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Contents

Foreword

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- y the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.
- z the third digit is incremented when editorial only changes have been incorporated in the document.

1 Scope

The present document specifies the control plane radio network layer signalling procedures between a NG-RAN node and the LMF. NRPPa supports the concerned functions by signalling procedures defined in this document.

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

[1] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".

[2] 3GPP TS 38.413:"NG-RAN; NG Application Protocol (NGAP)".

[3] 3GPP TS 38.300: "NR; NR and NG-RAN Overall Description; Stage 2".

[4] 3GPP TS 38.413: "NG-RAN; NG Application Protocol (NGAP)".

[5] 3GPP TR 25.921 (version.7.0.0): "Guidelines and principles for protocol description and error handling".

[6] ITU-T Recommendation X.691 (2002-07): "Information technology - ASN.1 encoding rules - Specification of Packed Encoding Rules (PER) ".

[7] 3GPP TS 36.104: "Evolved Universal Terrestrial Radio Access Network (E-UTRAN); Base Station (BS) radio transmission and reception".

[8] 3GPP TS 23.032:"Technical Specification Group Services and System Aspects; Universal Geographical Area Description (GAD)".

[9] 3GPP TS 36.133: "Evolved Universal Terrestrial Radio Access (E-UTRA); Requirements for support of radio resource management".

[10] 3GPP TS 36.211:"Evolved Universal Terrestrial Radio Access Network (E-UTRAN); Physical Channels and Modulation".

[11] IEEE Std 802.11™-2012, IEEE Standard for Information technology - Telecommunications and information exchange between systems - Local and metropolitan area network.

[12] 3GPP TS 36.455: " Evolved Universal Terrestrial Radio Access (E-UTRA); LTE Positioning Protocol A (LPPa)".

3 Definitions, symbols and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in 3GPP TR 21.905 [1] and the following apply. A term defined in the present document takes precedence over the definition of the same term, if any, in 3GPP TR 21.905 [1].

NG-RAN node: as defined in TS 38.300 [3].

ng-eNB: as defined in TS 38.300 [3].

3.2 Symbols

For the purposes of the present document, the following symbols apply:

<symbol> <Explanation>

3.3 Abbreviations

For the purposes of the present document, the abbreviations given in 3GPP TR 21.905 [1] and the following apply. An abbreviation defined in the present document takes precedence over the definition of the same abbreviation, if any, in 3GPP TR 21.905 [1].

CID	Cell-ID (positioning method)
E-CID	Enhanced Cell-ID (positioning method)
LMF	Location Management Function
OTDOA	Observed Time Difference of Arrival

4 General

4.1 Procedure specification principles

The principle for specifying the procedure logic is to specify the functional behaviour of the terminating NG-RAN Node exactly and completely. Any rule that specifies the behaviour of the originating NG-RAN Node shall be possible to be verified with information that is visible within the system.

The following specification principles have been applied for the procedure text in clause 8:

- The procedure text discriminates between:

  1) Functionality which "shall" be executed

     The procedure text indicates that the receiving node "shall" perform a certain function Y under a certain condition. If the receiving node supports procedure X but cannot perform functionality Y requested in the initiating message of a Class 1 EP, the receiving node shall respond with the message used to report unsuccessful outcome for this procedure, containing an appropriate cause value.

  2) Functionality which "shall, if supported" be executed

     The procedure text indicates that the receiving node "shall, if supported," perform a certain function Y under a certain condition. If the receiving node supports procedure X, but does not support functionality Y, the receiving node shall proceed with the execution of the EP, possibly informing the requesting node about the not supported functionality.

- Any required inclusion of an optional IE in a response message is explicitly indicated in the procedure text. If the procedure text does not explicitly indicate that an optional IE shall be included in a response message, the optional IE shall not be included. For requirements on including *Criticality Diagnostics* IE, see section 10.

4.2 Forwards and backwards compatibility

The forwards and backwards compatibility of the protocol is assured by a mechanism where all current and future messages, and IEs or groups of related IEs, include ID and criticality fields that are coded in a standard format that will not be changed in the future. These parts can always be decoded regardless of the standard version.

4.3 Specification notations

For the purposes of the present document, the following notations apply:

Procedure When referring to an elementary procedure in the specification the Procedure Name is written with the first letters in each word in upper case characters followed by the word "procedure", e.g. Handover Preparation procedure.

Message	When referring to a message in the specification the MESSAGE NAME is written with all letters in upper case characters followed by the word "message", e.g. ERROR INDICATION message.
IE	When referring to an information element (IE) in the specification the *Information Element Name* is written with the first letters in each word in upper case characters and all letters in Italic font followed by the abbreviation "IE", e.g. *Cause* IE.
Value of an IE	When referring to the value of an information element (IE) in the specification the "Value" is written as it is specified in sub clause 9.2 enclosed by quotation marks, e.g. "Value".

5 NRPPa services

The present clause describes the services an NG -RAN Node offers to the LMF.

5.1 NRPPa procedure modules

The procedures are divided into two modules as follows:

1. NRPPa Location Information Transfer Procedures;
2. NRPPa Management Procedures;

The NRPPa Location Information Transfer Procedures module contains procedures used to handle the transfer of positioning related information between NG-RAN Node and LMF.

The Management Procedures module contains procedures that are not related specifically to positioning, i.e. error handling.

5.2 Parallel transactions

Unless explicitly indicated in the procedure specification, at any instance in time one protocol peer may have more than one ongoing NRPPa procedure.

6 Services expected from lower layer

Within 5G RAN, NRPPa protocol uses the services provided by the NGAP protocol. An NRPPa message is carried inside an NGAP message.

NGAP signalling is described in TS 38.413 [2].

7 Functions of NRPPa

The NRPPa protocol provides the following functions:

- E-CID Location Information Transfer. This function allows the NG-RAN node to exchange location information with LMF for the purpose of E-CID positioning.
- OTDOA Information Transfer. This function allows the NG-RAN node to exchange information with the LMF for the purpose of OTDOA positioning.
- Reporting of General Error Situations. This function allows reporting of general error situations, for which function specific error messages have not been defined.

The mapping between the above functions and NRPPa EPs is shown in the table below.

Table 7-1: Mapping between NRPPa functions and NRPPa EPs

Function	Elementary Procedure(s)
E-CID Location Information Transfer	a) E-CID Measurement Initiation b) E-CID Measurement Failure Indication c) E-CID Measurement Report d) E-CID Measurement Termination
OTDOA Information Transfer	OTDOA Information Exchange
Reporting of General Error Situations	Error Indication

8 NRPPa procedures

8.1 Elementary procedures

In the following tables, all EPs are divided into Class 1 and Class 2 EPs.

Table 8.1-1: Class 1 Elementary Procedures

Elementary Procedure	Initiating Message	Successful Outcome	Unsuccessful Outcome
		Response message	Response message
E-CID Measurement Initiation	E-CID MEASUREMENT INITIATION REQUEST	E-CID MEASUREMENT INITIATION RESPONSE	E-CID MEASUREMENT INITIATION FAILURE
OTDOA Information Exchange	OTDOA INFORMATION REQUEST	OTDOA INFORMATION RESPONSE	OTDOA INFORMATION FAILURE

Table 8.1-2: Class 2 Elementary Procedures

Elementary Procedure	Initiating Message
E-CID Measurement Failure Indication	E-CID MEASUREMENT FAILURE INDICATION
E-CID Measurement Report	E-CID MEASUREMENT REPORT
E-CID Measurement Termination	E-CID MEASUREMENT TERMINATION COMMAND
Error Indication	ERROR INDICATION

8.2 Location Information Transfer Procedures

8.2.1 E-CID Measurement Initiation

8.2.1.1 General

The purpose of E-CID Measurement Initiation procedure is to allow the LMF to request the NG-RAN node to report E-CID measurements used by LMF to compute the location of the UE.

8.2.1.2 Successful Operation

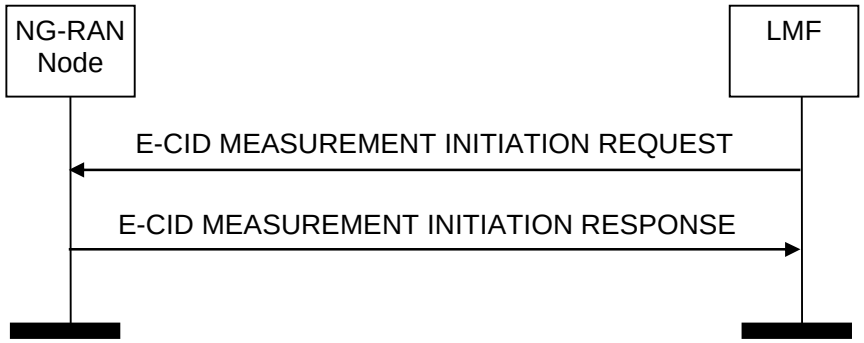

Figure 8.2.1.2-1: E-CID Measurement Initiation procedure, successful operation

The LMF initiates the procedure by sending an E-CID MEASUREMENT INITIATION REQUEST message. If the NG-RAN node is able to initiate the requested E-CID measurements, it shall reply with the E-CID MEASUREMENT INITIATION RESPONSE message.

The *Measured Results* IE shall be included in the *E-CID Measurement Result* IE of the E-CID MEASUREMENT INITIATION RESPONSE message when measurement results other than the "Cell-ID" have been requested.

If the *Report Characteristics* IE is set to "OnDemand", the NG-RAN node shall return the result of the measurement in the E-CID MEASUREMENT INITIATION RESPONSE message including, if available, the *NG-RAN Access Point Position* IE in the *E-CID Measurement Result* IE, and the LMF shall consider that the E-CID measurements for the UE has been terminated by the NG-RAN node. If available, the NG-RAN node shall include the *Cell Portion ID* IE in the E-CID MEASUREMENT INITIATION RESPONSE message. Upon reception of the *Cell Portion ID* IE, the LMF may use the value as the cell portion for the measurement. If the *Report Characteristics* IE is set to "OnDemand" and the *Inter-RAT Measurement Quantities* IE is included in the E-CID MEASUREMENT INITIATION REQUEST message, the NG-RAN node shall, if supported, provide the corresponding measurements, if available in the NG-RAN node, in the *Inter-RAT Measurement Result* IE in E-CID MEASUREMENT INITIATION RESPONSE message. If the *Report Characteristics* IE is set to "OnDemand" and the *WLAN Measurement Quantities* IE is included in the E-CID MEASUREMENT INITIATION REQUEST message, the NG-RAN node shall, if supported, provide the corresponding measurements, if available in the NG-RAN node, in the *WLAN Measurement Result* IE in E-CID MEASUREMENT INITIATION RESPONSE message.

If the *Report Characteristics* IE is set to "Periodic", the NG-RAN node shall initiate the requested measurements and shall reply with the E-CID MEASUREMENT INITIATION RESPONSE message without including either the *E-CID Measurement Result* IE or the *Cell Portion ID* IE in this message. The NG-RAN node shall then periodically initiate the E-CID Measurement Report procedure for the measurements, with the requested reporting periodicity.

8.2.1.3 Unsuccessful Operation

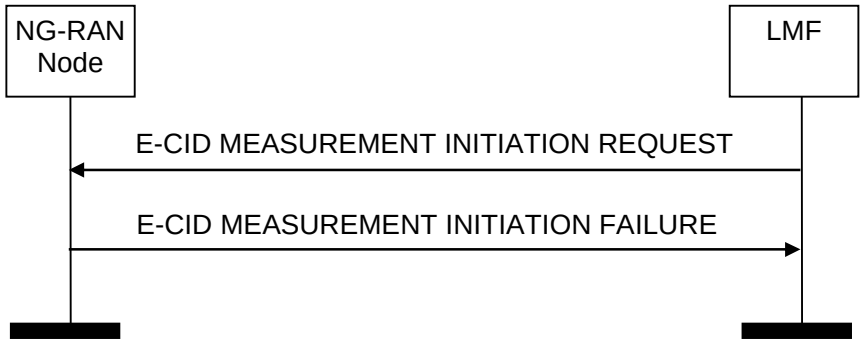

Figure 8.2.1.3-1: E-CID Measurement Initiation procedure, unsuccessful operation

If the NG-RAN node is not able to initiate at least one of the requested E-CID measurements, the NG-RAN node shall respond with an E-CID MEASUREMENT INITIATION FAILURE message.

8.2.2 E-CID Measurement Failure Indication

8.2.2.1 General

The purpose of the E-CID Measurement Failure Indication procedure is for the NG-RAN node to notify the LMF that the E-CID measurements previously requested with the E-CID Measurement Initiation procedure can no longer be reported.

8.2.2.2 Successful Operation

Figure 8.2.2.2-1: E-CID Measurement Failure Indication, successful operation

Upon reception of the E-CID MEASUREMENT FAILURE INDICATION message, the LMF shall consider that the E-CID measurements for the UE have been terminated by the NG-RAN node.

8.2.2.3 Unsuccessful Operation

Not applicable.

8.2.3 E-CID Measurement Report

8.2.3.1 General

The purpose of E-CID Measurement Report procedure is for the NG-RAN node to provide the E-CID measurements for the UE to the LMF.

8.2.3.2 Successful Operation

Figure 8.2.3.2-1: E-CID Measurement Report procedure, successful operation

The NG-RAN node initiates the procedure by sending an E-CID MEASUREMENT REPORT message. The E-CID MEASUREMENT REPORT message contains the E-CID measurement results according to the measurement configuration in the respective E-CID MEASUREMENT INITIATION REQUEST message.

The *Measured Results* IE shall be included in the *E-CID Measurement Result* IE of the E-CID MEASUREMENT REPORT message when measurement results other than the "Cell-ID" have been requested.

If available, the NG-RAN node shall include the *NG-RAN Access Point Position* IE which is the configured estimated serving antenna position in the *E-CID Measurement Result* IE within the E-CID MEASUREMENT REPORT message. Upon reception of this *NG-RAN Access Point Position* IE, the LMF may use the value as the geographical position of the NG-RAN access point.

If available, the NG-RAN node shall include the *Cell Portion ID* IE in the E-CID MEASUREMENT REPORT message. Upon reception of the *Cell Portion ID* IE, the LMF may use the value as the cell portion for the measurement.

8.2.3.3 Unsuccessful Operation

Not applicable.

8.2.4 E-CID Measurement Termination

8.2.4.1 General

The purpose of E-CID Measurement Termination procedure is to terminate periodical E-CID measurements for the UE performed by the NG-RAN node.

8.2.4.2 Successful Operation

Figure 8.2.4.2-1: E-CID Measurement Termination procedure, successful operation

The LMF initiates the procedure by generating an E-CID MEASUREMENT TERMINATION COMMAND message.

8.2.4.3 Unsuccessful Operation

Not applicable.

8.2.5 OTDOA Information Exchange

8.2.5.1 General

The purpose of the OTDOA Information Exchange procedure is to allow the LMF to request the NG-RAN node to transfer OTDOA information to the LMF.

8.2.5.2 Successful Operation

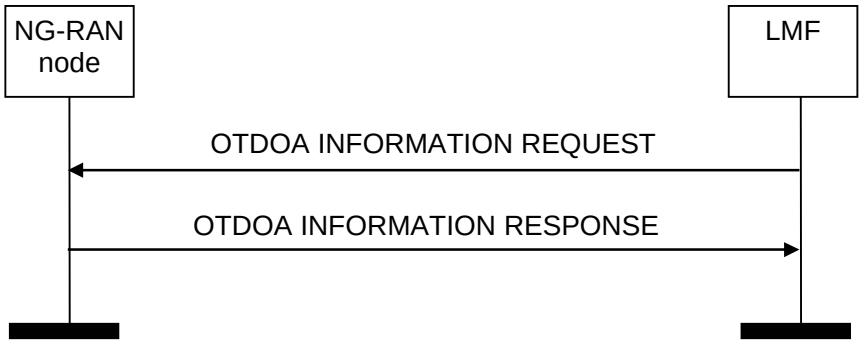

Figure 8.2.5.2-1: OTDOA Information Exchange procedure, successful operation

The LMF initiates the procedure by sending an OTDOA INFORMATION REQUEST message. The NG-RAN node responds with OTDOA INFORMATION RESPONSE message that contains the available OTDOA information applicable to the relevant cells/TPs.

8.2.5.3 Unsuccessful Operation

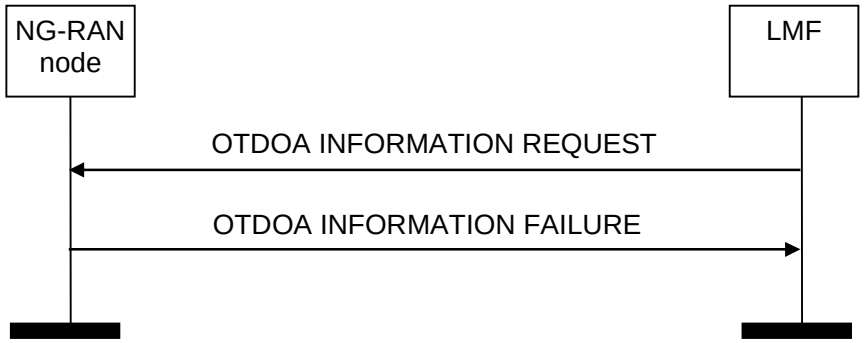

Figure 8.2.5.3-1: OTDOA Information Exchange procedure, unsuccessful operation

If the NG-RAN node does not have any OTDOA information to report, the NG-RAN node shall respond with an OTDOA INFORMATION FAILURE message.

8.3 Management Procedures

8.3.1 Error Indication

8.3.1.1 General

The Error Indication procedure is initiated by a node to report detected errors in one incoming message, provided they cannot be reported by an appropriate failure message.

8.3.1.2 Successful Operation

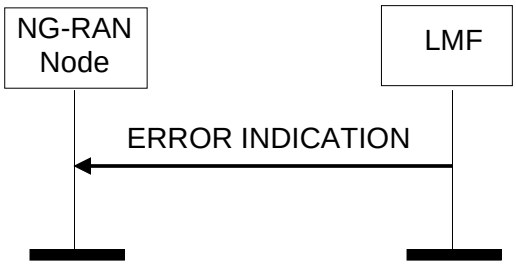

Figure 8.3.1.2-1: Error Indication procedure, LMF originated, successful operation

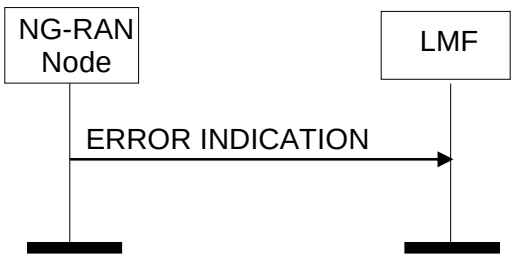

Figure 8.3.1.2-2: Error Indication procedure, NG-RAN node originated, successful operation

When the conditions defined in clause 10 are fulfilled, the Error Indication procedure is initiated by an ERROR INDICATION message sent from the receiving node.

The ERROR INDICATION message shall contain at least either the *Cause* IE or the *Criticality Diagnostics* IE.

8.3.1.3 Abnormal Conditions

Not applicable.

9 Elements for NRPPa Communication

9.0 General

Sub clauses 9.1 and 9.2 describe the structure of the messages and information elements required for the NRPPa protocol in tabular format. Sub clause 9.3 provides the corresponding ASN.1 definition.

The following attributes are used for the tabular description of the messages and information elements: Presence, Range Criticality and Assigned Criticality. Their definition and use can be found in TS 38.413 [4].

NOTE: The messages have been defined in accordance to the guidelines specified in TR 25.921 [5].

9.1 Message Functional Definition and Content

9.1.1 Messages for Location Information Transfer Procedures

9.1.1.1 E-CID MEASUREMENT INITIATION REQUEST

This message is sent by LMF to initiate E-CID measurements.

Direction: LMF → NG-RAN node.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.3		YES	reject
NRPPa Transaction ID	M		9.2.4		-	
LMF UE Measurement ID	M		INTEGER (1..15,…)		YES	reject
Report Characteristics	M		ENUMERATED (OnDemand, Periodic,…)		YES	reject
Measurement Periodicity	C-ifReportCharacteristicsPeriodic		ENUMERATED (120ms, 240ms, 480ms, 640ms, 1024ms, 2048ms, 5120ms, 10240ms, 1min, 6min, 12min, 30min, 60min,…)		YES	reject
Measurement Quantities		*1 .. <maxnoMeas>*			EACH	reject
>Measurement Quantities Item	M		ENUMERATED (Cell-ID, Angle of Arrival, Timing Advance Type 1, Timing Advance Type 2, RSRP, RSRQ,…)		-	-
Other-RAT Measurement Quantities		*0 .. <maxnoMeas>*			EACH	ignore
>Other-RAT Measurement Quantities Item	M		ENUMERATED (GERAN, UTRAN ,…)			
WLAN Measurement Quantities		0 .. <maxnoMeas>			EACH	ignore
>WLAN Measurement Quantities Item	M		ENUMERATED (WLAN, ...)		-	

Range bound	Explanation
maxnoMeas	Maximum no. of measured quantities that can be configured and reported with one message. Value is 63.

Condition	Explanation
ifReportCharacteristicsPeriodic	This IE shall be present if the *Report Characteristics* IE is set to the value "Periodic".

9.1.1.2 E-CID MEASUREMENT INITIATION RESPONSE

This message is sent by NG-RAN node to indicate that the requested E-CID measurement is successfully initiated.

Direction: NG-RAN node → LMF.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.3		YES	reject
NRPPa Transaction ID	M		9.2.4		-	
LMF UE Measurement ID	M		INTEGER (1..15,…)		YES	reject
RAN UE Measurement ID	M		INTEGER (1..15,…)		YES	reject
E-CID Measurement Result	O		9.2.5		YES	ignore
Criticality Diagnostics	O		9.2.2		YES	ignore
Cell Portion ID	O		9.2.12		YES	ignore
Other-RAT Measurement Result	O		9.2.13		YES	ignore
WLAN Measurement Result	O		9.2.14		YES	ignore

9.1.1.3 E-CID MEASUREMENT INITIATION FAILURE

This message is sent by NG-RAN node to indicate that the requested E-CID measurement cannot be initiated.

Direction: NG-RAN node → LMF.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.3		YES	reject
NRPPa Transaction ID	M		9.2.4		-	
LMF UE Measurement ID	M		INTEGER (1..15,…)		YES	reject
Cause	M		9.2.1		YES	ignore
Criticality Diagnostics	O		9.2.2		YES	ignore

9.1.1.4 E-CID MEASUREMENT FAILURE INDICATION

This message is sent by NG-RAN node to indicate that the previously requested E-CID measurement can no longer be reported.

Direction: NG-RAN node → LMF.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.3		YES	ignore
NRPPa Transaction ID	M		9.2.4		-	
LMF UE Measurement ID	M		INTEGER (1..15,…)		YES	reject
RAN UE Measurement ID	M		INTEGER (1..15,…)		YES	reject
Cause	M		9.2.1		YES	ignore

9.1.1.5 E-CID MEASUREMENT REPORT

This message is sent by NG-RAN node to report the results of the requested E-CID measurement.

Direction: NG-RAN node → LMF.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.3		YES	ignore
NRPPa Transaction ID	M		9.2.4		-	
LMF UE Measurement ID	M		INTEGER (1..15,…)		YES	reject
RAN UE Measurement ID	M		INTEGER (1..15,…)		YES	reject
E-CID Measurement Result	M		9.2.5		YES	ignore
Cell Portion ID	O		9.2.12		YES	ignore

9.1.1.6 E-CID MEASUREMENT TERMINATION COMMAND

This message is sent by the LMF to terminate the requested E-CID measurement.

Direction: LMF → NG-RAN node.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.3		YES	ignore
NRPPa Transaction ID	M		9.2.4		-	
LMF UE Measurement ID	M		INTEGER (1..15,…)		YES	reject
RAN UE Measurement ID	M		INTEGER (1..15,…)		YES	reject

9.1.1.7 OTDOA INFORMATION REQUEST

This message is sent by LMF to request OTDOA information.

Direction: LMF → NG-RAN node.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.3		YES	reject
NRPPa Transaction ID	M		9.2.4		-	
OTDOA Information Type		*1 .. <maxnoOTDOAtypes>*			EACH	reject
>OTDOA Information Item	M		ENUMERATED (pci, cellid, tac, earfcn, prsBandwidth, prsConfigIndex, cpLength, noDlFrames, noAntennaPorts, sFNInitTime, nG-RANAccessPointPosition, prsmutingconfiguration, prsid, tpid, tpType, crsCPlength, dlBandwidth, multipleprsConfigurationsperCell, prsOccasionGroup, prsFrequencyHoppingConfiguration, …)		-	-

Range bound	Explanation
maxnoOTDOAtypes	Maximum no. of OTDOA information types that can be requested and reported with one message. Value is 63.

9.1.1.8 OTDOA INFORMATION RESPONSE

This message is sent by NG-RAN node to provide OTDOA information.

Direction: NG-RAN node → LMF.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.3		YES	reject
NRPPa Transaction ID	M		9.2.4		-	
OTDOA Cells		*1 .. <maxCellinRANnode>*		Served cells/TPs that broadcast PRS. May be used to signal multiple PRS configurations per cell/TPs (up to 3 are supported in this release).	GLOBAL	ignore
>OTDOA Cell Information	M		9.2.15		-	-
Criticality Diagnostics	O		9.2.2		YES	ignore

Range bound	Explanation
maxCellinRANnode	Maximum no. cells that can be served by a RAN Node. Value is 16384.

9.1.1.9 OTDOA INFORMATION FAILURE

This message is sent by NG-RAN node to indicate that the OTDOA information cannot be provided.

Direction: ng-eNB → LMF.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.3		YES	reject
NRPPa Transaction ID	M		9.2.4		-	
Cause	M		9.2.1		YES	ignore
Criticality Diagnostics	O		9.2.2		YES	ignore

9.1.2 Messages for Management Procedures

9.1.2.1 ERROR INDICATION

This message is used to indicate that some error has been detected in the NG-RAN node or in the LMF.

Direction: LMF → NG-RAN node and NG-RAN node → LMF.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.3		YES	ignore
NRPPa Transaction ID	M		9.2.4		–	
Cause	O		9.2.1		YES	ignore
Criticality Diagnostics	O		9.2.2		YES	ignore

9.2 Information Element definitions

9.2.0 General

When specifying information elements which are to be represented by bit strings, if not otherwise specifically stated in the semantics description of the concerned IE or elsewhere, the following principle applies with regards to the ordering of bits:

- The first bit (leftmost bit) contains the most significant bit (MSB);
- The last bit (rightmost bit) contains the least significant bit (LSB);
- When importing bit strings from other specifications, the first bit of the bit string contains the first bit of the concerned information.

9.2.1 Cause

The purpose of the cause information element is to indicate the reason for a particular event for the whole protocol.

IE/Group Name	Presence	Range	IE Type and Reference	Semantics Description
CHOICE *Cause Group*	M			
>Radio Network Layer				
>>Radio Network Layer Cause	M		ENUMERATED (Unspecified, Requested Item not Supported, Requested Item Temporarily not Available, ...)	
>Protocol				
>>Protocol Cause	M		ENUMERATED (Transfer Syntax Error, Abstract Syntax Error (Reject), Abstract Syntax Error (Ignore and Notify), Message not Compatible with Receiver State, Semantic Error, Unspecified, Abstract Syntax Error (Falsely Constructed Message), ...)	
>Misc				
>>Miscellaneous Cause	M		ENUMERATED (Unspecified, ...)	

The meaning of the different cause values is described in the following table. In general, "not supported" cause values indicate that the concerned capability is missing. On the other hand, "not available" cause values indicate that the concerned capability is present, but insufficient resources were available to perform the requested action.

Radio Network Layer cause	Meaning
Unspecified	Sent when none of the above cause values applies but still the cause is Radio Network Layer related
Requested Item not Supported	The NG-RAN node does not support the requested measurement object, or cannot provide the requested information item.
Requested Item Temporarily not Available	The NG-RAN node can temporarily not provide the requested measurement object or information item.

Protocol cause	Meaning
Abstract Syntax Error (Reject)	The received message included an abstract syntax error and the concerned criticality indicated "reject" (see sub clause 10.3)
Abstract Syntax Error (Ignore and Notify)	The received message included an abstract syntax error and the concerned criticality indicated "ignore and notify" (see sub clause 10.3)
Abstract syntax error (falsely constructed message)	The received message contained IEs or IE groups in wrong order or with too many occurrences (see sub clause 10.3)
Message not Compatible with Receiver State	The received message was not compatible with the receiver state (see sub clause 10.4)
Semantic Error	The received message included a semantic error (see sub clause 10.4)
Transfer Syntax Error	The received message included a transfer syntax error (see sub clause 10.2)
Unspecified	Sent when none of the above cause values applies but still the cause is Protocol related

Miscellaneous cause	Meaning
Unspecified	Sent when none of the above cause values applies and the cause is not related to any of the categories Radio Network Layer, Transport Network Layer or Protocol.

9.2.2 Criticality Diagnostics

The *Criticality Diagnostics* IE is sent by the NG-RAN node or LMF when parts of a received message have not been comprehended or were missing, or if the message contained logical errors. When applicable, it contains information about which IEs were not comprehended or were missing. The conditions for inclusion of the *NRPPa Transaction ID* IE are described in clause 10.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
Procedure Code	O		INTEGER (0..255)	Procedure Code is to be used if Criticality Diagnostics is part of Error Indication procedure, and not within the response message of the same procedure that caused the error.
Triggering Message	O		ENUMERATED (initiating message, successful outcome, unsuccessful outcome)	The Triggering Message is used only if the Criticality Diagnostics is part of Error Indication procedure.
Procedure Criticality	O		ENUMERATED (reject, ignore, notify)	This Procedure Criticality is used for reporting the Criticality of the Triggering message (Procedure).
NRPPa Transaction ID	O		9.2.4	
Information Element Criticality Diagnostics		*0 .. <maxNrOfErrors>*		
>IE Criticality	M		ENUMERATED (reject, ignore, notify)	The IE Criticality is used for reporting the criticality of the triggering IE. The value "ignore"' shall not be used.
>IE ID	M		INTEGER (0..65535)	The IE ID of the not understood or missing IE.
>Type Of Error	M		ENUMERATED (not understood, missing, …)	

Range bound	Explanation
maxNrOfErrors	Maximum no. of IE errors allowed to be reported with a single message. The value for maxNroOfErrors is 256.

9.2.3 Message Type

The *Message Type* IE uniquely identifies the message being sent. It is mandatory for all messages.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
Procedure Code	M		INTEGER (0..255)	
Type of Message	M		CHOICE (Initiating Message, Successful Outcome, Unsuccessful Outcome, …)	

9.2.4 NRPPa Transaction ID

The *NRPPa Transaction ID* IE is used to associate all the messages belonging to the same procedure. Messages belonging to the same procedure shall use the same NRPPa Transaction ID.

The NRPPa Transaction ID is determined by the initiating peer of a procedure.

The NRPPa Transaction ID shall uniquely identify a procedure among all ongoing parallel procedures using the same procedure code, and initiated by the same protocol peer.

IE/Group Name	Presence	Range	IE Type and Reference	Semantics Description
NRPPa Transaction ID	M		INTEGER (0..32767)	

9.2.5 E-CID Measurement Result

The purpose of the E-CID Measurement Result information element is to provide the E-CID measurement result.

IE/Group Name	Presence	Range	IE Type and Reference	Semantics Description
Serving Cell ID	M		NG-RAN CGI 9.2.6	NG-RAN Cell Identifier of the serving cell
Serving Cell TAC	M		TAC 9.2.11	Tracking Area Code of the serving cell
NG-RAN Access Point Position	O		9.2.10	The configured estimated geographical position of the antenna of the cell.
Measured Results		*0 .. <maxnoMeas>*		
>CHOICE *Measured Results Value*	M			
>>Value Angle of Arrival EUTRA	M		INTEGER (0..719)	According to mapping in TS 36.133 [9]
>>Value Timing Advance Type 1 EUTRA	M		INTEGER (0..7690)	According to mapping in TS 36.133 [9]
>>Value Timing Advance Type 2 EUTRA	M		INTEGER (0..7690)	According to mapping in TS 36.133 [9]
>>**Result RSRP EUTRA**		*1 .. <maxCellReport>*		
>>> PCI EUTRA	M		INTEGER (0..503)	Physical Cell Identifier of the reported E-UTRA cell
>>>EARFCN	M		INTEGER (0.. 262143, …).	Corresponds to NDL for FDD and NDL/UL for TDD in ref. TS 36.104 [7]
>>> CGI EUTRA	O		9.2.6	Cell Global Identifier of the reported E-UTRA cell
>>>Value RSRP EUTRA	M		INTEGER (0..97, …)	
>>**Result RSRQ EUTRA**		*1 . <maxCellReport>*		
>>> PCI EUTRA	M		9.2.7	Physical Cell Identifier of the reported E-UTRA cell
>>>EARFCN	M		INTEGER (0..262143, …).	Corresponds to NDL for FDD and NDL/UL for TDD in ref. TS 36.104 [7]
>>> CGI EUTRA	O		9.2.7	Cell Global Identifier of the reported E-UTRA cell
>>>Value RSRQ EUTRA	M		INTEGER (0..34, …)	

Range bound	Explanation
maxnoMeas	Maximum no. of measured quantities that can be configured and reported with one message. Value is 63.
maxCellReport	Maximum no. of cells that can be reported with one message. Value is 9.

9.2.6 NG-RAN CGI

The NG-RAN Cell Global Identifier (CGI) is used to globally identify a cell.

IE/Group Name	Presence	Range	IE Type and Reference	Semantics Description
PLMN identity	M		9.2.8	
CHOICE *NG-RAN Cell*	M			
>NR Cell				
NR Cell Identifier	M		BIT STRING (36)	
>E-UTRAN Cell				
E-UTRAN Cell Identifier	M		BIT STRING (28)	

9.2.7 CGI EUTRA

The Cell Global Identifier EUTRA is used to globally identify an E-UTRA cell.

IE/Group Name	Presence	Range	IE Type and Reference	Semantics Description
PLMN identity	M		9.2.8	
E-UTRA Cell Identifier	M		BIT STRING (28)	

9.2.8 PLMN Identity

This IE indicates the PLMN Identity.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
PLMN Identity	M		OCTET STRING (SIZE(3))	Digits 0 to 9 encoded 0000 to 1001, 1111 used as filler digit. Two digits per octet: - bits 4 to 1 of octet n encoding digit 2n-1 - bits 8 to 5 of octet n encoding digit 2n PLMN Identity consists of 3 digits from MCC followed by either: - a filler digit plus 2 digits from MNC (in case of 2 digit MNC) or - 3 digits from MNC (in case of 3 digit MNC).

9.2.10 NG-RAN Access Point Position

The NG-RAN Access Point Position IE is used to identify the geographical position of an NG-RAN Access Point. It is expressed as ellipsoid point with altitude and uncertainty ellipsoid according to TS 23.032 [8].

IE/Group Name	Presence	Range	IE Type and Reference	Semantics Description
Latitude Sign	M		ENUMERATED (North, South)	
Degrees Of Latitude	M		INTEGER ($0..2^{23}$-1)	The IE value (N) is derived by this formula: $N \leq 2^{23} X /90 < N+1$ X being the latitude in degrees (0°.. 90°).
Degrees Of Longitude	M		INTEGER ($-2^{23}..2^{23}$-1)	The IE value (N) is derived by this formula: $N \leq 2^{24} X /360 < N+1$ X being the longitude in degrees (-180°..+180°).
Direction of Altitude	M		ENUMERATED (Height, Depth)	
Altitude	M		INTEGER ($0..2^{15}$-1)	The relation between the value (N) and the altitude (a) in meters it describes is $N \leq a < N+1$, except for $N=2^{15}-1$ for which the range is extended to include all greater values of (a).
Uncertainty semi-major	M		INTEGER (0..127)	The uncertainty "r" is derived from the "uncertainty code" k by $r = 10x(1.1^k-1)$.
Uncertainty semi-minor	M		INTEGER (0..127)	The uncertainty "r" is derived from the "uncertainty code" k by $r = 10x(1.1^k-1)$.
Orientation of major axis	M		INTEGER (0..179)	
Uncertainty Altitude	M		INTEGER (0..127)	The uncertainty altitude "h" expressed in metres is derived from the "uncertainty code" k, by: $h=45x(1.025^k-1)$.
Confidence	M		INTEGER (0..100)	In percentage

9.2.11 TAC

This information element is used to uniquely identify a Tracking Area Code.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
TAC	M		OCTET STRING (SIZE (3))	

9.2.12 Cell Portion ID

This parameter gives the current Cell Portion associated with the target UE. The Cell Portion ID is the unique identifier for a cell portion within a cell.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
Cell Portion ID	M		INTEGER (0..4095)	

9.2.13 Other-RAT Measurement Result

The purpose of the Inter-RAT Measurement Result information element is to provide the Inter-RAT measurement results.

IE/Group Name	Presence	Range	IE Type and Reference	Semantics Description
Other-RAT Measured Results		*1.. <maxnoMeas>*		
>CHOICE *Other-RAT Measured Results Value*	M			
>>**Result GERAN**	M	*1..<maxGERAN Meas>*		
>>>ARFCN of BCCH	M		INTEGER (0..1023, ...)	
>>>Physical CellId GERAN	M		INTEGER (0..63, ...)	
>>>RSSI	M		INTEGER (0..63, ...)	
>>**Result UTRAN**		*1..<maxUTRAN Meas>*		
>>>UARFCN	M		INTEGER (0..16383, ...)	
>>>CHOICE Physical CellId UTRA	M			
>>>>Physical CellId UTRA FDD	M		INTEGER (0..511, ...)	
>>>>Physical CellId UTRA TDD	M		INTEGER (0..127, ...)	
>>>UTRA RSCP	O		INTEGER (-5..91, ...)	
>>>UTRA EcNo	O		INTEGER (0..49, ...)	This IE applies to FDD only.

Range bound	Explanation
maxnoMeas	Maximum no. of measured quantities that can be configured and reported with one message. Value is 63.
maxGERANMeas	Maximum no. of GERAN cells that can be reported with one message. Value is 8.
maxUTRANMeas	Maximum no. of UTRAN cells that can be reported with one message. Value is 8.

9.2.14 WLAN Measurement Result

The WLAN Measurement Result information element provides the WLAN measurement results.

IE/Group Name	Presence	Range	IE Type and Reference	Semantics Description
WLAN Measured Results		*1.. <maxnoMeas>*		
>WLAN RSSI	M		INTEGER (0..141, ...)	
>SSID	O		OCTET STRING (SIZE(1..32))	Includes the SSID field as defined in subclause 8.4.2.2 of IEEE 802.11™ [11].
>BSSID	M		OCTET STRING (SIZE(6))	Includes the BSSID field as defined in subclause 8.2.4.3.4 of IEEE 802.11™ [11].
>HESSID	O		OCTET STRING (SIZE(6))	Includes the HESSID field as defined in subclause 8.4.2.94 of IEEE 802.11™ [11].
>Operating Class	O		INTEGER (0..255)	Indicates the WLAN Operating Class as defined in IEEE 802.11™ [11].
>Country Code			ENUMERATED (unitedStates, europe, japan, global, …)	Indicates the WLAN country code as defined in IEEE 802.11™ [11].
>WLAN Channel List		*0..1*		
>>WLAN Channel List Item		*1..<maxWLANchannels>*		
>>>WLAN Channel			INTEGER (0..255)	Indicates the WLAN channel number as defined in IEEE 802.11™ [11].
>WLAN Band	O		ENUMERATED (band2dot4, band5, …)	Indicates the WLAN band as defined in IEEE 802.11™ [11].

Range bound	Explanation
maxnoMeas	Maximum no. of measured quantities that can be configured and reported with one message. Value is 63.
maxWLANchannels	Maximum no. of WLAN channels that can be reported within one list. Value is 16.

9.2.15 OTDOA Cell Information

This IE contains OTDOA information of a cell/TP.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
OTDOA Cell Information		*1 .. <maxnoOTDOAtypes>*		
>CHOICE *OTDOA Cell Information Item*	M			
>>PCI EUTRA	M		INTEGER (0..503, …)	Physical Cell ID of the reported E-UTRA cell.
>>CGI EUTRA	M		9.2.7	Cell Global Identifier of the E-UTRA cell.
>>TAC	M		9.2.11	Tracking Area Code
>>EARFCN	M		INTEGER (0.. 262143, …)	Corresponds to N_{DL} for FDD and $N_{DL/UL}$ for TDD in ref. TS 36.104 [7].
>>PRS Bandwidth EUTRA	M		ENUMERATED (bw6, bw15, bw25, bw50, bw75, bw100, ...)	Transmission bandwidth of PRS
>>PRS Configuration Index EUTRA	M		INTEGER (0..4095, ...)	PRS Configuration Index, ref TS 36.211 [10]
>>CP Length EUTRA	M		ENUMERATED (Normal, Extended, ...)	Cyclic prefix length of the PRS
>>Number of DL Frames EUTRA	M		ENUMERATED (sf1, sf2, sf4, sf6, …)	Number of consecutive downlink subframes N_{PRS} with PRS, ref TS 36.211 [10]
>>Number of Antenna Ports EUTRA	M		ENUMERATED(n1-or-n2, n4, …)	Number of used antenna ports, where n1-or-n2 corresponds to 1 or 2 ports, n4 corresponds to 4 ports
>>SFN Initialisation Time EUTRA	M		BIT STRING (64)	Time in seconds relative to 00:00:00 on 1 January 1900 (calculated as continuous time without leap seconds and traceable to a common time reference) where binary encoding of the integer part is in the first 32 bits and binary encoding of the fraction part in the last 32 bits. The fraction part is expressed with a granularity of 1 /2**32 second.
>>NG-RAN Access Point Position	M		9.2.10	The configured estimated geographical position of the antenna of the cell/TP.
>>PRS Muting Configuration EUTRA	M		9.2.16	The configuration of positioning reference signals muting pattern.
>>PRS-ID EUTRA	M		INTEGER (0..4095, …)	PRS ID, ref TS 36.211 [10].
>>TP-ID EUTRA	M		INTEGER (0..4095, …)	Identity of the transmission point. This IE together with the *PCI* and/or *PRS-ID* may be used to identify the transmission point in case the same physical cell ID is shared by multiple transmission points.
>>TP Type EUTRA	M		ENUMERATED (prs-only-tp, …)	A TP which transmits PRS only.
>>Number of DL Frames-Extended EUTRA	M		INTEGER (1..160, …)	Number of consecutive downlink subframes N_{PRS} with PRS, ref TS 36.211 [10].
>>CRS CP Length EUTRA	M		ENUMERATED (Normal, Extended, ...)	Cyclic prefix length of the CRS.

>>DL Bandwidth EUTRA	M		ENUMERATED (bw6, bw15, bw25, bw50, bw75, bw100, ...)	DL transmission bandwidth expressed in units of resource blocks N_{RB}, ref TS 36.104 [7].
>>PRS Occasion Group EUTRA	M		ENUMERATED (og2, og4, og8, og16, og32, og64, og128, ...)	PRS occasion group in a PRS period, ref TS 36.211 [10].
>>PRS Frequency Hopping Configuration EUTRA	M		9.3.17	PRS frequency hopping configuration.

Range bound	Explanation
maxnoOTDOAtypes	Maximum no. of OTDOA information types that can be requested and reported with one message. Value is 63.

9.2.16 PRS Muting Configuration EUTRA

The *PRS Muting Configuration EUTRA* IE is used to describe the configuration of PRS muting patterns for the concerned cell/TP, according to TS 36.211 [10] and TS 36.133 [9].

IE/Group Name	Presence	Range	IE Type and Reference	Semantics Description
CHOICE *PRS Muting Configuration*	M			
>Two	M		BIT STRING (2)	If a bit is set to "0", it indicates that the PRS is muted in the corresponding PRS positioning occasion (numbering from any sub frame for which SFN=0) in a periodic cycle of length equal to the length of the bit string
>Four	M		BIT STRING (4)	Same as above
>Eight	M		BIT STRING (8)	Same as above
>Sixteen	M		BIT STRING (16)	Same as above
>thirty-two	M		BIT STRING (32)	Same as above
>sixty-four	M		BIT STRING (64)	Same as above
>one-hundred-and-twenty-eight	M		BIT STRING (128)	Same as above
>two-hundred-and-fifty-six	M		BIT STRING (256)	Same as above
>five-hundred-and-twelve	M		BIT STRING (512)	Same as above
>one-thousand-and-twenty-four	M		BIT STRING (1024)	Same as above

9.2.17 PRS Frequency Hopping Configuration EUTRA

The *PRS Frequency Hopping Configuration EUTRA* IE is used to describe the configuration of PRS frequency hopping for the concerned cell/TP, according to TS 36.211 [10].

IE/Group Name	Presence	Range	IE Type and Reference	Semantics Description
Number of Frequency Hopping Bands	M		ENUMERATED (twobands, fourbands, ...)	Number of bands for frequency hopping.
Band Positions		*1.. <maxnoFreqHoppingBandsMinusOne,...>*		
>NarrowBand Index	M		INTEGER (0..15, ...)	Narrowband Index

Range bound	Explanation

maxnoFreqHoppingBandsMinusOne	Maximum no. of frequency hopping bands minus one. Value is 7.

9.3 Message and Information Element Abstract Syntax (with ASN.1)

9.3.1 General

Sub clause 9.3 presents the Abstract Syntax of the NRPPa protocol with ASN.1. In case there is contradiction between the ASN.1 definition in this sub clause and the tabular format in sub clause 9.1 and 9.2, the ASN.1 shall take precedence, except for the definition of conditions for the presence of conditional elements, in which the tabular format shall take precedence.

The ASN.1 definition specifies the structure and content of NRPPa messages. NRPPa messages can contain any IEs specified in the object set definitions for that message without the order or number of occurrence being restricted by ASN.1. However, for this version of the standard, a sending entity shall construct an NRPPa message according to the PDU definitions module and with the following additional rules (Note that in the following, "IE" means an IE in the object set with an explicit id. If one IE needs to appear more than once in one object set, then the different occurrences have different IE ids):

- IEs shall be ordered (in an IE container) in the order they appear in object set definitions.
- Object set definitions specify how many times IEs may appear. An IE shall appear exactly once if the presence field in an object has value "mandatory". An IE may appear at most once if the presence field in an object has value "optional" or "conditional". If in a tabular format there is multiplicity specified for an IE (i.e. an IE list) then in the corresponding ASN.1 definition the list definition is separated into two parts. The first part defines an IE container list in which the list elements reside. The second part defines list elements. The IE container list appears as an IE of its own. For this version of the standard an IE container list may contain only one kind of list elements.

If an NRPPa message that is not constructed as defined above is received, this shall be considered as Abstract Syntax Error, and the message shall be handled as defined for Abstract Syntax Error in clause 10.

9.3.2 Usage of Private Message Mechanism for Non-standard Use

The private message mechanism for non-standard use may be used:

- for special operator (and/or vendor) specific features considered not to be part of the basic functionality, i.e. the functionality required for a complete and high-quality specification in order to guarantee multivendor inter-operability.
- by vendors for research purposes, e.g. to implement and evaluate new algorithms/features before such features are proposed for standardisation.

The private message mechanism shall not be used for basic functionality. Such functionality shall be standardised.

9.3.3 Elementary Procedure Definitions

```
-- **************************************************************
--
-- Elementary Procedure definitions
--
-- **************************************************************

NRPPA-PDU-Descriptions {
itu-t (0) identified-organization (4) etsi (0) mobileDomain (0)
ngran-access (22) modules (3) nrppa (4) version1 (1) nrppa-PDU-Descriptions (0) }
```

```
DEFINITIONS AUTOMATIC TAGS ::=

BEGIN

-- ********************************************************************
--
-- IE parameter types from other modules.
--
-- ********************************************************************

IMPORTS
    Criticality,
    ProcedureCode,
    NRPPATransactionID

FROM NRPPA-CommonDataTypes


    ErrorIndication,
    PrivateMessage,
    E-CIDMeasurementInitiationRequest,
    E-CIDMeasurementInitiationResponse,
    E-CIDMeasurementInitiationFailure,
    E-CIDMeasurementFailureIndication,
    E-CIDMeasurementReport,
    E-CIDMeasurementTerminationCommand,
    OTDOAInformationRequest,
    OTDOAInformationResponse,
    OTDOAInformationFailure


FROM NRPPA-PDU-Contents

    id-errorIndication,
    id-privateMessage,
    id-e-CIDMeasurementInitiation,
    id-e-CIDMeasurementFailureIndication,
    id-e-CIDMeasurementReport,
    id-e-CIDMeasurementTermination,
    id-oTDOAInformationExchange


FROM NRPPA-Constants;

-- ********************************************************************
--
-- Interface Elementary Procedure Class
--
-- ********************************************************************

NRPPA-ELEMENTARY-PROCEDURE ::= CLASS {
    &InitiatingMessage              ,
    &SuccessfulOutcome                          OPTIONAL,
```

```
    &UnsuccessfulOutcome                        OPTIONAL,
    &procedureCode              ProcedureCode   UNIQUE,
    &criticality                Criticality DEFAULT ignore
}
WITH SYNTAX {
    INITIATING MESSAGE          &InitiatingMessage
    [SUCCESSFUL OUTCOME     &SuccessfulOutcome]
    [UNSUCCESSFUL OUTCOME       &UnsuccessfulOutcome]
    PROCEDURE CODE              &procedureCode
    [CRITICALITY                &criticality]
}

-- **************************************************************
--
-- Interface PDU Definition
--
-- **************************************************************

NRPPA-PDU ::= CHOICE {
    initiatingMessage       InitiatingMessage,
    successfulOutcome       SuccessfulOutcome,
    unsuccessfulOutcome UnsuccessfulOutcome,
    ...
}

InitiatingMessage ::= SEQUENCE {
    procedureCode           NRPPA-ELEMENTARY-PROCEDURE.&procedureCode       ({NRPPA-ELEMENTARY-PROCEDURES}),
    criticality         NRPPA-ELEMENTARY-PROCEDURE.&criticality         ({NRPPA-ELEMENTARY-PROCEDURES}{@procedureCode}),
    nrppatransactionID      NRPPATransactionID,
    value                   NRPPA-ELEMENTARY-PROCEDURE.&InitiatingMessage   ({NRPPA-ELEMENTARY-PROCEDURES}{@procedureCode})
}

SuccessfulOutcome ::= SEQUENCE {
    procedureCode           NRPPA-ELEMENTARY-PROCEDURE.&procedureCode       ({NRPPA-ELEMENTARY-PROCEDURES}),
    criticality         NRPPA-ELEMENTARY-PROCEDURE.&criticality         ({NRPPA-ELEMENTARY-PROCEDURES}{@procedureCode}),
    nrppatransactionID      NRPPATransactionID,
    value                   NRPPA-ELEMENTARY-PROCEDURE.&SuccessfulOutcome   ({NRPPA-ELEMENTARY-PROCEDURES}{@procedureCode})
}

UnsuccessfulOutcome ::= SEQUENCE {
    procedureCode           NRPPA-ELEMENTARY-PROCEDURE.&procedureCode       ({NRPPA-ELEMENTARY-PROCEDURES}),
    criticality         NRPPA-ELEMENTARY-PROCEDURE.&criticality         ({NRPPA-ELEMENTARY-PROCEDURES}{@procedureCode}),
    nrppatransactionID      NRPPATransactionID,
    value                   NRPPA-ELEMENTARY-PROCEDURE.&UnsuccessfulOutcome ({NRPPA-ELEMENTARY-PROCEDURES}{@procedureCode})
}


-- **************************************************************
--
-- Interface Elementary Procedure List
--
-- **************************************************************

NRPPA-ELEMENTARY-PROCEDURES NRPPA-ELEMENTARY-PROCEDURE ::= {
```

```
    NRPPA-ELEMENTARY-PROCEDURES-CLASS-1         |
    NRPPA-ELEMENTARY-PROCEDURES-CLASS-2         ,
    ...
}

NRPPA-ELEMENTARY-PROCEDURES-CLASS-1 NRPPA-ELEMENTARY-PROCEDURE ::= {
    e-CIDMeasurementInitiation  |
    oTDOAInformationExchange        ,
    ...
}

NRPPA-ELEMENTARY-PROCEDURES-CLASS-2 NRPPA-ELEMENTARY-PROCEDURE ::= {
    e-CIDMeasurementFailureIndication       |
    e-CIDMeasurementReport                  |
    e-CIDMeasurementTermination             |
    errorIndication                     |
    privateMessage                          ,
    ...
}


-- **************************************************************
--
-- Interface Elementary Procedures
--
-- **************************************************************

e-CIDMeasurementInitiation NRPPA-ELEMENTARY-PROCEDURE ::= {
    INITIATING MESSAGE      E-CIDMeasurementInitiationRequest
    SUCCESSFUL OUTCOME      E-CIDMeasurementInitiationResponse
    UNSUCCESSFUL OUTCOME    E-CIDMeasurementInitiationFailure
    PROCEDURE CODE          id-e-CIDMeasurementInitiation
    CRITICALITY             reject
}

e-CIDMeasurementFailureIndication NRPPA-ELEMENTARY-PROCEDURE ::= {
    INITIATING MESSAGE      E-CIDMeasurementFailureIndication
    PROCEDURE CODE          id-e-CIDMeasurementFailureIndication
    CRITICALITY             ignore
}

e-CIDMeasurementReport NRPPA-ELEMENTARY-PROCEDURE ::= {
    INITIATING MESSAGE      E-CIDMeasurementReport
    PROCEDURE CODE          id-e-CIDMeasurementReport
    CRITICALITY             ignore
}

e-CIDMeasurementTermination NRPPA-ELEMENTARY-PROCEDURE ::= {
    INITIATING MESSAGE      E-CIDMeasurementTerminationCommand
    PROCEDURE CODE          id-e-CIDMeasurementTermination
    CRITICALITY             reject
}

oTDOAInformationExchange NRPPA-ELEMENTARY-PROCEDURE ::= {
```

```
    INITIATING MESSAGE      OTDOAInformationRequest
    SUCCESSFUL OUTCOME      OTDOAInformationResponse
    UNSUCCESSFUL OUTCOME    OTDOAInformationFailure
    PROCEDURE CODE          id-oTDOAInformationExchange
    CRITICALITY             reject
}

errorIndication NRPPA-ELEMENTARY-PROCEDURE ::= {
    INITIATING MESSAGE      ErrorIndication
    PROCEDURE CODE          id-errorIndication
    CRITICALITY         ignore
}


privateMessage          NRPPA-ELEMENTARY-PROCEDURE ::= {
    INITIATING MESSAGE      PrivateMessage
    PROCEDURE CODE          id-privateMessage
    CRITICALITY         ignore
}

END
```

9.3.4 PDU Definitions

```
-- **************************************************************
--
-- PDU definitions for NRPPa.
--
-- **************************************************************

NRPPA-PDU-Contents {
itu-t (0) identified-organization (4) etsi (0) mobileDomain (0)
ngran-access (22) modules (3) nrppa (4) version1 (1) nrppa-PDU-Contents (1) }

DEFINITIONS AUTOMATIC TAGS ::=

BEGIN

-- **************************************************************
--
-- IE parameter types from other modules.
--
-- **************************************************************

IMPORTS

    Cause,
    CriticalityDiagnostics,
    E-CID-MeasurementResult,
    OTDOACells,
    OTDOA-Information-Item,
    Measurement-ID,
    MeasurementPeriodicity,
```

```
    MeasurementQuantities,
    ReportCharacteristics,
    RequestedSRSTransmissionCharacteristics,
    Cell-Portion-ID,
    OtherRATMeasurementQuantities,
    OtherRATMeasurementResult,
    WLANMeasurementQuantities,
    WLANMeasurementResult

FROM NRPPA-IEs

    PrivateIE-Container{},
    ProtocolExtensionContainer{},
    ProtocolIE-Container{},
    ProtocolIE-ContainerList{},
    ProtocolIE-Single-Container{},
    NRPPA-PRIVATE-IES,
    NRPPA-PROTOCOL-EXTENSION,
    NRPPA-PROTOCOL-IES
FROM NRPPA-Containers


    maxnoOTDOAtypes,
    id-Cause,
    id-CriticalityDiagnostics,
    id-LMF-UE-Measurement-ID,
    id-OTDOACells,
    id-OTDOA-Information-Type-Group,
    id-OTDOA-Information-Type-Item,
    id-ReportCharacteristics,
    id-MeasurementPeriodicity,
    id-MeasurementQuantities,
    id-RAN-UE-Measurement-ID,
    id-E-CID-MeasurementResult,
    id-RequestedSRSTransmissionCharacteristics,
    id-Cell-Portion-ID,
    id-OtherRATMeasurementQuantities,
    id-OtherRATMeasurementResult,
    id-WLANMeasurementQuantities,
    id-WLANMeasurementResult

FROM NRPPA-Constants;

-- **************************************************************
--
-- E-CID MEASUREMENT INITIATION REQUEST
--
-- **************************************************************

E-CIDMeasurementInitiationRequest ::= SEQUENCE {
    protocolIEs     ProtocolIE-Container    {{E-CIDMeasurementInitiationRequest-IEs}},
    ...
}
```

```
E-CIDMeasurementInitiationRequest-IEs NRPPA-PROTOCOL-IES ::= {
    { ID id-LMF-UE-Measurement-ID           CRITICALITY reject  TYPE Measurement-ID                                 PRESENCE mandatory}|
    { ID id-ReportCharacteristics           CRITICALITY reject  TYPE ReportCharacteristics                          PRESENCE mandatory}|
    { ID id-MeasurementPeriodicity          CRITICALITY reject  TYPE MeasurementPeriodicity                         PRESENCE conditional}|
-- The IE shall be present if the Report Characteritics IE is set to “periodic” --
    { ID id-MeasurementQuantities           CRITICALITY reject  TYPE MeasurementQuantities                          PRESENCE mandatory}|
    { ID id-OtherRATMeasurementQuantities   CRITICALITY ignore  TYPE OtherRATMeasurementQuantities                PRESENCE optional}|
    { ID id-WLANMeasurementQuantities       CRITICALITY ignore  TYPE WLANMeasurementQuantities                      PRESENCE optional},
    ...
}

-- **************************************************************
--
-- E-CID MEASUREMENT INITIATION RESPONSE
--
-- **************************************************************

E-CIDMeasurementInitiationResponse ::= SEQUENCE {
    protocolIEs     ProtocolIE-Container    {{E-CIDMeasurementInitiationResponse-IEs}},
    ...
}

E-CIDMeasurementInitiationResponse-IEs NRPPA-PROTOCOL-IES ::= {
    { ID id-LMF-UE-Measurement-ID       CRITICALITY reject  TYPE Measurement-ID                PRESENCE mandatory}|
    { ID id-RAN-UE-Measurement-ID       CRITICALITY reject  TYPE Measurement-ID                PRESENCE mandatory}|
    { ID id-E-CID-MeasurementResult     CRITICALITY ignore  TYPE E-CID-MeasurementResult                          PRESENCE optional}|
    { ID id-CriticalityDiagnostics      CRITICALITY ignore  TYPE CriticalityDiagnostics         PRESENCE optional}|
    { ID id-Cell-Portion-ID             CRITICALITY ignore  TYPE Cell-Portion-ID                                  PRESENCE optional}|
    { ID id-OtherRATMeasurementResult   CRITICALITY ignore  TYPE OtherRATMeasurementResult      PRESENCE optional}|
    { ID id-WLANMeasurementResult       CRITICALITY ignore  TYPE WLANMeasurementResult          PRESENCE optional},
    ...
}

-- **************************************************************
--
-- E-CID MEASUREMENT INITIATION FAILURE
--
-- **************************************************************

E-CIDMeasurementInitiationFailure ::= SEQUENCE {
    protocolIEs                     ProtocolIE-Container        {{E-CIDMeasurementInitiationFailure-IEs}},
    ...
}


E-CIDMeasurementInitiationFailure-IEs NRPPA-PROTOCOL-IES ::= {
    { ID id-LMF-UE-Measurement-ID       CRITICALITY reject  TYPE Measurement-ID            PRESENCE mandatory}|
    { ID id-Cause                           CRITICALITY ignore  TYPE Cause                                      PRESENCE mandatory}|
    { ID id-CriticalityDiagnostics      CRITICALITY ignore  TYPE CriticalityDiagnostics     PRESENCE optional},
    ...
}

-- **************************************************************
--
```

```
-- E-CID MEASUREMENT FAILURE INDICATION
--
-- **************************************************************

E-CIDMeasurementFailureIndication ::= SEQUENCE {
    protocolIEs                     ProtocolIE-Container        {{E-CIDMeasurementFailureIndication-IEs}},
    ...
}


E-CIDMeasurementFailureIndication-IEs NRPPA-PROTOCOL-IES ::= {
    { ID id-LMF-UE-Measurement-ID       CRITICALITY reject  TYPE Measurement-ID            PRESENCE mandatory}|
    { ID id-RAN-UE-Measurement-ID       CRITICALITY reject  TYPE Measurement-ID            PRESENCE mandatory}|
    { ID id-Cause                           CRITICALITY ignore  TYPE Cause                                      PRESENCE mandatory},
    ...
}

-- **************************************************************
--
-- E-CID MEASUREMENT REPORT
--
-- **************************************************************

E-CIDMeasurementReport ::= SEQUENCE {
    protocolIEs                     ProtocolIE-Container        {{E-CIDMeasurementReport-IEs}},
    ...
}


E-CIDMeasurementReport-IEs NRPPA-PROTOCOL-IES ::= {
    { ID id-LMF-UE-Measurement-ID       CRITICALITY reject  TYPE Measurement-ID            PRESENCE mandatory}|
    { ID id-RAN-UE-Measurement-ID       CRITICALITY reject  TYPE Measurement-ID            PRESENCE mandatory}|
    { ID id-E-CID-MeasurementResult     CRITICALITY ignore  TYPE E-CID-MeasurementResult        PRESENCE mandatory}|
    { ID id-Cell-Portion-ID             CRITICALITY ignore  TYPE Cell-Portion-ID                PRESENCE optional},
    ...
}

-- **************************************************************
--
-- E-CID MEASUREMENT TERMINATION
--
-- **************************************************************

E-CIDMeasurementTerminationCommand ::= SEQUENCE {
    protocolIEs                     ProtocolIE-Container        {{E-CIDMeasurementTerminationCommand-IEs}},
    ...
}


E-CIDMeasurementTerminationCommand-IEs NRPPA-PROTOCOL-IES ::= {
    { ID id-LMF-UE-Measurement-ID       CRITICALITY reject  TYPE Measurement-ID            PRESENCE mandatory}|
    { ID id-RAN-UE-Measurement-ID       CRITICALITY reject  TYPE Measurement-ID            PRESENCE mandatory},
    ...
}
```

```
-- **************************************************************
--
-- OTDOA INFORMATION REQUEST
--
-- **************************************************************

OTDOAInformationRequest ::= SEQUENCE {
    protocolIEs     ProtocolIE-Container    {{OTDOAInformationRequest-IEs}},
    ...
}

OTDOAInformationRequest-IEs NRPPA-PROTOCOL-IES ::= {
    { ID id-OTDOA-Information-Type-Group        CRITICALITY reject  TYPE OTDOA-Information-Type                      PRESENCE mandatory},
    ...
}

OTDOA-Information-Type ::= SEQUENCE (SIZE(1..maxnoOTDOAtypes)) OF ProtocolIE-Single-Container { { OTDOA-Information-TypeIEs} }

OTDOA-Information-TypeIEs   NRPPA-PROTOCOL-IES ::= {
    { ID id-OTDOA-Information-Type-Item     CRITICALITY reject  TYPE OTDOA-Information-Type-Item                  PRESENCE mandatory},
    ...
}

OTDOA-Information-Type-Item ::= SEQUENCE {
    oTDOA-Information-Type-Item     OTDOA-Information-Item,
    iE-Extensions                   ProtocolExtensionContainer { { OTDOA-Information-Type-ItemExtIEs} } OPTIONAL,
    ...
}

OTDOA-Information-Type-ItemExtIEs NRPPA-PROTOCOL-EXTENSION ::= {
    ...
}

-- **************************************************************
--
-- OTDOA INFORMATION RESPONSE
--
-- **************************************************************

OTDOAInformationResponse ::= SEQUENCE {
    protocolIEs     ProtocolIE-Container    {{OTDOAInformationResponse-IEs}},
    ...
}

OTDOAInformationResponse-IEs NRPPA-PROTOCOL-IES ::= {
    { ID id-OTDOACells                      CRITICALITY ignore  TYPE OTDOACells                PRESENCE mandatory}|
    { ID id-CriticalityDiagnostics          CRITICALITY ignore  TYPE CriticalityDiagnostics     PRESENCE optional},
    ...
}

-- **************************************************************
--
-- OTDOA INFORMATION FAILURE
```

```
--
-- **************************************************************

OTDOAInformationFailure ::= SEQUENCE {
    protocolIEs                     ProtocolIE-Container        {{OTDOAInformationFailure-IEs}},
    ...
}


OTDOAInformationFailure-IEs NRPPA-PROTOCOL-IES ::= {
    { ID id-Cause                           CRITICALITY ignore  TYPE Cause                      PRESENCE mandatory}|
    { ID id-CriticalityDiagnostics          CRITICALITY ignore  TYPE CriticalityDiagnostics     PRESENCE optional},
    ...
}

-- **************************************************************
--
-- ERROR INDICATION
--
-- **************************************************************

ErrorIndication ::= SEQUENCE {
    protocolIEs     ProtocolIE-Container    {{ErrorIndication-IEs}},
    ...
}

ErrorIndication-IEs NRPPA-PROTOCOL-IES ::= {

    { ID id-Cause                           CRITICALITY ignore  TYPE Cause                      PRESENCE optional}|
    { ID id-CriticalityDiagnostics      CRITICALITY ignore  TYPE CriticalityDiagnostics PRESENCE optional},
    ...
}

-- **************************************************************
--
-- PRIVATE MESSAGE
--
-- **************************************************************

PrivateMessage ::= SEQUENCE {
    privateIEs      PrivateIE-Container {{PrivateMessage-IEs}},
    ...
}

PrivateMessage-IEs NRPPA-PRIVATE-IES ::= {
    ...
}

END
```

9.3.5 Information Element definitions

```
-- **************************************************************
```

```
--
-- Information Element Definitions
--
-- **********************************************************

NRPPA-IEs {
itu-t (0) identified-organization (4) etsi (0) mobileDomain (0)
ngran-access (22) modules (3) nrppa (4) version1 (1) nrppa-IEs (2) }

DEFINITIONS AUTOMATIC TAGS ::=

BEGIN

IMPORTS

    id-MeasurementQuantities-Item,
    maxCellinRANnode,
    maxCellReport,
    maxNrOfErrors,
    maxNoMeas,
    maxnoOTDOAtypes,
    maxServCell,
    id-OtherRATMeasurementQuantities-Item,
    id-WLANMeasurementQuantities-Item,
    maxGERANMeas,
    maxUTRANMeas,
    maxWLANchannels,
    maxnoFreqHoppingBandsMinusOne


FROM NRPPA-Constants

    Criticality,
    NRPPATransactionID,
    ProcedureCode,
    ProtocolIE-ID,
    TriggeringMessage

FROM NRPPA-CommonDataTypes

    ProtocolExtensionContainer{},
    ProtocolIE-Single-Container{},

    NRPPA-PROTOCOL-EXTENSION,
    NRPPA-PROTOCOL-IES

FROM NRPPA-Containers;

-- A

-- B

BCCH ::= INTEGER (0..1023, ...)
```

```
BSSID ::= OCTET STRING (SIZE(6))

-- C

Cause ::= CHOICE {
    radioNetwork        CauseRadioNetwork,
    protocol            CauseProtocol,
    misc                CauseMisc,
    ...
}

CauseMisc ::= ENUMERATED {
    unspecified,
    ...
}

CauseProtocol ::= ENUMERATED {
    transfer-syntax-error,
    abstract-syntax-error-reject,
    abstract-syntax-error-ignore-and-notify,
    message-not-compatible-with-receiver-state,
    semantic-error,
    unspecified,
    abstract-syntax-error-falsely-constructed-message,
    ...
}

CauseRadioNetwork ::= ENUMERATED {
    unspecified,
    requested-item-not-supported,
    requested-item-temporarily-not-available,
    ...

}

Cell-Portion-ID ::= INTEGER (0..4095,...)

CGI-EUTRA ::= SEQUENCE {
    pLMN-Identity               PLMN-Identity,
    eUTRAcellIdentifier         EUTRACellIdentifier,
    iE-Extensions               ProtocolExtensionContainer { {CGI-EUTRA-ExtIEs} } OPTIONAL,
    ...
}

CGI-EUTRA-ExtIEs NRPPA-PROTOCOL-EXTENSION ::= {
    ...
}

CPLength-EUTRA ::= ENUMERATED {
    normal,
    extended,
    ...
}
```

```
CriticalityDiagnostics ::= SEQUENCE {
    procedureCode                   ProcedureCode                   OPTIONAL,
    triggeringMessage               TriggeringMessage               OPTIONAL,
    procedureCriticality            Criticality                OPTIONAL,
    nrppatransactionID              NRPPATransactionID              OPTIONAL,
    iEsCriticalityDiagnostics       CriticalityDiagnostics-IE-List  OPTIONAL,
    iE-Extensions                   ProtocolExtensionContainer { {CriticalityDiagnostics-ExtIEs} }   OPTIONAL,
    ...
}


CriticalityDiagnostics-ExtIEs NRPPA-PROTOCOL-EXTENSION ::= {
    ...
}

CriticalityDiagnostics-IE-List ::= SEQUENCE (SIZE (1..maxNrOfErrors)) OF
    SEQUENCE {
        iECriticality           Criticality,
        iE-ID                   ProtocolIE-ID,
        typeOfError         TypeOfError,
        iE-Extensions           ProtocolExtensionContainer { {CriticalityDiagnostics-IE-List-ExtIEs} } OPTIONAL,
        ...
}

CriticalityDiagnostics-IE-List-ExtIEs NRPPA-PROTOCOL-EXTENSION ::= {
    ...
}


-- D

DL-Bandwidth-EUTRA ::= ENUMERATED {
    bw6,
    bw15,
    bw25,
    bw50,
    bw75,
    bw100,
    ...
}

-- E

E-CID-MeasurementResult ::= SEQUENCE {
    servingCell-ID                  NG-RAN-CGI,
    servingCellTAC                  TAC,
    nG-RANAccessPointPosition       NG-RANAccessPointPosition   OPTIONAL,
    measuredResults                 MeasuredResults             OPTIONAL,
    iE-Extensions                   ProtocolExtensionContainer { { E-CID-MeasurementResult-ExtIEs} } OPTIONAL,
    ...
}

E-CID-MeasurementResult-ExtIEs NRPPA-PROTOCOL-EXTENSION ::= {
    ...
```

```
}

EUTRACellIdentifier ::= BIT STRING (SIZE (28))

EARFCN ::= INTEGER (0..262143, ...)

-- F

-- G

-- H

HESSID ::= OCTET STRING (SIZE(6))

-- I

-- J

-- K

-- L

-- M

Measurement-ID ::= INTEGER (1..15, ...)

MeasurementPeriodicity ::= ENUMERATED {
    ms120,
    ms240,
    ms480,
    ms640,
    ms1024,
    ms2048,
    ms5120,
    ms10240,
    min1,
    min6,
    min12,
    min30,
    min60,
    ...
}

MeasurementQuantities ::= SEQUENCE (SIZE (1.. maxNoMeas)) OF ProtocolIE-Single-Container { {MeasurementQuantities-ItemIEs} }

MeasurementQuantities-ItemIEs NRPPA-PROTOCOL-IES ::= {
    { ID id-MeasurementQuantities-Item  CRITICALITY reject  TYPE MeasurementQuantities-Item     PRESENCE mandatory}
}

MeasurementQuantities-Item ::= SEQUENCE {
    measurementQuantitiesValue                 MeasurementQuantitiesValue,
    iE-Extensions                              ProtocolExtensionContainer { { MeasurementQuantitiesValue-ExtIEs} } OPTIONAL,
    ...
}
```

```
MeasurementQuantitiesValue-ExtIEs NRPPA-PROTOCOL-EXTENSION ::= {
    ...
}

MeasurementQuantitiesValue ::= ENUMERATED {
    cell-ID,
    angleOfArrival,
    timingAdvanceType1,
    timingAdvanceType2,
    rSRP,
    rSRQ,
    ...
}

MeasuredResults ::= SEQUENCE (SIZE (1.. maxNoMeas)) OF MeasuredResultsValue

MeasuredResultsValue ::= CHOICE {
    valueAngleOfArrival-EUTRA              INTEGER (0..719),
    valueTimingAdvanceType1-EUTRA          INTEGER (0..7690),
    valueTimingAdvanceType2-EUTRA          INTEGER (0..7690),
    resultRSRP-EUTRA                       ResultRSRP-EUTRA,
    resultRSRQ-EUTRA                       ResultRSRQ-EUTRA,
    measuredResultsValue-Extension         MeasuredResultsValue-Extension,
    ...
}

MeasuredResultsValue-Extension ::= ProtocolIE-Single-Container {{ MeasuredResultsValue-ExtensionIE }}

MeasuredResultsValue-ExtensionIE NRPPA-PROTOCOL-IES ::= {
    ...
}

-- N

NarrowBandIndex ::= INTEGER (0..15,...)

NG-RANAccessPointPosition ::= SEQUENCE {
    latitudeSign               ENUMERATED {north, south},
    latitude                   INTEGER (0..8388607),
    longitude                  INTEGER (-8388608..8388607),
    directionOfAltitude        ENUMERATED {height, depth},
    altitude                   INTEGER (0..32767),
    uncertaintySemi-major      INTEGER (0..127),
    uncertaintySemi-minor      INTEGER (0..127),
    orientationOfMajorAxis     INTEGER (0..179),
    uncertaintyAltitude        INTEGER (0..127),
    confidence                 INTEGER (0..100),
    iE-Extensions              ProtocolExtensionContainer { { NG-RANAccessPointPosition-ExtIEs} } OPTIONAL,
    ...
}

NG-RANAccessPointPosition-ExtIEs NRPPA-PROTOCOL-EXTENSION ::= {
    ...
```

```
}

NG-RAN-CGI ::= SEQUENCE {
    pLMN-Identity               PLMN-Identity,
    nG-RANcell      NG-RANCell,
    iE-Extensions               ProtocolExtensionContainer { {NG-RAN-CGI-ExtIEs} } OPTIONAL,
    ...
}

NG-RAN-CGI-ExtIEs NRPPA-PROTOCOL-EXTENSION ::= {
    ...
}

NG-RANCell ::= CHOICE {
    eUTRA-CellID    EUTRACellIdentifier,
    nR-CellID       NRCellIdentifier,
    ...
}

NRCellIdentifier ::= BIT STRING (SIZE (36))

NumberOfAntennaPorts-EUTRA ::= ENUMERATED {
        n1-or-n2,
        n4,
        ...
}

NumberOfDlFrames-EUTRA ::= ENUMERATED {
        sf1,
        sf2,
        sf4,
        sf6,
        ...
}

NumberOfDlFrames-Extended-EUTRA ::= INTEGER (1..160,...)

NumberOfFrequencyHoppingBands ::= ENUMERATED {
    twobands,
    fourbands,
    ...
}

-- O

OTDOACells ::= SEQUENCE (SIZE (1.. maxCellinRANnode)) OF SEQUENCE {
    oTDOACellInfo                   OTDOACell-Information,
    iE-Extensions                   ProtocolExtensionContainer { {OTDOACells-ExtIEs} } OPTIONAL,
    ...
}

OTDOACells-ExtIEs NRPPA-PROTOCOL-EXTENSION ::= {
    ...
}
```

```
OTDOACell-Information ::= SEQUENCE (SIZE (1..maxnoOTDOAtypes)) OF OTDOACell-Information-Item

OTDOACell-Information-Item ::= CHOICE {
    pCI-EUTRA                                   PCI-EUTRA,
    cGI-EUTRA                                   CGI-EUTRA,
    tAC                                         TAC,
    eARFCN                                      EARFCN,
    pRS-Bandwidth-EUTRA                         PRS-Bandwidth-EUTRA,
    pRS-ConfigurationIndex-EUTRA                PRS-ConfigurationIndex-EUTRA,
    cPLength-EUTRA                              CPLength-EUTRA,
    numberOfDlFrames-EUTRA                      NumberOfDlFrames-EUTRA,
    numberOfAntennaPorts-EUTRA                  NumberOfAntennaPorts-EUTRA,
    sFNInitialisationTime-EUTRA                 SFNInitialisationTime-EUTRA,
    nG-RANAccessPointPosition                   NG-RANAccessPointPosition,
    pRSMutingConfiguration-EUTRA                PRSMutingConfiguration-EUTRA,
    prsid-EUTRA                                 PRS-ID-EUTRA,
    tpid-EUTRA                                  TP-ID-EUTRA,
    tpType-EUTRA                                TP-Type-EUTRA,
    numberOfDlFrames-Extended-EUTRA             NumberOfDlFrames-Extended-EUTRA,
    crsCPlength-EUTRA                           CPLength-EUTRA,
    dL-Bandwidth-EUTRA                          DL-Bandwidth-EUTRA,
    pRSOccasionGroup-EUTRA                      PRSOccasionGroup-EUTRA,
    pRSFrequencyHoppingConfiguration-EUTRA      PRSFrequencyHoppingConfiguration-EUTRA,
    ...
}

OTDOA-Information-Item ::= ENUMERATED {
        pci,
        cGI,
        tac,
        earfcn,
        prsBandwidth,
        prsConfigIndex,
        cpLength,
        noDlFrames,
        noAntennaPorts,
        sFNInitTime,
        nG-RANAccessPointPosition,
        prsmutingconfiguration,
        prsid,
        tpid,
        tpType,
        crsCPlength,
        dlBandwidth,
        multipleprsConfigurationsperCell,
        prsOccasionGroup,
        prsFrequencyHoppingConfiguration,
        ...
}

OtherRATMeasurementQuantities ::= SEQUENCE (SIZE (0.. maxNoMeas)) OF ProtocolIE-Single-Container { {OtherRATMeasurementQuantities-ItemIEs} }

OtherRATMeasurementQuantities-ItemIEs NRPPA-PROTOCOL-IES ::= {
```

```
    { ID id-OtherRATMeasurementQuantities-Item  CRITICALITY reject  TYPE OtherRATMeasurementQuantities-Item PRESENCE mandatory}}

OtherRATMeasurementQuantities-Item ::= SEQUENCE {
    otherRATMeasurementQuantitiesValue          OtherRATMeasurementQuantitiesValue,
    iE-Extensions                               ProtocolExtensionContainer { { OtherRATMeasurementQuantitiesValue-ExtIEs} } OPTIONAL,
    ...
}

OtherRATMeasurementQuantitiesValue-ExtIEs NRPPA-PROTOCOL-EXTENSION ::= {
    ...
}

OtherRATMeasurementQuantitiesValue ::= ENUMERATED {
    geran,
    utran,
    ...
}

OtherRATMeasurementResult ::= SEQUENCE (SIZE (1.. maxNoMeas)) OF OtherRATMeasuredResultsValue

OtherRATMeasuredResultsValue ::= CHOICE {
    resultGERAN         ResultGERAN,
    resultUTRAN         ResultUTRAN,
    ...
}

-- P

PCI-EUTRA ::= INTEGER (0..503, ...)

PhysCellIDGERAN ::= INTEGER (0..63, ...)

PhysCellIDUTRA-FDD ::= INTEGER (0..511, ...)

PhysCellIDUTRA-TDD ::= INTEGER (0..127, ...)

PLMN-Identity ::= OCTET STRING (SIZE(3))

PRS-Bandwidth-EUTRA ::= ENUMERATED {
        bw6,
        bw15,
        bw25,
        bw50,
        bw75,
        bw100,
        ...
}

PRS-ConfigurationIndex-EUTRA ::= INTEGER (0..4095, ...)

PRS-ID-EUTRA    ::= INTEGER (0..4095, ...)

PRSMutingConfiguration-EUTRA ::= CHOICE {
    two                             BIT STRING (SIZE (2)),
```

```
    four                            BIT STRING (SIZE (4)),
    eight                           BIT STRING (SIZE (8)),
    sixteen                         BIT STRING (SIZE (16)),
    thirty-two                      BIT STRING (SIZE (32)),
    sixty-four                      BIT STRING (SIZE (64)),
    one-hundred-and-twenty-eight    BIT STRING (SIZE (128)),
    two-hundred-and-fifty-six       BIT STRING (SIZE (256)),
    five-hundred-and-twelve         BIT STRING (SIZE (512)),
    one-thousand-and-twenty-four    BIT STRING (SIZE (1024)),
    ...
}

PRSOccasionGroup-EUTRA ::= ENUMERATED {
    og2,
    og4,
    og8,
    og16,
    og32,
    og64,
    og128,
    ...
}

PRSFrequencyHoppingConfiguration-EUTRA ::= SEQUENCE {
    noOfFreqHoppingBands        NumberOfFrequencyHoppingBands,
    bandPositions               SEQUENCE(SIZE (1..maxnoFreqHoppingBandsMinusOne)) OF NarrowBandIndex,
    iE-Extensions               ProtocolExtensionContainer { { PRSFrequencyHoppingConfiguration-EUTRA-Item-IEs} } OPTIONAL,
    ...
}

PRSFrequencyHoppingConfiguration-EUTRA-Item-IEs NRPPA-PROTOCOL-EXTENSION ::= {
    ...
}

-- Q

-- R

ReportCharacteristics ::= ENUMERATED {
    onDemand,
    periodic,
    ...
}

RequestedSRSTransmissionCharacteristics ::= SEQUENCE {
    numberOfTransmissions   INTEGER (0..500, ...),
    bandwidth               INTEGER (1..100, ...),
    iE-Extensions           ProtocolExtensionContainer { { RequestedSRSTransmissionCharacteristics-ExtIEs} } OPTIONAL,
    ...
}

RequestedSRSTransmissionCharacteristics-ExtIEs NRPPA-PROTOCOL-EXTENSION ::= {
    ...
}
```

```
ResultRSRP-EUTRA ::= SEQUENCE (SIZE (1.. maxCellReport)) OF ResultRSRP-EUTRA-Item

ResultRSRP-EUTRA-Item ::= SEQUENCE {
    pCI-EUTRA           PCI-EUTRA,
    eARFCN              EARFCN,
    cGI-EUTRA           CGI-EUTRA OPTIONAL,
    valueRSRP-EUTRA     ValueRSRP-EUTRA,
    iE-Extensions       ProtocolExtensionContainer { { ResultRSRP-EUTRA-Item-ExtIEs} } OPTIONAL,
    ...
}

ResultRSRP-EUTRA-Item-ExtIEs NRPPA-PROTOCOL-EXTENSION ::= {
    ...
}

ResultRSRQ-EUTRA ::= SEQUENCE (SIZE (1.. maxCellReport)) OF ResultRSRQ-EUTRA-Item

ResultRSRQ-EUTRA-Item ::= SEQUENCE {
    pCI-EUTRA           PCI-EUTRA,
    eARFCN              EARFCN,
    cGI-UTRA            CGI-EUTRA OPTIONAL,
    valueRSRQ-EUTRA     ValueRSRQ-EUTRA,
    iE-Extensions       ProtocolExtensionContainer { { ResultRSRQ-EUTRA-Item-ExtIEs} } OPTIONAL,
    ...
}

ResultRSRQ-EUTRA-Item-ExtIEs NRPPA-PROTOCOL-EXTENSION ::= {
    ...
}

ResultGERAN ::= SEQUENCE (SIZE (1.. maxGERANMeas)) OF ResultGERAN-Item

ResultGERAN-Item ::= SEQUENCE {
    bCCH                BCCH,
    physCellIDGERAN     PhysCellIDGERAN,
    rSSI                RSSI,
    iE-Extensions       ProtocolExtensionContainer { { ResultGERAN-Item-ExtIEs} } OPTIONAL,
    ...
}

ResultGERAN-Item-ExtIEs NRPPA-PROTOCOL-EXTENSION ::= {
    ...
}

ResultUTRAN ::= SEQUENCE (SIZE (1.. maxUTRANMeas)) OF ResultUTRAN-Item

ResultUTRAN-Item ::= SEQUENCE {
    uARFCN              UARFCN,
    physCellIDUTRAN     CHOICE {
        physCellIDUTRA-FDD      PhysCellIDUTRA-FDD,
        physCellIDUTRA-TDD      PhysCellIDUTRA-TDD
    },
    uTRA-RSCP           UTRA-RSCP OPTIONAL,
```

```
    uTRA-EcN0           UTRA-EcN0 OPTIONAL,
    iE-Extensions       ProtocolExtensionContainer { { ResultUTRAN-Item-ExtIEs} } OPTIONAL,
    ...
}

ResultUTRAN-Item-ExtIEs NRPPA-PROTOCOL-EXTENSION ::= {
    ...
}

RSSI ::= INTEGER (0..63, ...)

-- S

SFNInitialisationTime-EUTRA ::= BIT STRING (SIZE (64))

SSID ::= OCTET STRING (SIZE(1..32))

-- T

TAC ::= OCTET STRING (SIZE(3))

TP-ID-EUTRA ::= INTEGER (0..4095, ...)

TP-Type-EUTRA ::= ENUMERATED { prs-only-tp, ... }

TypeOfError ::= ENUMERATED {
    not-understood,
    missing,
    ...
}

-- U

UARFCN ::= INTEGER (0..16383, ...)

UTRA-EcN0 ::= INTEGER (0..49, ...)

UTRA-RSCP ::= INTEGER (-5..91, ...)

-- V

ValueRSRP-EUTRA ::= INTEGER (0..97, ...)

ValueRSRQ-EUTRA ::= INTEGER (0..34, ...)

-- W

WLANMeasurementQuantities ::= SEQUENCE (SIZE (0.. maxNoMeas)) OF ProtocolIE-Single-Container { {WLANMeasurementQuantities-ItemIEs} }

WLANMeasurementQuantities-ItemIEs NRPPA-PROTOCOL-IES ::= {
    { ID id-WLANMeasurementQuantities-Item  CRITICALITY reject  TYPE WLANMeasurementQuantities-Item PRESENCE mandatory}}

WLANMeasurementQuantities-Item ::= SEQUENCE {
    wLANMeasurementQuantitiesValue          WLANMeasurementQuantitiesValue,
```

```
    iE-Extensions                       ProtocolExtensionContainer { { WLANMeasurementQuantitiesValue-ExtIEs} } OPTIONAL,
    ...
}

WLANMeasurementQuantitiesValue-ExtIEs NRPPA-PROTOCOL-EXTENSION ::= {
    ...
}

WLANMeasurementQuantitiesValue ::= ENUMERATED {
    wlan,
    ...
}

WLANMeasurementResult ::= SEQUENCE (SIZE (1..maxNoMeas)) OF WLANMeasurementResult-Item

WLANMeasurementResult-Item ::= SEQUENCE {
    wLAN-RSSI           WLAN-RSSI,
    sSID                SSID                    OPTIONAL,
    bSSID               BSSID                   OPTIONAL,
    hESSID              HESSID                  OPTIONAL,
    operatingClass      WLANOperatingClass      OPTIONAL,
    countryCode         WLANCountryCode         OPTIONAL,
    wLANChannelList     WLANChannelList         OPTIONAL,
    wLANBand            WLANBand                OPTIONAL,
    iE-Extensions       ProtocolExtensionContainer { { WLANMeasurementResult-Item-ExtIEs } }    OPTIONAL,
    ...
}

WLANMeasurementResult-Item-ExtIEs   NRPPA-PROTOCOL-EXTENSION ::= {
    ...
}

WLAN-RSSI ::= INTEGER (0..141, ...)

WLANBand ::= ENUMERATED {band2dot4, band5, ...}

WLANChannelList ::= SEQUENCE (SIZE (1..maxWLANchannels)) OF WLANChannel

WLANChannel ::= INTEGER (0..255)

WLANCountryCode ::= ENUMERATED {
    unitedStates,
    europe,
    japan,
    global,
    ...
}

WLANOperatingClass ::= INTEGER (0..255)

-- X

-- Y
```

```
-- Z

END
```

9.3.6 Common definitions

```
-- **************************************************************
--
-- Common definitions
--
-- **************************************************************

NRPPA-CommonDataTypes {
itu-t (0) identified-organization (4) etsi (0) mobileDomain (0)
ngran-access (22) modules (3) nrppa (4) version1 (1) nrppa-CommonDataTypes (3)}

DEFINITIONS AUTOMATIC TAGS ::=

BEGIN

-- **************************************************************
--
-- Extension constants
--
-- **************************************************************

maxPrivateIEs                                   INTEGER ::= 65535
maxProtocolExtensions                           INTEGER ::= 65535
maxProtocolIEs                                  INTEGER ::= 65535

-- **************************************************************
--
-- Common Data Types
--
-- **************************************************************

Criticality     ::= ENUMERATED { reject, ignore, notify }

NRPPATransactionID      ::= INTEGER (0..32767)


Presence        ::= ENUMERATED { optional, conditional, mandatory }

PrivateIE-ID    ::= CHOICE {
    local           INTEGER (0.. maxPrivateIEs),
    global          OBJECT IDENTIFIER
}

ProcedureCode       ::= INTEGER (0..255)

ProtocolIE-ID       ::= INTEGER (0..maxProtocolIEs)

TriggeringMessage   ::= ENUMERATED { initiating-message, successful-outcome, unsuccessful-outcome}
```

```
END
```

9.3.7 Constant definitions

```
-- **************************************************************
--
-- Constant definitions
--
-- **************************************************************

NRPPA-Constants {
itu-t (0) identified-organization (4) etsi (0) mobileDomain (0)
ngran-access (22) modules (3) nrppa (4) version1 (1) nrppa-Constants (4) }

DEFINITIONS AUTOMATIC TAGS ::=

BEGIN

IMPORTS

    ProcedureCode,
    ProtocolIE-ID
FROM NRPPA-CommonDataTypes;

-- **************************************************************
--
-- Elementary Procedures
--
-- **************************************************************

id-errorIndication                                      ProcedureCode ::= 0
id-privateMessage                                       ProcedureCode ::= 1
id-e-CIDMeasurementInitiation                           ProcedureCode ::= 2
id-e-CIDMeasurementFailureIndication                    ProcedureCode ::= 3
id-e-CIDMeasurementReport                               ProcedureCode ::= 4
id-e-CIDMeasurementTermination                          ProcedureCode ::= 5
id-oTDOAInformationExchange                             ProcedureCode ::= 6

-- **************************************************************
--
-- Lists
--
-- **************************************************************

maxNrOfErrors                           INTEGER ::= 256
maxCellinRANnode                        INTEGER ::= 3840
maxNoMeas                               INTEGER ::= 63
maxCellReport                           INTEGER ::= 9
maxnoOTDOAtypes                         INTEGER ::= 63
maxServCell                             INTEGER ::= 5
maxGERANMeas                            INTEGER ::= 8
maxUTRANMeas                            INTEGER ::= 8
```

```
maxWLANchannels                         INTEGER ::= 16
maxnoFreqHoppingBandsMinusOne           INTEGER ::= 7

-- **************************************************************
--
-- IEs
--
-- **************************************************************

id-Cause                                                    ProtocolIE-ID ::= 0
id-CriticalityDiagnostics                                   ProtocolIE-ID ::= 1
id-LMF-UE-Measurement-ID                                    ProtocolIE-ID ::= 2
id-ReportCharacteristics                                    ProtocolIE-ID ::= 3
id-MeasurementPeriodicity                                   ProtocolIE-ID ::= 4
id-MeasurementQuantities                                    ProtocolIE-ID ::= 5
id-RAN-UE-Measurement-ID                                    ProtocolIE-ID ::= 6
id-E-CID-MeasurementResult                                  ProtocolIE-ID ::= 7
id-OTDOACells                                               ProtocolIE-ID ::= 8
id-OTDOA-Information-Type-Group                             ProtocolIE-ID ::= 9
id-OTDOA-Information-Type-Item                              ProtocolIE-ID ::= 10
id-MeasurementQuantities-Item                               ProtocolIE-ID ::= 11
id-RequestedSRSTransmissionCharacteristics                  ProtocolIE-ID ::= 12
id-Cell-Portion-ID                                          ProtocolIE-ID ::= 14
id-OtherRATMeasurementQuantities                            ProtocolIE-ID ::= 15
id-OtherRATMeasurementQuantities-Item                       ProtocolIE-ID ::= 16
id-OtherRATMeasurementResult                                ProtocolIE-ID ::= 17
id-WLANMeasurementQuantities                                ProtocolIE-ID ::= 19
id-WLANMeasurementQuantities-Item                           ProtocolIE-ID ::= 20
id-WLANMeasurementResult                                    ProtocolIE-ID ::= 21

END
```

9.3.8 Container definitions

```
-- **************************************************************
--
-- Container definitions
--
-- **************************************************************

NRPPA-Containers {
itu-t (0) identified-organization (4) etsi (0) mobileDomain (0)
ngran-access (22) modules (3) nrppa (4) version1 (1) nrppa-Containers (5)}

DEFINITIONS AUTOMATIC TAGS ::=

BEGIN

-- **************************************************************
--
-- IE parameter types from other modules.
--
-- **************************************************************
```

```
IMPORTS
    maxPrivateIEs,
    maxProtocolExtensions,
    maxProtocolIEs,
    Criticality,
    Presence,
    PrivateIE-ID,
    ProtocolIE-ID
FROM NRPPA-CommonDataTypes;

-- **************************************************************
--
-- Class Definition for Protocol IEs
--
-- **************************************************************

NRPPA-PROTOCOL-IES ::= CLASS {
    &id                 ProtocolIE-ID           UNIQUE,
    &criticality        Criticality,
    &Value,
    &presence           Presence
}
WITH SYNTAX {
    ID                  &id
    CRITICALITY         &criticality
    TYPE                &Value
    PRESENCE            &presence
}

-- **************************************************************
--
-- Class Definition for Protocol Extensions
--
-- **************************************************************

NRPPA-PROTOCOL-EXTENSION ::= CLASS {
    &id                 ProtocolIE-ID       UNIQUE,
    &criticality        Criticality,
    &Extension,
    &presence           Presence
}
WITH SYNTAX {
    ID                  &id
    CRITICALITY         &criticality
    EXTENSION           &Extension
    PRESENCE            &presence
}

-- **************************************************************
--
-- Class Definition for Private IEs
--
-- **************************************************************
```

```
NRPPA-PRIVATE-IES ::= CLASS {
    &id                 PrivateIE-ID,
    &criticality        Criticality,
    &Value,
    &presence           Presence
}
WITH SYNTAX {
    ID                  &id
    CRITICALITY         &criticality
    TYPE                &Value
    PRESENCE            &presence
}

-- **************************************************************
--
-- Container for Protocol IEs
--
-- **************************************************************

ProtocolIE-Container { NRPPA-PROTOCOL-IES : IEsSetParam} ::=
    SEQUENCE (SIZE (0..maxProtocolIEs)) OF
    ProtocolIE-Field {{IEsSetParam}}

ProtocolIE-Single-Container { NRPPA-PROTOCOL-IES : IEsSetParam} ::=
    ProtocolIE-Field {{IEsSetParam}}

ProtocolIE-Field { NRPPA-PROTOCOL-IES : IEsSetParam} ::= SEQUENCE {
    id              NRPPA-PROTOCOL-IES.&id              ({IEsSetParam}),
    criticality     NRPPA-PROTOCOL-IES.&criticality     ({IEsSetParam}{@id}),
    value           NRPPA-PROTOCOL-IES.&Value           ({IEsSetParam}{@id})
}

-- **************************************************************
--
-- Container Lists for Protocol IE Containers
--
-- **************************************************************

ProtocolIE-ContainerList {INTEGER : lowerBound, INTEGER : upperBound, NRPPA-PROTOCOL-IES : IEsSetParam} ::=
    SEQUENCE (SIZE (lowerBound..upperBound)) OF
    ProtocolIE-Container {{IEsSetParam}}

-- **************************************************************
--
-- Container for Protocol Extensions
--
-- **************************************************************

ProtocolExtensionContainer { NRPPA-PROTOCOL-EXTENSION : ExtensionSetParam} ::=
    SEQUENCE (SIZE (1..maxProtocolExtensions)) OF
    ProtocolExtensionField {{ExtensionSetParam}}

ProtocolExtensionField { NRPPA-PROTOCOL-EXTENSION : ExtensionSetParam} ::= SEQUENCE {
```

```
    id                  NRPPA-PROTOCOL-EXTENSION.&id            ({ExtensionSetParam}),
    criticality         NRPPA-PROTOCOL-EXTENSION.&criticality   ({ExtensionSetParam}{@id}),
    extensionValue      NRPPA-PROTOCOL-EXTENSION.&Extension     ({ExtensionSetParam}{@id})
}

-- ************************************************************
--
-- Container for Private IEs
--
-- ************************************************************

PrivateIE-Container { NRPPA-PRIVATE-IES : IEsSetParam} ::=
    SEQUENCE (SIZE (1..maxPrivateIEs)) OF
    PrivateIE-Field {{IEsSetParam}}

PrivateIE-Field { NRPPA-PRIVATE-IES : IEsSetParam} ::= SEQUENCE {
    id              NRPPA-PRIVATE-IES.&id               ({IEsSetParam}),
    criticality     NRPPA-PRIVATE-IES.&criticality      ({IEsSetParam}{@id}),
    value           NRPPA-PRIVATE-IES.&Value            ({IEsSetParam}{@id})
}

END
```

9.4 Message transfer syntax

NRPPa shall use the ASN.1 Basic Packed Encoding Rules (BASIC-PER) Aligned Variant as transfer syntax, as specified in ref. ITU-T Rec. X.691 [6].

9.5 Timers

Void.

10 Handling of unknown, unforeseen and erroneous protocol data

Section 10 of TS 36.455 [12] is applicable for the purposes of the present document.

Annex A (informative): Change history

Change history							
Date	**Meeting**	**TDoc**	**CR**	**Rev**	**Cat**	**Subject/Comment**	**New version**
2017-08-23	RAN3#97	R3-173238				TS skeleton agreed	v0.0.0
2017-08-25	RAN3#97	R3-173374				TS 38.455 V0.1.0	v0.1.0
2017-10-18	RAN3#97bis	R3-173979				Implemented agreed pCR from R3#97bis	V0.2.0
2017-12-04	RAN3#98	R3-175064				Implemented agreed pCR from R3#98	V0.3.0
2018-01-31	RAN3 Adhoc 1801	R3-180658				Implemented agreed pCR from R3 Adhoc_1801	V0.5.0
2018-03-15	RAN3#99	R3-181595				Implemented agreed pCR's from R3#99	V0.6.0
2018-05-29	RAN3#100	R3-183598				Implemented agreed pCR's from R3#100	V0.7.0
2018-06	RAN#80	RP-181147				Submitted to RAN plenary for Approval	V1.0.0
2018-06	RAN#80	-	-	-	-	Specification approved at TSG-RAN and placed under change control	15.0.0

History

Document history		
V15.0.0	July 2018	Publication