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Family SL Satellite Radio Interface (Release 1);
Part 3: Control Plane and User Plane Specifications;
Sub-part 5: Adaptation Layer Interface

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Foreword

This Technical Specification (TS) has been produced by ETSI Technical Committee Satellite Earth Stations and Systems (SES).

The present document is part 3, sub-part 5 of a multi-part deliverable. Full details of the entire series can be found in ETSI TS 102 744-1-1 [i.4].

Modal verbs terminology

In the present document "**shall**", "**shall not**", "**should**", "**should not**", "**may**", "**need not**", "**will**", "**will not**", "**can**" and "**cannot**" are to be interpreted as described in clause 3.2 of the ETSI Drafting Rules (Verbal forms for the expression of provisions).

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Introduction

This multi-part deliverable (Release 1) defines a satellite radio interface that provides UMTS services to users of mobile terminals via geostationary (GEO) satellites in the frequency range 1 518,000 MHz to 1 559,000 MHz (downlink) and 1 626,500 MHz to 1 660,500 MHz and 1 668,000 MHz to 1 675,000 MHz (uplink).

1 Scope

The present document defines the Adaptation Layer (AL) peer-to-peer interface of the Family SL satellite radio interface between the Radio Network Controller (RNC) and the User Equipment (UE) used in the satellite network.

2 References

2.1 Normative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the reference document (including any amendments) applies.

Referenced documents which are not found to be publicly available in the expected location might be found at http://docbox.etsi.org/Reference.

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The following referenced documents are necessary for the application of the present document.

[1] ETSI TS 133 102: "Universal Mobile Telecommunications System (UMTS); 3G security; Security architecture (3GPP TS 33.102 Release 4)".

[2] ETSI TS 133 105: "Universal Mobile Telecommunications System (UMTS); Cryptographic algorithm requirements (3GPP TS 33.105 Release 4)".

[3] ETSI TS 125 331: "Universal Mobile Telecommunications System (UMTS); Radio Resource Control (RRC) protocol specification (3GPP TS 25.331 Release 4)".

[4] ETSI TS 102 744-1-4: "Satellite Earth Stations and Systems (SES); Family SL Satellite Radio Interface (Release 1); Part 1: General Specifications; Sub-part 4: Applicable External Specifications, Symbols and Abbreviations".

[5] ETSI TS 102 744-2-2: "Satellite Earth Stations and Systems (SES); Family SL Satellite Radio Interface (Release 1); Part 2: Physical Layer Specifications; Sub-part 2: Radio Transmission and Reception".

[6] ETSI TS 102 744-3-1: "Satellite Earth Stations and Systems (SES); Family SL Satellite Radio Interface (Release 1); Part 3: Control Plane and User Plane Specifications; Sub-part 1: Bearer Control Layer Interface".

[7] ETSI TS 102 744-3-4: "Satellite Earth Stations and Systems (SES); Family SL Satellite Radio Interface (Release 1); Part 3: Control Plane and User Plane Specifications; Sub-part 4: Bearer Connection Layer Operation".

[8] ETSI TS 102 744-3-6: "Satellite Earth Stations and Systems (SES); Family SL Satellite Radio Interface (Release 1); Part 3: Control Plane and User Plane Specifications; Sub-part 6: Adaptation Layer Operation".

2.2 Informative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the reference document (including any amendments) applies.

NOTE: While any hyperlinks included in this clause were valid at the time of publication, ETSI cannot guarantee their long term validity.

The following referenced documents are not necessary for the application of the present document but they assist the user with regard to a particular subject area.

[i.1] NMEA 0183 Interface Standard, Version 3.01, National Marine Electronics Association, January 2002.

[i.2] IETF RFC 2507 (1999): "IP Header Compression", M. Degermark, B. Nordgren, S. Pink.

[i.3] IETF RFC 3095 (2001): "Robust Header Compression (ROHC): Framework and four profiles: RTP, UDP, ESP, and uncompressed", C. Bormann, C. Burmeister, M. Degermark, H. Fukushima, H. Hannu, L-E. Jonsson, R. Hakenberg, T. Koren, K. Le, Z. Liu, A. Martensson, A. Miyazaki, K. Svanbro, T. Wiebke, T. Yoshimura, H. Zheng.

[i.4] ETSI TS 102 744-1-1: "Satellite Earth Stations and Systems (SES); Family SL Satellite Radio Interface (Release 1); Part 1: General Specifications; Sub-part 1: Services and Architectures".

3 Symbols and abbreviations

3.1 Symbols

For the purposes of the present document, the symbols given in ETSI TS 102 744-1-4 [4], clause 3 apply.

3.2 Abbreviations

For the purposes of the present document, the abbreviations given in ETSI TS 102 744-1-4 [4], clause 3 apply.

4 Adaptation Layer Interface

4.1 Radio Interface Layering

The satellite communication protocol is considered as a number of communication layers, as follows:

- Adaptation Layer (AL);
- Bearer Connection Layer (BCn); and
- Bearer Control Layer (BCt);
- Physical Layer (L1).

The satellite radio interface protocol stack is designed to seamlessly integrate with UMTS Non-Access Stratum entities, such as GPRS Mobility Management (GMM) and Mobility Management (MM), residing in the Core Network (CN) and in the upper layers of the User Equipment (UE).

The Adaptation Layer provides support to the UMTS Non-Access Stratum entities GMM and MM, and uses the services provided by the Bearer Connection Layer, as shown in Figure 4.1. The present document defines the Adaptation Layer peer-to-peer interface between the Radio Network Controller (RNC) and the UE, as shown in Figure 4.1.

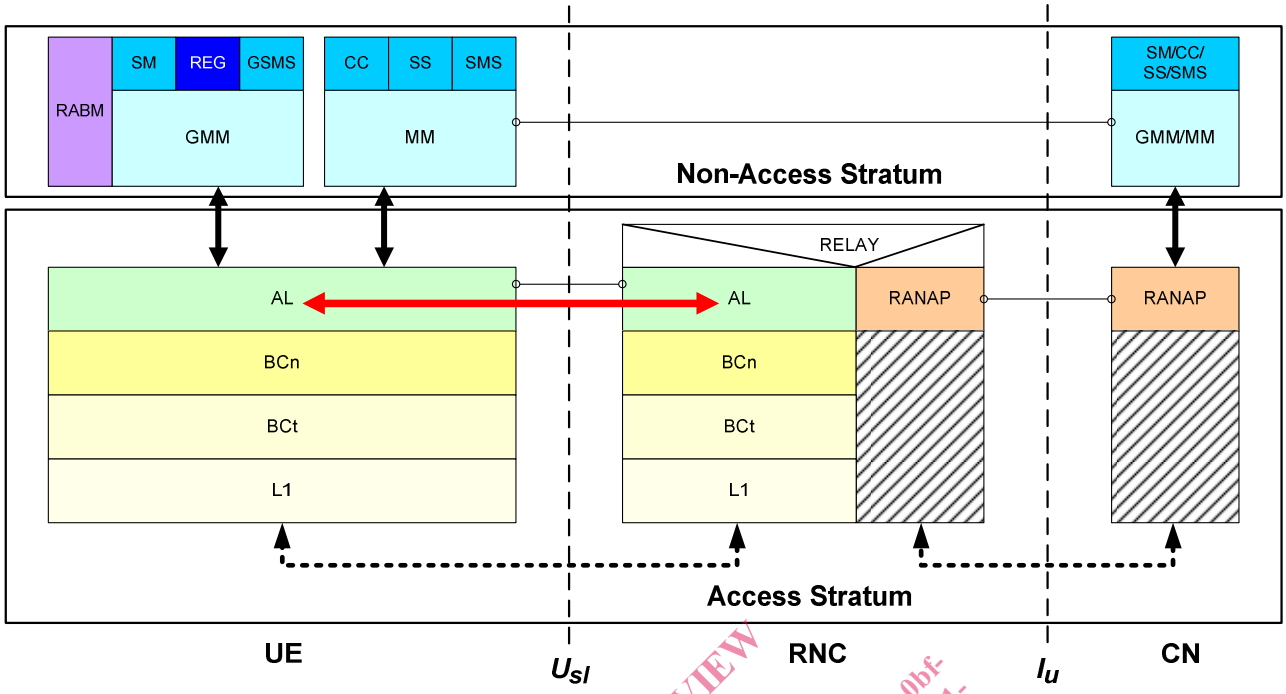

Figure 4.1: Control Plane Protocol Stack Layering with Adaptation Layer peer-to-peer interface indicated

4.2 Conventions used in the present document

4.2.1 Presentation

The following conventions are applied throughout the present document:

- In the ASN.1, variable names are always in lower case letters with hyphenation used to improve readability (e.g. ret-bct-pdu-header). Data Types in the ASN1. Always start with an upper case letter and may contain additional upper case letters to improve readability (e.g. ReturnBCtPDUHeader).
- In the explanatory text these variables are referred to in italics (e.g. *ret-bct-pdu-header)* while Data Types are shown in Helvetica typeface (e.g. BCnPDU).

The layout of the data structures defined in the ASN.1 is also shown in a graphical representation and gives examples of the usage of these structures. In general, the variable names are presented in the same way they are presented in the ASN.1, with the following exceptions:

- insufficient space does not allow the complete variable name to be presented and is therefore abbreviated;
- only one particular value can be assigned to a variable in the particular structure that is presented. In this case the variable is replaced by the appropriate numerical value;
- additional information may be added in brackets for explanatory reasons.

4.2.2 "Reserved" Fields and Values

Fields shown as Reserved BITSTRING (..) in the ASN.1 structures shall be set to zero by the sender and shall be ignored by the receiver.

Values not allocated in distinguished value lists shall not be used by the sender and shall be ignored by the receiver.

NOTE 1: Distinguished Value Lists of type Integer are being used instead of the ENUMERATED data type where the allocated number range is larger than the number of items to be enumerated.

NOTE 2: It should be noted that UEs may only support a lower RI-Version than the one supported by the RNC (see clause 6.1.2.2). In this case, it is likely that Broadcast SDUs/AVPs transmitted by the RNC contain values that are considered as "reserved" by those UEs.

4.2.3 Boolean Variables

BOOLEAN variables shall be encoded as follows:

```
TRUE    ::= 1
FALSE   ::= 0
```

4.2.4 ASN.1 Encoding Rules

The ASN.1 presentation provided in the present document for this interface specification is normative. The encoding rules used for this interface specification are provided in clause 4.3.4 of ETSI TS 102 744-3-1 [6].

5 Adaptation Layer

5.1 Overview

5.1.1 Responsibilities

The Adaptation Layer is responsible for the following:

- **Registration Management:** spot beam selection, system information handling, Non Access Stratum (NAS) system information notification, registration and deregistration (with the RNC), GPS position reporting and GPS position encryption.
- **Mobility Management Support:** providing RRC-like message transport and event notification services to GMM in NAS as well as integrity protection and ciphering control.
- **Radio Bearer Control:** handling signalling related to setup, modification, and release of radio bearers, configuring user plane protocol layers and entities and notifying NAS entities of resource assignments.

5.2 Adaptation Layer use of lower layer Service Access Points

To provide a seamless interface between the satellite network Access Stratum and the UMTS Non-Access Stratum, functional equivalents for a number of UTRAN Radio Resource Control (RRC) messages have been defined. Each RRC message is mapped to an equivalent message for the Satellite Radio Interface. Table 5.1 provides an overview of the relationships between RRC Messages and the equivalent satellite radio interface Common Signalling Messages (Unacknowledged Mode). Table 5.2 provides the same for the satellite radio interface UE Specific Signalling Messages (Acknowledged Mode).

Table 5.1: Mapping of RRC Messages to Satellite Radio Interface Common Signalling

RRC Message	Direction	Satellite Radio Interface Equivalent	See clause
PAGING TYPE 1	To UE	PagingType1	6.1.1
RRC CONNECTION REQUEST	From UE	Register	6.1.2
RRC CONNECTION SETUP	To UE	RegisterAck	6.1.3
RRC CONNECTION REJECT	To UE	RegisterRej	6.1.4
RRC CONNECTION RELEASE	To UE	DeregisterCommon	6.1.5

Table 5.2: Mapping of RRC Messages to Satellite Radio Interface UE Specific Signalling

RRC Message	Direction	Satellite Radio Interface Equivalent	See clause
RRC CONNECTION SETUP COMPLETE	From UE	RegisterComplete	6.2.10
RADIO BEARER SETUP	To UE	Establish	6.2.2
RADIO BEARER SETUP COMPLETE	From UE	EstablishAck	6.2.3
RADIO BEARER SETUP FAILURE	From UE	EstablishReject	6.2.11
RADIO BEARER RECONFIGURATION	To UE	Modify	6.2.6
RADIO BEARER RECONFIGURATION COMPLETE	From UE	ModifyAck	6.2.7
RADIO BEARER RECONFIGURATION FAILURE	From UE	ModifyReject	6.2.13
RADIO BEARER RELEASE	To UE	Release	6.2.4
RADIO BEARER RELEASE COMPLETE	From UE	ReleaseAck	6.2.5
RADIO BEARER RELEASE FAILURE	From UE	ReleaseReject	6.2.12
PAGING TYPE 2	To UE	PagingType2	6.2.14
INITIAL DIRECT TRANSFER	From UE	InitialDirectTransfer	6.2.15
UPLINK DIRECT TRANSFER	From UE	UplinkDirectTransfer	6.2.16
DOWNLINK DIRECT TRANSFER	To UE	DownlinkDirectTransfer	6.2.17
SECURITY MODE COMPLETE	From UE	SecurityModeComplete	6.2.19
SECURITY MODE FAILURE	From UE	SecurityModeFailure	6.2.20
SECURITY MODE COMMAND	To UE	SecurityModeCommand	6.2.18
SIGNALLING CONNECTION RELEASE REQUEST	From UE	SignallingConnectionReleaseReq	6.2.21
SIGNALLING CONNECTION RELEASE	To UE	SignallingConnectionRelease	6.2.22
RRC CONNECTION RELEASE	To UE	Deregister	6.2.27
RRC CONNECTION RELEASE COMPLETE	From UE	DeregisterAck	6.2.28

In addition to the above, a number of UE Specific Signalling Messages do not have a functional equivalent in UTRAN RRC and are required for the satellite radio interface. These are summarized in Table 5.3.

Table 5.3: UE Specific Signalling Messages without RRC equivalent

Satellite Radio Interface UE Specific Signalling Message	Direction	See clause
Handover	To UE	6.2.8
HandoverAck	From UE	6.2.9
UEPositionRequest	To UE	6.2.23
UEPositionResponse	From UE	6.2.24
RegModeUpdate	To UE	6.2.25
SystemInformation	To UE	6.2.26
HandoverRequest	To RNC	6.2.29

6 Adaptation Layer Protocol Data Units

6.0 General

The following clauses define the format of the Protocol Data Units which are used by the Adaptation Layer to signal its peer (AL-PDUs). Clause 6.1 specifies those AL-PDUs which are sent through Common Signalling (AL-ComPDUs), while clause 6.2 specifies those AL-PDUs which are sent on a UE Specific Signalling Connection (AL-SigPDUs).

6.1 Common Signalling Protocol Data Units (ALComPDUs)

6.1.0 General

Common Signalling PDUs are carried within a Common Protocol Data Unit (PDU) in the Bearer Control sub-layer, where the type of the Common Signalling PDU is carried within the ComSigType field within a Bearer Control PDU (see ETSI TS 102 744-3-1 [6]).

```
ALComPDU ::=
    CHOICE {
        empty-common-sig
            NULL,
        paging-type-1
            PagingType1
        register
            Register,
        register-ack
            RegisterAck,
        register-rej
            RegisterRej
        deregister-common
            DeregisterCommon
        }
```

6.1.1 PagingType1

6.1.1.0 General

The PagingType1 Signalling PDU is used by the RNC when the UE is not registered to indicate that the UE should initiate the Registration process. The Adaptation Layer shall inform the Non Access Stratum of the event. The PDU is defined as below, with format shown in Figure 6.1.

```
PagingType1 ::=
    SEQUENCE {
        cn-domain-identity
            CNDomainIdentity,
        paging-cause
            PagingCause
        }
```

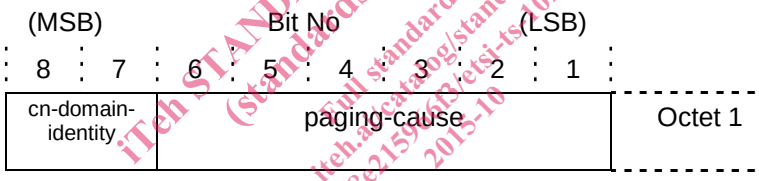

Figure 6.1: PagingType1 Common Signalling PDU

6.1.1.1 CNDomainIdentity

This parameter identifies the Core Network Domain, which originated the paging request. The parameter definition is the same as for the CNDomainIdentity Information Element (IE) specified in [3], clauses 10.3.1.1 and 11.3 as follows:

```
CNDomainIdentity ::=
    INTEGER {
        cs-domain (0),
        ps-domain (1),
        bm-domain (2),
    } (0..3)
```

6.1.1.2 PagingCause

This parameter is also sent from the Core Network and hence follows the definition of the PagingCause IE in [3], clauses 10.3.3.22 and 11.3 as follows:

```
PagingCause ::=
    INTEGER {
        terminatingConversationalCall (0),
        terminatingStreamingCall (1),
        terminatingInteractiveCall (2),
        terminatingBackgroundCall (3),
        terminatingHighPrioritySignalling (4),
        terminatingLowPrioritySignalling (5),
        terminatingCauseUnknown (6)
    } (0..63)
```

6.1.2 Register

6.1.2.0 General

The Register Common Signalling PDU is used by the UE to request the initiation of the registration process. Addressing is performed by the Bearer Control Layer using the Initial UE Identity. The Register Common Signalling PDU is defined as below, with structure as shown in Figure 6.2.

```
Register ::=
    SEQUENCE {
        reg-ref
            RegistrationReference,
        ai-version
            AIVersion,
        cn-domain-identity
            CNDomainIdentity,
        registration-cause
            RegistrationCause,
        reserved
            BITSTRING (SIZE (3)),
        ue-class
            UEClass
    }
```

8 (MSB)	7	6	5	4	3	2	1 (LSB)	
reg-ref								Octet 1
ai-version								Octet 2
cn-domain-identity		registration-cause						Octet 3
reserved			ue-class					Octet 4

Figure 6.2: Register Common Signalling PDU

The parameter *cn-domain-identity* is defined in clause 6.1.1.1.

6.1.2.1 RegistrationReference

The *reg-ref* field (Registration-Reference) carries a sequence number generated by the UE used to synchronize the forward and return registration information. This information is used at the RNC to determine whether this is a repeat registration request or a new registration request.

```
RegistrationReference ::=
    INTEGER (0..255)
```

When used in the RNC-UE direction, the Registration-Reference field either carries the value specified by the UE, or it may contain a NULL (0) value - indicating that the UE should obey the instruction regardless of the currently stored Registration Reference value.

6.1.2.2 RIVersion

The RI-Version field contains the Radio Interface (RI) version number to which the software within the UE was designed to operate. Note that the RI-Version number is used to refer to all layers within the Access Stratum. The interpretation of the RI-Version number is shown in Table 6.1.

```
RIVersion ::=
    INTEGER {
        syst-initial-release (129),
        syst-extension-1 (130)
        Syst-extension-2 (131)
    } (0..255)
```