggregated bandwidth and the number of maximum MIMO layers. In all cases, it is up to the gNB whether to accommodate the request.

For sidelink, the UE can report SL traffic pattern(s) to NG-RAN, for periodic traffic.

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## X.Y Support of AI/ML for NR Air Interface

### X.Y.1 Overview

The objective of AI/ML for NR air interface is to improve network performance and user experience, through AI/ML-enabled enhancements to the following features: beam management, CSI prediction and positioning accuracy.

### X.Y.2 AI/ML-based Beam Management

#### X.Y.2.1 Introduction

AI/ML based beam management utilizes intra-cell downlink beam prediction of the serving cell to reduce measurement/RS overhead and to improve the accuracy of beam selection. Two types of beam prediction are supported as follows:

- Spatial-domain downlink transmission beam prediction for one set of beams based on measurement results of another set of beams.

- Temporal-domain downlink transmission beam prediction for one set of beams based on historic measurement results of another set of beams. These two sets may be the same.

For AI/ML based beam management, both NW-side model and UE-side model are supported.

#### X.Y.2.2 Data Collection for Mode Training

For NW-side model, model training, data collection can be initiated by OAM (via immediate MDT) or by gNB. The following enhancements are introduced for training data collection over air interface:

- UE can be configured by gNB to log and report L1 measurement results.

*Editor's note: FFS if multiple configurations can be provided to the UE. FFS if dynamic activation/deactivation is support.*

- Both periodic and radio condition-based event-triggered data logging are supported. UE can use L3 measurement event-triggered to determine whether to perform data logging. The UE stores the logged data at the AS layer buffer. When the memory reserved for storing logged data becomes full, the UE stops measurement and logging for data collection purposes, and UE indicates the data availability to the network. The UE can also send this data availability indication when UE buffer status reaches threshold, if configured.

*Editor's note: FFS if other event(s) for data logging are supported.*

- To reduce UE power consumption, when low power state is detected, the UE can indicate the low power state to the network, if configured. Upon reception of the low power status indication, the network should de-configure UE to release the data collection configuration.

NOTE 1: It is up to UE Implementation how buffer threshold reached and low power is determined.

- During handover the UE can retain the logged data and the UE can indicate the availability of logged data to network and network decides whether the logged data should be kept or not. Upon UE transitioning to RRC\_IDLE/INACTIVE or UE experiencing RLF, UE discards any stored data.

*Editor's note: FFS how to handle idle/inactive and RLF cases and whether we have a unified handling.*

For UE-side model, the network can configure whether UE is allowed to initiate a request about data collection configuration (e.g., start/stop, preferred configuration from a list of candidate configuration provided by network). The network can also provide UE with data collection configuration or release the data collection configuration (at any point in time), with or without UE request.

*Editor's note: FFS whether an indication from UE to network is needed when UE cannot perform data collection based on received configuration.*

#### X.Y.2.3 Applicability Reporting

*Editor's note: The content in this sub-clause will be further refined/update based on further progress.*

For UE side model, based on UE supported functionalities, the Network provide inference configuration associated with NW-side additional conditions to UE. The UE can report its applicable functionalities and subsequent applicable functionalities change to Network. The basic procedure of applicability reporting is described as in Figure X.Y.2.3-1.



Figure X.Y.2.3-1: Initial applicability and applicability status change reporting

1. The network inquiries about the UE capability information.

2. n

3. n

4. UE can decide the applicable AI/ML functionalities based on e.g., NW-side additional conditions (if provided), UE-side additional conditions (internally known by UE) and model availability in the UE. T

5. The network transmits an *RRCReconfiguration* message to the UE including the inference configuration.

6. The UE transmits an *RRCReconfigurationComplete* message to the network.

NOTE 1: Upon receiving one or more inference configuration(s), UE shall maintain all the inference configuration(s) no matter the inference configuration is applicable or inapplicable until the network releases it explicitly.

7.

NOTE 2: Together with non-applicability change reporting, UE further indicates a simple cause value of inapplicability change.

8. The network transmits an *RRCReconfiguration* message to the UE including the inference configuration.

9. The UE transmits an *RRCReconfigurationComplete* message to the network.

When provided with periodic CSI configuration consistent with reported UE capabilities in CSI report configuration, upon reporting the applicable functionalities, the UE autonomously activates the applicable AI/ML functionalities. When provided with semi-persistent CSI and/or aperiodic CSI configuration, upon reporting the applicable AI/ML functionalities, applicable AI/ML functionality activation follows the CSI measurement and reporting, i.e., semi-persistent reporting can be activated by MAC CE/DCI and aperiodic CSI reporting can be activated by DCI.

When an activated AI/ML functionality becomes inapplicable, the UE does not autonomously deactivate it. Upon reception of UE indication of the functionality becoming non-applicable, the network should deactivate or release this activated functionality.

*Editor's note: FFS signaling details for option B (e.g., whether it is signaling in CSI-Report Config or otherconfig) and activation.*

During handover, the target gNB can provide UE with NW-side additional conditions and/or the inference configuration related to the target gNB via handover command. Then the UE can report its applicable/non-applicable AI/ML functionalities to the target gNB after the handover completion.

*Editor's note: FFS how the applicable functionality is decided if NW-side additional condition is not provided*

NOTE 3: UAI can be sent from the source gNB to the target gNB using existing signaling.

For NW-side model, the CSI measurement and reporting is used to acquire input data for inference.

NOTE 4: For NW-side model, required network side additional condition is left up to the network implementation.

#### X.Y.2.4 Monitoring and Management

For NW-side model, the gNB is responsible for performance monitoring (i.e., calculate performance metrics). UE will not be involved in management decisions (e.g., selection, (de)activation, switching etc.) of gNB-side model, except for being configured to provide the required measurement/data. Additionally, the UE will not be informed about any gNB-side management decision.

For UE-side model, the network can initiate performance monitoring, and can make management decisions based on the performance monitoring results. The network can configure UE to assist performance monitoring, or network can calculate performance metrics based on measurement report from UE.

### X.Y.3 AI/ML-based CSI prediction

*Editor's note: This section will be updated based on further progress in RAN1. FFS which agreements of AI/ML-based beam management can be reused.*

### X.Y.4 AI/ML-based Positioning

AI/ML-based Positioning is described in TS 38.305 [42].

*END OF CHANGES*

# Annex of meeting agreements:

RAN2 agreements related to the WI phase are listed in the following, and the agreements related to the study part, e.g., UE side data collection, are not listed since they are not to be captured in this specification.

## RAN2 129bis

### Beam management

|  |
| --- |
| **Agreements on option B**  1 RAN2 assumes UE receives RRCReconfiguration message including one set or multiple sets of inference related parameters via OtherConfig for option B. This assumption can be confirmed (i.e., whether to reconsider CSI-ReportConfig) after receiving Option B inference related parameters (e.g., in RAN1 RRC parameters list).  Potential aspects to consider if RAN2 revisit:  - To reconsider CSI-ReportConfig for option B, for example, if the list of inference related parameters is fully contained within existing CSI-ReportConfig.  - to take into accounts UE behaviour when confirming the assumption e.g., whether option A and option B result in different UE behavior |

Agreements on applicability reporting

1. Together with inapplicability reporting, UE further indicates a simple cause value of inapplicability FFS how to define this simple cause related to model availability and how we capture it in the spec
2. Upon receiving one or more full inference configuration(s) via RRCReconfiguration message, UE shall maintain all the full inference configuration(s) no matter the full inference configuration is applicable or inapplicable until the network releases it explicitly.
3. No prohibit timer is introduced

### NW side data collection

Agreements on data collection configuration

* The UE can request measurement configuration for data collection of AI/ML based beam management. The request can contain one or more of the following:

• An indication on start/stop of data collection

• Preferred configuration from a list of candidate configurations provided by NW. Details of signaling are FFS. It is up to network what it configures at the end.

* Introduce UAI message for UE request of data collection measurement configuration. And it is up to UE implementation when to send the request.

|  |
| --- |
| **Agreements on availability indication**   * Availability indication can be triggered due to:   + Full buffer being reached (if configured)   + Buffer threshold being reached (if configured).   + Low power (if configured) * The UE send a UAI that indicates:   + Data is available   + Reason for trigger (full buffer, threshold)   + Low power indication * The encoding of the data is available/UAI and the cause value is FFS   NOTE: it is up to UE Implementation how buffer threshold reached and low power is determined |

**Agreements on data collection configuration**

1. The measurement configuration of AI/ML data collection can configure measurements for multiple sets of resources and use cases (e.g. BM, Mobility, etc)

**Agreements**

1. For temporal domain, the network is made aware whether there is a gap between two consecutive samples. FFS amount of gap and whether this is implicit or explicit
2. New SRB can be configured for NW-side data collection (with lower priority)

**Agreements on Idle/inactive and HO**

1. Introduce 1-bit indication on whether to release or retain un-retrieved data in RRCReconfiguration during/before HO. Source gNB decides whether the data should be kept. The indication is provided in RRCReconfiguration (i.e. not in RRC Reconfiguration from target cell). FFS signaling details.
2. Upon going to RRC\_IDLE, RLF, or RRC\_INACTIVE, UE discards any logged data

## RAN2 129

### Beam management

**Agreements**

1. Inference configuration/parameters can be signalled in step 3 and/or Inference configuration can be signalled in step 5 (i.e. option a and option b from RAN1).
2. The full inference configuration is sent in CSI-ReportConfig.
3. Upon receiving a full inference configuration, the UE sends the initial applicability report in RRCReconfigurationComplete. UAI can be sent to update applicability.
4. FFS signaling details for option B (e.g. whether it is signaling in CSI-Report Config or otherconfig)

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| Agreements applicability reporting and management   * Support the explicit reporting of applicability/inapplicability in initial report and subsequent reporting it reports only applicability it changed. FFS if we report explicit cause * If option A is configured in Step 3, for periodic CSI reporting, the UE autonomously activate the applicable functionalities upon reporting applicable functionalities via RRCReconfigurationComplete in step 4 (i.e. without need to wait RRCReconfiguration in Step 5). * The provided periodic CSI configuration should be consistent with reported UE capabilities * FFS option B * Semi-persistent and aperiodic CSI reporting of applicable functionality is activated following legacy CSI framework:   Semi-persistent reporting, activated by MAC CE/DCI  Aperiodic CSI reporting, activated by DCI |

### NW side data collection

All agreements for NW side data collection

1. Support the use of L3 measurement event triggered (i.e. L3 serving cell measurements becoming worse/better than a threshold for TTT) to determine whether the UE performs logging or not. L1 measurement event triggered will not be supported. FFS what to log
2. Low power bit indication is supported
3. Data availability indication is supported. FFS when this would be triggered
4. As baseline, the UEInformationResponse contains one or more logged measurement entries in chronological order (i.e. starting from the oldest measurement entries stored in the UE memory), and an availability indication if there are further data available for transmission. Same principles as for logged MDT.
5. UE retains logged data during handover (HO). FFS if there is scenarios where the UE needs to release the data and how does the UE know and if control from network is needed
6. UE indicates availability of logged data during handover (i.e., within the RRCReconfigurationComplete message) (if data is retained in the UE).
7. FFS how to handle idle/inactive and RLF cases and whether we have a unified.

### UE side data collection

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| Agreements  Extend the following agreements on data collection configuration in AI/ML based beam management to general UE-side data collection configuration:   1. Data collection related configuration(s) and associated ID(s)(if needed) can be included in training data collection configuration. 2. For data collection configuration UE-side model training, the UE can send a request for data collection (e.g. start/stop). FFS whether a suggested data collection configuration/associated IDs (if specified)/parameters can be provided to the network. 3. The network can provide or release the data collection configuration (at any point in time), with or without UE request. 4. The following methods for network control of the initiation and configuration for data collection:    1. The network can decide when to start/stop the data collection and send configuration.    2. The network can configure whether UE is allowed to initiate request for data collection (e.g. start/stop indication). |

## RAN2 128

### General

### Beam management

**Agreements**

1. When a functionality configured by the network to be reported via UAI, becomes from non-applicable to applicable, the UE can reports it to the network. FFS detailed design
2. When a functionality becomes non-applicable the UE doesn’t autonomously deactivate. NW is expected to deactivate active functionality when it receives report from UE that it is non-applicable.
3. FFS whether the UE reports explicitly “non-applicable” functionality when there is a change of applicability. Verify this aligns with RAN1 configuration design
4. Applicable functionality reporting at handover is supported with the same RRC procedure that will be specified within a cell, as a baseline, i.e. the NW-side additional conditions and/or the inference configuration related to the target gNB are transmitted by the target gNB as part of the HO command, and the UE in response transmits the applicability report (either in RRCReconfigurationComplete or in UAI) to the target gNB after completing the handover.
5. Source cell UAI (as is) can be sent from source cell to target cell using existing signaling. No further optimizations will be considered in RAN2 related to UAI.
6. For BM use case for UE-side model, data collection related configuration(s) (e.g., measurement resources configuration) and associated ID(s) can be included in training data collection configuration.
7. For data collection configuration UE-side model training, the UE can send a request for data collection. FFS what the request contains.
8. The network can provide the data collection configuration (at any point in time), with or without UE request.
9. The following methods for network control of the initiation and configuration for data collection:

- The network can decide when to start/stop the data collection and send configuration.

- The network can configure whether UE is allowed to initiate request for data collection.

1. FFS whether an indication from UE to network is needed when UE can’t perform data collection based on received configuration

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| **Agreements on NW side data collection**   1. Focus on the following three radio condition event based logging    * + L3 serving cell measurement based (e.g. X1/X2 similar to A1/A2)      + Beam based events (e.g. beam becomes top-1 beam and number of measurements is less than configured value)      + L1 beam level measurement 2. Measurements on aperiodic CSI resources are not reported for NW sided data collection. 3. Data collection is controlled by the network. The UE will not autonomously stop when low power state is detected. 4. The UE reports to the network when the power state is low. We will not specify how the UE determines low power state. The network should de-configure the data collection (this can be captured in stage 2). 5. The UE reports to the network when buffer is or may become full. FFS when it reports (before and/or after). 6. The UE can report the reason for triggering of indication for the status (e.g. low power state, low memory). FFS how this is signalled and if the reporting can be part of availability indication. |

## RAN2 127bis

### General

### Beam management

**Agreements for BM**

1. UAI is supported and RRCReconfigurationComplete message can be used to report applicable functionality. We should aim to align the design on how the applicable functionality are signaled. FFS on the applicability reporting content.
2. FFS if inference configuration can be signalled in step3.
3. UE can report to the network when an applicable AI functionality becomes non-applicable. FFS how this is signaled (e.g. explicitly/implicitly). Consider different scenarios, whether it is regarding an active functionality)
4. Data collection initiation and configuration for data collection is under network control. FFS how the NW determines whether data collection should be initiated (e.g. via UE requests (UE directly or UE server)
5. For the purpose of discussion of AI/ML BM LCM operations, existing procedures and terminologies from the CSI Framework should be used, including those defined for aperiodic, semipersistent on PUCCH, semipersistent on PUSCH, and periodic reporting configurations (as/if defined in RAN1 pending response LS from RAN1).
6. For now, RAN2 will not define terminology specific to the activation or deactivation for AI/ML models. Can come back to this discussion later.

**Agreements on NW side data collection**

1. Periodic logging is supported for training data collection procedure in R19
2. Event-triggered data logging will be supported. At least radio condition based event triggered logging will be supported. FFS the details of radio condition based event. FFS if other events are supported.
3. Periodic reporting of logged data is not supported.
4. On-demand reporting of the logged measurements will be specified
5. *UEInformationRequest*/ *UEInformationResponse* is used for on-demand reporting of AI/ML training data collection. FFS of details of the message
6. The UE can indicates the availability of logged data to the network to assist network to trigger *UEInformationRequest*. FFS trigger/definition of availability indication. and FFS how data availability indication is sent to the network.
7. Low priority SRB will be used. FFS new SRB or use of SRB4
8. For data collection for both NW-sided/UE sided BM model training, at least L1-RSRPs and/or beam-IDs needs to be collected by UE. FFS if other data needs to be collected based on RAN1 progress.

## RAN2 127

### General

**Agreements on definitions**

1. Supported functionalities refer to functionalities that UE can indicate by using UE capability information (via RRC/LPP signalling)
2. Applicable functionalities refers to functionalities that the UE is ready to apply for inference
3. Activated functionalities refers to functionalities already enabled for performing inference

### Beam management

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| **Agreements on procedures**  - Step 1: Network sends *UECapabilityEnqiry* message to initiate the procedure to a UE reporting its AI/ML supported functionalities.  - Step 2: UE sends *UECapablityInformation* message to network, containing supported functionalities at the UE side.  - “Step 3”: Following configurations are provided from NW to UE:  1) UE is allowed to do UAI reporting via *OtherConfig*.  2) Network may provide NW-side additional condition. FFS on the RRC signalling and whether it is mandatory or optional.  3) FFS on configuration (e.g. inference configuration) of supported functionalities. FFS on the content of configuration.  - UE decides the applicable functionalities based on NW-side additional conditions (if provided), UE-side additional conditions (internally known by UE) and model availability in device. FFS whether other configuration can considered by UE (e.g. inference configuration). FFS how the applicable functionality is decided if NW-side additional condition is not provided in step 3.  - “Step 4”: UE reports applicable functionality in the following scenarios:  1) Upon being configured to provide applicable functionality and upon change of applicable functionality via UAI  2) As response to NW-side additional condition requesting applicable functionality reporting in step 3, FFS other network configuration (e.g. inference configuration), FFS via UAI or *RRCReconfigurationComplete*, etc  - Step 5:  1) Network configures inference configuration to UE after applicable functionality reporting, if inference configuration based on supported functionality is not provided in Step 3 (i.e. inference configuration is provided in Step 5).  2) If inference configuration based on supported functionality is provided in Step 3, it is up to network implementation whether to provide an updated configuration or not.  - The applicable functionality may be activated by receiving its inference configuration when it is provided in Step 5. FFS the initial activation state. FFS on initial state of applicable functionality if inference configuration of supported functionality is provided in Step 3. FFS on additional L1/L2 signaling for activation/deactivation. FFS if multiple applicable functionalities can be activated at the same time. FFS what is the granularity of functionality  - We will write an LS to RAN1 to provide our agreements and ask specific questions that RAN2 needs to enable progress. |

**Agreements**

1. As the baseline approach, the UE receives the measurement configuration for AI/ML-enabled features/FGs for data collection and logging of measurements. The network can explicitly configure the UE whether the corresponding data collection and logging (if supported) should be immediately started. FFS if multiple configurations can be provided to the UE. FFS if dynamic activation/deactivation is support.
2. UE stores the logged training data at AS layer with a minimum AS layer memory size supported by the UE. FFS on the memory size. This is across all use cases
3. When UE reaches its buffer limitation the UE stops measurement for data collection purposes and logging.
4. Measurements for data collection purposes and logging based can be controlled based on power state of the UE. It is up to UE implementation how the UE determines power state. FFS whether the UE stops autonomously or if it reports to the network .
5. FFS whether AS buffer event based reporting is supported. FFS if we send availability indication or full report if it is supported
6. FFS on event based data collection/logging
7. On-demand request from the network is supported. FFS details on signalling

**Agreements**

1. The UE implementation can determine how many entries to include in the list radio measurements information, such that the maximum PDCP SDU size is not exceeded. No standardized RRC segmentation procedure is needed (as for the logged MDT measurements)
2. Data collection report will not be transmitted over SRB1. FFS which SRB is used.

## RAN2 126

### General

**Agreements**

1 RAN2 will support functionality activation/deactivation after inference configuration. FFS initial state of configuration and how activation/deactivation is achieved. FFS what Deactivation refers to: examples discussed: 1) fallback to legacy 2) switching, etc.

2 We will work offline on the definitions for functionality types and define what is availability.

3 The UE will indicate the gNB/LMF whether the AI/ML functionality is available/applicable. For a functionality to be applicable at least there should at least one model available within it. FFS other details on what is applicability/non-applicability.

### Beam management

**Agreements for NW-sided model for Beam Management**

1 For the network-side model, required network side additional condition is left up to the network implementation

2 RAN2 will wait for RAN1 for any required UE side additional conditions.

3 For network-sided model for BM use case, RAN2 confirms that UE inputs for inference at network-sided model will rely on L1 signaling, RAN2 will not further spend time on this aspect.

4 The gNB is responsible for monitoring its own performance. RAN2 will work on RAN2 specifications enhancements associated to gNB-side model monitoring, only based on RAN1 inputs, if any

**Agreements**

4 For NW-side additional conditions, RAN2 assumes that RRC signaling from gNB to UE can be designed for consistency between inference and training. RAN2 will wait for RAN1 input for further details. FFS if the same applies to positioning

5 For BM use case, As a baseline the UE determines whether a functionality is applicable. Existing UAI framework is used at least for proactive reporting of applicable functionality. FFS reactive

**Agreements for beam management**

1. For gNB centric and OAM centric (for RRC signaling between UE and gNB), reporting multiple instances of logged L1 measurement result from UE to gNB via a RRC message as configured by gNB is an optional feature. FFS how to handle case when single RRC message is not sufficient. FFS if there will be any further enhancement needed pending RAN1 agreement.

2. Immediate MDT is the baseline framework for OAM-centric data collection for the training of a network-sided model

3. Enhance the immediate MDT framework to support periodical reporting. FFS whether and what event-based reporting is supported and FFS on network request reporting

## RAN2 125bis

### General

**Agreements**

1 RAN2 confirms that UE will not be informed about any gNB/LMF-sided model/functionality management decision (e.g., selection, (de)activation, switching, fallback, etc.)

2 RAN2 confirms that UE will not be involved in any gNB/LMF-sided model/functionality management decision making (e.g., selection, (de)activation, switching, fallback, etc.), except being configured to provide the required measurement/data.

3 RAN2 focuses on the data collection procedure from UE to NW (e.g., gNB, LMF, or OAM) for the sake of NW-sided model LCM (including training, inference, management).

Agreements

1. Which AI/ML-enabled Features/FGs and functionalities are supported should be standardized. The details wait for RAN1’s progress. “supported” means that the UE is capable of supporting the functionality and doesn’t mean neccesarily that the UE has the model available. FFS what functionality refers to.

2. Supported AI/ML-enabled Features/FGs and supported functionalities are included in UE capability.

**Agreements for positioning and beam management**

1. Support proactive reporting of UE-sided applicable functionality, e.g., the UE reports its applicable AI/ML functionalities via UAI message/LPP message.
2. Support reactive reporting of UE-sided applicable functionality. The NW configures AI/ML functionalities via RRC/LPP message. FFS what the configuration contains. FFS how to report applicable functionality and what is applicable functionality

3 FFS how the two approaches will be specified and whether we can combine them into one procedure. FFS how to report applicable functionality, what is applicable functionality, how the UE determines which function is applicable or not (if it is needed)

**Agreements:**

1 For UE-sided model, for the functionality management, the “network decision, network-initiated” AI/ML management is supported as a baseline. The following can be considered further “UE autonomous, decision reported to the network”, “Network decision, UE-initiated” (i.e. proactive approach).

2 “UE-autonomous, UE’s decision is not reported to the network” is not considered for Rel-19

Agreement @R1#119

At least for the monitoring Type 1 Option 2 of UE-side model monitoring (when applicable), support to reuse CSI framework for the configuration for monitoring result report in L1 signaling:

* Dedicated resource set(s) for monitoring and report configuration for monitoring are configured in a dedicated CSI report configuration used for monitoring
  + The ID of an inference report configuration is configured in the configuration for monitoring to link the inference report configuration and monitoring report configuration
    - FFS how to identify the connection between RSs in the resource set(s) for monitoring and Set A beams
  + FFS on whether to support all the combination on time domain behavior of the *reportConfigType* for infernece report and the *reportConfigType* for monitoring report
  + FFS on the timing related issues
  + UE measures the dedicated resource set(s) for monitoring.

Agreement @R1#118bis

For BM-Case1 and BM-Case2 with a UE-sided AI/ML model, for Option 2 (UE-assisted performance monitoring),

* At least support Alt 1: Top 1 or Top K beam prediction accuracy (with or without margin) by comparing the prediction results and the Top 1 or Top K beam based on the measurements from a resource set/ resources for monitoring
  + FFS on detail definition of the metric, including whether/how to configure or define a window for calculation
  + FFS: on other details including how to configure the resource set/resources for monitoring, including
    - E.g. whether/how to use full set of Set A for measurement. If the full set A is not configured, whether/how to define the metric
* FFS other alternatives

At least for the monitoring Type 1 Option 2 of UE-side model monitoring (when applicable), consider the following options with potential down selection for the configuration for monitoring:

* Option 1: The resource set(s) for monitoring and report configuration for monitoring are configured (when applicable) within CSI report configuration used for inference
  + FFS: the resource set(s) for monitoring
  + UE measures the resource set(s) for monitoring.
  + FFS how/when to report the monitoring results.
* Option 2: Dedicated resource set(s) for monitoring and report configuration for monitoring are configured in a dedicated CSI report configuration used for monitoring
  + The dedicated report configuration used for monitoring links to an inference report configuration
    - FFS how to identify the connection between RSs in the resource set(s) for monitoring and Set A beams
  + UE measures the resource set(s) for monitoring.
  + FFS when to report the monitoring results.

Agreement @R1#118

For BM-Case1 and BM-Case2 with a UE-sided AI/ML model, for Option 2 (UE-assisted performance monitoring), further study at least the following alternatives, including:

* Alt 1: Top 1 or Top K beam prediction accuracy (with or without margin) by comparing the prediction results and the Top 1 or Top K beam based on the measurements from a resource set/resources for monitoring
* Alt 2: The L1-RSRP difference information based on actual measurement of the L1-RSRP of one or more of Top K predicted beam, and L1-RSRP measurements from a resource set/resources for monitoring
* Alt 3: The RSRP difference information between the predicted RSRP and measured L1-RSRP of corresponding beam(s) of a resource set/resources for monitoring
  + Note: resources for Set B for monitoring are not precluded and can be study.
  + Note: this is only applicable when the model can predict RSRP
* Alt 4: The probability information of the predicted beam(s) to be the Top 1 or Top K beam
  + Note: this is only applicable when the model can generate probability information
* FFS: for Alt 1/2/3, on other details including how to configure the resource set/resources for monitoring, including
  + E.g. whether/how to use full set of Set A for measurement. If not, whether/how to obtain the measurement of the predicted Top 1 or Top K beam for calculating the prediction accuracy or the RSRP difference.
* For all alternatives, study whether the performance information is calculated per sample (one-shot), or per set of samples (window)

Agreement @R2#117

For BM-Case1 and BM-Case2 with a UE-side AI/ML model:

* Support Type 1 performance monitoring, including the following two options:
  + Option 1 (NW-side performance monitoring):
    - UE sends a report to NW (for the calculation of performance metric at NW)
      * Measurement results from resource set for monitoring, e.g., L1-RSRP and/or RS index is supported as the content of the report
      * FFS on other contents
    - The report is at least configured/triggered by NW
    - Note: this may or may not have additional spec impact
  + Option 2 (UE-assisted performance monitoring):
    - UE calculates performance metric(s)
      * FFS how to report and what to report
  + FFS whether to trigger the report based on event(s) for Option 1 and/or Option 2
* FFS Type 2 performance monitoring

### Beam management

**Agreements:**

1. RAN2 to consider an RRC configuration to configure radio measurements and the related reporting to enable data collection for NW-side training
2. For AI/ML based beam management, RAN2 assumes the L1 measurement framework shall be used for configuring the input data of the NW side AI/ML model inference. FFS if further enhancements are needed
3. There is no specification impact associated to gNB-side model inference, depending on further RAN1 input.
4. FFS whether rhere is specification impact associated to gNB-side model monitoring.

**Agreements**

1 For the NW-side data collection related to beam management use cases, RAN2 to consider gNB-centric and OAM-centric approaches

2 We aim that the same measurement framework is applied to both gNB-centric data collection and OAM-centric data collection for NW-side data collection.

3 RAN2 supports enhancements to MDT for data collection framework for training. FSS Whether to enhance logged or immediate MDT

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