**TSG RAN Meeting #19** **RP-030084**
**Birmingham, UK, 11 - 14 March 2003**

**Title** **CRs (Rel-6 only) to TS 25.401, 25.450, 25.452, 25.453 on Open interface between the SMLC and the SRNC within the UTRAN to support Rel-4 positioning methods**
**Source** **TSG RAN WG3**
**Agenda Item** **9.3.2**

**Note: With following CRs corresponding Release 6 specifications have to be introduced.**

| RAN3 Tdoc | Spec | curr. Vers. | new Vers. | REL | CR | Rev | Cat | Title | Work item |
|---|---|---|---|---|---|---|---|---|---|
| R3-030048 | 25.401 | 5.5.0 | 6.0.0 | REL-6 | 065 | - | C | 25.401 CR on revising the definition of SAS to support all REL-4 UE positioning methods | LCS-Rel4Pos |
| R3-030049 | 25.450 | 5.1.0 | 6.0.0 | REL-6 | 003 | - | C | 25.450 CR on revising the position calculation function and definition of SAS to support all REL-4 UE positioning methods | LCS-Rel4Pos |
| R3-030050 | 25.452 | 5.0.0 | 6.0.0 | REL-6 | 001 | - | C | 25.452 CR on revising the definition of SAS to support all REL-4 UE positioning methods | LCS-Rel4Pos |
| R3-030362 | 25.453 | 5.4.0 | 6.0.0 | REL-6 | 022 | 2 | C | 25.453 CR on revising the position calculation function and definition of SAS to support all REL-4 UE positioning methods | LCS-Rel4Pos |

**3GPP TSG-RAN WG3 Meeting #34** **Tdoc R3-030048**
**Sophia Antipolis, France, 17th – 21st February 2003**

CR-Form-v7

# CHANGE REQUEST

⌘ **25.401** **CR** **065** ⌘ **rev** **-** ⌘ Current version: **5.5.0** ⌘

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***Proposed change affects:*** UICC apps⌘ ☐ ME ☐ Radio Access Network ☒ Core Network ☐

| | | |
|---|---|---|
| ***Title:*** | ⌘ | CR on revising the definition of SAS to support all REL-4 UE positioning methods |
| ***Source:*** | ⌘ | RAN WG3 |
| ***Work item code:*** | ⌘ | LCS-Rel4Pos |
| ***Date:*** | ⌘ | 17/02/2003 |
| ***Category:*** | ⌘ | **C** |
| ***Release:*** | ⌘ | REL-6 |

*Use one of the following categories:*
***F*** *(correction)*
***A*** *(corresponds to a correction in an earlier release)*
***B*** *(addition of feature),*
***C*** *(functional modification of feature)*
***D*** *(editorial modification)*
Detailed explanations of the above categories can be found in 3GPP TR 21.900.

*Use one of the following releases:*
*2 (GSM Phase 2)*
*R96 (Release 1996)*
*R97 (Release 1997)*
*R98 (Release 1998)*
*R99 (Release 1999)*
*Rel-4 (Release 4)*
*Rel-5 (Release 5)*
*Rel-6 (Release 6)*

| | | |
|---|---|---|
| ***Reason for change:*** | ⌘ | During RAN #13, modifications to the UE positioning Stage-2 specification (TS 25.305) were approved in order to extend the scope of the Stand-Alone SMLC (SAS) so that its position calculation functionality could support all Rel-4 UE positioning methods.<br><br>Currently, the definition and abbreviation of "SAS" in TS 25.401 include only the A-GPS positioning method and are not consistent with TS 25.305. |
| ***Summary of change:*** | ⌘ | The definition and abbreviation of "SAS" are changed from "Standalone A-GPS SMLC" to the more generic "Stand-Alone SMLC". |
| ***Consequences if not approved:*** | ⌘ | The extension of SAS position calculation functionality to all Rel 4 positioning methods will not be realized. |

| | | | | | |
|---|---|---|---|---|---|
| ***Clauses affected:*** | ⌘ | 3.1, 3.2, 6 | | | |
| | | **Y** | **N** | | |
| ***Other specs affected:*** | ⌘ | **X** | | Other core specifications | ⌘ TS 25.450<br>TS 25.452<br>TS 25.453 |
| | | | **X** | Test specifications | |
| | | | **X** | O&M Specifications | |
| ***Other comments:*** | ⌘ | | | | |

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1) Fill out the above form. The symbols above marked ⌘ contain pop-up help information about the field that they are closest to.

2) Obtain the latest version for the release of the specification to which the change is proposed. Use the MS Word "revision marks" feature (also known as "track changes") when making the changes. All 3GPP specifications can be downloaded from the 3GPP server under ftp://ftp.3gpp.org/specs/ For the latest version, look for the directory name with the latest date e.g. 2001-03 contains the specifications resulting from the March 2001 TSG meetings.

3) With "track changes" disabled, paste the entire CR form (use CTRL-A to select it) into the specification just in front of the clause containing the first piece of changed text. Delete those parts of the specification which are not relevant to the change request.

# 3 Definitions and abbreviations

## 3.1 Definitions

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

**ALCAP:** generic name for the transport signalling protocols used to set-up and tear-down transport bearers

**Cell:** Radio Network object that can be uniquely identified by a User Equipment from a (cell) identification that is broadcasted over a geographical area from one *UTRAN Access Point*
A Cell is either FDD or TDD mode.

**Iu:** interface between an RNC and an MSC, SGSN or CBC, providing an interconnection point between the RNS and the Core Network. It is also considered as a reference point

**Iub:** interface between the RNC and the Node B

**Iur:** logical interface between two RNCs
Whilst logically representing a point to point link between RNCs, the physical realisation need not be a point to point link.

**Iur-g:** logical interface between RNC/BSS and BSS
Whilst logically representing a point to point link between RNC/BSS and BSS, the physical realisation need not be a point to point link.

**Logical Model:** Logical Model defines an abstract view of a network or network element by means of information objects representing network element, aggregations of network elements, the topological relationship between the elements, endpoints of connections (termination points), and transport entities (such as connections) that transport information between two or more termination points

The information objects defined in the Logical Model are used, among others, by connection management functions. In this way, a physical implementation independent management is achieved.

**Node B:** logical node in the RNS responsible for radio transmission / reception in one or more cells to/from the UE
The logical node terminates the Iub interface towards the RNC.

**Radio Resources:** resources that constitute the radio interface in UTRAN, e.g. frequencies, scrambling codes, spreading factors, power for common and dedicated channels

**Node B Application Part:** Radio Network Signalling over the Iub

**Radio Network Controller:** logical node in the RNS in charge of controlling the use and the integrity of the radio resources

**Controlling RNC:** role an RNC can take with respect to a specific set of Node B's
There is only one Controlling RNC for any Node B. The Controlling RNC has the overall control of the logical resources of its node B's.

**Radio Network Subsystem:** RNS can be either a full UTRAN or only a part of a UTRAN
An RNS offers the allocation and release of specific radio resources to establish means of connection in between an UE and the UTRAN. A Radio Network Subsystem contains one RNC and is responsible for the resources and transmission/reception in a set of cells.

**Serving RNS:** 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.

**Drift RNS:** role an RNS can take with respect to a specific connection between an UE and UTRAN
An RNS that supports the Serving RNS with radio resources when the connection between the UTRAN and the UE need to use cell(s) controlled by this RNS is referred to as Drift RNS.

**Radio Access Network Application Part:** Radio Network Signalling over the Iu

**Radio Network Subsystem Application Part:** Radio Network Signalling over the Iur

**RRC Connection:** point-to-point bi-directional connection between RRC peer entities on the UE and the UTRAN sides, respectively
An UE has either zero or one RRC connection.

**Stand-Aalone ~~A-GPS-~~SMLC:** logical node that interconnects to the RNC over the Iupc interface via the PCAP protocol
This node provides GPS related data to the RNC and may perform the position calculation function.

**User Equipment:** Mobile Equipment with one or several UMTS Subscriber Identity Module(s)
A device allowing a user access to network services via the Uu interface. The UE is defined in ref. [8]. If this term is used in the context of Iur-g, it means MS in case it uses radio resources of a DBSS.

**Universal Terrestrial Radio Access Network:** UTRAN is a conceptual term identifying that part of the network which consists of RNCs and Node Bs between Iu an Uu
The concept of UTRAN instantiation is currently undefined.

**UTRAN Access Point:** conceptual point within the UTRAN performing radio transmission and reception
A UTRAN access point is associated with one specific *cell*, i.e. there exists one UTRAN access point for each cell. It is the UTRAN-side end point of a *radio link*.

**Radio Link:** "radio link" is a logical association between a single User Equipment and a single UTRAN access point
Its physical realisation comprises one or more radio bearer transmissions.

**Radio Link Set:** set of one or more Radio Links that has a common generation of Transmit Power Control (TPC) commands in the DL

**Uu:** Radio interface between UTRAN and the User Equipment

**RAB sub-flows:** Radio Access Bearer can be realised by UTRAN through several sub-flows
These sub-flows correspond to the NAS service data streams that have QoS characteristics that differ in a predefined manner within a RAB e.g. different reliability classes.

RAB sub-flows have the following characteristics:

1) The sub-flows of a RAB are established and released at the RAB establishment and release, respectively.

2) The sub-flows of a RAB are submitted and delivered together at the RAB SAP.

3) The sub-flows of a RAB are carried over the same Iu transport bearer.

4) The sub-flows of a RAB are organised in a predefined manner at the SAP and over the Iu interface. The organisation is imposed by the NAS as part of its co-ordination responsibility.

**Set of co-ordinated DCHs:** set of co-ordinated DCHs is a set of dedicated transport channels that are always established and released in combination
Individual DCHs within a set of co-ordinated DCHs cannot be operated on individually e.g. if the establishment of one DCH fails, the establishment of all other DCHs in the set of co-ordinated DCHs shall be terminated unsuccessfully. A set of coordinated DCHs is transferred over one transport bearer. All DCHs in a set of co-ordinated DCHs shall have the same TTI.

**Shared Network Area (SNA):** Area consisting or one or more LA's to which access can be controlled.

## 3.2 Abbreviations

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

| | |
|---|---|
| AAL | ATM Adaptation Layer |
| AAL2 | ATM Adaptation Layer 2 |
| ALCAP | Access Link Control Application Part |
| ATM | Asynchronous Transfer Mode |
| BM-IWF | Broadcast Multicast Interworking Function |
| BMC | Broadcast/Multicast Control |

| | |
|---|---|
| BSS | Base Station Subsystem |
| CBC | Cell Broadcast Centre |
| CBS | Cell Broadcast Service |
| CN | Core Network |
| CPCH | Common Packet Channel |
| CRNC | Controlling Radio Network Controller |
| DCH | Dedicated Channel |
| DL | Downlink |
| DRNS | Drift RNS |
| EDGE | Enhanced Data rates for Global Evolution |
| FACH | Forward Access Channel |
| FFS | For Further Study |
| GERAN | GSM EDGE Radio Access Network |
| GSM | Global System for Mobile Communications |
| GTP | GPRS Tunnelling Protocol |
| IPv4 | Internet Protocol, version 4 |
| IPv6 | Internet Protocol, version 6 |
| LA | Location Area |
| MAC | Medium Access Control |
| NAS | Non Access Stratum |
| NBAP | Node B Application Part |
| NNSF | NAS Node Selection Fuction |
| NSAP | Network Service Access Point |
| PCH | Paging Channel |
| PLMN | Public Land Mobile Network |
| QoS | Quality of Service |
| RAB | Radio Access Bearer |
| RACH | Random Access Channel |
| RANAP | Radio Access Network Application Part |
| RNC | Radio Network Controller |
| RNL | Radio Network Layer |
| RNS | Radio Network Subsystem |
| RNSAP | Radio Network Subsystem Application Part |
| RNTI | Radio Network Temporary Identity |
| SAB | Service Area Broadcast |
| SAS | Stand-Aalone ~~A-GPS~~ SMLC |
| SMLC | Serving Mobile Location Centre |
| SNA | Shared Network Area |
| SRNC | Serving Radio Network Controller |
| SRNS | Serving RNS |
| TEID | Tunnel Endpoint Identifier |
| TNL | Transport Network Layer |
| TTI | Transmission Time Interval |
| UDP | User Datagram Protocol |
| UE | User Equipment |
| UL | Uplink |
| UMTS | Universal Mobile Telecommunication System |
| URA | UTRAN Registration Area |
| USIM | UMTS Subscriber Identity Module |
| UTRAN | Universal Terrestrial Radio Access Network |

*… <NEXT MODIFIED SECTION> …*

# 6 UTRAN Architecture

The UTRAN consists of a set of Radio Network Subsystems connected to the Core Network through the Iu.

A RNS consists of a Radio Network Controller one or more Node Bs and optionally one SAS. A Node B is connected to the RNC through the Iub interface.

A Node B can support FDD mode, TDD mode or dual-mode operation.

There are two chip-rate options in the TDD mode: 3.84 Mcps TDD and 1.28 Mcps TDD. Each TDD cell supports either of these options.

A Node B which supports TDD cells can support one chip-rate option only, or both options.

A RNC which supports TDD cells can support one chip-rate option only, or both options.

The RNC is responsible for the Handover decisions that require signalling to the UE.

A RNC may include a combining/splitting function to support combination/splitting of information streams (see subclause 7.2.4.3).

Inside the UTRAN, the RNCs of the Radio Network Subsystems can be interconnected together through the Iur. Iu(s) and Iur are logical interfaces. Iur can be conveyed over direct physical connection between RNCs or virtual networks using any suitable transport network.

The UTRAN architecture is shown in figure 4.

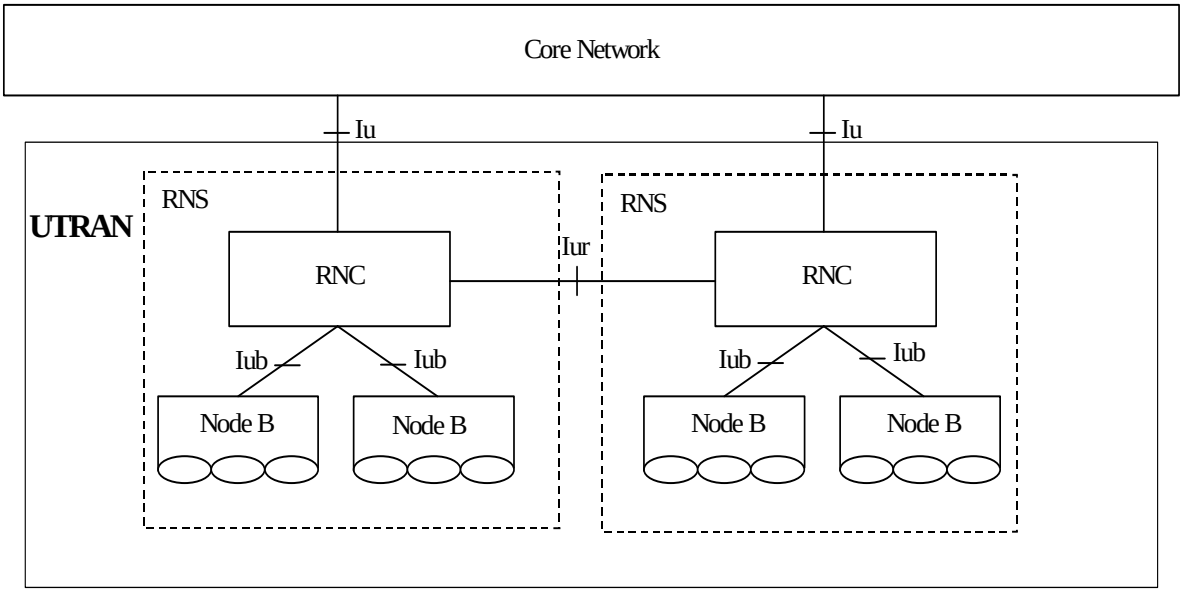


**Figure 4: UTRAN Architecture**

Regarding the ~~A GPS~~ UE positioning method, the RNC may have full internal support for this function and/or may be connected to one SAS via the Iupc interface. The following picture illustrates the resulting UTRAN architecture when the Iupc interface is adopted.

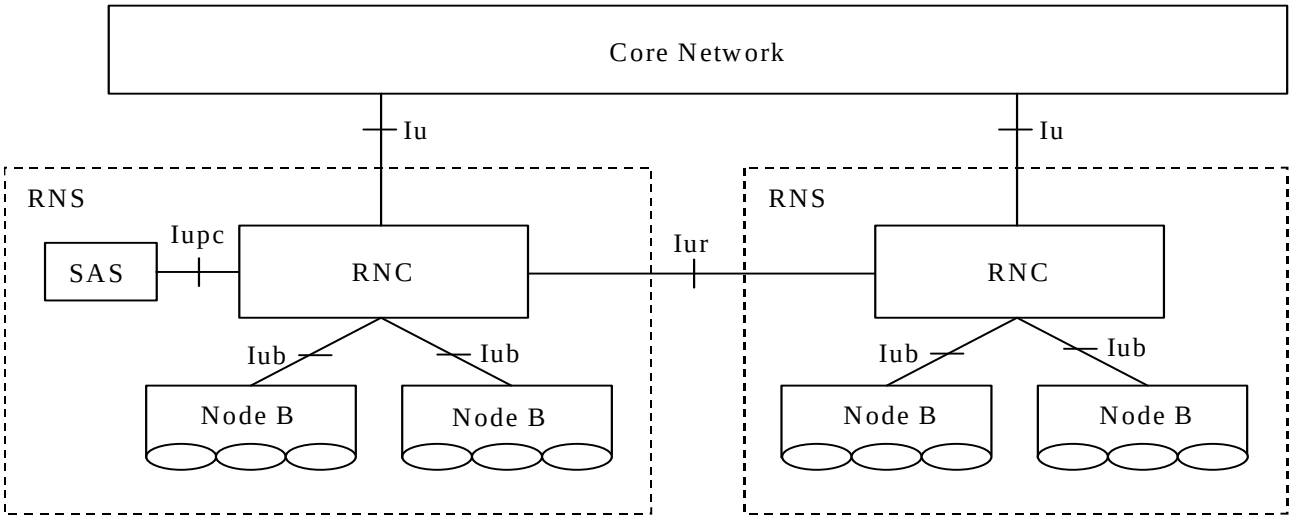


**Figure 4a: UTRAN Architecture with the Iupc option**

**3GPP TSG-RAN WG3 Meeting #34** **Tdoc R3-030049**
**Sophia Antipolis, France, 17th – 21st February 2003**

CR-Form-v7

# CHANGE REQUEST

⌘ **25.450** **CR** **003** ⌘ **rev** **-** ⌘ Current version: **5.1.0** ⌘

*For **HELP** on using this form, see bottom of this page or look at the pop-up text over the ⌘ symbols.*

***Proposed change affects:*** UICC apps⌘ ☐ ME ☐ Radio Access Network ☒ Core Network ☐

| | | |
|---|---|---|
| ***Title:*** | ⌘ | CR on revising the position calculation function and definition of SAS to support all REL-4 UE positioning methods |
| ***Source:*** | ⌘ | RAN WG3 |
| ***Work item code:*** | ⌘ | LCS-Rel4Pos |
| ***Date:*** | ⌘ | 17/02/2003 |
| ***Category:*** | ⌘ | **C** |
| ***Release:*** | ⌘ | REL-6 |

*Use one of the following categories:*
***F*** *(correction)*
***A*** *(corresponds to a correction in an earlier release)*
***B*** *(addition of feature),*
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Detailed explanations of the above categories can be found in 3GPP TR 21.900.

*Use one of the following releases:*
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*R97 (Release 1997)*
*R98 (Release 1998)*
*R99 (Release 1999)*
*Rel-4 (Release 4)*
*Rel-5 (Release 5)*
*Rel-6 (Release 6)*

| | | |
|---|---|---|
| ***Reason for change:*** | ⌘ | During RAN #13, modifications to the UE positioning Stage-2 specification (TS 25.305) were approved in order to extend the scope of the Stand-Alone SMLC (SAS) so that its position calculation functionality could support all Rel-4 UE positioning methods.<br><br>Currently, the definition and abbreviation of "SAS" in TS 25.450 include only the A-GPS positioning method and are not consistent with TS 25.305. In addition, the PCAP Position Calculation Services description mentions only the A-GPS positioning method. |
| ***Summary of change:*** | ⌘ | The definition and abbreviation of "SAS" are changed from "Standalone A-GPS SMLC" to the more generic "Stand-Alone SMLC". In addition, the PCAP Position Calculation Services description is generalised beyond the A-GPS positioning method. |
| ***Consequences if not approved:*** | ⌘ | The extension of SAS position calculation functionality to all Rel 4 positioning methods will not be realized. |

| | | | | | |
|---|---|---|---|---|---|
| ***Clauses affected:*** | ⌘ | 1, 3.1, 3.2, 4.4.2 | | | |
| | | **Y** | **N** | | |
| ***Other specs*** | ⌘ | **X** | | Other core specifications | ⌘ TS 25.453<br>TS 25.452<br>TS 25.401 |
| ***affected:*** | | | **X** | Test specifications | |
| | | | **X** | O&M Specifications | |

| ***Other comments:*** | ⌘ | |
|---|---|---|

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# 1 Scope

The present document is an introduction to the TSG RAN TS 25.45z series of UMTS Technical Specifications that define the Iupc Interface. The Iupc interface is a logical interface for the interconnection of Stand-Aalone A-GPS SMLC (SAS) and Radio Network Controller (RNC) components of the Universal Terrestrial Radio Access Network (UTRAN) for the UMTS system.

# 2 References

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

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


[1] 3GPP TS 25.401: "UTRAN Overall Description".

[2] 3GPP TS 25.451: "UTRAN Iupc Interface: Layer 1".

[3] 3GPP TS 25.452: "UTRAN Iupc Interface: Signalling Transport".

[4] 3GPP TS 25.453: "UTRAN Iupc Interface PCAP Signalling".

[5] ITU-T Recommendation Q.711 (7/96): "Functional description of the signalling connection control part".

[6] ITU-T Recommendation Q.712 (7/96): "Definition and function of signalling connection control part messages".

[7] ITU-T Recommendation Q.713 (7/96): "Signalling connection control part formats and codes".

[8] ITU-T Recommendation Q.714 (7/96): "Signalling connection control part procedures".

[9] 3GPP TS 23.003: "Numbering, Addressing and Identification".

[10] 3GPP TS 23.110: "UMTS Access Stratum Services and Functions".


# 3 Definitions and abbreviations

## 3.1 Definitions

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

**Stand-Aalone A-GPS SMLC (SAS):** logical node that interconnects to the RNC over the Iupc interface via the PCAP protocol
This node provides GPS related data to the RNC and may perform the position calculation function.

## 3.2 Abbreviations

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

AAL5 ATM Adaptation Layer type 5

| | |
|---|---|
| A-GPS | Assisted GPS |
| ATM | Asynchronous Transfer Mode |
| CRNC | Controlling Radio Network Controller |
| GPS | Global Positioning System |
| GT | Global Title |
| IP | Internet Protocol |
| M3UA | SS7 MTP3 User Adaptation Layer |
| MTP | Message Transfer Part |
| PCAP | Position Calculation Application Part |
| RNC | Radio Network Controller |
| SAS | Stand-Aalone ~~A-GPS-~~SMLC |
| SCCP | Signalling Connection Control Part |
| SCTP | Stream Control Transmission Protocol |
| SMLC | Serving Mobile Location Centre |
| SPC | Signalling Point Code |
| SRNC | Serving Radio Network Controller |
| SS7 | Signalling System N° 7 |
| SSCF-NNI | Service Specific Co-ordination Function - Network Node Interface |
| SSCOP | Service Specific Connection Oriented Protocol |
| SSN | Sub-System Number |
| UE | User Equipment |
| UMTS | Universal Mobile Telecommunication System |
| UTRAN | Universal Terrestrial Radio Access Network |

## 3.3 Specification Notations

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

[FDD] This tagging of a word indicates that the word preceding the tag "[FDD]" applies only to FDD. This tagging of a heading indicates that the heading preceding the tag "[FDD]" and the section following the heading applies only to FDD.

[TDD] This tagging of a word indicates that the word preceding the tag "[TDD]" applies only to TDD, including 3.84Mcps TDD and 1.28Mcps TDD. This tagging of a heading indicates that the heading preceding the tag "[TDD]" and the section following the heading applies only to TDD, including 3.84Mcps TDD and 1.28Mcps TDD.

[3.84Mcps TDD] This tagging of a word indicates that the word preceding the tag “[3.84Mcps TDD]” applies only to 3.84Mcps TDD. This tagging of a heading indicates that the heading preceding the tag “[3.84Mcps TDD]” and the section following the heading applies only to 3.84Mcps TDD.

[1.28Mcps TDD] This tagging of a word indicates that the word preceding the tag "[1.28Mcps TDD]" applies only to 1.28Mcps TDD. This tagging of a heading indicates that the heading preceding the tag "[1.28Mcps TDD]" and the section following the heading applies only to 1.28Mcps TDD.

[FDD - …] This tagging indicates that the enclosed text following the "[FDD - " applies only to FDD. Multiple sequential paragraphs applying only to FDD are enclosed separately to enable insertion of TDD specific (or common) paragraphs between the FDD specific paragraphs.

[TDD - …] This tagging indicates that the enclosed text following the "[TDD - " applies only to TDD including 3.84Mcps TDD and 1.28Mcps TDD. Multiple sequential paragraphs applying only to TDD are enclosed separately to enable insertion of FDD specific (or common) paragraphs between the TDD specific paragraphs.

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[1.28Mcps TDD - …] This tagging indicates that the enclosed text following the "[1.28Mcps TDD – " applies only to 1.28Mcps TDD. Multiple sequential paragraphs applying only to 1.28Mcps TDD are enclosed separately to enable insertion of FDD and TDD specific (or common) paragraphs between the 1.28Mcps TDD specific paragraphs.

Procedure When referring to a 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. RNSAP Basic Mobility Procedures.

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. RADIO LINK SETUP REQUEST message.

Frame When referring to a control or data frame in the specification, the CONTROL/DATA FRAME NAME is written with all letters in upper case characters followed by the words "control/data frame", e.g. DCH data frame.

# 4 General Aspects

## 4.1 Introduction

The logical interface between a RNC and a SAS within the UTRAN is referred to the Iupc interface.

## 4.2 Iupc Interface General Principles

The general principles for the specification of the Iupc interface are as follows:

- the Iupc interface should be open;
- complex functionality shall as far as possible be avoided over Iupc. Advanced optimisation solutions may be added in later versions of the standard;
- from a logical standpoint, the Iupc is a point-to-point signalling interface between an RNC and SAS within the UTRAN, even though there may not be a direct physical connection between these two nodes;
- one RNC may connect to one SAS. One SAS may provide services to one RNC;
- neither the physical structure nor any internal protocols of the RNC or SAS shall be visible over Iupc and are thus not limiting factors, e.g., when introducing future technology.

## 4.3 Iupc Interface Specification Objectives

The Iupc interface specifications shall facilitate the following:

- inter-connection of RNCs and SASs from different manufacturers;
- separation of Iupc interface Application functionality and Transport Network functionality to facilitate introduction of future technology.

## 4.4 Iupc Interface Capabilities

### 4.4.1 General

The Iupc interface connects a RNC and a SAS.

### 4.4.2 Position Calculation Services

The Iupc interface enables an SRNC and a SAS to exchange information that is related to the positioning of a single UE. These exchanges involve the transfer of UE Positioning~~GPS~~ measurement data or UE position estimate data.

### 4.4.3 Information Exchange Services

The Iupc interface enables an RNC to request specific GPS related data from an SAS on demand, on modification, or at regular intervals.

**3GPP TSG-RAN WG3 Meeting #34**
**Sophia Antipolis, France, 17th – 21st February 2003**

***Tdoc R3-030050***

*CR-Form-v7*

# CHANGE REQUEST

⌘ **25.452** **CR** **001** ⌘ **rev** **-** ⌘ Current version: **5.0.0** ⌘

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***Proposed change affects:*** UICC apps⌘ ☐ ME ☐ Radio Access Network ☒ Core Network ☐

| | | |
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*Rel-6 (Release 6)*

| | | |
|---|---|---|
| ***Reason for change:*** | ⌘ | During RAN #13, modifications to the UE positioning Stage-2 specification (TS 25.305) were approved in order to extend the scope of the Stand-Alone SMLC (SAS) so that its position calculation functionality could support all Rel-4 UE positioning methods.<br><br>Currently, the definition and abbreviation of "SAS" in TS 25.452 include only the A-GPS positioning method and are not consistent with TS 25.305. |
| ***Summary of change:*** | ⌘ | The definition and abbreviation of "SAS" have been changed from "Standalone A-GPS SMLC" to the more generic "Stand-Alone SMLC". |
| ***Consequences if not approved:*** | ⌘ | The extension of SAS position calculation functionality to all Rel 4 positioning methods will not be realized. |

| | | | | | |
|---|---|---|---|---|---|
| ***Clauses affected:*** | ⌘ | 1, 3.1, 3.2 | | | |
| | | **Y** | **N** | | |
| ***Other specs affected:*** | ⌘ | **X** | | Other core specifications | TS 25.450<br>TS 25.453<br>TS 25.401 |
| | | | **X** | Test specifications | |
| | | | **X** | O&M Specifications | |
| ***Other comments:*** | ⌘ | | | | |

**How to create CRs using this form:**
Comprehensive information and tips about how to create CRs can be found at http://www.3gpp.org/specs/CR.htm. Below is a brief summary:

1) Fill out the above form. The symbols above marked ⌘ contain pop-up help information about the field that they are closest to.

2) Obtain the latest version for the release of the specification to which the change is proposed. Use the MS Word "revision marks" feature (also known as "track changes") when making the changes. All 3GPP specifications can be downloaded from the 3GPP server under ftp://ftp.3gpp.org/specs/ For the latest version, look for the directory name with the latest date e.g. 2001-03 contains the specifications resulting from the March 2001 TSG meetings.

3) With "track changes" disabled, paste the entire CR form (use CTRL-A to select it) into the specification just in front of the clause containing the first piece of changed text. Delete those parts of the specification which are not relevant to the change request.

# 1 Scope

The present document specifies the signalling transport related to PCAP signalling to be used across the Iupc interface. The Iupc interface is a logical interface for the interconnection of Stand-Aalone ~~A-GPS-~~SMLC (SAS) and Radio Network Controller (RNC) components of the Universal Terrestrial Radio Access Network (UTRAN) for the UMTS system. The radio network control signalling between these nodes is based upon the Position Calculation Application Part (PCAP).

# 2 References

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

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


[1] 3GPP TS 25.422: "UTRAN Iur Interface Signalling Transport".

[2] ITU-T Recommendation Q.711 (1996): "Functional description of the signalling connection control part".

[3] ITU-T Recommendation Q.712 (1996): "Definition and function of Signalling connection control part messages".

[4] ITU-T Recommendation Q.713 (1996): "Signalling connection control part formats and codes".

[5] ITU-T Recommendation Q.714 (1996): "Signalling connection control part procedures".

[6] ITU-T Recommendation Q.715 (1996): "Signalling connection control part user guide".

[7] ITU-T Recommendation Q.716 (1993): "Signalling Connection Control Part (SCCP) performance".


# 3 Definitions and abbreviations

## 3.1 Definitions

For the purposes of the present document, the following definition applies:

**Stand-Alone ~~A-GPS-~~SMLC (SAS):** A logical node that interconnects to the RNC over the Iupc interface via the PCAP protocol. This node provides GPS related data to the RNC, and may perform the position calculation function.

## 3.2 Abbreviations

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

| | |
|---|---|
| AAL5 | ATM Adaptation Layer type 5 |
| A-GPS | Assisted GPS |
| ATM | Asynchronous Transfer Mode |
| CRNC | Controlling Radio Network Controller |
| GPS | Global Positioning System |

| | |
|---|---|
| GT | Global Title |
| IP | Internet Protocol |
| M3UA | SS7 MTP3 User Adaptation Layer |
| MTP | Message Transfer Part |
| PCAP | Position Calculation Application Part |
| RNC | Radio Network Controller |
| SAP | Service Access Point |
| SAS | Stand-Aalone ~~A-GPS-~~SMLC |
| SCCP | Signalling Connection Control Part |
| SCTP | Stream Control Transmission Protocol |
| SMLC | Serving Mobile Location Centre |
| SPC | Signalling Point Code |
| SRNC | Serving Radio Network Controller |
| SS7 | Signalling System N$^{o}$ 7 |
| SSCF-NNI | Service Specific Co-ordination Function – Network Node Interface |
| SSCOP | Service Specific Connection Oriented Protocol |
| SSN | Sub-System Number |
| UE | User Equipment |
| UMTS | Universal Mobile Telecommunication System |
| UTRAN | UMTS Terrestrial Radio Access Network |

**3GPP TSG-RAN WG3 Meeting #34** **Tdoc R3-030362**
**Sophia Antipolis, France, 17th – 21st February 2003**

CR-Form-v7

# CHANGE REQUEST

⌘ **25.453** **CR** **022** ⌘ **rev** **2** ⌘ Current version: **5.4.0** ⌘

*For **HELP** on using this form, see bottom of this page or look at the pop-up text over the ⌘ symbols.*

***Proposed change affects:*** UICC apps⌘ ☐ ME ☐ Radio Access Network ☒ Core Network ☐

| | | |
|---|---|---|
| ***Title:*** | ⌘ | CR on revising the position calculation function and definition of SAS to support all REL-4 UE positioning methods |
| ***Source:*** | ⌘ | RAN WG3 |
| ***Work item code:*** | ⌘ | LCS-Rel4Pos |
| ***Date:*** | ⌘ | 17/02/2003 |
| ***Category:*** | ⌘ | **C** |
| ***Release:*** | ⌘ | REL-6 |

*Use one of the following categories:*
***F*** *(correction)*
***A*** *(corresponds to a correction in an earlier release)*
***B*** *(addition of feature),*
***C*** *(functional modification of feature)*
***D*** *(editorial modification)*
Detailed explanations of the above categories can be found in 3GPP TR 21.900.

*Use one of the following releases:*
*2* *(GSM Phase 2)*
*R96* *(Release 1996)*
*R97* *(Release 1997)*
*R98* *(Release 1998)*
*R99* *(Release 1999)*
*Rel-4* *(Release 4)*
*Rel-5* *(Release 5)*
*Rel-6* *(Release 6)*

| | | |
|---|---|---|
| ***Reason for change:*** | ⌘ | During RAN #13, modifications to the UE positioning Stage-2 specification (TS 25.305) were approved in order to extend the scope of the Stand-Alone SMLC (SAS) so that its position calculation functionality could support all Rel-4 UE positioning methods.<br><br>Currently, the PCAP signalling specification (TS 25.453) only supports the A-GPS positioning method. |
| ***Summary of change:*** | ⌘ | The definitions of the Stand-Alone SMLC and the Position Calculation procedure have been revised to support all Rel 4 UE-positioning methods (Cell ID, OTDOA, and A-GPS).<br><br>Specifically, the POSITION CALCULATION REQUEST message (clause 9.1.3) is updated to add measurements and reference assistance info to enable:<br><br>- Cell ID positioning method<br>- OTDOA positioning method<br><br>Seven new IEs have been proposed for addition to clause 9.2.2 to support the additional positioning methods introduced for clause 9.1.3.<br><br>The corresponding ASN.1 code changes have been included as well.<br><br>The POSITION CALCULATION RESPONSE message remains unchanged. |
| ***Consequences if not approved:*** | ⌘ | The extension of SAS position calculation functionality to all Rel 4 positioning methods will not be realized. |

| | | | | | |
|---|---|---|---|---|---|
| ***Clauses affected:*** | ⌘ | 1, 2, 3.1, 3.2, 5, 7, 8.2.3, 9.1.3, 9.2.2.3, 9.2.2.a-g, 9.3.3, 9.3.4, 9.3.6 | | | |
| | | **Y** | **N** | | |
| ***Other specs*** | ⌘ | **X** | | Other core specifications | ⌘ TS 25.450<br>TS 25.452<br>TS 25.401 |
| ***affected:*** | | | **X** | Test specifications | |
| | | | **X** | O&M Specifications | |

***Other comments:*** ⌘

The CR (022) is the follow-up revision of R3-030009 discussed during last RAN WG3 Rel-6 Ad Hoc meeting in Wokingham (17 Jan). For this most recent version, agreed action points (conclusions) from Wokingham are addressed. In addition to the tabular modifications, the corresponding ASN.1 material has been included.

With respect to the action points from Wokingham, please consider the following changed aspects:

**a)** List in clause 9.2.2.a starts range with '1'; similar change also made to clause 9.2.2.b.

**b)** Clause 9.1.3: 'Cell-ID Measured Results' renamed 'Cell-ID Measured Results Sets'
- criticality fields are changed to show GLOBAL/reject and appropriate dashes
- criticality fileds for 'OTDOA Meas Group' changed as well (YES/reject)

**c)** Three OTDOA-related groups are consolidated under 'OTDOA Measurement Group'

**d)** New IEs proposed for addition to clause 9.1.3 now appear at end of table 6

**e)** Primary CPICH infos are replaced by UC-ID's (aligned with RNSAP)

**f)** 'Cell Position' for OTDOA cases is replaced with 'UTRAN Access Point Position with Altitude'; 'Cell Position' for Cell-ID case is clarified to be 'Geographical Area'.

**g)** Several editorial changes are made to show parameter groups in bold text and CHOICE options in italics.

With respect to the open issue regarding the timestamping of OTDOA measurement sets, it has been proposed to add a 'Measurement Delay' field to the 'OTDOA Measured Results Info List' IE in 9.2.2.b. Accordingly, several fields related to timing drift have been proposed for incorporation into the 'OTDOA Neighbour Cell Info' and 'OTDOA Reference Cell Info" IEs in 9.2.2.c and 9.2.2.d respectively.

As a result of helpful comments received during the review of the draft version of the R3-030051 contribution, the following additional modifications have been incorporated into this proposal:

**a)** As mentioned above, occurrences of 'Primary CPICH Info' have been replaced with 'UC-ID'. Although this could possibly be done with the 'C-ID' parameter, it was commented that 'UC-ID' allows flexibility for OTDOA cases in which cells from two different RNCs may be involved.

**b)** The adjustment to the 'Cause' IE in clause 9.2.2.3 has been expanded to allow a wider variety of possible error reasons.

**c)** It was commented that when RxTx time difference information is included in clause 9.2.2.a, incorporation of this RxTx/RTT information into a position calculation requires knowledge of the position (and possibly the altitude) of the NodeB antenna. Thus, the 'UTRAN Access Point Position with Altitude' has been included within the 'UE Rx-Tx time difference info' group of clause 9.2.2.a.

---------- revision 1 ----------

This "rev 1" of CR 022 is the follow-up revision of R3-030051 discussed during RAN WG3 meeting #34. Please consider the following changed aspects resulting from comments on R3-030051. As a convenience, these additional proposed change areas are highlighted with yellow shading:

a) Clause 9.2.2.3: Added Radio Network Layer Cause values are now shown after the existing ellipsis notation.

b) Clause 9.2.2.a: Previous "Geographical Area" and "UE Rx-Tx time difference info" elements are now arranged as a CHOICE of "Cell-ID Info Type"

- Within this CHOICE structure, "Geographical Area" is provided as an optional element witin the "UE Rx-Tx time difference info"

- “UE Rx-Tx time difference type 2” field type/reference now shown as Integer instead of Real, with unit/range/step details provided in semantics description column

c) ASN.1, page 27: Extension IEs proposed for addition to PositionCalculationRequest are now shown as optional instead of mandatory.

d) ASN.1, page 32: New values proposed for CauseRadioNetwork are added after the existing ellipsis.

e) ASN.1, page 33: CellId-MeasuredResultsSets now shown with SIZE starting with “1”

f) ASN.1, page 33: CellId-MeasuredResultsInfoList now shown with SIZE starting with “1”

g) ASN.1, page 33: CellIdInfoType CHOICE description introduced according to tabular changes above in item “b”

h) ASN.1, page 44: OTDOA-NeighbourCellInfoList now shown with SIZE starting with “1”

i) ASN.1, page 44: OTDOA-MeasuredResultsSets now shown with SIZE starting with “1”

j) ASN.1, page 44: SFNSFNValue changed from (0..65535) to (0..614399) as in RNSAP.

k) ASN.1, page 45: SFN added to TUTRANGPSMeasurementValueInformation to match tabular. Also, SFN definition of INTEGER (0..4095) is added.

l) ASN.1, page 47: Identifiers for CellId-MeasuredResultsSets & OTDOA-MeasurementGroup are added.

---------- revision 2 ----------

This “rev 2” of CR 022 is the follow-up revision of R3-030325 submitted during RAN WG3 meeting #34 and subsequently considered for e-mail approval. Please consider the following changed aspects resulting from comments on R3-030325. As a convenience, these additional proposed change areas are highlighted with light-blue shading:

a) Editorial (tabular):

- Indentations implemented with MSWord Indent Function (instead of spaces)
- Each word of IEs are capitalised
- Names of IE groups are bolded
- Entries in ‘Range’ column are italicised
- Empty rows removed

b) Clause 9.2.2.a: ‘Cell-ID Measured Results Info’ IE is restructured to match that of the original proposal in R3-030051 (Mandatory ‘Geographical Area’; Optional ‘UE Rx-Tx Time Difference Info’).

c) Clause 9.2.2.b: Range of ‘UE SFN-SFN Observed Time Difference Type 2 Info’ clarified to be ‘1’.

d) Clause 9.2.2.c: Range of ‘TUTRAN-GPS’ clarified to be ‘1’.

e) Clause 9.2.2.d: Range of ‘TUTRAN-GPS’ clarified to be ‘1’.

f) ASN.1, page 28: Added comma to ‘PositionCalcuationRequestExtensions’

g) ASN.1, page 33: Removed comma from ‘CauseRadioNetwork’

h) ASN.1, page 34: ‘CellId-MeasuredResultsInfo’ aligned with tabular in 9.2.2.a

- ‘iE-Extensions’ added to ‘UE-RxTxTimeDifferenceInfo’, ‘UE-PositioningMeasQuality’, ‘UTRANAccessPointPositionAltitude’

i) ASN.1, page 44: ‘OTDOA-MeasurementGroupInfo’ simplified to ‘OTDOA-MeasurementGroup’

j) ASN.1, page 45: ‘TUTRANGPSMeasurementValueInfo’ changed to ‘TUTRANGPSMeasurementValueInfoList’

k) ASN.1, page 45: ‘iE-Extensions’ added to ‘UE-SFNSFNTimeDifferenceInfo’, ‘UC-ID’, ‘SFNSFNMeasurementValueInfo’

l) ASN.1, page 46: Added missing ‘TUTRANGPSMeasurementValueInfoList’ description

m) ASN.1, page 46: ‘TUTRANGPSMeasurementValueInformation’ changed to ‘TUTRANGPSMeasurementValueInfo’

- ‘iE-Extensions’ added to ‘TUTRANGPSMeasurementValueInfo’

n) ASN.1, page 49: Protocol IE Ids allocated for ‘id-CellId-MeasuredResultsSets’ and ‘id-OTDOA-MeasurementGroup’

o) Clause 9.2.2.a: ‘UE Rx-Tx Time Difference Info’ group changed to ‘Round Trip Time Info’ group, italics removed, group title bolded accordingly.

p) Clause 9.2.2.a: Semantics description for ‘UE Rx-Tx Time Difference Type 2’

| | |
|---|---|
| | measurement replaced with mapping reference to 25.133.<br>q) ASN.1, page 34: In 'CellId-MeasuredResultsInfo', 'UE-RxTxTimeDifferenceInfoList' replaced by an OPTIONAL 'RoundTripTimeInfo'. 'UE-RxTxTimeDifferenceInfo' replaced by 'RoundTripTimeInfo'. Definition of 'UE-RxTxTimeDifferenceInfoList' removed.<br>r) ASN.1, page 34: Instances of 'UE-RxTxTimeDifference' replaced with 'UE-RxTxTimeDifferenceType2'. Also, mapping comments removed from below 'UE-RxTxTimeDifferenceType2' definition (mapping reference is in tabular).<br>s) ASN.1, page 45: In 'OTDOA-ReferenceCellInfo', 'tUTRANGPSMeasurementValueInfoList' replaced by an OPTIONAL 'tUTRANGPSMeasurementValueInfo'.<br>t) ASN.1, page 45: 'UE-SFNSFNTimeDifferenceInfo' replaced by 'UE-SFNSFNTimeDifferenceType2Info'<br>u) ASN.1, page 45: 'UE-SFNSFNTimeDifference' replaced by 'UE-SFNSFNTimeDifferenceType2'<br>v) ASN.1, page 46: Definition of 'tUTRANGPSMeasurementValueInfoList' removed.<br><br>w) Clause 9.2.2.a: Structural adjustment to 'Cell-ID Measured Results Info List'<br>- 'UTRAN Access Point with Altitude' moved from 'Round Trip Time Info' group to common part<br>- 'Geographical Area' presence is changed from 'M' to 'O'<br>- 'UC-ID' added to common part as measured cell identifier<br>x) ASN.1, page 34: Alignment to tabular adjustments made in item 'w' directly above<br>- 'UTRANAccessPointwithAltitude' moved from 'RoundTripTimeInfo' group to common part of 'CellId-MeasuredResultsInfo'<br>- 'UE-PositionEstimate' presence changed from 'M' to 'O' in 'CellId-MeasuredResultsInfo'<br>- 'UC-ID' added to common part of 'CellId-MeasuredResultsInfo' |

**How to create CRs using this form:**

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1) Fill out the above form. The symbols above marked ⌘ contain pop-up help information about the field that they are closest to.
2) Obtain the latest version for the release of the specification to which the change is proposed. Use the MS Word "revision marks" feature (also known as "track changes") when making the changes. All 3GPP specifications can be downloaded from the 3GPP server under ftp://ftp.3gpp.org/specs/ For the latest version, look for the directory name with the latest date e.g. 2001-03 contains the specifications resulting from the March 2001 TSG meetings.
3) With "track changes" disabled, paste the entire CR form (use CTRL-A to select it) into the specification just in front of the clause containing the first piece of changed text. Delete those parts of the specification which are not relevant to the change request.

# 1 Scope

The present document specifies the *Positioning Calculation Application Part (PCAP)* between the Radio Network Controller (RNC) and the Stand-Aalone ~~A-GPS-~~SMLC (SAS). It fulfills the RNC-SAS communication requirements specified in [6] and thus defines the Iupc interface and its associated signaling procedures.

# 2 References

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

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


[1] 3GPP TS 25.450: "UTRAN Iupc interface general aspects and principles".

[2] 3GPP TS 25.451: "UTRAN Iupc interface layer 1".

[3] 3GPP TS 25.452: "UTRAN Iupc interface signalling transport".

[4] 3GPP TS 25.331: "Radio Resource Control (RRC) Protocol Specification".

[5] 3GPP TS 25.401: "UTRAN Overall Description".

[6] 3GPP TS 25.305: "Stage 2 functional specification of UE positioning in UTRAN".

[7] ITU-T Recommendation X.680 (1997): "Information technology - Abstract Syntax Notation One (ASN.1): Specification of basic notation".

[8] ITU-T Recommendation X.681 (1997): "Information technology - Abstract Syntax Notation One (ASN.1): Information object specification".

[9] ITU-T Recommendation X.691 (1997): "Information technology - ASN.1 encoding rules: Specification of Packed Encoding Rules (PER)".

[10] ICD-GPS-200: "Navstar GPS Space Segment/Navigation User Interface".

[11] 3GPP TS 23.032: "Universal Geographical Area Description (GAD)".

[12] 3GPP TR 25.921: "Guidelines and principles for protocol description and error handling".

[13] 3GPP TS 25.133: "Requirements for support of Radio Resource management (FDD)".

# 3 Definitions and abbreviations

## 3.1 Definitions

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

**Stand-Aalone ~~A-GPS~~ SMLC (SAS):** logical node that interconnects to the RNC over the Iupc interface via the PCAP protocol
An SAS performs the following procedures:

- provide GPS related data to the RNC;
- performs the position calculation function ~~for UE-assisted GPS~~ based upon UE Positioning measurement data.

**Elementary Procedure:** PCAP consists of Elementary Procedures (EPs)
An Elementary Procedure is a unit of interaction between the RNC and the SAS. 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.

Class 2 EPs are considered always successful.

**Information Exchange Context:** Information Exchange Context is created by the first Information Exchange Initiation Procedure initiated by the RNC and requested from the SAS
The Information Exchange Context is deleted by the Information Exchange Termination or the Information Exchange Failure procedure when there is no more Information Exchange to be provided by the RNC to the SAS. The Information Exchange Context is identified by an SCCP connection as, for Information Exchanges, only the connection oriented mode of the signalling bearer is used.

## 3.2 Abbreviations

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

| | |
|---|---|
| A-GPS | Assisted GPS |
| ASN.1 | Abstract Syntax Notation One |
| CN | Core Network |
| CRNC | Controlling RNC |
| DGPS | Differential GPS |
| EP | Elementary Procedure |
| GPS | Global Positioning System |
| MSC | Mobile services Switching Center |
| OTDOA | Observed Time Difference Of Arrival |
| PCAP | Positioning Calculation Application Part |
| PRC | Pseudorange Correction |
| RNC | Radio Network Controller |
| RNS | Radio Network Subsystem |
| RRC | Radio Resource Control |
| SAS | Stand-Aalone ~~A-GPS~~ SMLC |
| SCCP | Signalling Connection Control Part |

| | |
|---|---|
| SIB | System Information Block |
| SMLC | Serving Mobile Location Center |
| SRNC | Serving RNC |
| SRNS | Serving RNS |
| TOW | Time of Week |
| UE | User Equipment |
| UTRAN | Universal Terrestrial Radio Access Network |

***… <NEXT MODIFIED SECTION> …***

# 5 PCAP Services

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

1. Position Calculation Service: They are related to a single UE and involve the transfer of ~~GPS~~ UE Positioning measurement data and UE position estimate data over the Iupc interface between the SRNC and the SAS. They utilise connectionless signalling transport provided by the Iupc signalling bearer.

2. Information Exchange Service: They involve the transfer of GPS related data over the Iupc interface between the RNC and the SAS on demand, on modification, or at regular intervals. They utilise connection-oriented signalling transport provided by the Iupc signalling bearer.

# 6 Services Expected from Signalling Transport

Signalling transport [3] shall provide the following service for the PCAP.

1. Connection oriented data transfer service. This service is supported by a signalling connection between the RNC 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.

2. Connectionless data transfer service. PCAP shall be notified in case a PCAP message did not reach the intended peer PCAP entity.

# 7 Functions of PCAP

PCAP has the following functions:

- Position Calculation. This function enables the SRNC to interact with an SAS in the process of performing a position estimate of a UE.

- Information Exchange. This function enables the RNC to obtain GPS related data from an SAS.

- Reporting of General Error Situations. This function allows reporting of general error situations for which function specific error messages have not been defined.

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

**Table 1: Mapping between functions and PCAP elementary procedures**

| Function | Elementary Procedure(s) |
|---|---|
| Position Calculation | a) Position Calculation |
| Information Exchange | a) Information Exchange Initiation<br>b) Information Reporting<br>c) Information Exchange Termination<br>d) Information Exchange Failure |
| Reporting of General Error Situations | a) Error Indication |

# 8 PCAP Procedures

## 8.1 Elementary Procedures

In the following tables, all EPs are divided into class 1 and class 2 EPs (see clause 3.1 for explanation of the different classes).

**Table 2: Class 1**

| Elementary Procedure | Initiating Message | Successful Outcome | Unsuccessful Outcome |
|---|---|---|---|
| | | Response message | Response message |
| Position Calculation | POSITION CALCULATION REQUEST | POSITION CALCULATION RESPONSE | POSITION CALCULATION FAILURE |
| Information Exchange Initiation | IINFORMATION EXCHANGE INITIATION REQUEST | INFORMATION EXCHANGE INITIATION RESPONSE | INFORMATION EXCHANGE INITIATION FAILURE |

**Table 3: Class 2**

| Elementary Procedure | Message |
|---|---|
| Information Reporting | INFORMATION REPORT |
| Information Exchange Termination | INFORMATION EXCHANGE TERMINATION REQUEST |
| Information Exchange Failure | INFORMATION EXCHANGE FAILURE INDICATION |
| Error Indication | ERROR INDICATION |

## 8.2 Position Calculation

### 8.2.1 General

The purpose of the Position Calculation procedure is to enable an SRNC to query an SAS for a position estimate of a UE. The procedure uses connectionless signalling.

## 8.2.2 Successful Operation

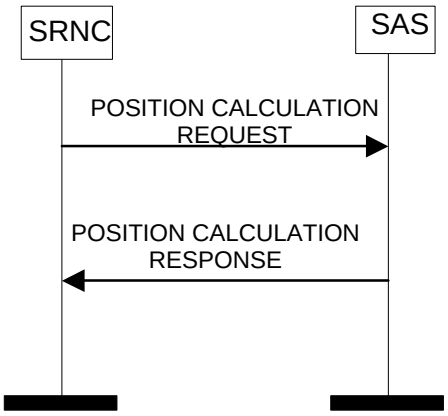


**Figure 1: Position Calculation procedure, Successful Operation**

The procedure is initiated with a POSITION CALCULATION REQUEST message sent from the SRNC to the SAS. When the SAS receives the POSITION CALCULATION REQUEST message, it shall calculate the UE position based on the provided measurement data.

**Response Message:**

If the SAS was able to calculate the position estimate, it shall respond with a POSITION CALCULATION RESPONSE message.

## 8.2.3 Unsuccessful Operation

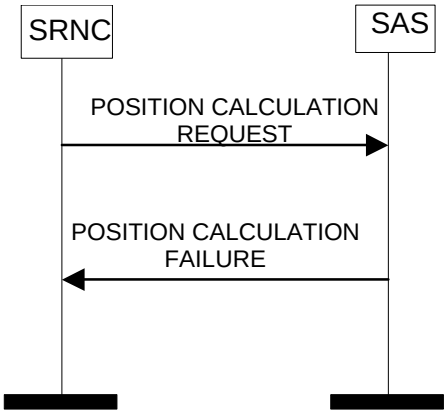


**Figure 2: Position Calculation procedure, Unsuccessful Operation**

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

Typical cause values are:

- Invalid reference information;
- Position calculation error: invalid GPS measured results;
- Processing Overload;
- Hardware Failure;
- O&M Intervention.

*… <NEXT MODIFIED SECTION> …*

## 9.1.3 Position Calculation Request

**Table 6**

| IE/Group Name | Presence | Range | IE type and reference | Semantics description | Criticality | Assigned Criticality |
|---|---|---|---|---|---|---|
| Message Type | M | | 9.2.2.24 | | YES | reject |
| Transaction ID | M | | 9.2.2.28 | | - | |
| | | | | | | |
| Initial UE Position Estimate | M | | 9.2.2.6 | | YES | reject |
| **Measured Results** | | *0..<maxNoOfSets>* | | | | |
| >GPS Measured Results | M | | 9.2.2.12 | | YES | reject |
| **Cell-ID Measured Results Sets** | | *0..<maxNoOfSets>* | | | GLOBAL | reject |
| >Cell-ID Measured Results Info List | M | | 9.2.2.a | | - | |
| **OTDOA Measurement Group** | | *0..1* | | | YES | reject |
| >OTDOA Reference Cell Info | M | | 9.2.2.d | | - | |
| **>OTDOA Neighbour Cell Info List** | | *1..<maxNoOfMeasNCell >* | | | - | |
| >>OTDOA Neighbour Cell Info | M | | 9.2.2.c | | - | |
| **>OTDOA Measured Results Sets** | | *1..<maxNoOfSets>* | | | - | |
| >>OTDOA Measured Results Info List | M | | 9.2.2.b | | - | |

**Table 7**

| Range bound | Explanation |
|---|---|
| MaxNoOfMeasNCell | Maximum number of neighbouring cells on which information can be reported. The value of MaxNoOfMeasCell is 32. |
| MaxNoOfSets | Maximum number of sets of ~~GPS~~ Measured Results included in the Position Calculation Request message. The value for maxNoOfSets is 3. |

*… <NEXT MODIFIED SECTION> …*

### 9.2.2.2 Altitude and direction

**Table 19**

| IE/Group Name | Presence | Range | IE type and reference | Semantics description |
|---|---|---|---|---|
| Direction of Altitude | M | | ENUMERATED (Height, Depth) | |
| Altitude | M | | INTEGER ( $0...2^{15}-1$) | The relation between the value (N) and the altitude (a) in meters it describes is $N \leq a < N+1$, except for $N=2^{15}-1$ for which the range is extended to include all greater values of (a). |

### 9.2.2.3 Cause

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

**Table 20**

| IE/Group Name | Presence | Range | IE Type and Reference | Semantics Description |
|---|---|---|---|---|
| CHOICE *Cause Group* | | | | |
| *>Radio Network Layer* | | | | |
| >>Radio Network Layer Cause | M | | ENUMERATED<br>(invalid reference information,<br>information temporarily not available,<br>information provision not supported for the object,<br>position calculation error: invalid GPS measured results,<br>...,<br>position calculation error: invalid Cell-ID measured results,<br>position calculation error: invalid OTDOA measured results,<br>position calculation error: A-GPS positioning method not supported,<br>position calculation error: Cell-ID positioning method not supported,<br>position calculation error: OTDOA positioning method not supported) | |
| *>Transport Layer* | | | | |
| >>Transport Layer Cause | M | | ENUMERATED<br>(Transport Resource Unavailable,<br>Unspecified,<br>...) | |
| *>Protocol* | | | | |
| >>Protocol Cause | M | | ENUMERATED<br>(Transfer Syntax Error,<br>Abstract Syntax Error (Reject),<br>Abstract Syntax Error (Ignore and Notify),<br>Message not Compatible with Receiver State,<br>Semantic Error,<br>Unspecified,<br>Abstract Syntax Error (Falsely Constructed Message),<br>...) | |
| *> Misc* | | | | |
| >>Misc Cause | M | | ENUMERATED<br>(Processing Overload,<br>Hardware Failure,<br>O&M Intervention,<br>Unspecified<br>...) | |

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.

**Table 21**

| Radio Network Layer cause | Meaning |
|---|---|
| Invalid reference information | The reference information (GPS-UTRAN Time Relationship Uncertainty and/or Initial UE Position Estimate) provided by the RNC are invalid |
| Information temporarily not available | The information requested by RNC is temporarily not available |
| Information Provision not supported for the object | The SAS does not support provision of the requested information for the concerned object types |
| Position calculation error: invalid GPS measured results | The SAS cannot calculate position due to invalid GPS measured results |
| Position calculation error: invalid Cell-ID measured results | The SAS cannot calculate position due to invalid Cell-ID measured results |
| Position calculation error: invalid OTDOA measured results | The SAS cannot calculate position due to invalid OTDOA measured results |
| Position calculation error: A-GPS positioning method not supported | The SAS cannot calculate position because it does not support the A-GPS positioning method |
| Position calculation error: Cell-ID positioning method not supported | The SAS cannot calculate position because it does not support the Cell-ID positioning method |
| Position calculation error: OTDOA positioning method not supported | The SAS cannot calculate position because it does not support the OTDOA positioning method |

**Table 22**

| 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 |

**Table 23**

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

**Table 24**

| Miscellaneous cause | Meaning |
|---|---|
| Processing Overload | RNC/SAS processing overload |
| Hardware Failure | RNC/SAS hardware failure |
| O&M Intervention | Operation and Maintenance intervention related to RNC/SAS 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 |

***… <NEXT MODIFIED SECTION> …***

### 9.2.2.6 Geographical Area

*Geographical Area* IE is used to identify an area using geographical coordinates. The reference system is the same as the one used in [11].

**Table 30**

| IE/Group Name | Presence | Range | IE type and reference | Semantics description |
|---|---|---|---|---|
| CHOICE *Geographical Area* | | | | |
| >*Point* | | | | Ellipsoid point |
| >>Geographical Coordinates | M | | 9.2.2.7 | |
| >*Point With Uncertainty* | | | | Ellipsoid point with uncertainty circle |
| >>Geographical Coordinates | M | | 9.2.2.7 | |
| >>Uncertainty Code | M | | INTEGER( 0...127) | The uncertainty "r" is derived from the "uncertainty code" k by $r = 10x(1.1^k-1)$ |
| >*Polygon* | | | | List of Ellipsoid points |
| **>>Polygon** | | *1..<maxnoofPoints>* | | |
| >>>Geographical Coordinates | M | | 9.2.2.7 | |
| >*Ellipsoid point with uncertainty Ellipse* | | | | |
| >>Geographical Coordinates | M | | 9.2.2.7 | |
| >>Uncertainty Ellipse | M | | 9.2.2.30 | |
| >>Confidence | M | | INTEGER( 0...127) | |
| >*Ellipsoid point with altitude* | | | | |
| >>Geographical Coordinates | M | | 9.2.2.7 | |
| >>Altitude and direction | M | | 9.2.2.2 | |
| >*Ellipsoid point with altitude and uncertainty Ellipsoid* | | | | |
| >>Geographical Coordinates | M | | 9.2.2.7 | |
| >>Altitude and direction | M | | 9.2.2.2 | |
| >>Uncertainty Ellipse | M | | 9.2.2.30 | |
| >>Uncertainty Altitude | M | | INTEGER( 0...127) | |
| >>Confidence | M | | INTEGER( 0...127) | |
| >*Ellipsoid Arc* | | | | |
| >>Geographical Coordinates | M | | 9.2.2.7 | |
| >>Inner radius | M | | INTEGER ( $0...2^{16}-1$) | The relation between the value (N) and the radius (r) in meters it describes is $5N \leq r < 5(N+1)$, except for $N=2^{16}-1$ for which the range is extended to include all grater values of (r). |
| >>Uncertainty radius | M | | INTEGER( 0...127) | The uncertainty "r" is derived from the "uncertainty code" k by $r = 10x(1.1^k-1)$ |
| >>Offset angle | M | | INTEGER( 0...179) | The relation between the value (N) and the angle (a) in degrees it describes is $2N \leq a < 2(N+1)$ |

| IE/Group Name | Presence | Range | IE type and reference | Semantics description |
|---|---|---|---|---|
| >>Included angle | M | | INTEGER( 0...179) | The relation between the value (N) and the angle (a) in degrees it describes is 2N≤ a <2(N+1) |
| >>Confidence | M | | INTEGER( 0...127) | |

**Table 31**

| Range bound | Explanation |
|---|---|
| MaxnoofPoints | Maximum no. of points in polygon. Value is 15. |

### 9.2.2.7 Geographical Coordinates

This IE contains the geographical coordinates.

**Table 32**

| IE/Group Name | Presence | Range | IE type and reference | Semantics description |
|---|---|---|---|---|
| Latitude Sign | M | | ENUMERATED (North, South) | |
| Degrees Of Latitude | M | | INTEGER ( $0...2^{23}-1$) | The IE value (N) is derived by this formula: $N \leq 2^{23} X /90 < N+1$ X being the latitude in degree (0°.. 90°) |
| Degrees Of Longitude | M | | INTEGER ( $-2^{23}...2^{23}-1$) | The IE value (N) is derived by this formula: $N \leq 2^{24} X /360 < N+1$ X being the longitude in degree (-180°..+180°) |

*… <NEXT MODIFIED SECTION> …*

## 9.2.2.a Cell-ID Measured Results Info List

This IE contains the Cell-ID measurements of signals associated with one or more cells.

| IE/Group Name | Presence | Range | IE Type and Reference | Semantics Description |
|---|---|---|---|---|
| **Cell-ID Measured Results Info** | | *1..< maxNoOfMeasNCell >* | | |
| >UC-ID | M | | | The identifier of the measured cell. |
| >UTRAN Access Point Position with Altitude | M | | 9.2.2.f | Exact geographical position of the base station antenna. |
| >Geographical Area | O | | 9.2.2.6 | |
| **>Round Trip Time Info** | | *0..1* | | |
| >>UE Rx-Tx Time Difference Type 2 | M | | INTEGER (0..8191) | According to mapping in [13]. |
| >>UE Positioning Measurement Quality | M | | 9.2.2.e | Quality of the UE Rx-Tx time difference measurement. |
| >>Round Trip Time | M | | INTEGER (0..32767) | According to mapping in [13]. |

**Table 7**

| Range bound | Explanation |
|---|---|
| MaxNoOfMeasNCell | Maximum number of neighbour cells on which information can be reported. The value of MaxNoOfMeasNCell is 32. |

## 9.2.2.b OTDOA Measured Results Info List

This IE contains the OTDOA measurements of signals sent from the reference and neighbour cells.

| IE/Group Name | Presence | Range | IE Type and Reference | Semantics Description |
|---|---|---|---|---|
| **OTDOA Measured Results Info** | | *1..<MaxnoofMeasNCell>* | | |
| >UC-ID | M | | 9.2.2.g | The identifier of the neighbour cell. |
| **>UE SFN-SFN Observed Time Difference Type 2 Info** | | *1* | | |
| >>SFN-SFN Observed Time Difference Type 2 | M | | INTEGER (0..40961) | Gives the observed timing of the neighbour cell relative to the reference cell. |
| >>UE Positioning Measurement Quality | M | | 9.2.2.e | Quality of the observed time difference measurement. |
| >>Measurement Delay | M | | INTEGER (0..65535) | The interval of time, in units of 10ms frames, spanning the following two events:<br><br>1) Time of applicability of the SFN-SFN Value or TUTRAN-GPS/SFN relationship provided for the corresponding neighbour cell in 9.2.2.c.<br><br>2) The point in time when this corresponding SFN-SFN observed time difference measurement was captured by the UE. |

| Range bound | Explanation |
|---|---|
| MaxNoOfMeasNCell | Maximum number of neighbouring cells on which information can be reported. The value of MaxNoOfMeasNCell is 32. |

## 9.2.2.c OTDOA Neighbour Cell Info

| IE/Group Name | Presence | Range | IE Type and Reference | Semantics Description |
|---|---|---|---|---|
| UC-ID | M | | 9.2.2.g | The identifier of the neighbour cell. |
| UTRAN Access Point Position with Altitude | M | | 9.2.2.f | Exact geographical position of the base station antenna. |
| CHOICE *Relative Timing Difference Info* | M | | | |
| *>SFN-SFN Measurement Value Information* | | | | |
| >>SFN-SFN Value | M | | INTEGER (0..614399) | |
| >>SFN-SFN Quality | O | | INTEGER (0..255) | Indicates the standard deviation (std) of the SFN-SFN otd (observed time difference) measurements in 1/16 chip. SFN-SFN Quality = $\sqrt{E[(x-\mu)^2]}$ = std of reported SFN-SFN Value, where x is the reported SFN-SFN Value and $\mu$ = E[x] is the expectation value of x. |
| >>SFN-SFN Drift Rate | M | | INTEGER (-100..+100) | Indicates the SFN-SFN drift rate in 1/256 chip per second. A positive value indicates that the Reference cell clock is running at a greater frequency than the measured neighbouring cell. |
| >>SFN-SFN Drift Rate Quality | O | | INTEGER (0..100) | Indicates the standard deviation (std) of the SFN-SFN drift rate measurements in 1/256 chip per second. SFN-SFN Drift Rate Quality = $\sqrt{E[(x-\mu)^2]}$ = std of reported SFN-SFN Drift Rate, where x is the reported SFN-SFN Drift Rate and $\mu$ = E[x] is the expectation value of x. |
| *>$T_{UTRAN-GPS}$ Measurement Value Information* | | | | |
| >>SFN | M | | INTEGER (0..4095) | SFN during which the $T_{UTRAN-GPS}$ measurement was performed |
| **>>$T_{UTRAN-GPS}$** | | *1* | | Indicates the UTRAN GPS Timing of Cell Frame for LCS. |
| >>>MS | M | | INTEGER (0..16383) | Most significant part |
| >>>LS | M | | INTEGER (0..4294967295) | Least significant part |
| >>$T_{UTRAN-GPS}$ Quality | O | | INTEGER (0..255) | Indicates the standard deviation (std) of the $T_{UTRAN-GPS}$ measurements in 1/16 chip. $T_{UTRAN-GPS}$ Quality = $\sqrt{E[(x-\mu)^2]}$ = std of reported $T_{UTRAN-GPS}$ Value, where x is the reported $T_{UTRAN-GPS}$ Value and $\mu$ = E[x] is the expectation value of x. |
| >>$T_{UTRAN-GPS}$ Drift Rate | M | | INTEGER (-50..+50) | Indicates the $T_{UTRAN-GPS}$ drift rate in 1/256 chip per second. A positive value indicates that the UTRAN clock is running at a lower frequency than GPS clock. |

| | | | | |
|---|---|---|---|---|
| >>$T_{UTRAN-GPS}$ Drift Rate Quality | O | | INTEGER (0..50) | Indicates the standard deviation (std) of the $T_{UTRAN-GPS}$ drift rate measurements in 1/256 chip per second. $T_{UTRAN-GPS}$ Drift Rate Quality = $\sqrt{E[(x-\mu)^2]}$ = std of reported $T_{UTRAN-GPS}$ Drift Rate, where x is the reported $T_{UTRAN-GPS}$ Drift Rate and $\mu = E[x]$ is the expectation value of x. |

## 9.2.2.d OTDOA Reference Cell Info

| IE/Group Name | Presence | Range | IE Type and Reference | Semantics Description |
|---|---|---|---|---|
| UC-ID | M | | 9.2.2.g | The identifier of the reference cell. |
| UTRAN Access Point Position with Altitude | M | | 9.2.2.f | Exact geographical position of the base station antenna. |
| **$T_{UTRAN-GPS}$ Measurement Value Information** | | *0..1* | | |
| >SFN | M | | INTEGER (0..4095) | SFN during which the $T_{UTRAN-GPS}$ measurement was performed |
| **>$T_{UTRAN-GPS}$** | | *1* | | Indicates the UTRAN GPS Timing of Cell Frame for LCS. |
| >>MS | M | | INTEGER (0..16383) | Most significant part |
| >>LS | M | | INTEGER (0..4294967295) | Least significant part |
| >$T_{UTRAN-GPS}$ Quality | O | | INTEGER (0..255) | Indicates the standard deviation (std) of the $T_{UTRAN-GPS}$ measurements in 1/16 chip. $T_{UTRAN-GPS}$ Quality = $\sqrt{E[(x-\mu)^2]}$ = std of reported $T_{UTRAN-GPS}$ Value, where x is the reported $T_{UTRAN-GPS}$ Value and $\mu$ = E[x] is the expectation value of x. |
| >$T_{UTRAN-GPS}$ Drift Rate | M | | INTEGER (-50..+50) | Indicates the $T_{UTRAN-GPS}$ drift rate in 1/256 chip per second. A positive value indicates that the UTRAN clock is running at a lower frequency than GPS clock. |
| >$T_{UTRAN-GPS}$ Drift Rate Quality | O | | INTEGER (0..50) | Indicates the standard deviation (std) of the $T_{UTRAN-GPS}$ drift rate measurements in 1/256 chip per second. $T_{UTRAN-GPS}$ Drift Rate Quality = $\sqrt{E[(x-\mu)^2]}$ = std of reported $T_{UTRAN-GPS}$ Drift Rate, where x is the reported $T_{UTRAN-GPS}$ Drift Rate and $\mu$ = E[x] is the expectation value of x. |

## 9.2.2.e UE Positioning Measurement Quality

| IE/Group Name | Presence | Range | IE Type and Reference | Semantics Description |
|---|---|---|---|---|
| Std Resolution | M | | BIT STRING(2) | Std Resolution field includes the resolution used in Std of Measurements field. Encoding on two bits as follows:<br>'00' 10 meters<br>'01' 20 meters<br>'10' 30 meters<br>'11' Reserved |
| Number of Measurements | M | | BIT STRING(3) | The 'Number of Measurements' field indicates how many measurements have been used in the UE to determine the sample standard deviation of the measurements. Following 3 bit |

| | | | | |
|---|---|---|---|---|
| | | | | encoding is used:<br>'001' 5-9<br>'010' 10-14<br>'011' 15-24<br>'100' 25-34<br>'101' 35-44<br>'110' 45-54<br>'111' 55 or more<br>Special case:<br>'000':In this case the field 'Std of Measurements' contains the std of the reported measurement value = $\sqrt{E[(x-\mu)^2]}$, where x is the reported value and $\mu = E[x]$ is the expectation value (i.e. the true value) of x. This std can be used irrespective of the number of measurements and reporting of the number of measurements is not needed. Also other measurements such as Ec/No or Rx levels can be utilised in this case to evaluate the 'Std of Measurements' reported in this IE. |
| Std of Measurements | M | | BIT STRING(5) | Std of Measurements field includes sample standard deviation of measurements (when number of measurements is reported in 'Number of Measurements' field) or standard deviation of the reported measurement value = $\sqrt{E[(x-\mu)^2]}$, where x is the reported value and $\mu = E[x]$ is the expectation value (i.e. the true value) of x (when '000' is given in 'Number of Measurements' field).<br>Following linear 5 bit encoding is used:<br>'00000' 0 - (R*1-1) meters<br>'00001' R*1 – (R*2-1) meters<br>'00010' R*2 – (R*3-1) meters<br>…<br>'11111' R*31 meters or more<br>where R is the resolution defined by Std Resolution field. E.g. R=20 m corresponds to 0-19 m, 20-39 m,…,620+ m. |

## 9.2.2.f UTRAN Access Point Position with Altitude

The UTRAN Access Point Position with Altitude indicates the exact geographical position of the base station antenna. The altitude shall be included when available.

| IE/Group Name | Presence | Range | IE Type and Reference | Semantics Description |
|---|---|---|---|---|
| Geographical Coordinates | M | | 9.2.2.7 | |
| Altitude and direction | O | | 9.2.2.2 | |

### 9.2.2.g UTRAN Cell Identifier (UC-ID)

The UC-ID (UTRAN Cell identifier) is the identifier of a cell in one UTRAN.

| IE/Group Name | Presence | Range | IE Type and Reference | Semantics Description |
|---|---|---|---|---|
| RNC-ID | M | | INTEGER (0..4095) | The identifier of one RNC in UTRAN. |
| C-ID | M | | INTEGER (0..65535) | The identifier of a cell in one RNS. |

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

## 9.3.0 General

PCAP ASN.1 definition conforms with [7], [8], and [9].

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 clause 10.3.6.

Clause 9.3 presents the Abstract Syntax of PCAP protocol with ASN.1. In case there is contradiction between the ASN.1 definition in this clause and the tabular format in clauses 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(4) version1 (1) pcap-PDU-Descriptions (0)}

DEFINITIONS AUTOMATIC TAGS ::=

BEGIN

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

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

IMPORTS
    Criticality,
    ProcedureCode,
    TransactionID
FROM PCAP-CommonDataTypes

    PositionCalculationRequest,
    PositionCalculationResponse,
    PositionCalculationFailure,
    InformationExchangeInitiationRequest,
    InformationExchangeInitiationResponse,
    InformationExchangeInitiationFailure,
    InformationReport,
    InformationExchangeTerminationRequest,
    InformationExchangeFailureIndication,
    ErrorIndication,
    PrivateMessage
FROM PCAP-PDU-Contents

    id-PositionCalculation,
    id-InformationExchangeInitiation,
    id-InformationReporting,
    id-InformationExchangeTermination,
    id-InformationExchangeFailure,
    id-ErrorIndication,
    id-privateMessage
FROM PCAP-Constants;

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

PCAP-ELEMENTARY-PROCEDURE ::= CLASS {
    &InitiatingMessage          ,
    &SuccessfulOutcome          OPTIONAL,
    &UnsuccessfulOutcome        OPTIONAL,
    &Outcome                    OPTIONAL,
    &procedureCode              ProcedureCode   UNIQUE,
    &criticality                Criticality     DEFAULT ignore
}

WITH SYNTAX {
    INITIATING MESSAGE          &InitiatingMessage
    [SUCCESSFUL OUTCOME         &SuccessfulOutcome]
    [UNSUCCESSFUL OUTCOME       &UnsuccessfulOutcome]
    [OUTCOME                    &Outcome]
    PROCEDURE CODE              &procedureCode
    [CRITICALITY                &criticality]
}

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

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


InitiatingMessage ::= SEQUENCE {
    procedureCode   PCAP-ELEMENTARY-PROCEDURE.&procedureCode        ({PCAP-ELEMENTARY-PROCEDURES}),
    criticality     PCAP-ELEMENTARY-PROCEDURE.&criticality          ({PCAP-ELEMENTARY-
PROCEDURES}{@procedureCode}),
    transactionID   TransactionID,
```

```
    value           PCAP-ELEMENTARY-PROCEDURE.&InitiatingMessage    ({PCAP-ELEMENTARY-
PROCEDURES}{@procedureCode})
}

SuccessfulOutcome ::= SEQUENCE {
    procedureCode   PCAP-ELEMENTARY-PROCEDURE.&procedureCode        ({PCAP-ELEMENTARY-PROCEDURES}),
    criticality     PCAP-ELEMENTARY-PROCEDURE.&criticality          ({PCAP-ELEMENTARY-
PROCEDURES}{@procedureCode}),
    transactionID   TransactionID,
    value           PCAP-ELEMENTARY-PROCEDURE.&SuccessfulOutcome    ({PCAP-ELEMENTARY-
PROCEDURES}{@procedureCode})
}

UnsuccessfulOutcome ::= SEQUENCE {
    procedureCode   PCAP-ELEMENTARY-PROCEDURE.&procedureCode        ({PCAP-ELEMENTARY-PROCEDURES}),
    criticality     PCAP-ELEMENTARY-PROCEDURE.&criticality          ({PCAP-ELEMENTARY-
PROCEDURES}{@procedureCode}),
    transactionID   TransactionID,
    value           PCAP-ELEMENTARY-PROCEDURE.&UnsuccessfulOutcome  ({PCAP-ELEMENTARY-
PROCEDURES}{@procedureCode})
}

Outcome ::= SEQUENCE {
    procedureCode   PCAP-ELEMENTARY-PROCEDURE.&procedureCode    ({PCAP-ELEMENTARY-PROCEDURES}),
    criticality     PCAP-ELEMENTARY-PROCEDURE.&criticality      ({PCAP-ELEMENTARY-
PROCEDURES}{@procedureCode}),
    transactionID   TransactionID,
    value           PCAP-ELEMENTARY-PROCEDURE.&Outcome          ({PCAP-ELEMENTARY-
PROCEDURES}{@procedureCode})
}

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

PCAP-ELEMENTARY-PROCEDURES PCAP-ELEMENTARY-PROCEDURE ::= {
    PCAP-ELEMENTARY-PROCEDURES-CLASS-1  |
    PCAP-ELEMENTARY-PROCEDURES-CLASS-2  ,
    ...
}

PCAP-ELEMENTARY-PROCEDURES-CLASS-1 PCAP-ELEMENTARY-PROCEDURE ::= {
    positionCalculation         |
    informationExchangeInitiation,
    ...
}


PCAP-ELEMENTARY-PROCEDURES-CLASS-2 PCAP-ELEMENTARY-PROCEDURE ::= {
    informationReporting            |
    informationExchangeTermination  |
    informationExchangeFailure      |
    errorIndication             |
    privateMessage,
    ...
}


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

positionCalculation PCAP-ELEMENTARY-PROCEDURE ::= {
    INITIATING MESSAGE      PositionCalculationRequest
    SUCCESSFUL OUTCOME      PositionCalculationResponse
    UNSUCCESSFUL OUTCOME    PositionCalculationFailure
    PROCEDURE CODE          id-PositionCalculation
    CRITICALITY             ignore
}


informationExchangeInitiation PCAP-ELEMENTARY-PROCEDURE ::= {
    INITIATING MESSAGE      InformationExchangeInitiationRequest
    SUCCESSFUL OUTCOME      InformationExchangeInitiationResponse
```

```
    UNSUCCESSFUL OUTCOME    InformationExchangeInitiationFailure
    PROCEDURE CODE          id-InformationExchangeInitiation
    CRITICALITY             reject
}


informationReporting PCAP-ELEMENTARY-PROCEDURE ::= {
    INITIATING MESSAGE      InformationReport
    PROCEDURE CODE          id-InformationReporting
    CRITICALITY             ignore
}


informationExchangeTermination PCAP-ELEMENTARY-PROCEDURE ::= {
    INITIATING MESSAGE      InformationExchangeTerminationRequest
    PROCEDURE CODE          id-InformationExchangeTermination
    CRITICALITY             ignore
}


informationExchangeFailure PCAP-ELEMENTARY-PROCEDURE ::= {
    INITIATING MESSAGE      InformationExchangeFailureIndication
    PROCEDURE CODE          id-InformationExchangeFailure
    CRITICALITY             ignore
}


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

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


END
```

## 9.3.3 PDU Definitions

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

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

DEFINITIONS AUTOMATIC TAGS ::=

BEGIN

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

IMPORTS
    Cause,
    CriticalityDiagnostics,
    GPS-UTRAN-TRU,
    InformationExchangeID,
    InformationReportCharacteristics,
    InformationType,
    MeasuredResultsList,
    RequestedDataValue,
    RequestedDataValueInformation,
    UE-PositionEstimate,
    CellId-MeasuredResultsSets,
    OTDOA-MeasurementGroup
```

```
FROM PCAP-IEs

    TransactionID
FROM PCAP-CommonDataTypes

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

    id-Cause,
    id-CriticalityDiagnostics,
    id-GPS-UTRAN-TRU,
    id-InformationExchangeID,
    id-InformationExchangeObjectType-InfEx-Rprt,
    id-InformationExchangeObjectType-InfEx-Rqst,
    id-InformationExchangeObjectType-InfEx-Rsp,
    id-InformationReportCharacteristics,
    id-InformationType,
    id-MeasuredResultsList,
    id-RequestedDataValue,
    id-RequestedDataValueInformation,
    id-TransactionID,
    id-UE-PositionEstimate,
    id-CellId-MeasuredResultsSets,
    id-OTDOA-MeasurementGroup
FROM PCAP-Constants;


-- **************************************************************
--
-- POSITION CALCULATION REQUEST
--
-- **************************************************************

PositionCalculationRequest ::= SEQUENCE {
    protocolIEs         ProtocolIE-Container       { {PositionCalculationRequestIEs} },
    protocolExtensions  ProtocolExtensionContainer { {PositionCalculationRequestExtensions} }
    OPTIONAL,
    ...
}

PositionCalculationRequestIEs PCAP-PROTOCOL-IES ::= {
    { ID id-UE-PositionEstimate     CRITICALITY reject  TYPE UE-PositionEstimate    PRESENCE
mandatory   } |
    { ID id-MeasuredResultsList     CRITICALITY reject  TYPE MeasuredResultsList    PRESENCE
mandatory   },
    ...
}

PositionCalculationRequestExtensions PCAP-PROTOCOL-EXTENSION ::= {
    { ID id-CellId-MeasuredResultsSets      CRITICALITY reject  TYPE CellId-MeasuredResultsSets
PRESENCE optional   } |
    { ID id-OTDOA-MeasurementGroup          CRITICALITY reject  TYPE OTDOA-MeasurementGroup
PRESENCE optional   },
    ...
}

-- **************************************************************
--
-- POSITION CALCULATION RESPONSE
--
-- **************************************************************

PositionCalculationResponse ::= SEQUENCE {
    protocolIEs         ProtocolIE-Container       { {PositionCalculationResponseIEs} },
    protocolExtensions  ProtocolExtensionContainer { {PositionCalculationResponseExtensions} }
    OPTIONAL,
    ...
}

PositionCalculationResponseIEs PCAP-PROTOCOL-IES ::= {
```

```
    { ID id-UE-PositionEstimate         CRITICALITY ignore  TYPE UE-PositionEstimate        PRESENCE
mandatory } |
    { ID id-CriticalityDiagnostics      CRITICALITY ignore  TYPE CriticalityDiagnostics     PRESENCE
optional    },
    ...
}

PositionCalculationResponseExtensions PCAP-PROTOCOL-EXTENSION ::= {
    ...
}

-- **************************************************************
--
-- POSITION CALCULATION FAILURE
--
-- **************************************************************

PositionCalculationFailure ::= SEQUENCE {
    protocolIEs         ProtocolIE-Container       { {PositionCalculationFailureIEs} },
    protocolExtensions  ProtocolExtensionContainer { {PositionCalculationFailureExtensions} }
    OPTIONAL,
    ...
}

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

PositionCalculationFailureExtensions PCAP-PROTOCOL-EXTENSION ::= {
    ...
}


-- **************************************************************
--
-- INFORMATION EXCHANGE INITIATION REQUEST
--
-- **************************************************************

InformationExchangeInitiationRequest ::= SEQUENCE {
    protocolIEs             ProtocolIE-Container    {{InformationExchangeInitiationRequest-IEs}},
    protocolExtensions      ProtocolExtensionContainer  {{InformationExchangeInitiationRequest-
Extensions}}        OPTIONAL,
    ...
}

InformationExchangeInitiationRequest-IEs PCAP-PROTOCOL-IES ::= {
    { ID id-InformationExchangeID                       CRITICALITY reject  TYPE
InformationExchangeID                   PRESENCE    mandatory }|
    { ID id-InformationExchangeObjectType-InfEx-Rqst    CRITICALITY reject  TYPE
InformationExchangeObjectType-InfEx-Rqst        PRESENCE mandatory }|
    -- This IE represents both the Information Exchange Object Type IE and the choice based on the
Information Exchange Object Type
    -- as described in the tabular message format in clause 9.1.
    { ID id-InformationType                             CRITICALITY reject  TYPE InformationType
                    PRESENCE    mandatory }|
    { ID id-InformationReportCharacteristics            CRITICALITY reject  TYPE
InformationReportCharacteristics    PRESENCE    mandatory }|
    { ID id-GPS-UTRAN-TRU                               CRITICALITY reject  TYPE GPS-UTRAN-TRU
                    PRESENCE conditional },
    -- This IE shall be present if the information requested in the Information Type IE contains
GPS-related data
    ...
}

InformationExchangeInitiationRequest-Extensions PCAP-PROTOCOL-EXTENSION ::= {
    ...
}

InformationExchangeObjectType-InfEx-Rqst ::= CHOICE {
    referencePosition               RefPosition-InfEx-Rqst,
    ...
}
```

```
RefPosition-InfEx-Rqst ::= SEQUENCE {
    referencePositionEstimate       UE-PositionEstimate,
    iE-Extensions                   ProtocolExtensionContainer  { { RefPositionItem-InfEx-Rqst-
ExtIEs} }       OPTIONAL,
    ...
}

RefPositionItem-InfEx-Rqst-ExtIEs PCAP-PROTOCOL-EXTENSION ::= {
    ...
}



-- **************************************************************
--
-- INFORMATION EXCHANGE INITIATION RESPONSE
--
-- **************************************************************

InformationExchangeInitiationResponse ::= SEQUENCE {
    protocolIEs             ProtocolIE-Container    {{InformationExchangeInitiationResponse-IEs}},
    protocolExtensions      ProtocolExtensionContainer  {{InformationExchangeInitiationResponse-
Extensions}}        OPTIONAL,
    ...
}

InformationExchangeInitiationResponse-IEs PCAP-PROTOCOL-IES ::= {
    { ID    id-InformationExchangeID                    CRITICALITY ignore  TYPE
InformationExchangeID                   PRESENCE    mandatory }|
    { ID    id-InformationExchangeObjectType-InfEx-Rsp  CRITICALITY ignore  TYPE
InformationExchangeObjectType-InfEx-Rsp     PRESENCE    mandatory }|
    { ID    id-CriticalityDiagnostics                   CRITICALITY ignore  TYPE
CriticalityDiagnostics                  PRESENCE    optional    },
    ...
}

InformationExchangeInitiationResponse-Extensions PCAP-PROTOCOL-EXTENSION ::= {
    ...
}

InformationExchangeObjectType-InfEx-Rsp ::= CHOICE {
    referencePosition               RefPosition-InfEx-Rsp,
    ...
}

RefPosition-InfEx-Rsp ::= SEQUENCE {
    requestedDataValue              RequestedDataValue,
    iE-Extensions                   ProtocolExtensionContainer  { { RefPositionItem-InfEx-Rsp-
ExtIEs} }       OPTIONAL,
    ...
}

RefPositionItem-InfEx-Rsp-ExtIEs PCAP-PROTOCOL-EXTENSION ::= {
    ...
}


-- **************************************************************
--
-- INFORMATION EXCHANGE INITIATION FAILURE
--
-- **************************************************************

InformationExchangeInitiationFailure ::= SEQUENCE {
    protocolIEs             ProtocolIE-Container    {{InformationExchangeInitiationFailure-IEs}},
    protocolExtensions      ProtocolExtensionContainer  {{InformationExchangeInitiationFailure-
Extensions}}        OPTIONAL,
    ...
}

InformationExchangeInitiationFailure-IEs PCAP-PROTOCOL-IES ::= {
    { ID    id-InformationExchangeID        CRITICALITY     ignore  TYPE InformationExchangeID
    PRESENCE    mandatory }|
    { ID    id-Cause                        CRITICALITY     ignore  TYPE Cause
    PRESENCE    mandatory }|
    { ID    id-CriticalityDiagnostics       CRITICALITY     ignore  TYPE CriticalityDiagnostics
    PRESENCE    optional    },
    ...
```

```
}

InformationExchangeInitiationFailure-Extensions PCAP-PROTOCOL-EXTENSION ::= {
    ...
}

-- **************************************************************
--
-- INFORMATION REPORT
--
-- **************************************************************

InformationReport ::= SEQUENCE {
    protocolIEs             ProtocolIE-Container        {{InformationReport-IEs}},
    protocolExtensions      ProtocolExtensionContainer  {{InformationReport-Extensions}}
    OPTIONAL,
    ...
}

InformationReport-IEs PCAP-PROTOCOL-IES ::= {
    { ID    id-InformationExchangeID                        CRITICALITY ignore  TYPE
InformationExchangeID       PRESENCE    mandatory }|
    { ID    id-InformationExchangeObjectType-InfEx-Rprt     CRITICALITY ignore  TYPE
InformationExchangeObjectType-InfEx-Rprt    PRESENCE    mandatory },
    ...
}

InformationReport-Extensions PCAP-PROTOCOL-EXTENSION ::= {
    ...
}

InformationExchangeObjectType-InfEx-Rprt ::= CHOICE {
    referencePosition               RefPosition-InfEx-Rprt,
    ...
 }

RefPosition-InfEx-Rprt ::= SEQUENCE {
    requestedDataValueInformation   RequestedDataValueInformation,
    iE-Extensions                   ProtocolExtensionContainer  {{ RefPositionItem-InfEx-Rprt-ExtIEs
}}      OPTIONAL,
    ...

 }

RefPositionItem-InfEx-Rprt-ExtIEs PCAP-PROTOCOL-EXTENSION ::= {
    ...
}


-- **************************************************************
--
-- INFORMATION EXCHANGE TERMINATION REQUEST
--
-- **************************************************************

InformationExchangeTerminationRequest ::= SEQUENCE {
    protocolIEs             ProtocolIE-Container        {{InformationExchangeTerminationRequest-
IEs}},
    protocolExtensions      ProtocolExtensionContainer  {{InformationExchangeTerminationRequest-
Extensions}}        OPTIONAL,
    ...
}

InformationExchangeTerminationRequest-IEs PCAP-PROTOCOL-IES ::= {
    { ID    id-InformationExchangeID            CRITICALITY     ignore  TYPE InformationExchangeID
            PRESENCE    mandatory},
    ...
}

InformationExchangeTerminationRequest-Extensions PCAP-PROTOCOL-EXTENSION ::= {
    ...
}


-- **************************************************************
--
-- INFORMATION EXCHANGE FAILURE INDICATION
--
```

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

InformationExchangeFailureIndication ::= SEQUENCE {
    protocolIEs             ProtocolIE-Container        {{InformationExchangeFailureIndication-
IEs}},
    protocolExtensions      ProtocolExtensionContainer  {{InformationExchangeFailureIndication-
Extensions}}                OPTIONAL,
    ...
}

InformationExchangeFailureIndication-IEs PCAP-PROTOCOL-IES ::= {
    { ID    id-InformationExchangeID            CRITICALITY ignore          TYPE
InformationExchangeID           PRESENCE    mandatory   }|
    { ID    id-Cause                            CRITICALITY ignore          TYPE Cause
                PRESENCE    mandatory   },
    ...
}

InformationExchangeFailureIndication-Extensions PCAP-PROTOCOL-EXTENSION ::= {
    ...
}


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

ErrorIndication ::= SEQUENCE {
    protocolIEs         ProtocolIE-Container       { {ErrorIndicationIEs} },
    protocolExtensions  ProtocolExtensionContainer { {ErrorIndicationExtensions} }  OPTIONAL,
    ...
}

ErrorIndicationIEs PCAP-PROTOCOL-IES ::= {
    { ID id-Cause                       CRITICALITY ignore  TYPE Cause                      PRESENCE
optional } |
    { ID id-CriticalityDiagnostics      CRITICALITY ignore  TYPE CriticalityDiagnostics     PRESENCE
optional },
        ...
}

ErrorIndicationExtensions PCAP-PROTOCOL-EXTENSION ::= {
    ...
}


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

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

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

END
```

## 9.3.4 Information Element Definitions

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

PCAP-IEs {
```

```
itu-t (0) identified-organization (4) etsi (0) mobileDomain (0)
umts-Access (20) modules (3) pcap(4) version1 (1) pcap-IEs (2) }

DEFINITIONS AUTOMATIC TAGS ::=

BEGIN

IMPORTS
    maxNrOfErrors,
    maxSat,
    maxSatLess1,
    maxNrOfLevels,
    maxNrOfMeasNCell,
    maxNrOfPoints,
    maxNrOfExpInfo,
    id-TypeOfError,
    id-MessageStructure
FROM PCAP-Constants

    Criticality,
    ProcedureCode,
    ProtocolIE-ID,
    TransactionID,
    TriggeringMessage
FROM PCAP-CommonDataTypes

    ProtocolExtensionContainer{},
    PCAP-PROTOCOL-EXTENSION
FROM PCAP-Containers;


-- **************************************************************
--
-- Almanac and Satellite Health SIB
--
-- **************************************************************

AlmanacAndSatelliteHealthSIB ::=    SEQUENCE {
    gpsAlmanacAndSatelliteHealth        GPS-AlmanacAndSatelliteHealth,
    satMask                             BIT STRING (SIZE (1..32)),
    lsbTOW                              BIT STRING (SIZE (8))
}


-- **************************************************************
--
-- Cause IE
--
-- **************************************************************

Cause ::= CHOICE {
    radioNetwork            CauseRadioNetwork,
    transport               CauseTransport,
    protocol                CauseProtocol,
    misc                    CauseMisc,
    ...
}
CauseRadioNetwork ::= ENUMERATED {
    invalid-reference-information,
    information-temporarily-not-available,
    information-provision-not-supported-for-the-object,
    position-calculation-error-invalid-GPS-measured-results,
    ...,
    position-calculation-error-invalid-CellID-measured-results,
    position-calculation-error-invalid-OTDOA-measured-results,
    position-calculation-error-AGPS-positioning-method-not-supported,
    position-calculation-error-CellID-positioning-method-not-supported,
    position-calculation-error-OTDOA-positioning-method-not-supported
}

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 {
    processing-overload,
    hardware-failure,
    o-and-m-intervention,
    unspecified,
    ...
}

-- **************************************************************
--
-- Cell Id Measured Results Sets
--
-- **************************************************************

CellId-MeasuredResultsSets ::=          SEQUENCE (SIZE (1..maxNrOfSets)) OF
    CellId-MeasuredResultsInfoList

CellId-MeasuredResultsInfoList ::=      SEQUENCE (SIZE (1..maxNrOfMeasNCell)) OF
    CellId-MeasuredResultsInfo

CellId-MeasuredResultsInfo ::=          SEQUENCE {
    uC-ID                               UC-ID,
    uTRANAccessPointPositionAltitude    UTRANAccessPointPositionAltitude,
    ue-PositionEstimate                 UE-PositionEstimate             OPTIONAL,
    roundTripTimeInfo                   RoundTripTimeInfo               OPTIONAL,
    iE-Extensions                       ProtocolExtensionContainer { { CellId-MeasuredResultsInfo-
ExtIEs } }      OPTIONAL,
    ...
}

CellId-MeasuredResultsInfo-ExtIEs PCAP-PROTOCOL-EXTENSION ::= {
    ...
}

RoundTripTimeInfo ::=                   SEQUENCE {
    ue-RxTxTimeDifferenceType2          UE-RxTxTimeDifferenceType2,
    ue-PositioningMeasQuality           UE-PositioningMeasQuality,
    roundTripTime                       RoundTripTime,
    iE-Extensions                       ProtocolExtensionContainer { { RoundTripTimeInfo-ExtIEs } }
        OPTIONAL,
    ...
}

RoundTripTimeInfo-ExtIEs PCAP-PROTOCOL-EXTENSION ::= {
    ...
}

UE-RxTxTimeDifferenceType2 ::=          INTEGER (0..8191)

UE-PositioningMeasQuality ::=           SEQUENCE {
    stdResolution                       BIT STRING (SIZE (2)),
    numberOfMeasurements                BIT STRING (SIZE (3)),
    stdOfMeasurements                   BIT STRING (SIZE (5)),
    iE-Extensions                       ProtocolExtensionContainer { { UE-PositioningMeasQuality-
ExtIEs } }      OPTIONAL,
    ...
}

UE-PositioningMeasQuality-ExtIEs PCAP-PROTOCOL-EXTENSION ::= {
    ...
}

RoundTripTime ::=                       INTEGER (0..32767)
-- Actual value RoundTripTime = IE value * 0.0625 + 876

UTRANAccessPointPositionAltitude ::=    SEQUENCE {
```

```
    geographicalCoordinates             GeographicalCoordinates,
    ga-AltitudeAndDirection             GA-AltitudeAndDirection         OPTIONAL,
    iE-Extensions                   ProtocolExtensionContainer { { UTRANAccessPointPositionAltitude-
ExtIEs } }      OPTIONAL,
    ...
}

UTRANAccessPointPositionAltitude-ExtIEs PCAP-PROTOCOL-EXTENSION ::= {
    ...
}

-- **************************************************************
--
-- CriticalityDiagnostics
--
-- **************************************************************

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

CriticalityDiagnostics-IE-List ::= SEQUENCE (SIZE (1..maxNrOfErrors)) OF
    SEQUENCE {
        iECriticality           Criticality,
        iE-ID                   ProtocolIE-ID,
        repetitionNumber        RepetitionNumber0       OPTIONAL,
        iE-Extensions           ProtocolExtensionContainer { {CriticalityDiagnostics-IE-List-ExtIEs}
} OPTIONAL,
        ...
    }

CriticalityDiagnostics-IE-List-ExtIEs PCAP-PROTOCOL-EXTENSION ::= {
{   ID id-MessageStructure      CRITICALITY ignore      EXTENSION MessageStructure      PRESENCE
optional    }|
{   ID id-TypeOfError           CRITICALITY ignore      EXTENSION TypeOfError           PRESENCE
mandatory   },
    ...
}

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

RepetitionNumber0 ::= INTEGER (0..255, ...)
RepetitionNumber1 ::= INTEGER (1..256, ...)


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

-- **************************************************************
--
-- DGPSCorrections
--
-- **************************************************************


DGPSCorrections ::=                 SEQUENCE {
    gps-TOW-sec                         INTEGER (0..604799),
    statusHealth                        DiffCorrectionStatus,
    dgps-CorrectionSatInfoList          DGPS-CorrectionSatInfoList  OPTIONAL,
    -- not included if satelliteHealth is equal to noData or invalidData
    iE-Extensions                       ProtocolExtensionContainer { { DGPSCorrections-ExtIEs } }
    OPTIONAL,
    ...
}
```

```
DGPSCorrections-ExtIEs PCAP-PROTOCOL-EXTENSION ::= {
    ...
}


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                               INTEGER (0..63),
    iode                                INTEGER (0..239),
    udre                                UDRE,
    prc                                 PRC,
    rrc                                 RRC,
    deltaPRC2                           DeltaPRC,
    deltaRRC2                           DeltaRRC,
    deltaPRC3                           DeltaPRC,
    deltaRRC3                           DeltaRRC
}

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)




-- **************************************************************
--
-- UE-PositionEstimate (i.e., Geographical Area)
--
-- **************************************************************

-- UE-PositionEstimate is based on Geographical Area Description in 23.032

UE-PositionEstimate ::= CHOICE {
    point                       GA-Point,
    pointWithUnCertainty        GA-PointWithUnCertainty,
    polygon                     GA-Polygon,
    pointWithUncertaintyEllipse GA-PointWithUnCertaintyEllipse,
    pointWithAltitude           GA-PointWithAltitude,
    pointWithAltitudeAndUncertaintyEllipsoid        GA-PointWithAltitudeAndUncertaintyEllipsoid,
    ellipsoidArc                GA-EllipsoidArc,
    ...
}

GeographicalCoordinates ::= SEQUENCE {
    latitudeSign            ENUMERATED { north, south },
    latitude                INTEGER (0..8388607),
    longitude               INTEGER (-8388608..8388607),
    iE-Extensions           ProtocolExtensionContainer { {GeographicalCoordinates-ExtIEs} }
OPTIONAL,
    ...
}

GeographicalCoordinates-ExtIEs PCAP-PROTOCOL-EXTENSION ::= {
    ...
}

GA-AltitudeAndDirection ::= SEQUENCE {
    directionOfAltitude     ENUMERATED {height, depth},
    altitude        INTEGER (0..32767),
```

```
    ...
}

GA-EllipsoidArc ::= SEQUENCE {
    geographicalCoordinates     GeographicalCoordinates,
    innerRadius                 INTEGER (0..65535),
    uncertaintyRadius           INTEGER (0..127),
    offsetAngle                 INTEGER (0..179),
    includedAngle               INTEGER (0..179),
    confidence                  INTEGER (0..127),
    iE-Extensions               ProtocolExtensionContainer { { GA-EllipsoidArc-ExtIEs} } OPTIONAL,
    ...
}

GA-EllipsoidArc-ExtIEs PCAP-PROTOCOL-EXTENSION ::= {
    ...
}

GA-Point ::= SEQUENCE {
    geographicalCoordinates     GeographicalCoordinates,
    iE-Extensions           ProtocolExtensionContainer { {GA-Point-ExtIEs} } OPTIONAL,
    ...
}

GA-Point-ExtIEs PCAP-PROTOCOL-EXTENSION ::= {
    ...
}

GA-PointWithAltitude ::= SEQUENCE {
    geographicalCoordinates     GeographicalCoordinates,
    altitudeAndDirection        GA-AltitudeAndDirection,
    iE-Extensions               ProtocolExtensionContainer { { GA-PointWithAltitude-ExtIEs} }
OPTIONAL,
    ...
}

GA-PointWithAltitude-ExtIEs PCAP-PROTOCOL-EXTENSION ::= {
    ...
}

GA-PointWithAltitudeAndUncertaintyEllipsoid ::= SEQUENCE {
    geographicalCoordinates     GeographicalCoordinates,
    altitudeAndDirection        GA-AltitudeAndDirection,
    uncertaintyEllipse          GA-UncertaintyEllipse,
    uncertaintyAltitude         INTEGER (0..127),
    confidence                  INTEGER (0..127),
    iE-Extensions               ProtocolExtensionContainer { { GA-
PointWithAltitudeAndUncertaintyEllipsoid-ExtIEs} } OPTIONAL,
    ...
}

GA-PointWithAltitudeAndUncertaintyEllipsoid-ExtIEs PCAP-PROTOCOL-EXTENSION ::= {
    ...
}

GA-PointWithUnCertainty ::=SEQUENCE {
    geographicalCoordinates     GeographicalCoordinates,
    iE-Extensions           ProtocolExtensionContainer { {GA-PointWithUnCertainty-ExtIEs} }
OPTIONAL,
    uncertaintyCode         INTEGER (0..127)
}

GA-PointWithUnCertainty-ExtIEs PCAP-PROTOCOL-EXTENSION ::= {
    ...
}

GA-PointWithUnCertaintyEllipse ::= SEQUENCE {
    geographicalCoordinates     GeographicalCoordinates,
    uncertaintyEllipse          GA-UncertaintyEllipse,
    confidence                  INTEGER (0..127),
    iE-Extensions               ProtocolExtensionContainer { { GA-PointWithUnCertaintyEllipse-
ExtIEs} } OPTIONAL,
    ...
}

GA-PointWithUnCertaintyEllipse-ExtIEs PCAP-PROTOCOL-EXTENSION ::= {
    ...
}
```

```
GA-Polygon ::= SEQUENCE (SIZE (1..maxNrOfPoints)) OF
    SEQUENCE {
        geographicalCoordinates     GeographicalCoordinates,
        iE-Extensions           ProtocolExtensionContainer { {GA-Polygon-ExtIEs} } OPTIONAL,
        ...
    }

GA-Polygon-ExtIEs PCAP-PROTOCOL-EXTENSION ::= {
    ...
}

GA-UncertaintyEllipse ::= SEQUENCE {
    uncertaintySemi-major       INTEGER (0..127),
    uncertaintySemi-minor       INTEGER (0..127),
    orientationOfMajorAxis      INTEGER (0..179),
    ...
}



-- **************************************************************
--
-- GPS-AcquisitionAssistance:
--
-- **************************************************************


GPS-AcquisitionAssistance ::=   SEQUENCE {
    gps-TOW-1msec                       INTEGER (0..604799999),
    satelliteInformationList            AcquisitionSatInfoList,
    iE-Extensions                       ProtocolExtensionContainer { { GPS-AcquisitionAssistance-
ExtIEs } }      OPTIONAL,
    ...
}

GPS-AcquisitionAssistance-ExtIEs PCAP-PROTOCOL-EXTENSION ::= {
    ...
}

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

AcquisitionSatInfo ::=              SEQUENCE {
    satID                               INTEGER (0..63),
    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
}

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)
}


-- **************************************************************
--
-- GPS Almanac and Satellite Health
--
```

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


GPS-AlmanacAndSatelliteHealth ::=   SEQUENCE {
    wn-a                                BIT STRING (SIZE (8)),
    almanacSatInfoList                  AlmanacSatInfoList,
    svGlobalHealth                      BIT STRING (SIZE (192)) OPTIONAL,
    iE-Extensions                       ProtocolExtensionContainer { { GPS-
AlmanacAndSatelliteHealth-ExtIEs } }        OPTIONAL,
    ...
}

GPS-AlmanacAndSatelliteHealth-ExtIEs PCAP-PROTOCOL-EXTENSION ::= {
    ...
}


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

AlmanacSatInfo ::=                  SEQUENCE {
    dataID                              BIT STRING (SIZE (2)),
    satID                               INTEGER (0..63),
    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))
}


-- **************************************************************
--
-- GPS Clock And Ephemeris Parameters
--
-- **************************************************************

GPS-ClockAndEphemerisParameters ::= 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)),
    iE-Extensions                       ProtocolExtensionContainer { { GPS-
ClockAndEphemerisParameters-ExtIEs } }      OPTIONAL,
    ...
}
```

```
GPS-ClockAndEphemerisParameters-ExtIEs PCAP-PROTOCOL-EXTENSION ::= {
    ...
}

SubFrame1Reserved ::=               SEQUENCE {
    reserved1                           BIT STRING (SIZE (23)),
    reserved2                           BIT STRING (SIZE (24)),
    reserved3                           BIT STRING (SIZE (24)),
    reserved4                           BIT STRING (SIZE (16))
}


-- **************************************************************
--
-- GPS Ionospheric Model
--
-- **************************************************************


 GPS-Ionospheric-Model ::=          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)),
    iE-Extensions                       ProtocolExtensionContainer { { GPS-Ionospheric-Model-ExtIEs
} }     OPTIONAL,
    ...
}

GPS-Ionospheric-Model-ExtIEs PCAP-PROTOCOL-EXTENSION ::= {
    ...
}

-- **************************************************************
--
-- GPS Measured Results
--
-- **************************************************************

MeasuredResultsList ::=             SEQUENCE (SIZE (0..maxNrOfSets)) OF
    GPS-MeasuredResults

maxNrOfSets                         INTEGER ::= 3

GPS-MeasuredResults ::=             SEQUENCE {
    gps-TOW-1msec                       INTEGER (0..604799999),
    gps-MeasurementParamList            GPS-MeasurementParamList,
    gps-TOW-rem-usec                    INTEGER (0..999)            OPTIONAL,
    iE-Extensions                       ProtocolExtensionContainer { { GPS-MeasuredResults-ExtIEs }
}       OPTIONAL,
    ...
}

GPS-MeasuredResults-ExtIEs PCAP-PROTOCOL-EXTENSION ::= {
    ...
}

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

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 }


-- **************************************************************
--
-- GPS Navigation Model
--
-- **************************************************************


GPS-NavigationModel ::=             SEQUENCE {
    navigationModelSatInfoList          NavigationModelSatInfoList
}

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

NavigationModelSatInfo ::=          SEQUENCE {
    satID                               INTEGER (0..63),
    satelliteStatus                     SatelliteStatus,
    gps-clockAndEphemerisParms              GPS-ClockAndEphemerisParameters OPTIONAL,
    -- This IE is not present if satelliteStatus is es-SN
    iE-Extensions                       ProtocolExtensionContainer { { NavigationModelSatInfo-ExtIEs
} }     OPTIONAL,
    ...
}

NavigationModelSatInfo-ExtIEs PCAP-PROTOCOL-EXTENSION ::= {
    ...
}

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



-- **************************************************************
--
-- GPS Real Time Integrity
--
-- **************************************************************

GPS-RealTimeIntegrity ::= CHOICE {
    badSatellites       BadSatList,
    noBadSatellites     NoBadSatellites
}

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

NoBadSatellites ::= NULL


-- **************************************************************
--
-- GPS Reference Time
--
-- **************************************************************

GPS-ReferenceTime ::=               SEQUENCE {
    gps-Week                            INTEGER (0..1023),
    gps-TOW-1msec                       INTEGER (0..604799999),
    gps-TOW-rem-usec                    INTEGER (0..999)                    OPTIONAL,
    gps-TOW-AssistList                  GPS-TOW-AssistList                  OPTIONAL,
    iE-Extensions                       ProtocolExtensionContainer { { GPS-ReferenceTime-ExtIEs } }
        OPTIONAL,
    ...
}

GPS-ReferenceTime-ExtIEs PCAP-PROTOCOL-EXTENSION ::= {
```

```
    ...
}

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

GPS-TOW-Assist ::=                  SEQUENCE {
    satID                               INTEGER (0..63),
    tlm-Message                         BIT STRING (SIZE (14)),
    antiSpoof                           ENUMERATED {present, notPresent},
    alert                               ENUMERATED {present, notPresent},
    tlm-Reserved                        BIT STRING (SIZE (2))
}


-- **************************************************************
--
-- GPS Transmission TOW
--
-- **************************************************************

GPS-Transmission-TOW ::= INTEGER (0..604799)



-- **************************************************************
--
-- GPS UTC Model
--
-- **************************************************************

GPS-UTC-Model ::=                   SEQUENCE {
    a1                                  BIT STRING (SIZE (24)),
    a0                                  BIT STRING (SIZE (32)),
    t-ot                                BIT STRING (SIZE (8)),
    delta-t-LS                          BIT STRING (SIZE (8)),
    wn-t                                BIT STRING (SIZE (8)),
    wn-lsf                              BIT STRING (SIZE (8)),
    dn                                  BIT STRING (SIZE (8)),
    delta-t-LSF                         BIT STRING (SIZE (8)),
    iE-Extensions                       ProtocolExtensionContainer { { GPS-UTCmodel-ExtIEs } }
    OPTIONAL,
    ...
}

GPS-UTCmodel-ExtIEs PCAP-PROTOCOL-EXTENSION ::= {
    ...
}


-- **************************************************************
--
-- GPS UTRAN Time Relationship Uncertainty
-- nsec=nanosecond, usec=microsecond, msec=millisecond, sec=second
--
-- **************************************************************

GPS-UTRAN-TRU ::=   ENUMERATED {
                        nsec-50,
                        nsec-500,
                        usec-1,
                        usec-10,
                        msec-1,
                        msec-10,
                        msec-100,
                        unreliable }


-- **************************************************************
--
-- Information Exchange ID
--
-- **************************************************************

InformationExchangeID ::= INTEGER (0..1048575)
```

```
-- **************************************************************
--
-- Information Report Characteristics
--
-- **************************************************************

InformationReportCharacteristics ::= SEQUENCE {
    type                    InformationReportCharacteristicsType,
    periodicity             InformationReportPeriodicity        OPTIONAL,
    -- present if type indicates periodic
    ...
}

InformationReportCharacteristicsType ::= ENUMERATED {
    onDemand,
    periodic,
    onModification,
    ...
}


InformationReportPeriodicity ::= CHOICE {
    min             INTEGER (1..60,...),
-- Unit min, Step 1min
    hour            INTEGER (1..24,...),
-- Unit hour, Step 1hour
    ...
}

-- **************************************************************
--
-- Information Type
--
-- **************************************************************


InformationType ::= CHOICE {
    implicitInformation         MethodType,
    explicitInformation         ExplicitInformationList,
    ...
}


ExplicitInformationList ::= SEQUENCE (SIZE (1..maxNrOfExpInfo)) OF ExplicitInformation

ExplicitInformation ::= CHOICE {
    almanacAndSatelliteHealth       AlmanacAndSatelliteHealth,
    utcModel                        UtcModel,
    ionosphericModel                IonosphericModel,
    navigationModel                 NavigationModel,
    dgpsCorrections                 DgpsCorrections,
    referenceTime                   ReferenceTime,
    acquisitionAssistance           AcquisitionAssistance,
    realTimeIntegrity               RealTimeIntegrity,
    almanacAndSatelliteHealthSIB    AlmanacAndSatelliteHealthSIB-InfoType,
    ...
}

AlmanacAndSatelliteHealth ::= NULL

UtcModel ::= SEQUENCE {
    transmissionTOWIndicator        TransmissionTOWIndicator,
    ...
}

IonosphericModel ::= SEQUENCE {
    transmissionTOWIndicator        TransmissionTOWIndicator,
    ...
}

NavigationModel ::= SEQUENCE {
    transmissionTOWIndicator        TransmissionTOWIndicator,
    navModelAdditionalData              NavModelAdditionalData          OPTIONAL,
    ...
}


NavModelAdditionalData ::= SEQUENCE {
```

```
    gps-Week                            INTEGER (0..1023),
    gps-TOE                             INTEGER (0..167),
    t-TOE-limit                         INTEGER (0..10),
    satRelatedDataList                  SatelliteRelatedDataList,
    ...
}

SatelliteRelatedDataList ::= SEQUENCE (SIZE (0..maxSatLess1)) OF SatelliteRelatedData

SatelliteRelatedData ::= SEQUENCE {
    satID                               INTEGER (0..63),
    iode                                INTEGER (0..239)
}

DgpsCorrections ::= NULL

ReferenceTime ::= NULL

AcquisitionAssistance ::= NULL

RealTimeIntegrity ::= NULL

AlmanacAndSatelliteHealthSIB-InfoType ::= SEQUENCE {
    transmissionTOWIndicator        TransmissionTOWIndicator,
    ...
}


TransmissionTOWIndicator ::= ENUMERATED {
    requested,
    not-Requested
}

-- **************************************************************
--
-- Message Structure
--
-- **************************************************************

MessageStructure ::= SEQUENCE (SIZE (1..maxNrOfLevels)) OF
    SEQUENCE {
        iE-ID                   ProtocolIE-ID,
        repetitionNumber        RepetitionNumber1       OPTIONAL,
        iE-Extensions           ProtocolExtensionContainer { {MessageStructure-ExtIEs} } OPTIONAL,
        ...
    }

MessageStructure-ExtIEs PCAP-PROTOCOL-EXTENSION ::= {
    ...
}


-- **************************************************************
--
-- Method Type
--
-- **************************************************************

MethodType ::= ENUMERATED {
    ue-assisted,
    ue-based
}


-- **************************************************************
--
-- OTDOA Measurement Group
--
-- **************************************************************

OTDOA-MeasurementGroup ::=          SEQUENCE {
    otdoa-ReferenceCellInfo             OTDOA-ReferenceCellInfo,
    otdoa-NeighbourCellInfoList         OTDOA-NeighbourCellInfoList,
    otdoa-MeasuredResultsSets           OTDOA-MeasuredResultsSets,
    iE-Extensions                       ProtocolExtensionContainer { { OTDOA-MeasurementGroup-ExtIEs
} }     OPTIONAL,
    ...
}
```

```
OTDOA-MeasurementGroup-ExtIEs PCAP-PROTOCOL-EXTENSION ::= {
    ...
}

OTDOA-ReferenceCellInfo ::=             SEQUENCE {
    uC-ID                               UC-ID,
    uTRANAccessPointPositionAltitude    UTRANAccessPointPositionAltitude,
    tUTRANGPSMeasurementValueInfo       TUTRANGPSMeasurementValueInfo               OPTIONAL,
    iE-Extensions                       ProtocolExtensionContainer { { OTDOA-ReferenceCellInfo-
ExtIEs } }      OPTIONAL,
    ...
}

OTDOA-ReferenceCellInfo -ExtIEs PCAP-PROTOCOL-EXTENSION ::= {
    ...
}

OTDOA-NeighbourCellInfoList ::=         SEQUENCE (SIZE (1..maxNrOfMeasNCell)) OF
    OTDOA-NeighbourCellInfo

OTDOA-NeighbourCellInfo ::=             SEQUENCE {
    uC-ID                               UC-ID,
    uTRANAccessPointPositionAltitude    UTRANAccessPointPositionAltitude,
    relativeTimingDifferenceInfo        RelativeTimingDifferenceInfo,
    iE-Extensions                       ProtocolExtensionContainer { { OTDOA-NeighbourCellInfo-
ExtIEs } }      OPTIONAL,
    ...
}

OTDOA-NeighbourCellInfo -ExtIEs PCAP-PROTOCOL-EXTENSION ::= {
    ...
}

OTDOA-MeasuredResultsSets ::=           SEQUENCE (SIZE (1..maxNrOfSets)) OF
    OTDOA-MeasuredResultsInfoList

OTDOA-MeasuredResultsInfoList ::=       SEQUENCE (SIZE (1..maxNrOfMeasNCell)) OF
    OTDOA-MeasuredResultsInfo

OTDOA-MeasuredResultsInfo ::=           SEQUENCE {
    uC-ID                               UC-ID,
    ue-SFNSFNTimeDifferenceType2Info    UE-SFNSFNTimeDifferenceType2Info,
    iE-Extensions                       ProtocolExtensionContainer { { OTDOA-MeasuredResultsInfo-
ExtIEs } }      OPTIONAL,
    ...
}

OTDOA-MeasuredResultsInfo-ExtIEs PCAP-PROTOCOL-EXTENSION ::= {
    ...
}

UE-SFNSFNTimeDifferenceType2Info ::=    SEQUENCE {
    ue-SFNSFNTimeDifferenceType2        INTEGER (0..40961),
    ue-PositioningMeasQuality           UE-PositioningMeasQuality,
    measurementDelay                    INTEGER (0..65535),
    iE-Extensions                       ProtocolExtensionContainer { { UE-SFNSFNTimeDifferenceInfo-
ExtIEs } }      OPTIONAL,
    ...
}

UE-SFNSFNTimeDifferenceInfo-ExtIEs PCAP-PROTOCOL-EXTENSION ::= {
    ...
}

UC-ID ::=                               SEQUENCE {
    rNC-ID                              INTEGER (0..4095),
    c-ID                                INTEGER (0..65535),
    iE-Extensions                       ProtocolExtensionContainer { { UC-ID-ExtIEs } }
    OPTIONAL,
    ...
}
```

```
UC-ID-ExtIEs PCAP-PROTOCOL-EXTENSION ::= {
    ...
}

RelativeTimingDifferenceInfo ::= CHOICE {
    sFNSFNMeasurementValueInfo          SFNSFNMeasurementValueInfo,
    tUTRANGPSMeasurementValueInfo       TUTRANGPSMeasurementValueInfo,
    ...
}

SFNSFNMeasurementValueInfo ::=          SEQUENCE {
    sFNSFNValue                         SFNSFNValue,
    sFNSFNQuality                       SFNSFNQuality                   OPTIONAL,
    sFNSFNDriftRate                     SFNSFNDriftRate,
    sFNSFNDriftRateQuality              SFNSFNDriftRateQuality          OPTIONAL,
    iE-Extensions                       ProtocolExtensionContainer { { SFNSFNMeasurementValueInfo-
ExtIEs } }      OPTIONAL,
    ...
}

SFNSFNMeasurementValueInfo-ExtIEs PCAP-PROTOCOL-EXTENSION ::= {
    ...
}

SFNSFNValue ::=                         INTEGER (0..614399)

SFNSFNQuality ::=                       INTEGER (0..255)
-- Unit chip, Step 1/16 chip, Range 0.. 255/16 chip

SFNSFNDriftRate ::=                     INTEGER (-100..100)
-- Unit chip/s, Step 1/256 chip/s, Range -100/256..+100/256 chip/s

SFNSFNDriftRateQuality ::=              INTEGER (0..100)
-- Unit chip/s, Step 1/256 chip/s, Range 0..100/256 chip/s

TUTRANGPSMeasurementValueInfo ::= SEQUENCE {
    sFN                                 SFN,
    tUTRANGPS                           TUTRANGPS,
    tUTRANGPSQuality                    TUTRANGPSQuality                OPTIONAL,
    tUTRANGPSDriftRate                  TUTRANGPSDriftRate,
    tUTRANGPSDriftRateQuality           TUTRANGPSDriftRateQuality       OPTIONAL,
    iE-Extensions                       ProtocolExtensionContainer { {
TUTRANGPSMeasurementValueInfo-ExtIEs } }        OPTIONAL,
    ...
}

TUTRANGPSMeasurementValueInfo-ExtIEs PCAP-PROTOCOL-EXTENSION ::= {
    ...
}

SFN ::=                                 INTEGER (0..4095)

TUTRANGPS ::=                           SEQUENCE {
    ms-part                             INTEGER (0..16383),
    ls-part                             INTEGER (0..4294967295)
}

TUTRANGPSQuality ::=                    INTEGER (0..255)
-- Unit chip, Step 1/16 chip, Range 0.. 255/16 chip

TUTRANGPSDriftRate ::=                  INTEGER (-50..50)
-- Unit chip/s, Step 1/256 chip/s, Range -50/256..+50/256 chip/s

TUTRANGPSDriftRateQuality ::=           INTEGER (0..50)
-- Unit chip/s, Step 1/256 chip/s, Range 0..50/256 chip/s


-- **************************************************************
--
-- Requested Data Value
--
-- **************************************************************

RequestedDataValue ::= SEQUENCE {
    gpsAlmanacAndSatelliteHealth        GPS-AlmanacAndSatelliteHealth               OPTIONAL,
    gps-UTC-Model                       GPS-UTC-Model                               OPTIONAL,
```

```
    gps-Ionospheric-Model               GPS-Ionospheric-Model                       OPTIONAL,
    gps-NavigationModel                 GPS-NavigationModel                         OPTIONAL,
    dgpsCorrections                     DGPSCorrections                             OPTIONAL,
    referenceTime                       GPS-ReferenceTime                           OPTIONAL,
    gps-AcquisitionAssistance           GPS-AcquisitionAssistance                   OPTIONAL,
    gps-RealTime-Integrity              GPS-RealTimeIntegrity                       OPTIONAL,
    almanacAndSatelliteHealthSIB        AlmanacAndSatelliteHealthSIB                OPTIONAL,
    gps-Transmission-TOW                GPS-Transmission-TOW                        OPTIONAL,
    iE-Extensions                       ProtocolExtensionContainer { { RequestedDataValue-ExtIEs} }
        OPTIONAL,
    ...
}

--at least one of the above IEs shall be present in the requested data value

RequestedDataValue-ExtIEs PCAP-PROTOCOL-EXTENSION ::= {
    ...
}

-- **************************************************************
--
-- Requested Data Value Information
--
-- **************************************************************

RequestedDataValueInformation ::= CHOICE {
    informationAvailable        InformationAvailable,
    informationNotAvailable     InformationNotAvailable
}

InformationAvailable::= SEQUENCE {
    requestedDataValue      RequestedDataValue,
    iE-Extensions           ProtocolExtensionContainer { { InformationAvailable-ExtIEs} }
    OPTIONAL,
    ...
}

InformationAvailable-ExtIEs PCAP-PROTOCOL-EXTENSION ::= {
    ...
}

InformationNotAvailable ::= NULL


END
```

## 9.3.5 Common Definitions

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

PCAP-CommonDataTypes {
itu-t (0) identified-organization (4) etsi (0) mobileDomain (0)
umts-Access (20) modules (3) pcap(4) version1 (1) pcap-CommonDataTypes (3)  }

DEFINITIONS AUTOMATIC TAGS ::=

BEGIN

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

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

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

```
-- **************************************************************
Criticality     ::= ENUMERATED { reject, ignore, notify }

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

PrivateIE-ID    ::= CHOICE {
    local               INTEGER (0..65535),
    global              OBJECT IDENTIFIER
}


ProcedureCode       ::= INTEGER (0..255)


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

TransactionID       ::= CHOICE {
    shortTID            INTEGER (0..127),
    longTID             INTEGER (0..32767)
}

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

END
```

## 9.3.6 Constant Definitions

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

PCAP-Constants {
itu-t (0) identified-organization (4) etsi (0) mobileDomain (0)
umts-Access (20) modules (3) pcap(4) version1 (1) pcap-Constants (4) }

DEFINITIONS AUTOMATIC TAGS ::=

BEGIN

IMPORTS
    ProcedureCode,
    ProtocolIE-ID
FROM PCAP-CommonDataTypes;


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

id-PositionCalculation              ProcedureCode ::= 1
id-InformationExchangeInitiation    ProcedureCode ::= 2
id-InformationReporting             ProcedureCode ::= 3
id-InformationExchangeTermination   ProcedureCode ::= 4
id-InformationExchangeFailure       ProcedureCode ::= 5
id-ErrorIndication                  ProcedureCode ::= 6
id-privateMessage                   ProcedureCode ::= 7



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

maxNrOfErrors                       INTEGER ::= 256
maxSat                              INTEGER ::= 16
maxSatLess1                         INTEGER ::= 15
maxNrOfLevels                       INTEGER ::= 256
maxNrOfPoints                       INTEGER ::= 15
maxNrOfExpInfo                      INTEGER ::= 32
```

```
maxNrOfMeasNCell                        INTEGER ::= 32

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

id-Cause                                        ProtocolIE-ID ::= 1
id-CriticalityDiagnostics                       ProtocolIE-ID ::= 2
id-GPS-UTRAN-TRU                                ProtocolIE-ID ::= 3
id-InformationExchangeID                        ProtocolIE-ID ::= 4
id-InformationExchangeObjectType-InfEx-Rprt     ProtocolIE-ID ::= 5
id-InformationExchangeObjectType-InfEx-Rqst     ProtocolIE-ID ::= 6
id-InformationExchangeObjectType-InfEx-Rsp      ProtocolIE-ID ::= 7
id-InformationReportCharacteristics             ProtocolIE-ID ::= 8
id-InformationType                              ProtocolIE-ID ::= 9
id-MeasuredResultsList                          ProtocolIE-ID ::= 10
id-MessageStructure                             ProtocolIE-ID ::= 19
id-MethodType                                   ProtocolIE-ID ::= 11
id-RefPosition-InfEx-Rqst                       ProtocolIE-ID ::= 12
id-RefPosition-InfEx-Rsp                        ProtocolIE-ID ::= 13
id-RefPosition-Inf-Rprt                         ProtocolIE-ID ::= 14
id-RequestedDataValue                           ProtocolIE-ID ::= 15
id-RequestedDataValueInformation                ProtocolIE-ID ::= 16
id-TransactionID                                ProtocolIE-ID ::= 17
id-UE-PositionEstimate                          ProtocolIE-ID ::= 18
id-TypeOfError                                  ProtocolIE-ID ::= 21
id-CellId-MeasuredResultsSets                   ProtocolIE-ID ::= 20
id-OTDOA-MeasurementGroup                       ProtocolIE-ID ::= 22

END
```

## 9.3.7 Container Definitions

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

PCAP-Containers {
itu-t (0) identified-organization (4) etsi (0) mobileDomain (0)
umts-Access (20) modules (3) pcap(4) version1 (1) pcap-Containers (5) }

DEFINITIONS AUTOMATIC TAGS ::=

BEGIN

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

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

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

PCAP-PROTOCOL-IES ::= CLASS {
    &id                 ProtocolIE-ID       UNIQUE,
    &criticality        Criticality,
    &Value,
    &presence           Presence
```

```
}
WITH SYNTAX {
    ID                  &id
    CRITICALITY         &criticality
    TYPE                &Value
    PRESENCE            &presence
}

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

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

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

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

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

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

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

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

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

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

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

ProtocolExtensionField {PCAP-PROTOCOL-EXTENSION : ExtensionSetParam} ::= SEQUENCE {
    id                  PCAP-PROTOCOL-EXTENSION.&id             ({ExtensionSetParam}),
    criticality         PCAP-PROTOCOL-EXTENSION.&criticality    ({ExtensionSetParam}{@id}),
    extensionValue      PCAP-PROTOCOL-EXTENSION.&Extension      ({ExtensionSetParam}{@id})
}

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

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

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

END
```

## 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 [9].

The following encoding rules apply in addition to what has been specified in X.691 [9]:

When a bitstring value is placed in a bit-field as specified in 15.6 to 15.11 in [9], the leading bit of the bitstring value shall be placed in the leading bit of the bit-field, and the trailing bit of the bitstring value shall be placed in the trailing bit of the bit-field.

NOTE - When using the "bstring" notation, the leading bit of the bitstring value is on the left, and the trailing bit of the bitstring value is on the right. The term ‘leading bit’ is to be interpreted as equal to the term ‘first bit’ defined in [7].