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This contribution is made available as a reference to support discussion of the "Work Item Description for an Open SMLC-SRNC Interface within the UTRAN to support A-GPS" provided in RP-010081.

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Contents

Foreword

This Technical Specification has been produced by the 3rd Generation Partnership Project (3GPP).

The contents of the present document are subject to continuing work within the TSG and may change following formal TSG approval. Should the TSG modify the contents of the present document, it will be re-released by the TSG with an identifying change of release date and an increase in version number as follows:

Version x.y.z

where:

- x the first digit:
  - 1 presented to TSG for information;
  - 2 presented to TSG for approval;
  - 3 or greater indicates TSG approved document under change control.
- 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 radio network layer signalling protocol called UE Positioning Application Part (PCAP) for the Iupc interface. PCAP supports the functions of the Iupc interface 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] UMTS 25.412: "3rd Generation Partnership Project (3GPP) Technical Specification Group Radio Access Network; UTRAN Iu Interface Signalling Transport".

[2] UMTS 25.331: "3rd Generation Partnership Project (3GPP) Technical Specification Group Radio Access Network; RRC Protocol Specification".

[3] UMTS 25.401: "3rd Generation Partnership Project (3GPP) Technical Specification Group Radio Access Network; UTRAN Overall Description".

[4] UMTS 25.305: "3rd Generation Partnership Project (3GPP) Technical Specification Group Radio Access Network; Stage 2 Functional Specification of UE Positioning in UTRAN".

[5] X.680, (12/97) "Information Technology - Abstract Syntax Notation One (ASN.1):Specification of basic notation".

[6] X.681, (12/97) "Information Technology - Abstract Syntax Notation One (ASN.1): Information object specification".

[7] X.691, (12/97) "Information technology - ASN.1 encoding rules - Specification of Packed Encoding Rules (PER)".

3 Definitions, symbols and abbreviations

3.1 Definitions

For the purposes of the present document, the following terms and definitions apply.

Serving RNS (SRNS): role an RNS can take with respect to a specific connection between an UE and UTRAN. There is one Serving RNS for each UE that has a connection to UTRAN. The Serving RNS is in charge of the radio connection between a UE and the UTRAN. The Serving RNS terminates the Iu for this UE

Serving RNC (SRNC): SRNC is the RNC belonging to SRNS

Stand-Alone A-GPS SMLC (SAS): A network element that interconnects to the RNC over the Iupc interface via the PCAP protocol. An SAS performs the following procedures:

- Provide GPS assistance data to the SRNC to be delivered through point-to-point channels to UE;

- Provide GPS assistance data to the CRNC to be delivered through broadcast channels to UE;
- Performs the position calculation function for UE assisted GPS.

Elementary Procedure: PCAP protocol consists of Elementary Procedures (EPs). An Elementary Procedure is a unit of interaction between the RNC and the SAS. These Elementary Procedures are defined separately and are intended to be used to build up complete sequences in a flexible manner. If the independence between some EPs is restricted, it is described under the relevant EP description. Unless otherwise stated by the restrictions, the EPs may be invoked independently of each other as stand alone procedures, which can be active in parallel.

An EP consists of an initiating message and possibly a response message. Two kinds of EPs are used:

- **Class 1:** Elementary Procedures with response (success or failure).
- **Class 2:** Elementary Procedures without response.

For Class 1 EPs, the types of responses can be as follows:

Successful:

- A signalling message explicitly indicates that the elementary procedure successfully completed with the receipt of the response.

Unsuccessful:

- A signalling message explicitly indicates that the EP failed.
- On time supervision expiry (i.e. absence of expected response).

Class 2 EPs are considered always successful.

3.2 Symbols

Void.

3.3 Abbreviations

A-GPS	Assisted GPS
AS	Access Stratum
ASN.1	Abstract Syntax Notation One
CN	Core Network
CRNC	Controlling RNC
EP	Elementary Procedure
GPS	Global Positioning System
MSC	Mobile services Switching Center
NAS	Non Access Stratum
N-PDU	Network – Protocol Data Unit
PCAP	Positioning Calculation Application Part
PDU	Protocol Data Unit
RANAP	Radio Access Network Application Part
RNC	Radio Network Controller
RNS	Radio Network Subsystem
RRC	Radio Resource Control
SAI	Service Area Identifier
SAS	Stand-alone A-GPS SMLC
SCCP	Signalling Connection Control Part
SDU	Service Data Unit
SMLC	Serving Mobile Location Center
SRNC	Serving RNC
SRNS	Serving RNS
UE	User Equipment
UTRAN	UMTS Terrestrial Radio Access Network

4 General

4.1 Procedure Specification Principles

The principle for specifying the procedure logic is to specify the functional behaviour of the SAS exactly and completely. The RNC functional behaviour is left unspecified. The PCAP related Position Estimate, Assistance Data, Broadcast Data, and Abort procedures are exceptions from this principle.

4.2 Forwards and Backwards Compatibility

The forwards and backwards compatibility of the protocol is assured by 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. Position Estimate 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. POSITION ESTIMATE REQUEST 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. *Request Type* 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 subclause 9.2 enclosed by quotation marks, e.g. "Abstract Syntax Error (Reject)" or "Geographical Coordinates ".

5 PCAP Services

PCAP provides the signalling service between RNC and SAS that is required to fulfill the PCAP functions described in clause 7. PCAP services are categorized as follows:

1. Point-to-Point Service: They are related to a specific UE and involve the transfer of GPS assistance data and GPS Measurement Data over the Iupc interface between the SRNC and the SAS. They utilise connection-oriented signalling transport provided by the Iupc signalling bearer.

2. Broadcast Service: They are related to specified UEs or all UEs in a specified area, and involve the transfer of GPS assistance data over the Iupc interface between the CRNC and the SAS. They utilise connection-oriented signalling transport provided by the Iupc signalling bearer.

6 Services Expected from Signalling Transport

Signalling transport (ref. [1]) shall provide the following service for the PCAP.

Connection oriented data transfer service. This service is supported by a signalling connection between the SRNC and the SAS. It shall be possible to dynamically establish and release signalling connections based on the need. Each

point-to-point operation shall have its own signalling connection. The signalling connection shall provide in sequence delivery of PCAP messages. PCAP shall be notified if the signalling connection breaks.

7 Functions of PCAP

PCAP protocol has the following functions:

- Point-to-Point. This function enables the SRNC to interact with an SAS in the process of performing a position estimate of a UE or providing GPS assistance data to a UE.
- Broadcast. This function enables the CRNC to obtain the GPS assistance data used in UE positioning related RRC broadcast mechanisms.

The mapping between the above functions and PCAP elementary procedures is shown in the table 1.

Table 1: Mapping between functions and PCAP elementary procedures

Function	Elementary Procedure(s)
Point-to-Point	a) Position Estimate b) Measurement Data c) Implicit Assistance Data d) Explicit Assistance Data e) Abort
Broadcast	a) Broadcast Data b) Abort

8 PCAP Procedures

8.1 Elementary Procedures

In the following tables, all EPs are divided into Class 1 and Class 2 EPs (see subclause 3.1 for explanation of the different classes):

Table 1: Class 1

Elementary Procedure	Initiating Message	Successful Outcome	Unsuccessful Outcome
		Response message	Response message
Position Estimate	POSITION ESTIMATE REQUEST	POSITION ESTIMATE RESPONSE	POSITION ESTIMATE FAILURE
Measurement Data	MEASUREMENT DATA REQUEST	MEASUREMENT DATA RESPONSE	MEASUREMENT DATA FAILURE
Implicit Assistance Data	IMPLICIT ASSISTANCE DATA REQUEST	IMPLICIT ASSISTANCE DATA RESPONSE	IMPLICIT ASSISTANCE DATA FAILURE
Explicit Assistance Data	EXPLICIT ASSISTANCE DATA REQUEST	EXPLICIT ASSISTANCE DATA RESPONSE	EXPLICIT ASSISTANCE DATA FAILURE
Broadcast Data	BROADCAST DATA REQUEST	BROADCAST DATA RESPONSE	BROADCAST DATA FAILURE

Table 2: Class 2

Elementary Procedure	Message
Abort	ABORT

The following applies concerning interference between Elementary Procedures:

- The Abort procedure takes precedence over all other EPs.

8.2 Position Estimate

8.2.1 General

The purpose of the Position Estimate procedure is to enable a SRNC to query a SAS for a position estimate of a UE. The procedure uses connection oriented signalling.

The SRNC shall initiate the Position Estimate procedure for UEs that support the following positioning method types:

- UE assisted;

- UE assisted is preferred, but UE based is allowed;

- UE based is preferred, but UE assisted is allowed.

For UEs that only support the UE based positioning method the Position Estimate procedure is not applicable.

8.2.2 Successful Operation

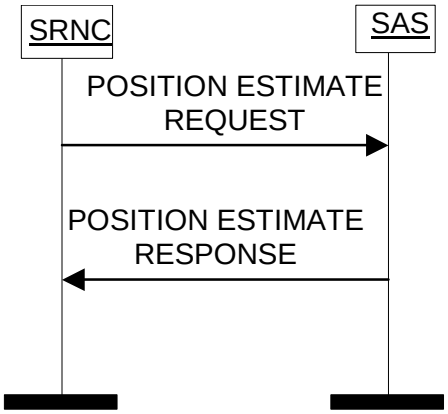

Figure 1: Position Estimate procedure. Successful Operation.

The SRNC shall initiate the procedure by sending a POSITION ESTIMATE REQUEST message. When sending the POSITION ESTIMATE REQUEST message, the SRNC shall start the T_{PE} timer. The POSITION ESTIMATE REQUEST message will contain data enabling the SAS to perform its task. Specifically the following data is included; an initial position estimate of the UE, a GPS-UTRAN time relationship uncertainty, and the method type (UE based / UE assisted preferences or UE assisted).

Note in all cases, the Measurement Data procedure needs to be executed within the Position Estimate procedure. In cases where the UE based positioning method is used, the POSITION ESTIMATE RESPONSE message will not contain the position estimate and will only serve to bring closure to the POSITION ESTIMATE REQUEST message.

8.2.3 Unsuccessful Operation

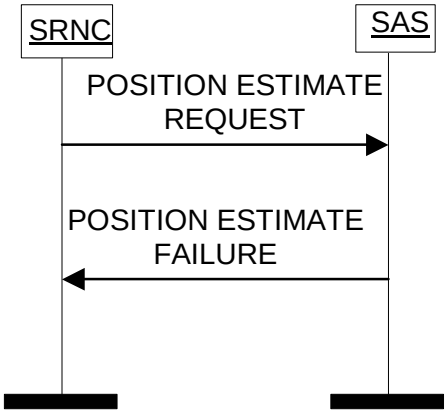

Figure 2 Position Estimate procedure. Unsuccessful Operation.

If the SAS is unable to perform the position estimate for any reason, it shall return a POSITION ESTIMATE FAILURE message to the SRNC.

8.2.4 Abnormal Conditions

If the SRNC decides to stop the Position Estimate procedure for any reason it shall send an ABORT message to the SAS.

8.3 Measurement Data

8.3.1 General

The purpose of the Measurement Data procedure is to enable the exchange of GPS positioning related information between a SAS and a SRNC. The information exchanged is directly associated with A-GPS specific UE positioning RRC call flows. The procedure uses connection oriented signalling.

8.3.2 Successful Operation

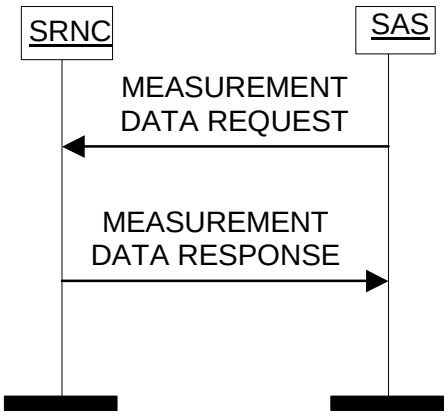

Figure 3 Measurement Data procedure. Successful Operation.

The SAS shall initiate the procedure by sending a MEASUREMENT DATA REQUEST message. When sending the MEASUREMENT DATA REQUEST message, the SAS shall start the T_{MD} timer. The MEASUREMENT DATA REQUEST message will contain GPS assistance data enabling the SRNC to request a UE to perform an A-GPS positioning attempt.

In cases where the UE assisted positioning method is used, the GPS measurement data is returned to the SAS within the MEASUREMENT DATA RESPONSE message. In cases where the UE based positioning method is used, the

MEASUREMENT DATA RESPONSE message will not contain the GPS measurement data and will only serve to bring closure to the MEASUREMENT DATA REQUEST message.

8.3.3 Unsuccessful Conditions

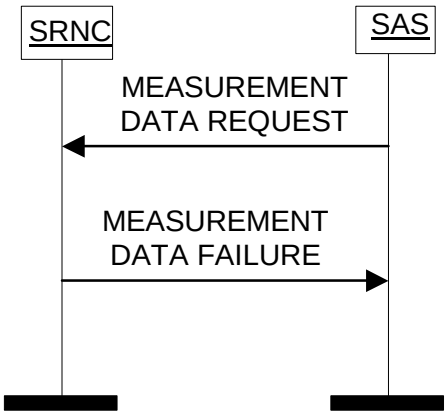

Figure 4 Measurement Data procedure. Unsuccessful Operation.

If the SRNC is unable to collect the measurement data, it shall return a MEASUREMENT DATA FAILURE message to the SAS.

8.4 Implicit Assistance Data

8.4.1 General

The purpose of the Implicit Assistance Data procedure is to enable a SRNC to query a SAS for GPS assistance data in the support of an UE based position estimate. The procedure uses connection oriented signalling.

8.4.2 Successful Operation

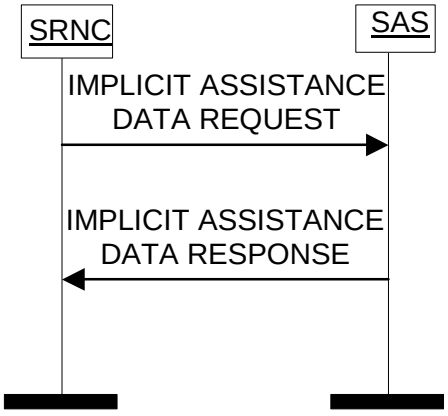

Figure 5: Implicit Assistance Data procedure. Successful Operation.

The SRNC shall initiate the procedure by sending an IMPLICIT ASSISTANCE DATA REQUEST message. When sending the IMPLICIT ASSISTANCE DATA REQUEST message, the SRNC shall start the T_{IAD} timer. The IMPLICIT ASSISTANCE DATA REQUEST message informs the SAS that assistance data is needed to support a UE based positioning attempt. This message contains an initial position estimate of the UE and a GPS-UTRAN time relationship uncertainty.

8.4.3 Unsuccessful Conditions

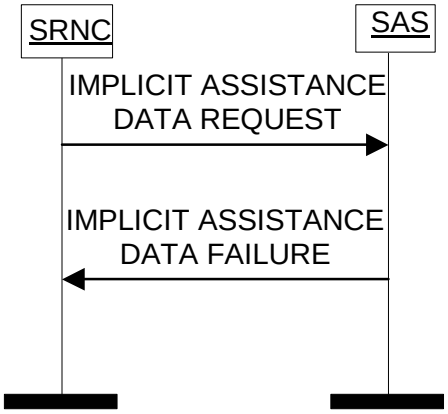

Figure 6 Implicit Assistance Data procedure. Unsuccessful Operation.

If the SAS is unable to perform the request for assistance data for any reason, it shall return an IMPLICIT ASSISTANCE DATA FAILURE message to the SRNC.

8.4.4 Abnormal Conditions

If the SRNC decides the assistance data is no longer needed for any reason it shall send an ABORT message to the SAS.

8.5 Explicit Assistance Data

8.5.1 General

The purpose of the Explicit Assistance Data procedure is to enable a SRNC to query a SAS for a specific set of GPS assistance data. This procedure is used in support of mobile originated assistance data requests and in cases where the UE requests additional assistance data during a positioning attempt. The procedure uses connection oriented signalling.

8.5.2 Successful Operation

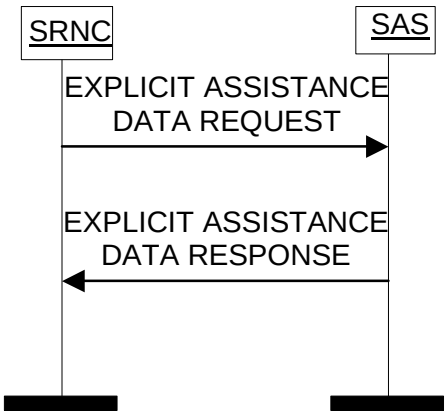

Figure 7: Explicit Assistance Data procedure. Successful Operation.

The SRNC shall initiate the procedure by sending an EXPLICIT ASSISTANCE DATA REQUEST message. When sending the EXPLICIT ASSISTANCE DATA REQUEST message, the SRNC shall start the T_{EAD} timer. This message contains an initial position estimate of the UE, a GPS-UTRAN time relationship uncertainty, and a list of the types of GPS assistance data being explicitly requested.

8.5.3 Unsuccessful Operation

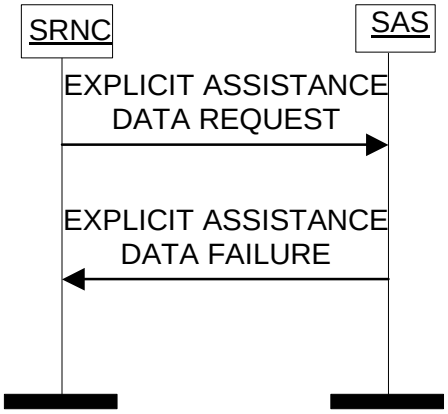

Figure 8 Explicit Assistance Data procedure. Unsuccessful Operation.

If the SAS is unable to perform the request for assistance data for any reason, it shall return an EXPLICIT ASSISTANCE DATA FAILURE message to the SRNC.

8.5.4 Abnormal Conditions

If the SRNC decides the assistance data is no longer needed for any reason it shall send an ABORT message to the SAS.

8.6 Broadcast Data

8.6.1 General

The purpose of the Broadcast Data procedure is to enable a CRNC to query a SAS for a specific set of GPS assistance data. The procedure uses connection oriented signalling.

8.6.2 Successful Operation

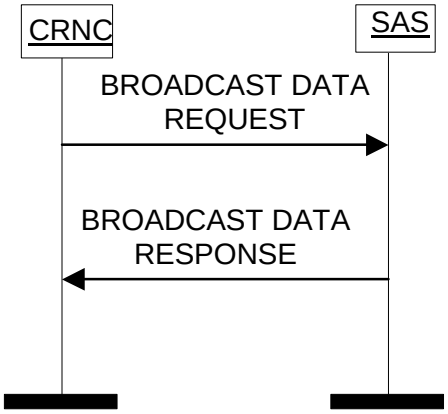

Figure 9 Broadcast Data procedure. Successful Operation.

The CRNC shall initiate the procedure by sending a BROADCAST DATA REQUEST message. When sending the BROADCAST DATA REQUEST message, the CRNC shall start the T_{BD} timer. This message contains data necessary for the SAS to provide the appropriate GPS broadcast data to the CRNC. Specifically it contains a reference position estimate, a GPS-UTRAN time relationship uncertainty, and a list of the types of GPS broadcast data being explicitly requested.

8.6.3 Unsuccessful Operation

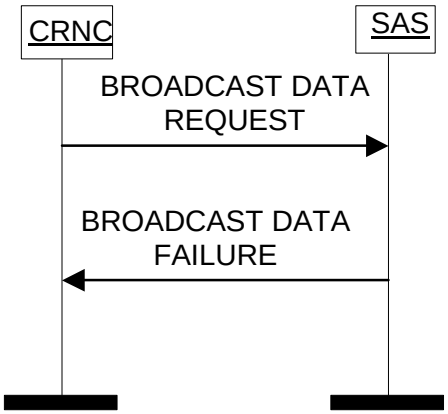

Figure 10 Broadcast Data procedure. Unsuccessful Operation

If the SAS is unable to perform the request for assistance data for any reason, it shall return an BROADCAST DATA FAILURE message to the CRNC.

8.6.4 Abnormal Conditions

If the CRNC decides the broadcast assistance data is no longer needed for any reason it shall send an ABORT message to the SAS.

8.7 Abort

8.7.1 General

The purpose of the Abort procedure is to cancel an ongoing procedure, either the Position Estimate procedure, the Implicit Assistance Data procedure, the Explicit Assistance Data procedure, or the Broadcast Data procedure. The procedure uses connection oriented signalling.

8.7.2 Successful Operation

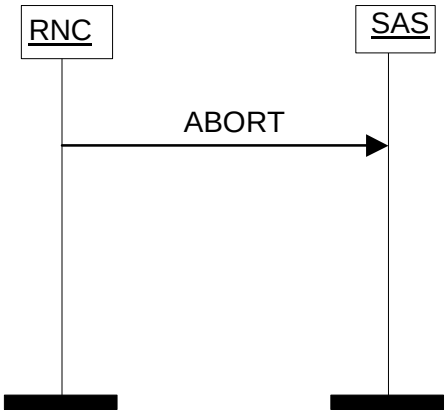

Figure 11: Abort procedure. Successful Operation.

In the event that a RNC wants to cancel an ongoing procedure it sends an ABORT message to the SAS. The SAS will immediately stop the referenced procedure.

8.8 Error Indication

8.8.1 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.

This procedure shall use the signalling bearer mode specified below.

8.8.2 Successful Operation

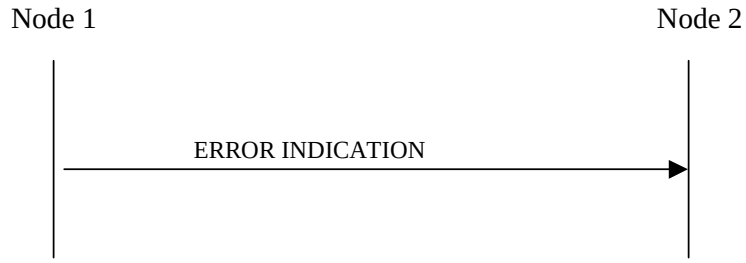

Figure 12: Error Indication procedure, Successful Operation

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. This message shall use the same mode of the signalling bearer and the same signalling bearer connection (if connection oriented) as the message that triggers the procedure.

Node 1 and Node 2 are the RNC and SAS, but there must be at least one of each network element. For example, if Node 1 is an RNC, then Node 2 is a SAS.

Typical cause values for the ERROR INDICATION message are:

Protocol Causes:

- Transfer Syntax Error
- Abstract Syntax Error (Reject)
- Abstract Syntax Error (Ignore and Notify)
- Message not Compatible with Receiver State
- Unspecified

9 Elements for PCAP Communication

9.1 Message Functional Definition and Content

9.1.1 General

Section 9.1 presents the contents of PCAP messages in tabular format. The corresponding ASN.1 definition is presented in section 9.3. In case there is contradiction between the tabular format in section 9.1 and the ASN.1 definition, the ASN.1 shall take precedence, except for the definition of conditions for the presence of conditional IEs, where the tabular format shall take precedence.

NOTE: The messages have been defined in accordance to the guidelines specified in UMTS 25.921.

9.1.2 Message Contents

9.1.2.1 Presence

All information elements in the message descriptions below are marked mandatory, optional or conditional according to the following table:

Table 1: Meaning of abbreviations used in PCAP messages

Abbreviation	Meaning
M	IE's marked as Mandatory (M) will always be included in the message.
O	IE's marked as Optional (O) may or may not be included in the message.
C	IE's marked as Conditional (C) will be included in a message only if the condition is satisfied. Otherwise the IE is not included.

9.1.2.2 Criticality

Each Information Element or Group of Information Elements may have a criticality information applied to it. Following cases are possible:

Table 3: Meaning of content within "Criticality" column

Abbreviation	Meaning
–	No criticality information is applied explicitly.
YES	Criticality information is applied. This is usable only for non-repeatable IEs
GLOBAL	The IE and all its repetitions together have one common criticality information. This is usable only for repeatable IEs.
EACH	Each repetition of the IE has its own criticality information. It is not allowed to assign different criticality values to the repetitions. This is usable only for repeatable IEs.

9.1.3 POSITION ESTIMATE REQUEST

Direction: SRNC → SAS.

Signalling bearer mode: Connection oriented.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.1.1		YES	reject
Transaction ID	M		9.2.1.2		-	
GPS-UTRAN Time Relationship Uncertainty	M		9.2.1.6		YES	reject
Initial UE Position Estimate	M		9.2.1.14		YES	reject
Method Type	M		9.2.1.4		YES	reject

9.1.4 POSITION ESTIMATE RESPONSE

Direction: SAS → SRNC.

Signalling bearer mode: Connection oriented.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.1.1		YES	reject
Transaction ID	M		9.2.1.2		-	
UE Position Estimate	C - ifUEAssisted		9.2.1.15		YES	ignore
Criticality Diagnostics	O		9.2.1.5		YES	ignore

Condition	Explanation
IfUEAssited	This IE is only present for UE assisted call flows.

9.1.5 POSITION ESTIMATE FAILURE

Direction: SAS → SRNC.

Signalling bearer mode: Connection oriented.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.1.1		YES	reject
Transaction ID	M		9.2.1.2		-	
Cause	M		9.2.1.3		YES	ignore
Criticality Diagnostics	O		9.2.1.5		YES	ignore

9.1.6 MEASUREMENT DATA REQUEST

Direction: SAS → SRNC.

Signalling bearer mode: Connection oriented.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.1.1		YES	reject
Transaction ID	M		9.2.1.2		-	
UP GPS Assistance Data	M		9.2.1.7		YES	reject

9.1.7 MEASUREMENT DATA RESPONSE

Direction: SRNC → SAS.

Signalling bearer mode: Connection oriented.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.1.1		YES	reject
Transaction ID	M		9.2.1.2		-	
UP GPS Measured Results	C - ifUEAssisted		9.2.1.8		YES	ignore
Criticality Diagnostics	O		9.2.1.5		YES	ignore

Condition	Explanation
IfUEAssited	This IE is only present for UE assisted call flows.

9.1.8 MEASUREMENT DATA FAILURE

Direction: SRNC → SAS.

Signalling bearer mode: Connection oriented.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.1.1		YES	reject
Transaction ID	M		9.2.1.2		-	
Cause	M		9.2.1.3		YES	ignore
Criticality Diagnostics	O		9.2.1.5		YES	ignore

9.1.9 IMPLICIT ASSISTANCE DATA REQUEST

Direction: SRNC → SAS.

Signalling bearer mode: Connection oriented.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.1.1		YES	reject
Transaction ID	M		9.2.1.2		-	
GPS-UTRAN Time Relationship Uncertainty	M		9.2.1.6		YES	reject
Initial UE Position Estimate	M		9.2.1.14		YES	reject

9.1.10 IMPLICIT ASSISTANCE DATA RESPONSE

Direction: SAS → SRNC.

Signalling bearer mode: Connection oriented.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.1.1		YES	reject
Transaction ID	M		9.2.1.2		-	
UP GPS Assistance Data	M		9.2.1.7		YES	ignore
Criticality Diagnostics	O		9.2.1.5		YES	ignore

9.1.11 IMPLICIT ASSISTANCE DATA FAILURE

Direction: SAS → SRNC.

Signalling bearer mode: Connection oriented.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.1.1		YES	reject
Transaction ID	M		9.2.1.2		-	
Cause	M		9.2.1.3		YES	ignore
Criticality Diagnostics	O		9.2.1.5		YES	ignore

9.1.12 EXPLICIT ASSISTANCE DATA REQUEST

Direction: SRNC → SAS.

Signalling bearer mode: Connection oriented.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.1.1		YES	reject
Transaction ID	M		9.2.1.2		-	
UP GPS Additional Assistance Data Request	M		9.2.1.9		YES	reject
GPS-UTRAN Time Relationship Uncertainty	M		9.2.1.6		YES	reject
Initial UE Position Estimate	M		9.2.1.14		YES	reject

9.1.13 EXPLICIT ASSISTANCE DATA RESPONSE

Direction: SAS → SRNC.

Signalling bearer mode: Connection oriented.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.1.1		YES	reject
Transaction ID	M		9.2.1.2		-	
UP GPS Assistance Data	M		9.2.1.7		YES	ignore
Criticality Diagnostics	O		9.2.1.5		YES	ignore

9.1.14 EXPLICIT ASSISTANCE DATA FAILURE

Direction: SAS → SRNC.

Signalling bearer mode: Connection oriented.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.1.1		YES	reject
Transaction ID	M		9.2.1.2		-	
Cause	M		9.2.1.3		YES	ignore
Criticality Diagnostics	O		9.2.1.5		YES	ignore

9.1.15 BROADCAST DATA REQUEST

Direction: CRNC → SAS.

Signalling bearer mode: Connection oriented.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.1.1		YES	reject
Transaction ID	M		9.2.1.2		-	
UP GPS SIBs Indicator	M		9.2.1.13		YES	reject
GPS-UTRAN Time Relationship Uncertainty	M		9.2.1.6		YES	reject
Reference Position Estimate	M		9.2.1.14		YES	reject

9.1.16 BROADCAST DATA RESPONSE

Direction: SAS → CRNC.

Signalling bearer mode: Connection oriented.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.1.1		YES	reject
Transaction ID	M		9.2.1.2		-	
SIB 15.1	O		9.2.1.10		YES	Ignore
SIB 15.2	O		9.2.1.11		YES	Ignore
SIB 15.3	O		9.2.1.12		YES	Ignore
Criticality Diagnostics	O		9.2.1.5		YES	ignore

9.1.17 BROADCAST DATA FAILURE

Direction: SAS → CRNC.

Signalling bearer mode: Connection oriented.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.1.1		YES	reject
Transaction ID	M		9.2.1.2		-	
Cause	M		9.2.1.3		YES	ignore
Criticality Diagnostics	O		9.2.1.5		YES	ignore

9.1.18 ABORT

Direction: RNC → SAS.

Signalling bearer mode: Connection oriented.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.1.1		YES	ignore
Transaction ID	M		9.2.1.2		-	
Cause	M		9.2.1.3		YES	ignore

9.1.19 ERROR INDICATION

Direction: RNC ↔ SAS.

Signalling bearer mode: Connection oriented.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.1.1		YES	ignore
Transaction ID	M		9.2.1.2		-	
Cause	C_ifalone		9.2.1.3		YES	ignore
Criticality Diagnostics	C_ifalone		9.2.1.5		YES	ignore

Condition	Explanation
C_ifalone	At least either the Cause IE or the Criticality Diagnostics IE shall be present.

9.2 Information Element Functional Definitions and Contents

9.2.0 General

Section 9.2 presents the PCAP IE definitions in tabular format. The corresponding ASN.1 definition is presented in section 9.3. In case there is contradiction between the tabular format in section 9.2 and the ASN.1 definition, the ASN.1 shall take precedence, except for the definition of conditions for the presence of conditional elements, where the tabular format shall take precedence.

9.2.1 Radio Network Layer Related IEs

9.2.1.1 Message Type

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
Message Type				Assumed max no of messages is 256.
>Procedure Code	M		ENUMERATED (Position Estimate, Measurement Data, Implicit Assistance Data, Explicit Assistance Data, Broadcast Data, Abort, Error Indication)	
>Type of Message	M		ENUMERATED (Initiating Message, Successful Outcome, Unsuccessful Outcome, Outcome)	

9.2.1.2 Transaction ID

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

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

The 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
Transaction ID			INTEGER (0..32767)	

9.2.1.3 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*				
>Radio Network Layer				
>>Radio Network Layer Cause	M		ENUMERATED (invalid reference information, undefined UE error, request denied by UE, UE timeout, assistance data not available, ...)	
>Transport Layer				
>>Transport Layer Cause	M		ENUMERATED (Transport Resource Unavailable, Unspecified, ...)	
>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				
>>Misc Cause	M		ENUMERATED (Control Processing Overload, Hardware Failure, O&M Intervention, Not enough User Plane Processing Resources, Unspecified ...)	

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

Radio Network Layer cause	Meaning
Invalid reference information	The reference information provided by the RNC are invalid
Undefined UE error	The Measurement Data cannot be returned to SAS due to undefined UE error
Request denied by UE	The Measurement Data cannot be returned to SAS due to request being rejected by UE
UE timeout	The Measurement Data cannot be returned to SAS due to UE timeout
Assistance data not available	The Assistance Data requested by RNC is not available

Transport Network Layer cause	Meaning
Transport resource unavailable	The required transport resources are not available

Unspecified	Sent when none of the above cause values applies but still the cause is Transport Network Layer related

Protocol cause	Meaning
Abstract Syntax Error (Reject)	The received message included an abstract syntax error and the concerning criticality indicated "reject" (see subclause 10.3)
Abstract Syntax Error (Ignore and Notify)	The received message included an abstract syntax error and the concerning criticality indicated "ignore and notify" (see subclause 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 subclause 10.3)
Message not Compatible with Receiver State	The received message was not compatible with the receiver state (see subclause 10.4)
Semantic Error	The received message included a semantic error (see subclause 10.4)
Transfer Syntax Error	The received message included a transfer syntax error (see section 10.2)
Unspecified	Sent when none of the above cause values applies but still the cause is Protocol related

Miscellaneous cause	Meaning
Control Processing Overload	DRNS control processing overload
Hardware Failure	DRNS hardware failure
Not enough User Plane Processing Resources	DRNS has insufficient user plane processing resources available
O&M Intervention	Operation and Maintenance intervention related to DRNS equipment
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.

9.2.1.4 Method Type

The Method Type specifies the preferences between UE assisted and UE based operation or that only UE assisted operation is supported.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
Method Type			ENUMERATED (UE_Assisted , UE_Assisted preferred but UE_Based allowed, UE_Based preferred but UE_Asssited allowed.)	

9.2.1.5 Criticality Diagnostics

IE/Group Name	Presence	Range	IE type and reference	Semantics description
Criticality Diagnostics				
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 operation that caused the error
Triggering Message	O		ENUMERATED(initiating message, successful outcome, unsuccessful outcome, outcome)	The Triggering Message is used only if the Criticality diagnostics is part of Error Indication procedure except when the procedure code is not understood.
Criticality Response	O		ENUMERATED(reject, ignore, notify)	This Criticality response IE is used for reporting the Criticality of the Triggering message
Information Element Criticality Diagnostics		0 to <maxnoof errors>		
>Criticality Response	M		ENUMERATED(reject, ignore, notify)	The Criticality response IE 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
>Repetition Number	O		INTEGER (1..256)	The repetition number of the not understood IE if applicable

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

9.2.1.6 GPS-UTRAN Time Relationship Uncertainty

Information Element/Group name	Need	Multi	Type and Reference	Semantics description
GPS-UTRAN Time Relationship Uncertainty	MP		ENUMERATED (10ns, 20ns, 40ns, 80ns, 100ns, 200ns, 400ns, 800ns, 1us, 2us, 4us, 8us, 10us, 20us, 40us, 80us, 100us, 200us, 400us, 800us, 1ms, 2ms, 4ms, 8ms, 10ms, 20ms, 40ms, 80ms, 100ms, 200ms, 400ms, 800ms, 1sec, 2sec, 4sec, 8sec, unknown)	SRNC estimate of uncertainty in GPS-UTRAN time relationship

9.2.1.7 UP GPS assistance data

This element contains a single GPS assistance message that supports both UE-assisted and UE-based GPS methods.

Information Element/Group name	Need	Multi	Type and Reference	Semantics description
UP GPS reference time	OP		UP GPS reference time 10.3.7.96	(Note 1)
UP GPS reference position	OP		9.2.1.14	Ellipsoid point with altitude and uncertainty ellipsoid
UP GPS DGPS corrections	OP		UP GPS DGPS corrections 10.3.7.91	(Note 1)
UP GPS navigation model	OP		UP GPS navigation model 10.3.7.94	(Note 1)
UP GPS ionospheric model	OP		UP GPS ionospheric model 10.3.7.92	(Note 1)
UP GPS UTC model	OP		UP GPS UTC model 10.3.7.97	(Note 1)
UP GPS almanac	OP		UP GPS almanac 10.3.7.89	(Note 1)
UP GPS acquisition assistance	OP		UP GPS acquisition assistance 10.3.7.88	(Note 1)
UP GPS real-time integrity	OP		UP GPS real-time integrity 10.3.7.95	(Note 1)

Note 1: The “Type and Reference” column entry in this table corresponds to a section number of TS 25.331 V3.5.0.

9.2.1.8 UP GPS measured results

The purpose of this information element is to provide reported GPS measurement information from the SRNC to the SAS.

Information Element/Group name	Need	Multi	Type and Reference	Semantics description
Reference SFN	OP		Integer(0..4095)	The SFN for which the location is valid
GPS TOW msec	MP		Integer(0..6.048*10^8-1)	GPS Time of Week in milliseconds (rounded down to the nearest millisecond unit). This time is the GPS TOW measured by the UE. If the Reference SFN field is present it is the ms flank closest to the beginning of that frame. GPS Time of Week in microseconds = 1000 * GPS TOW msec + GPS TOW rem usec
GPS TOW rem usec	CV-capability and request		Integer(0..999)	GPS Time of Week in microseconds MOD 1000.
Measurement Parameters	MP	1 to <maxSat>		
>Satellite ID	MP		Enumerated(0..63)	
>C/N_o	MP		Integer(0..63)	the estimate of the carrier-to-noise ratio of the received signal from the particular satellite used in the measurement. It is given in whole dBs. Typical levels observed by UE-based GPS units will be in the range of 20 – 50 dB.
>Doppler	MP		Integer(-32768..32768)	Hz, scale factor 0.2.
>Whole GPS Chips	MP		Integer(0..1023)	Unit in GPS chips
>Fractional GPS Chips	MP		Integer(0..(2^{10}-1))	Scale factor 2^{-10}
>Multipath Indicator	MP		Enumerated(NM, low, medium, high)	See note 1
>Pseudorange RMS Error	MP		Enumerated(range index 0..range index 63)	See note 2

Condition	Explanation
Capability and request	This field is included only if the UE has this capability *and* if it was requested in the UP reporting quantity

NOTE 1: The following table gives the mapping of the multipath indicator field.

Value	Multipath Indication
NM	Not measured
Low	MP error < 5m
Medium	5m < MP error < 43m
High	MP error > 43m

NOTE 2: The following table gives the bitmapping of the Pseudorange RMS Error field.

Range Index	Mantissa	Exponent	Floating-Point value, x_i	Pseudorange value, P
0	000	000	0.5	P < 0.5
1	001	000	0.5625	0.5 <= P < 0.5625
I	X	Y	$0.5 * (1 + x/8) * 2^y$	x_{i-1} <= P < x_i
62	110	111	112	104 <= P < 112
63	111	111	--	112 <= P

9.2.1.9 UP GPS Additional Assistance Data Request

Information Element/Group name	Need	Multi	Type and Reference	Semantics description
Almanac	MP		Boolean	TRUE means requested
UTC Model	MP		Boolean	TRUE means requested
Ionospheric model	MP		Boolean	TRUE means requested
Navigation Model	MP		Boolean	TRUE means requested
DGPS Corrections	MP		Boolean	TRUE means requested
Reference Location	MP		Boolean	TRUE means requested
Reference Time	MP		Boolean	TRUE means requested
Acquisition Assistance	MP		Boolean	TRUE means requested
Real-Time Integrity	MP		Boolean	TRUE means requested
Navigation Model Additional data	CV-*Navigation Model*			this IE is present only if "Navigation Model" is set to TRUE otherwise it is absent
>GPS Week	MP		Integer (0..1023)	
>GPS_Toe	MP		Integer (0..167)	GPS time of ephemeris in hours of the latest ephemeris set contained by the UE
>T-Toe limit	MP		Integer (0..10)	ephemeris age tolerance of the UE to UTRAN in hours
>Satellite related data	MP	0 to <NSAT>		
>>SatID	MP		Integer (0..63)	
>>IODE	MP		Integer (0..239)	Issue of Data Ephemeris for SatID

9.2.1.10 System Information Block type 15.1

Information Element/Group name	Need	Multi	Type and Reference	Semantics description
UTRAN Time Flag	MP		Bitstring(1)	
Node B Clock Drift Flag	MP		Bitstring(1)	
Node B Clock Drift	OP		Real(-0.1..0.1 by a proper step)	This IE provides an estimate of the drift rate of the Node B clock relative to GPS time. It has units of μsec/sec (ppm) and a range of ±0.1. This IE aids the UE in maintaining the relation between GPS and cell timing over a period of time. A positive value for Node B Clock Drift indicates that the Node B clock is running at a greater frequency than desired.
Reference Location	MP		As defined in TS23.032	Provides a prior knowledge of the approximate location of the UE
SFN	OP		Integer(0..4095)	The SFN that occurs at the Reference GPS TOW time
Reference GPS TOW	MP		Integer(0..6.047*10^{11})	GPS Time of Week with scaling factor of 1 usec. This field time-stamps the start of the frame with SFN=0.
Status/Health	MP		Enumerated(UDRE scale 1.0, UDRE scale 0.75, UDRE scale 0.5, UDRE scale 0.3, UDRE scale 0.2, UDRE scale 0.1, no data, invalid data)	This field indicates the status of the differential corrections.
DPGS information	CV-Status	1..<maxSat>		The following fields contain the DPGS corrections. If the Cipher information is included these fields are ciphered.
>SatID	MP		Enumerated (0…63)	The satellite ID number.
>IODE	MP		Integer(0..255)	This IE is the sequence number for the ephemeris for the particular satellite. The MS can use this IE to determine if new ephemeris is used for calculating the corrections that are provided in the broadcast message. This eight-bit IE is incremented for each new set of ephemeris for the satellite and may occupy the numerical range of [0, 239] during normal operations.
>UDRE	MP		Enumerated(UDRE ≤ 1.0 m, 1.0m < UDRE ≤ 4.0m, 4.0m <	User Differential Range Error. This field provides an estimate of the uncertainty (1-σ) in the corrections for the particular satellite. The value in this field shall be multiplied by the UDRE Scale Factor in the

Information Element/Group name	Need	Multi	Type and Reference	Semantics description
			UDRE ≤ 8.0m, 8.0m < UDRE)	Status field to determine the final UDRE estimate for the particular satellite.
>PRC	MP		Integer(-2047..2047)	Scaling factor 0.32 meters (different from [13])
>RRC	MP		Integer(-127..127)	Scaling factor 0.032 meters/sec (different from [13])
>Delta PRC2	MP		Integer(-127..127)	The difference in the pseudorange correction between the satellite's ephemeris identified by IODE and the previous ephemeris two issues ago IODE –2.
>Delta RRC2	MP		Integer(-7..7)	The difference in the pseudorange rate-of-change correction between the satellite's ephemeris identified by IODE and IODE-2.

Condition	Explanation
Status/Health	This IE is mandatory if "status" is not equal to "no data" or "invalid data", otherwise the IE is not needed

9.2.1.11 System Information Block type 15.2

Information Element/Group name	Need	Multi	Type and Reference	Semantics description
Transmission TOW	MP		Enumerated(0. 1048575)	The approximate GPS time-of-week when the message is broadcast
SatID	MP		Enumerated(0..63)	Satellite ID
TLM Message	MP		Bit string(14)	
TLM Revd (C)	MP		Bit string(2)	
HOW	MP		Bit string(22)	
WN	MP		Bit string(10)	
C/A or P on L2	MP		Bit string(2)	
URA Index	MP		Bit string(4)	
SV Health	MP		Bit string(6)	
IODC	MP		Bit string($10^{(1)}$)	
L2 P Data Flag	MP		Bit string(1)	
SF 1 Reserved	MP		Bit string(87)	
T_{GD}	MP		Bit string(8)	
t_{oc}	MP		Bit string($16^{(1)}$)	
af_2	MP		Bit string(8)	
af_1	MP		Bit string(16)	
af_0	MP		Bit string(22)	
C_{rs}	MP		Bit string(16)	
Δn	MP		Bit string(16)	
M_0	MP		Bit string(32)	
C_{uc}	MP		Bit string(16)	
e	MP		Bit string($32^{(1)}$)	
C_{us}	MP		Bit string(16)	
$(A)^{1/2}$	MP		Bit string($32^{(1)}$)	
t_{oe}	MP		Bit string($16^{(1)}$)	
Fit Interval Flag	MP		Bit string(1)	
AODO	MP		Bit string(5)	
C_{ic}	MP		Bit string(16)	
$OMEGA_0$	MP		Bit string(32)	
C_{is}	MP		Bit string(16)	
i_0	MP		Bit string(32)	
C_{rc}	MP		Bit string(16)	
ω	MP		Bit string(32)	
OMEGAdot	MP		Bit string(24)	
Idot	MP		Bit string(14)	
Spare/zero fill	MP		Bit string(20)	

9.2.1.12 System Information Block type 15.3

Information Element/Group name	Need	Multi	Type and Reference	Semantics description
Transmission TOW	MP		Enumerated(0. 1048575)	The approximate GPS time-of-week when the message is broadcast
SatMask	MP		Bitstring(1..32)	indicates the satellites that contain the pages being broadcast in this data set
LSB TOW	MP		Bit string(8)	
GPS Info	MP	1 to <Max_Dat_rep>		
>SFIO 0	MP		Bit string(1)	Each repetition corresponds to a different page no. as described in the table below
>Data ID	MP		Bit string(2)	
>Page No.	MP		Bit string(6)	
>Word 3	MP		Bit string(16)	
>Word 4	MP		Bit string(24)	
>Word 5	MP		Bit string(24)	
>Word 6	MP		Bit string(24)	
>Word 7	MP		Bit string(24)	
>Word 8	MP		Bit string(24)	
>Word 9	MP		Bit string(24)	
>Word 10	MP		Bit string(22)	
Spare/zero fill	MP		Bit string(5)	

Mapping of Almanac, Health, Iono, and UTC Data to Subframe Number and Page Number

Data Type	Subframe	Page(s)
Almanac Data (SV1 – 24)	5	1 - 24
Almanac Data (SV25 – 32)	4	2, 3, 4, 5, 7, 8, 9, 10
SV Health (SV1 – 24)	5	25
SV Health (SV25 – 32)	4	25
Iono/UTC Corrections	4	18

Multi Bound	Explanation
Max_Dat_rep	Maximum number of repeats=3

9.2.1.13 UP GPS SIBs Indicator

Information Element/Group name	Need	Multi	Type and Reference	Semantics description
UP GPS SIBs Indicator	MP		Bitstring (3)	This IE is a bitmap indicating which SIBs are being requested. '000' is reserved '001' means SIB15.1 requested '010' means SIB15.2 requested … '111' means all requested

9.2.1.14 Ellipsoid point with Altitude and uncertainty ellipsoid

This IE contains the description of an ellipsoid point with altitude and uncertainty ellipsoid as in [23.032].

Information Element/Group name	Need	Multi	Type and Reference	Semantics description
Latitude sign	MP		Enumerated (North, South)	
Degrees Of Latitude	MP		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 degree (0°.. 90°)
Degrees Of Longitude	MP		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 degree (-180°..+180°)
Altitude Direction	MP		Enumerated (Height, Depth)	
Altitude	MP		Integer ($0..2^{15}-1$)	The IE value (*N*) is derived by this formula: $N \leq a < N+1$ *a* being the altitude in metres
Uncertainty semi-major	MP		Integer (0...127)	The uncertainty *r* is derived from the "uncertainty code" *k* by $r = 10x(1.1^k-1)$
Uncertainty semi-minor	MP		Integer (0...127)	The uncertainty *r* is derived from the "uncertainty code" *k* by $r = 10x(1.1^k-1)$
Orientation of major axis	MP		Integer (0..179 by step of 2)	The IE value (*N*) is derived by this formula: $N \leq a / 2 < N+1$ *a* being the orientation in degree (0°.. 360°)
Uncertainty Altitude	MP		Integer(0..127)	The uncertainty in altitude, h, expressed in metres is mapped from the IE value (*K*), with the following formula: $h = C\left((1+x)^K - 1\right)$ with $C = 45$ and $x = 0.025$.
Confidence	MP		Integer (0..100)	in percentage

9.2.1.15 UE Position Estimate

This IE contains the description of the position estimate of the UE as described in 25.331.

Information Element/Group name	Need	Multi	Type and Reference	Semantics description
Reference SFN	OP		Integer(0..4095)	The SFN for which the location is valid
GPS TOW msec	MP		Integer(0..6.048*10^8-1)	GPS Time of Week in milliseconds (rounded down to the nearest millisecond unit). This time is the GPS TOW measured by the UE. If the Reference SFN field is present it is the ms flank closest to the beginning of that frame. GPS Time of Week in microseconds = 1000 * GPS TOW msec + GPS TOW rem usec
GPS TOW rem usec	MP		Integer(0..999)	GPS Time of Week in microseconds MOD 1000.
Position Estimate	MP		9.2.1.14	Ellipsoid point with altitude and uncertainty ellipsoid

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

9.3.0 General

PCAP ASN.1 definition conforms with [5], [6], and [7].

The ASN.1 definition specifies the structure and content of PCAP messages. PCAP 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 a PCAP 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 needed 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 where 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 a PCAP 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 section 10.3.6.

Section 9.3 presents the Abstract Syntax of PCAP protocol with ASN.1. In case there is contradiction between the ASN.1 definition in this section and the tabular format in sections 9.1 and 9.2, the ASN.1 shall take precedence, except for the definition of conditions for the presence of conditional elements, where the tabular format shall take precedence.

9.3.1 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 interoperability;
- 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.

9.3.2 Elementary Procedure Definitions

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

PCAP-PDU-Descriptions  {
itu-t (0) identified-organization (4) etsi (0) mobileDomain (0)
umts-Access (20) modules (3) pcap("value to be assigned") version1 (1) pcap-PDU-Descriptions (0)}

DEFINITIONS AUTOMATIC TAGS ::=

BEGIN

IMPORTS
    PositionEstimateRequest,
    PositionEstimateResponse,
    PositionEstimateFailure,
    MeasurementDataRequest,
    MeasurementDataResponse,
    MeasurementDataFailure,
    ImplicitAssistanceDataRequest,
    ImplicitAssistanceDataResponse,
    ImplicitAssistanceDataFailure,
    ExplicitAssistanceDataRequest,
    ExplicitAssistanceDataResponse,
    ExplicitAssistanceDataFailure,
    BroadcastDataRequest,
    BroadcastDataResponse,
    BroadcastDataFailure,
    Abort,
    ErrorIndication
FROM PCAP-PDU-Contents;


-- **************************************************************
--
-- Interface PDU definitions
--
-- **************************************************************

PCAP-PDU ::= CHOICE {
    initiatingMessage       InitiatingMessage,
    successfulOutcome       SuccessfulOutcome,
    unsuccessfulOutcome     UnsuccessfulOutcome,
    outcome                 Outcome,
    ...
}

InitiatingMessage ::= CHOICE {
    positionEstimateReq     PositionEstimateRequest,
    measurementDataReq      MeasurementDataRequest,
    implAssistanceDataReq   ImplicitAssistanceDataRequest,
    explAssistanceDataReq   ExplicitAssistanceDataRequest,
    broadcastDataReq        BroadcastDataRequest,
    abort                   Abort,
    errorIndication         ErrorIndication,
    ...
}

SuccessfulOutcome ::= CHOICE {
    positionEstimateResp    PositionEstimateResponse,
    measurementDataResp     MeasurementDataResponse,
    implAssistanceDataResp  ImplicitAssistanceDataResponse,
    explAssistanceDataResp  ExplicitAssistanceDataResponse,
    broadcastDataReq        BroadcastDataResponse,
    ...
}

UnsuccessfulOutcome ::= CHOICE {
```

```
    positionEstimateFail    PositionEstimateFailure,
    measurementDataFail     MeasurementDataFailure,
    implAssistanceDataFail  ImplicitAssistanceDataFailure,
    explAssistanceDataFail  ExplicitAssistanceDataFailure,
    broadcastDataFail       BroadcastDataFailure,
    ...
}

Outcome ::= CHOICE {
    default                 NULL,
    ...
}

END


-- **************************************************************
--
-- PDU definitions for PCAP.
--
-- **************************************************************

PCAP-PDU-Contents {
itu-t (0) identified-organization (4) etsi (0) mobileDomain (0)
umts-Access (20) modules (3) pcap("value to be assigned") version1 (1) pcap-PDU-Contents (1) }

DEFINITIONS AUTOMATIC TAGS ::=

BEGIN

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

IMPORTS
    Cause,
    CriticalityDiagnostics,
    GPS-UTRAN-TimeRelationshipUncertainty,
    MethodType,
    SysInfoType15-1,
    SysInfoType15-2,
    SysInfoType15-3,
    TransactionID,
    UPAP-EllipsoidPointwAlt&Uncertainty,
    UPAP-PositionEstimate,
    UP-GPS-AdditionalAssistanceDataRequest,
    UP-GPS-AssistanceData,
    UP-GPS-Measurement,
    UP-GPS-SIBsIndicator
FROM PCAP-IEs;


-- **************************************************************
--
-- Position Estimate Request
--
-- **************************************************************

PositionEstimateRequest ::= SEQUENCE {
    transactionID           TransactionID,
    initialUEpositionEst    UPAP-PositionEstimate,
    gps-UTRAN-TRU           GPS-UTRAN-TimeRelationshipUncertainty,
    methodType              MethodType,
    ...
}

-- **************************************************************
--
-- Position Estimate Response
--
-- **************************************************************

PositionEstimateResponse ::= SEQUENCE {
    transactionID           TransactionID,
    uePositionEst           UPAP-PositionEstimate   OPTIONAL,
    criticalityDiag         CriticalityDiagnostics  OPTIONAL,
```

```
    ...
}

-- **********************************************************
--
-- Position Estimate Failure
--
-- **********************************************************

PositionEstimateFailure ::= SEQUENCE {
    transactionID           TransactionID,
    cause                   Cause,
    criticalityDiag         CriticalityDiagnostics  OPTIONAL,
    ...
}


-- **********************************************************
--
-- Measure Data Request
--
-- **********************************************************

MeasureDataRequest ::= SEQUENCE {
    transactionID           TransactionID,
    up-GPS-AssistData       UP-GPS-AssistanceData,
    ...
}

-- **********************************************************
--
-- Measure Data Response
--
-- **********************************************************

MeasureDataResponse ::= SEQUENCE {
    transactionID           TransactionID,
    up-GPS-Measurement      UP-GPS-Measurement  OPTIONAL,
    criticalityDiag         CriticalityDiagnostics  OPTIONAL,
    ...
}

-- **********************************************************
--
-- Measure Data Failure
--
-- **********************************************************

MeasureDataFailure ::= SEQUENCE {
    transactionID           TransactionID,
    cause                   Cause,
    criticalityDiag         CriticalityDiagnostics  OPTIONAL,
    ...
}


-- **********************************************************
--
-- Implicit Assistance Data Request
--
-- **********************************************************

ImplicitAssistanceDataRequest ::= SEQUENCE {
    transactionID           TransactionID,
    initialUEpositionEst    UPAP-PositionEstimate,
    gps-UTRAN-TRU           GPS-UTRAN-TimeRelationshipUncertainty,
    ...
}

-- **********************************************************
--
-- Implicit Assistance Data Response
--
-- **********************************************************

ImplicitAssistanceDataResponse ::= SEQUENCE {
    transactionID           TransactionID,
    up-GPS-AssistData       UP-GPS-AssistanceData,
```

```
    criticalityDiag         CriticalityDiagnostics  OPTIONAL,
    ...
}

-- **************************************************************
--
-- Implicit Assistance Data Failure
--
-- **************************************************************

ImplicitAssistanceDataFailure ::= SEQUENCE {
    transactionID           TransactionID,
    cause                   Cause,
    criticalityDiag         CriticalityDiagnostics  OPTIONAL,
    ...
}


-- **************************************************************
--
-- Explicit Assistance Data Request
--
-- **************************************************************

ExplicitAssistanceDataRequest ::= SEQUENCE {
    transactionID               TransactionID,
    up-GPS-AddAssistDataReq     UP-GPS-AdditionalAssistanceDataRequest,
    initialUEpositionEst        UPAP-PositionEstimate,
    gps-UTRAN-TRU               GPS-UTRAN-TimeRelationshipUncertainty,
    ...
}

-- **************************************************************
--
-- Explicit Assistance Data Response
--
-- **************************************************************

ExplicitAssistanceDataResponse ::= SEQUENCE {
    transactionID           TransactionID,
    up-GPS-AssistData       UP-GPS-AssistanceData,
    criticalityDiag         CriticalityDiagnostics  OPTIONAL,
    ...
}

-- **************************************************************
--
-- Explicit Assistance Data Failure
--
-- **************************************************************

ExplicitAssistanceDataFailure ::= SEQUENCE {
    transactionID           TransactionID,
    cause                   Cause,
    criticalityDiag         CriticalityDiagnostics  OPTIONAL,
    ...
}


-- **************************************************************
--
-- Broadcast Data Request
--
-- **************************************************************

BroadcastDataRequest ::= SEQUENCE {
    transactionID           TransactionID,
    up-GPS-SIBsIndicator    UP-GPS-SIBsIndicator,
    refPositionEst          UPAP-PositionEstimate,
    gps-UTRAN-TRU           GPS-UTRAN-TimeRelationshipUncertainty,
    ...
}

-- **************************************************************
--
-- Broadcast Data Response
--
-- **************************************************************
```

```
BroadcastDataResponse ::= SEQUENCE {
    transactionID           TransactionID,
    sib15-1                 SysInfoType15-1         OPTIONAL,
    sib15-2                 SysInfoType15-2         OPTIONAL,
    sib15-3                 SysInfoType15-3         OPTIONAL,
    criticalityDiag         CriticalityDiagnostics  OPTIONAL,
    ...
}

-- **************************************************************
--
-- Broadcast Data Failure
--
-- **************************************************************

BroadcastDataFailure ::= SEQUENCE {
    transactionID           TransactionID,
    cause                   Cause,
    criticalityDiag         CriticalityDiagnostics  OPTIONAL,
    ...
}


-- **************************************************************
--
-- Abort
--
-- **************************************************************

Abort ::= SEQUENCE {
    transactionID           TransactionID,
    cause                   Cause,
    ...
}


-- **************************************************************
--
-- Error Indication
--
-- **************************************************************

ErrorIndication ::= SEQUENCE {
    transactionID           TransactionID,
    cause                   Cause                   OPTIONAL,
    criticalityDiag         CriticalityDiagnostics  OPTIONAL,
    ...
}

END



PCAP-IEs {
itu-t (0) identified-organization (4) etsi (0) mobileDomain (0)
umts-Access (20) modules (3) pcap("value to be assigned") version1 (1) pcap-IEs (2) }

DEFINITIONS AUTOMATIC TAGS ::=

BEGIN

-- **************************************************************
--
-- Cause: Definitions from 25.433, except new CauseRadioNetwork
--
-- **************************************************************

Cause ::= CHOICE {
    radioNetwork            CauseRadioNetwork,
    transport               CauseTransport,
    protocol                CauseProtocol,
    misc                    CauseMisc,
    ...
}
CauseRadioNetwork ::= ENUMERATED {
    invalid-reference-information,
    undefined-UE-error,
```

```
    request-denied-by-UE,
    ue-timeout,
    assistance-data-not-available,
    ...
}

CauseTransport ::= ENUMERATED {
    transport-resource-unavailable,
    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,
    ...
}


CauseMisc ::= ENUMERATED {
    control-processing-overload,
    hardware-failure,
    oam-intervention,
    not-enough-user-plane-processing-resources,
    unspecified,
    ...
}


-- **************************************************************
--
-- CriticalityDiagnostics: Definitions from 25.413
-- However, it is not complete and requires more work....
--
-- **************************************************************

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

ProcedureCode       ::= INTEGER (0..255)

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

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

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

ProtocolIE-ID ::= INTEGER (0..65535)

RepetitionNumber ::= INTEGER (1..256)

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

ProtocolExtensionField {RANAP-PROTOCOL-EXTENSION : ExtensionSetParam} ::= SEQUENCE {
    id                  RANAP-PROTOCOL-EXTENSION.&id            ({ExtensionSetParam}),
```

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

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

-- other definitions related to CriticalityDiagnostics shall be provided in a future
-- revision of this document


-- **************************************************************
--
-- GPS-UTRAN-TimeRelationshipUncertainty: New
-- (nsec=nanosecond, usec=microsecond, msec=millisecond, sec=second)
--
-- **************************************************************

GPS-UTRAN-TimeRelationshipUncertainty ::=   ENUMERATED {
                                                nsec-10,
                                                nsec-20,
                                                nsec-40,
                                                nsec-80,
                                                nsec-100,
                                                nsec-200,
                                                nsec-400,
                                                nsec-800,
                                                usec-1,
                                                usec-2,
                                                usec-4,
                                                usec-8,
                                                usec-10,
                                                usec-20,
                                                usec-40,
                                                usec-80,
                                                usec-100,
                                                usec-200,
                                                usec-400,
                                                usec-800,
                                                msec-1,
                                                msec-2,
                                                msec-4,
                                                msec-8,
                                                msec-10,
                                                msec-20,
                                                msec-40,
                                                msec-80,
                                                msec-100,
                                                msec-200,
                                                msec-400,
                                                msec-800,
                                                sec-1,
                                                sec-2,
                                                sec-4,
                                                sec-8,
                                                sec-10,
                                                unknown }


-- **************************************************************
--
-- MethodType: New
--
-- **************************************************************

MethodType ::= ENUMERATED {
    ue-assisted,
    ue-assisted-preferred-but-ue-based-allowed,
    ue-based-preferred-but-ue-assisted-allowed
}



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

```
--
-- SysInfoType15-1: Definitions from 25.331 v3.5.0
--                  (may require revision based on 25.331 CRs)
--                  Also, NodeB-ClockDrift definition changed
--
-- ************************************************************

SysInfoType15-1 ::=                 SEQUENCE {
    -- DGPS corrections
        up-DGPS-SIB-Data                UP-DGPS-SIB-Data
}


UP-DGPS-SIB-Data ::=                SEQUENCE {
    nodeBClockDrift                     NodeB-ClockDrift                    OPTIONAL,
    referenceLocationforSIB             ReferenceLocationforSIB,
    referenceSFN                        ReferenceSFN                        OPTIONAL,
    referenceGPS-TOW                    GPS-TOW-1usec,
    statusHealth                        DiffCorrectionStatus,
    dgps-InformationList                DGPS-InformationList
}

NodeB-ClockDrift ::=                    INTEGER (0..16)

-- As defined in 23.032 (2D with 24bits for each coordinate)
ReferenceLocationforSIB ::=         SEQUENCE {
    ellipsoidPoint                      EllipsoidPoint
}

EllipsoidPoint ::=                      OCTET STRING (SIZE (7))

ReferenceSFN ::=                        INTEGER (0..4095)

GPS-TOW-1usec ::=                   SEQUENCE {
    tow-1msec                           GPS-TOW-1msec,
    tow-rem-usec                        GPS-TOW-rem-usec
}

GPS-TOW-1msec ::=                       INTEGER (0..604799999)

GPS-TOW-rem-usec ::=                    INTEGER (0..999)


-- ************************************************************
--
-- SysInfoType15-2: Definitions from 25.331 v3.5.0
--                  (may require revision based on 25.331 CRs)
--                  Also, NodeB-ClockDrift definition changed
--
-- ************************************************************

SysInfoType15-2 ::=                 SEQUENCE {
-- Ephemeris and clock corrections
    up-Ephe-SIB-Data                    UP-Ephe-SIB-Data
}

UP-Ephe-SIB-Data ::=                SEQUENCE {
    transmissionTOW                     INTEGER (0..1048575),
    satID                               SatID,
    tlmMessage                          BIT STRING (SIZE (14)),
    tlmRevd                             BIT STRING (SIZE (2)),
    how                                 BIT STRING (SIZE (22)),
    wn                                  BIT STRING (SIZE (10)),
    navModel                            NavModel
}

SatID ::=                               INTEGER (0..63)

NavModel ::=                        SEQUENCE {
    codeOnL2                            BIT STRING (SIZE (2)),
    uraIndex                            BIT STRING (SIZE (4)),
    satHealth                           BIT STRING (SIZE (6)),
    iodc                                BIT STRING (SIZE (10)),
    l2Pflag                             BIT STRING (SIZE (1)),
    sf1Revd                             SubFrame1Reserved,
    t-GD                                BIT STRING (SIZE (8)),
    t-oc                                BIT STRING (SIZE (16)),
    af2                                 BIT STRING (SIZE (8)),
```

```
    af1                                 BIT STRING (SIZE (16)),
    af0                                 BIT STRING (SIZE (22)),
    c-rs                                BIT STRING (SIZE (16)),
    delta-n                             BIT STRING (SIZE (16)),
    m0                                  BIT STRING (SIZE (32)),
    c-uc                                BIT STRING (SIZE (16)),
    e                                   BIT STRING (SIZE (32)),
    c-us                                BIT STRING (SIZE (16)),
    a-Sqrt                              BIT STRING (SIZE (32)),
    t-oe                                BIT STRING (SIZE (16)),
    fitInterval                         BIT STRING (SIZE (1)),
    aodo                                BIT STRING (SIZE (5)),
    c-ic                                BIT STRING (SIZE (16)),
    omega0                              BIT STRING (SIZE (32)),
    c-is                                BIT STRING (SIZE (16)),
    i0                                  BIT STRING (SIZE (32)),
    c-rc                                BIT STRING (SIZE (16)),
    omega                               BIT STRING (SIZE (32)),
    omegaDot                            BIT STRING (SIZE (24)),
    iDot                                BIT STRING (SIZE (14))
}

-- Reserved bits in subframe 1 of the GPS navigation message
SubFrame1Reserved ::=               SEQUENCE {
    reserved1                           BIT STRING (SIZE (23)),
    reserved2                           BIT STRING (SIZE (24)),
    reserved3                           BIT STRING (SIZE (24)),
    reserved4                           BIT STRING (SIZE (16))
}


-- ************************************************************
--
-- SysInfoType15-3: Definitions from 25.331 v3.5.0
--                  (may require revision based on 25.331 CRs)
--                  Also, NodeB-ClockDrift definition changed
--
-- ************************************************************

SysInfoType15-3 ::=                 SEQUENCE {
    -- Almanac and other data
        transmissionTOW                 INTEGER (0..1048575),
        satMask                         BIT STRING (SIZE (1..32)),
        lsbTOW                          BIT STRING (SIZE (8)),
        up-Alma-SIB-DataList            UP-Alma-SIB-DataList
}

UP-Alma-SIB-DataList ::=            SEQUENCE (SIZE (1..3)) OF
                                        UP-Alma-SIB-Data

UP-Alma-SIB-Data ::=                SEQUENCE {
    sfID                                INTEGER (0..1),
    dataID                              INTEGER (0..3),
    pageNo                              INTEGER (0..63),
    word3                               BIT STRING (SIZE (16)),
    word4                               BIT STRING (SIZE (24)),
    word5                               BIT STRING (SIZE (24)),
    word6                               BIT STRING (SIZE (24)),
    word7                               BIT STRING (SIZE (24)),
    word8                               BIT STRING (SIZE (24)),
    word9                               BIT STRING (SIZE (24)),
    word10                              BIT STRING (SIZE (22))
}


-- ************************************************************
--
-- TransactionID: New
--
-- ************************************************************

TransactionID       INTEGER (0..32767)



-- ************************************************************
--
-- UPAP-EllipsoidPointwAlt&Uncertainty: Based on definition in 23.032
```

```
-- but limited to "ellipsoid point with altitude and uncertainty
-- ellipsoid"
--
-- ************************************************************

-- UPAP-EllipsoidPointwAlt&Uncertainty is based on Geographical Area Description in 23.032
-- It is a limited form of the Ext-GeographicalInformation type imported from
-- MAP-LCS-Datatypes in 29.002.

UPAP-EllipsoidPointwAlt&Uncertainty ::= OCTET STRING (SIZE (14))
    -- Refers to the Ellipsoid point with altitude and uncertainty ellipsoid
    -- geographical information defined in 23.032.
    -- This is composed of 1 or more octets with an internal structure according
    -- to 3GPP 23.032
    -- Octet 1: Type of shape, only the following shape in 23.032 is allowed:
    --      (c) Ellipsoid point with altitude and uncertainty ellipsoid
    -- Any other value in octet 1 shall be treated as invalid
    -- Octets 2 to 14 for case (c) – Ellipsoid point with altitude and
    -- uncertainty ellipsoid:
    --      Degrees of Latitude            3 octets
    --      Degrees of Longitude           3 octets
    --      Altitude                       2 octets
    --      Uncertainty semi-major axis    1 octet
    --      Uncertainty semi-minor axis    1 octet
    --      Angle of major axis            1 octet
    --      Uncertainty altitude           1 octet
    --      Confidence                     1 octet

    -- A UPAP-PositionEstimate parameter containing any other shape or an
    -- incorrect number of octets or coding according to 23.032 shall be
    -- treated as invalid data by a receiver


-- ************************************************************
--
-- UPAP-PositionEstimate: Based on definition in 25.331
-- but limited to "ellipsoid point with altitude and uncertainty
-- ellipsoid"
--
-- ************************************************************

UPAP-PositionEstimate ::=              SEQUENCE {
    referenceSFN                       ReferenceSFN               OPTIONAL,
    gps-TOW-1msec                      GPS-TOW-1msec,
    gps-TOW-rem-usec                   GPS-TOW-rem-usec,
    upap-EllipsoidptwAlt&Uncertainty   UPAP-EllipsoidPointwAlt&Uncertainty
}

-- ReferenceSFN, see SysInfoType15-1

-- GPS-TOW-1msec, see SysInfoType15-1

-- GPS-TOW-rem-usec, see SysInfoType15-1



-- ************************************************************
--
-- UP-GPS-AdditionalAssistanceDataRequest: definition based on
-- information in CR-25.331-GPSv1, Section 10.3.7.88a
-- However, this parameter needs to be updated to match
-- R2-0103XX-CR GPS+OTDOA, Section 10.3.7.88a
--
-- ************************************************************

UP-GPS-AdditionalAssistanceDataRequest ::= SEQUENCE {
    requestFlags                       UP-GPS-AdditionalAssistanceDataRequestFlags,
    gps-Week                           INTEGER (0..1023),
    gps-TOE                            INTEGER (0..167),
    t-TOE-limit                        INTEGER (0..10),
    satRelatedDataList                 SatelliteRelatedDataList,
    ...
}

UP-GPS-AdditionalAssistanceDataRequestFlags ::= BIT STRING {
                                       reqAlmanac(0),
                                       reqUtcModel(1),
                                       reqIonosphericModel(2),
```

```
                                    reqNavigationModel(3),
                                    reqDgpsCorrections(4),
                                    reqReferenceLocation(5),
                                    reqReferenceTime(6),
                                    reqAquisitionAssistance(7),
                                    reqRealTimeIntegrity(8) }   (SIZE (9)
)

SatelliteRelatedDataList ::= SEQUENCE (SIZE (1..maxsat)) OF SatelliteRelatedData

maxSat  INTEGER ::= 16

SatelliteRelatedData ::= SEQUENCE {
    satID                           SatID,
    iode                            INTEGER (0..239)
}

--  SatID, see SysInfoType15-2


-- ********************************************************
--
-- UP-GPS-AssistanceData: Definitions from 25.331
--
-- ********************************************************

UP-GPS-AssistanceData ::=           SEQUENCE {
    up-GPS-ReferenceTime                UP-GPS-ReferenceTime                OPTIONAL,
    up-GPS-ReferenceLocation            UPAP-PositionEstimate               OPTIONAL,
    up-GPS-DGPS-Corrections             UP-GPS-DGPS-Corrections             OPTIONAL,
    up-GPS-NavigationModel              UP-GPS-NavigationModel              OPTIONAL,
    up-GPS-IonosphericModel             UP-GPS-IonosphericModel             OPTIONAL,
    up-GPS-UTC-Model                    UP-GPS-UTC-Model                    OPTIONAL,
    up-GPS-Almanac                      UP-GPS-Almanac                      OPTIONAL,
    up-GPS-AcquisitionAssistance        UP-GPS-AcquisitionAssistance        OPTIONAL,
    up-GPS-Real-timeIntegrity           BadSatList                          OPTIONAL
}

UP-GPS-ReferenceTime ::=            SEQUENCE {
    gps-Week                            INTEGER (0..1023),
    gps-TOW                             GPS-TOW-1usec,
    sfn                                 INTEGER (0..4095),
    gps-TOW-AssistList                  GPS-TOW-AssistList                  OPTIONAL
}

GPS-TOW-AssistList ::=              SEQUENCE (SIZE (1..maxSat)) OF
                                        GPS-TOW-Assist

GPS-TOW-Assist ::=                  SEQUENCE {
    satID                               SatID,
    tlm-Message                         BIT STRING (SIZE (14)),
    antiSpoof                           BOOLEAN,
    alert                               BOOLEAN,
    tlm-Reserved                        BIT STRING (SIZE (2))
}

-- maxSat, see UP-GPS-AdditionalAssistanceDataRequest

-- UPAP-PositionEstimate, see previous definition

UP-GPS-DGPS-Corrections ::=         SEQUENCE {
    gps-TOW                             INTEGER (0..604799),
    statusHealth                        DiffCorrectionStatus,
    dgps-CorrectionSatInfoList          DGPS-CorrectionSatInfoList
}

DiffCorrectionStatus ::=            ENUMERATED {
                                        udre-1-0, udre-0-75, udre-0-5, udre-0-3,
                                        udre-0-2, udre-0-1, noData, invalidData }

DGPS-CorrectionSatInfoList ::=      SEQUENCE (SIZE (1..maxSat)) OF
                                        DGPS-CorrectionSatInfo

DGPS-CorrectionSatInfo ::=          SEQUENCE {
    satID                               SatID,
    iode                                BIT STRING (SIZE (8)),
    udre                                UDRE,
    prc                                 PRC,
```

```
    rrc                                 RRC,
    deltaPRC2                           DeltaPRC,
    deltaRRC2                           DeltaRRC,
    deltaPRC3                           DeltaPRC,
    deltaRRC3                           DeltaRRC
}

--  SatID, see SysInfoType15-2


UDRE ::=                            ENUMERATED {
                                        lessThan1,
                                        between1-and-4,
                                        between4-and-8,
                                        over8 }

PRC ::=                             INTEGER (-2047..2047)

RRC ::=                             INTEGER (-127..127)

DeltaPRC ::=                        INTEGER (-127..127)

DeltaRRC ::=                        INTEGER (-7..7)

UP-GPS-NavigationModel ::=          SEQUENCE {
    n-SAT                               INTEGER (1..16),
    navigationModelSatInfoList          NavigationModelSatInfoList
}

NavigationModelSatInfoList ::=      SEQUENCE (SIZE (1..maxSat)) OF
                                        NavigationModelSatInfo

NavigationModelSatInfo ::=          SEQUENCE {
    satID                               SatID,
    satelliteStatus                     SatelliteStatus,
    navModel                            NavModel
}

--  SatID, see SysInfoType15-2

SatelliteStatus ::=                 ENUMERATED {
                                        ns-NN-U,
                                        es-SN,
                                        es-NN-U,
                                        es-NN-C }

--  NavModel, see SysInfoType15-2

UP-GPS-IonosphericModel ::=         SEQUENCE {
    alfa0                               BIT STRING (SIZE (8)),
    alfa1                               BIT STRING (SIZE (8)),
    alfa2                               BIT STRING (SIZE (8)),
    alfa3                               BIT STRING (SIZE (8)),
    beta0                               BIT STRING (SIZE (8)),
    beta1                               BIT STRING (SIZE (8)),
    beta2                               BIT STRING (SIZE (8)),
    beta3                               BIT STRING (SIZE (8))
}

UP-GPS-UTC-Model ::=                SEQUENCE {
    a1                                  BIT STRING (SIZE (24)),
    a0                                  BIT STRING (SIZE (32)),
    t-ot                                BIT STRING (SIZE (8)),
    wn-t                                BIT STRING (SIZE (8)),
    delta-t-LS                          BIT STRING (SIZE (8)),
    wn-lsf                              BIT STRING (SIZE (8)),
    dn                                  BIT STRING (SIZE (8)),
    delta-t-LSF                         BIT STRING (SIZE (8))
}

UP-GPS-Almanac ::=                  SEQUENCE {
    wn-a                                BIT STRING (SIZE (8)),
    almanacSatInfoList                  AlmanacSatInfoList
}

AlmanacSatInfoList ::=              SEQUENCE (SIZE (1..maxSat)) OF
                                        AlmanacSatInfo
```

```
AlmanacSatInfo ::=                  SEQUENCE {
    satID                               SatID,
    e                                   BIT STRING (SIZE (16)),
    t-oa                                BIT STRING (SIZE (8)),
    deltaI                              BIT STRING (SIZE (16)),
    omegaDot                            BIT STRING (SIZE (16)),
    satHealth                           BIT STRING (SIZE (8)),
    a-Sqrt                              BIT STRING (SIZE (24)),
    omega0                              BIT STRING (SIZE (24)),
    m0                                  BIT STRING (SIZE (24)),
    omega                               BIT STRING (SIZE (24)),
    af0                                 BIT STRING (SIZE (11)),
    af1                                 BIT STRING (SIZE (11))
}

--  SatID, see SysInfoType15-2

UP-GPS-AcquisitionAssistance ::=    SEQUENCE {
    referenceTime                       CHOICE {
        utran-ReferenceTime                 UTRAN-ReferenceTime,
        gps-ReferenceTimeOnly               INTEGER (0..604799999)
    },
    satelliteInformationList            AcquisitionSatInfoList
}


UTRAN-ReferenceTime ::=             SEQUENCE {
    gps-TOW                             GPS-TOW-1usec,
    sfn                                 INTEGER (0..4095)
}

-- GPS-TOW-1usec, see SysInfoType15-1

AcquisitionSatInfoList ::=          SEQUENCE (SIZE (1..maxSat)) OF
                                        AcquisitionSatInfo

AcquisitionSatInfo ::=              SEQUENCE {
    satID                               SatID,
    doppler0thOrder                     INTEGER (-2048..2047),
    extraDopplerInfo                    ExtraDopplerInfo                    OPTIONAL,
    codePhase                           INTEGER (0..1022),
    integerCodePhase                    INTEGER (0..19),
    gps-BitNumber                       INTEGER (0..3),
    codePhaseSearchWindow               CodePhaseSearchWindow,
    azimuthAndElevation                 AzimuthAndElevation                 OPTIONAL
}
--  SatID, see SysInfoType15-2

ExtraDopplerInfo ::=                SEQUENCE {
    doppler1stOrder                     INTEGER (-42..21),
    dopplerUncertainty                  DopplerUncertainty
}

DopplerUncertainty ::=              ENUMERATED {
                                        hz12-5, hz25, hz50, hz100, hz200 }

CodePhaseSearchWindow ::=           ENUMERATED {
                                        w1023, w1, w2, w3, w4, w6, w8,
                                        w12, w16, w24, w32, w48, w64,
                                        w96, w128, w192 }

AzimuthAndElevation ::=             SEQUENCE {
    azimuth                             INTEGER (0..31),
    elevation                           INTEGER (0..7)
}

BadSatList ::=                      SEQUENCE (SIZE (1..maxSat)) OF
                                        INTEGER (0..63)



-- ************************************************************
--
-- UP-GPS-Measurement: Definitions from 25.331
--
-- ************************************************************
```

```
UP-GPS-Measurement ::=              SEQUENCE {
    referenceSFN                        ReferenceSFN                OPTIONAL,
    gps-TOW-1msec                       GPS-TOW-1msec,
    gps-TOW-rem-usec                    GPS-TOW-rem-usec            OPTIONAL,
    gps-MeasurementParamList            GPS-MeasurementParamList
}

-- ReferenceSFN, see SysInfoType15-1

-- GPS-TOW-1msec, see SysInfoType15-1

-- GPS-TOW-rem-usec, see SysInfoType15-1

GPS-MeasurementParamList ::=        SEQUENCE (SIZE (1..maxSat)) OF
                                        GPS-MeasurementParam

-- maxSat, see UP-GPS-AdditionalAssistanceDataRequest

GPS-MeasurementParam ::=            SEQUENCE {
    satelliteID                         INTEGER (0..63),
    c-N0                                INTEGER (0..63),
    doppler                             INTEGER (-32768..32768),
    wholeGPS-Chips                      INTEGER (0..1023),
    fractionalGPS-Chips                 INTEGER (0..1023),
    multipathIndicator                  MultipathIndicator,
    pseudorangeRMS-Error                INTEGER (0..63)
}

MultipathIndicator ::=              ENUMERATED {
                                        nm,
                                        low,
                                        medium,
                                        high }


-- **************************************************************
--
-- UP-GPS-SIBsIndicator: New (did not find 25.331 Section 10.3.2.48.18)
--
-- **************************************************************

UP-GPS-SIBsIndicator ::= BIT STRING {
                            reqSysInfoType15-1(0),
                            reqSysInfoType15-2(1),
                            reqSysInfoType15-3(2) } (SIZE (3)
)


END


-- **************************************************************
--
-- Need to provide statement of transfer syntax
-- (e.g., see clause 12 in 25.331
--
-- **************************************************************
```

9.4 Message Transfer Syntax

PCAP shall use the ASN.1 Basic Packed Encoding Rules (BASIC-PER) Aligned Variant as transfer syntax as specified in ref. [7].

9.5 Timers

T_{PE}

- Specifies the maximum time for Position Estimate procedure in the SRNC.

T_{MD}

- Specifies the maximum time for Measurement Data procedure in the SAS.

T_{IAD}

- Specifies the maximum time for Implicit Assistance Data procedure in the SRNC.

T_{EAD}

- Specifies the maximum time for Explicit Assistance Data procedure in the SRNC.

T_{BD}

- Specifies the maximum time Broadcast Data procedure in the CRNC.

10 Handling of Unknown, Unforeseen and Erroneous Protocol Data

10.1 General

Protocol Error cases can be divided into three classes:

- Transfer Syntax Error.
- Abstract Syntax Error.
- Logical Error.

Protocol errors can occur in the following functions within a receiving node:

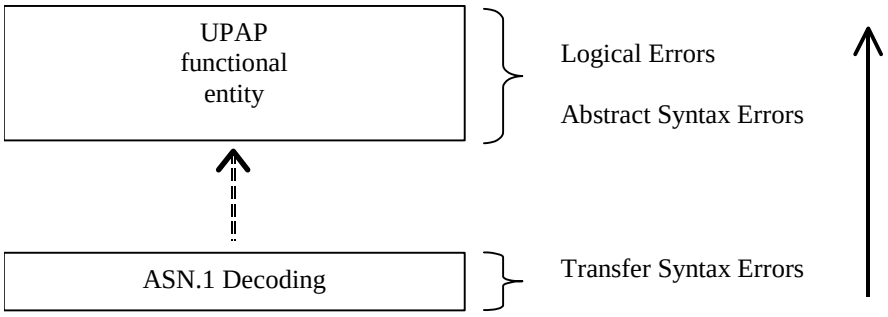

Figure 22: Protocol Errors in PCAP

10.2 Transfer Syntax Error

A Transfer Syntax Error occurs when the receiver is not able to decode the received physical message. Transfer syntax errors are always detected in the process of ASN.1 decoding. If a Transfer Syntax Error occurs, the receiver should initiate Error Indication procedure with appropriate cause value for the Transfer Syntax protocol error.

10.3 Abstract Syntax Error

10.3.1 General

An Abstract Syntax Error occurs when the receiving functional PCAP entity:

1. receives IEs or IE groups that cannot be understood (unknown IE id);

2. receives IEs for which the logical range is violated (e.g.: ASN.1 definition: 0 to 15, the logical range is 0 to 10 (values 11 to 15 are undefined), and 12 will be received; this case will be handled as an abstract syntax error using criticality information sent by the originator of the message);

3. does not receive IEs or IE groups but according to the specified presence of the concerning object, the IEs or IE groups should have been present in the received message.

4. receives IEs or IE groups that are defined to be part of that message in wrong order or with too many occurrences of the same IE or IE group

Cases 1 and 2 (not comprehended IE/IE group) are handled based on received Criticality information. Case 3 (missing IE/IE group) is handled based on Criticality information and Presence information for the missing IE/IE group specified in the version of the specification used by the receiver. Case 4 (IEs or IE groups in wrong order or with too many occurrences) results in rejecting the procedure.

If an Abstract Syntax Error occurs, the receiver shall read the remaining message and shall then for each detected Abstract Syntax Error that belong to cases 1-3 act according to the Criticality Information and Presence Information for the IE/IE group due to which Abstract Syntax Error occurred in accordance with subclauses 10.3.4 and 10.3.5. The handling of case 4 is specified in subclause 10.3.6.

10.3.2 Criticality Information

In the PCAP messages there is criticality information set for individual IEs and/or IE groups. This criticality information instructs the receiver how to act when receiving an IE or an IE group that is not comprehended, i.e. the entire item (IE or IE group) which is not (fully or partially) comprehended shall be treated in accordance with its own criticality information as specified in chapter 10.3.4.

In addition, the criticality information is used in case of the missing IE/IE group abstract syntax error (see subclause 10.3.5).

The receiving node shall take different actions depending on the value of the Criticality Information. The three possible values of the Criticality Information for an IE/IE group are:

- Reject IE.
- Ignore IE and Notify Sender.
- Ignore IE.

The following rules restrict when a receiving entity may consider an IE, an IE group, or an EP not comprehended (not implemented), and when action based on criticality information is applicable:

1. IE or IE group: When one new or modified IE or IE group is implemented for one EP from a standard version, then other new or modified IEs or IE groups specified for that EP in that standard version shall be considered comprehended by a receiving entity (some may still remain unsupported).

   Note that this restriction is not applicable to a sending entity for constructing messages.

2. EP: The comprehension of different EPs within a standard version or between different standard versions is not mandated. Any EP that is not supported may be considered not comprehended, even if another EP from that standard version is comprehended, and action based on criticality shall be applied.

10.3.3 Presence Information

For many IEs/IE groups which are optional according to the ASN.1 transfer syntax, PCAP specifies separately if the presence of these IEs/IE groups is optional or mandatory with respect to RNS application by means of the presence field of the concerning object of class PCAP-PROTOCOL-IES, PCAP -PROTOCOL-IES-PAIR, PCAP -PROTOCOL-EXTENSION or PCAP -PRIVATE-IES.

The presence field of the indicated classes supports three values:

1. Optional;
2. Conditional;

3. Mandatory.

If an IE/IE group is not included in a received message and the presence of the IE/IE group is mandatory or the presence is conditional and the condition is true according to the version of the specification used by the receiver, an abstract syntax error occurs due to a missing IE/IE group.

10.3.4 Not comprehended IE/IE group

10.3.4.1 Procedure Code

The receiving node shall treat the different types of received criticality information of the *Procedure Code* according to the following:

Reject IE:

- If a message is received with a *Procedure Code* marked with "*Reject IE*" which the receiving node does not comprehend, the receiving node shall reject the procedure using the Error Indication procedure.

Ignore IE and Notify Sender:

- If a message is received with a *Procedure Code* marked with "*Ignore IE and Notify Sender*" which the receiving node does not comprehend, the receiving node shall ignore the procedure and initiate the Error Indication procedure.

Ignore IE:

- If a message is received with a *Procedure Code* marked with "*Ignore IE*" which the receiving node does not comprehend, the receiving node shall ignore the procedure.

10.3.4.2 IEs other than the Procedure Code

The receiving node shall treat the different types of received criticality information of an IEs/IE group other than the *Procedure Code* according to the following:

Reject IE:

- If a message *initiating* a procedure is received containing one or more IEs/IE group marked with "*Reject IE*" which the receiving node does not comprehend; none of the functional requests of the message shall be executed. The receiving node shall reject the procedure and report the rejection of one or more IEs/IE group using the message normally used to report unsuccessful outcome of the procedure.

- If a message *initiating* a procedure that does not have a message to report unsuccessful outcome is received containing one or more IEs/IE groups marked with "*Reject IE*" which the receiving node does not comprehend, the receiving node shall initiate the Error Indication procedure.

- If a *response* message is received containing one or more IEs marked with "*Reject IE*", that the receiving node does not comprehend, the receiving node shall initiate local error handling.

Ignore IE and Notify Sender:

- If a message *initiating* a procedure is received containing one or more IEs/IE groups marked with "*Ignore IE and Notify Sender*" which the receiving node does not comprehend, the receiving node shall ignore the content of the not comprehended IEs/IE groups, continue with the procedure as if the not comprehended IEs/IE groups were not received (except for the reporting) using the understood IEs/IE groups, and report in the response message of the procedure that one or more IEs/IE groups have been ignored.

- if a message *initiating* a procedure that does not have a message to report the outcome of the procedure is received containing one or more IEs/IE groups marked with "*Ignore IE and Notify Sender*" which the receiving node does not comprehend, the receiving node shall ignore the content of the not comprehended IEs/IE groups, continue with the procedure as if the not comprehended IEs/IE groups were not received (except for the reporting) using the understood IEs/IE groups, and initiate the Error Indication procedure to report that one or more IEs/IE groups have been ignored.

- If a *response* message is received containing one or more IEs/IE groups marked with "*Ignore IE and Notify Sender*" which the receiving node does not comprehend, the receiving node shall ignore the content of the not comprehended IEs/IE groups and initiate the Error Indication procedure.

Ignore IE:

- If a message *initiating* a procedure is received containing one or more IEs/IE groups marked with "*Ignore IE*" which the receiving node does not comprehend, the receiving node shall ignore the content of the not comprehended IEs/IE groups and continue with the procedure as if the not comprehended IEs/IE groups were not received using the understood IEs/IE groups.

10.3.5 Missing IE or IE group

The receiving node shall treat the missing IE/IE group according to the criticality information for the missing IE/IE group in the received message specified in the version of this specification used by the receiver:

Reject IE:

- if a received message *initiating* a procedure is missing one or more IEs/IE groups with specified criticality "*Reject IE*"; none of the functional requests of the message shall be executed. The receiving node shall reject the procedure and report the missing IEs/IE groups using the message normally used to report unsuccessful outcome of the procedure.

- if a received message *initiating* a procedure that does not have a message to report unsuccessful outcome is missing one or more IEs/IE groups with specified criticality "*Reject IE*", the receiving node shall initiate the Error Indication procedure.

- if a received *response* message is missing one or more IEs/IE groups with specified criticality "*Reject IE*, the receiving node shall initiate local error handling.

Ignore IE and Notify Sender:

- if a received message *initiating* a procedure is missing one or more IEs/IE groups with specified criticality "*Ignore IE and Notify Sender*", the receiving node shall continue with the procedure based on the other IEs/IE groups present in the message and report in the response message of the procedure that one or more IEs/IE groups were missing.

- if a received message *initiating* a procedure that does not have a message to report the outcome of the procedure is missing one or more IEs/IE groups with specified criticality "*Ignore IE and Notify Sender*", the receiving node shall continue with the procedure based on the other IEs/IE groups present in the message and initiate the Error Indication procedure to report that one or more IEs/IE groups were missing.

- if a received *response* message is missing one or more IEs/IE groups with specified criticality "*Ignore IE and Notify Sender*", the receiving node shall initiate the Error Indication procedure.

Ignore IE:

- if a received message *initiating* a procedure is missing one or more IEs/IE groups with specified criticality "*Ignore IE*", the receiving node shall continue with the procedure based on the other IEs/IE groups present in the message.

10.3.6 IEs or IE groups received in wrong order or with too many occurrences

If a message with IEs or IE groups in wrong order or with too many occurrences is received, the receiving node shall behave according to the following:

- If a message *initiating* a procedure is received containing IEs or IE groups in wrong order or with too many occurrences, none of the functional requests of the message shall be executed. The receiving node shall reject the procedure and report the cause value "Abstract Syntax Error (Falsely Constructed Message)" using the message normally used to report unsuccessful outcome of the procedure.

- If a message *initiating* a procedure that does not have a message to report unsuccessful outcome is received containing IEs or IE groups in wrong order or with too many occurrences, the receiving node shall initiate the Error Indication procedure, and use cause value "Abstract Syntax Error (Falsely Constructed Message)".

- If a *response* message is received containing IEs or IE groups in wrong order or with too many occurrences, the receiving node shall initiate local error handling.

10.4 Logical Error

Logical error situations occur when a message is comprehended correctly, but the information contained within the message is not valid (i.e. semantic error), or describes a procedure which is not compatible with the state of the receiver. In these conditions, the following behaviour shall be performed (unless otherwise specified) as defined by the class of the elementary procedure, irrespective of the criticality information of the IEs/IE groups containing the erroneous values.

Class 1:

Where the logical error occurs in a request message of a class 1 procedure, and the procedure has a failure message, the failure message shall be sent with an appropriate cause value. Typical cause values are:

- Semantic Error.

- Message not compatible with receiver state.

Where the logical error is contained in a request message of a class 1 procedure, and the procedure does not have a failure message, the Error Indication procedure shall be initiated with an appropriate cause value.

Where the logical error exists in a response message of a class 1 procedure, local error handling shall be initiated.

Class 2:

Where the logical error occurs in a message of a class 2 procedure, the Error Indication procedure shall be initiated with an appropriate cause value.

Annex A (informative): Change history

Change history					
TSG RAN#	Version	CR	Tdoc RAN	New Version	Subject/Comment
	-	-			
		-	-		

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TSG-RAN Working Group 3 LCS Meeting
Cardiff, South Wales 26th February – 2nd March 2001

R3-011070

Source:	**Qualcomm Europe**
Title:	**Draft PCAP protocol specification**
Document for:	**Discussion and Approval**
Agenda Item:	**13.1.1**

At the 3GPP LCS Work Shop held in London on 1/11/01and 1/12/01 it was agreed that for A-GPS positioning, sufficient functional separation existed with RNC functions to justify the opening the interface towards a standalone SMLC. As a result a work item has been drafted and presented to RAN 2. The work item will be presented to the RAN Plenary for approval.

The objective of this work item is to provide for support of an open interface between the SMLC and the RNC within the UTRAN for the support of A-GPS positioning. This new interface would be analogous to the Lb interface defined in the GSM LCS specifications with the exceptions that the positioning messages are terminated at the RNC and mapped to release 99 RRC messages and that the positioning messages also support broadcast of LCS assistance data in support of the RRC broadcast messages.

The addition of the interface should be compatible the release 99 Iu, Iur and Iub and radio interfaces. The addition of this interface does not preclude the A-GPS to be supported in the SRNC.

The contribution represents the third draft of the PCAP protocol to be supported on this new interface. The first draft was presented at the RAN 3 UP Ad-Hoc in Helsinki Finland on 2/12 and 2/13. The second draft was contained in R2-010359 and was submitted to the UP Ad-Hoc at RAN 2 #19. This current draft reflects the latest stage 2 TS25.305 agreement as contained in R2-UP010023 from the UP Ad-Hoc in RAN 2 #19.