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Satellite Earth Stations and Systems (SES);
Family SL Satellite Radio Interface (Release 1);
Part 3: Control Plane and User Plane Specifications;
Sub-part 2: Bearer Control Layer Operation

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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 2 of a multi-part deliverable. Full details of the entire series can be found in ETSI TS 102 744-1-1 [i.1].

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 Bearer Control Layer (BCt) operation of the Family SL satellite radio interface between the Radio Network Controller (RNC) and the User Equipment (UE) used in the satellite network. The Bearer Control Layer (BCt) peer-to-peer interface is described in ETSI TS 102 744-3-1 [8].

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 135 201: "Universal Mobile Telecommunications System (UMTS); Specification of the 3GPP confidentiality and integrity algorithms; Document 1: f8 and f9 specifications (3GPP TS 35.201 Release 4)".

[4] ETSI TS 102 744-1-3: "Satellite Earth Stations and Systems (SES); Family SL Satellite Radio Interface (Release 1); Part 1: General Specifications; Sub-part 3: Satellite Radio Interface Overview".

[5] 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".

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

[7] 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".

[8] 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".

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

[10] ETSI TS 102 744-3-9: "Satellite Earth Stations and Systems (SES); Family SL Satellite Radio Interface (Release 1); Part 3: Control Plane and User Plane Specifications; Sub-part 9: Initiation and Operation of User Plane".

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

[12] ETSI TS 102 744-3-5: "Satellite Earth Stations and Systems (SES); Family SL Satellite Radio Interface (Release 1); Part 3: Control Plane and User Plane Specifications; Sub-part 5: Adaptation Layer Interface".

2.2 Informative references

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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] 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 [5], clause 3 apply.

3.2 Abbreviations

For the purposes of the present document, the abbreviations given in ETSI TS 102 744-1-4 [5], clause 3 apply.

4 General Architecture

The Bearer Control Layer (BCt) provides medium access control functionality for both the control and user planes. Figure 4.1 illustrates the position of the Bearer Control Layer within the Family SL air interface protocol stack. An overview of the radio interface layering and relationship to the Bearer Control Layer is provided in ETSI TS 102 744-1-3 [4], clause 4 and ETSI TS 102 744-3-1 [8], clause 4. An overview of the Bearer Control Layer operation is provided in ETSI TS 102 744-1-3 [4], clause 7.

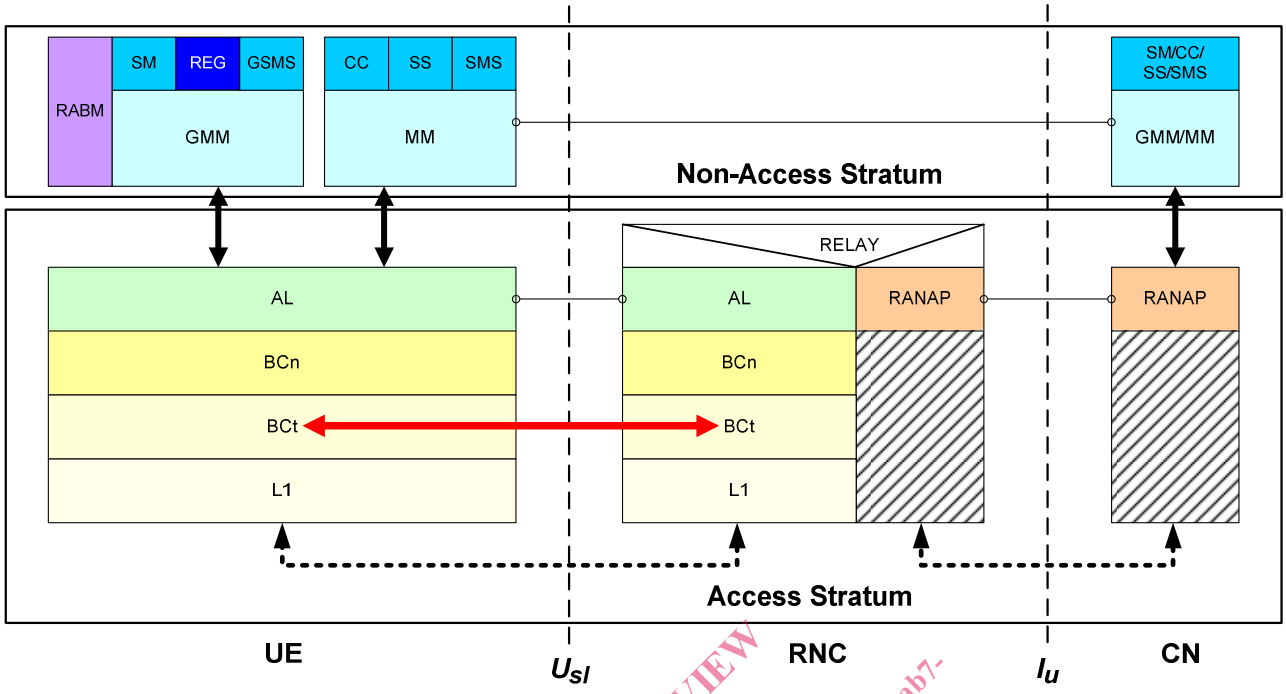

Figure 4.1: Bearer Control Layer Position in Protocol Stack (Control Plane Illustrated)

The Bearer Control Layer is responsible for the management and set-up of physical bearers. Its operations include:

- Transfer of data over one or more forward and return physical bearers (each RNC supports multiple forward and return physical bearers)
- Transfer of data to and from UEs where each UE may have multiple simultaneous data connections each with its own QoS requirements
- Dynamic switching of UE between different forward and return bearers
- Handover of connections to/from other Bearer Control entities for mobility management purposes without the need to close and restart connections
- Reconfiguration of connection QoS during the life-time of a connection (supported by Bearer Control layer on QoS command from Adaptation Layer)
- Perform timing measurement and adjustment
- Perform link adaptation to optimize data rate of the system
- Perform Sleep Mode operation to allow UE to conserve power
- Perform resource management control, including admission control, time slot allocation, etc., to ensure the QoS of each UEconnection is met

The functions of the Bearer Control Layer are provided to the upper layers via a number of different service access points (SAPs).

The Bearer Control Layer consists of a number of Bearer Control Processes, each controlling a number of associated forward and return bearers. Typically one RNC Bearer Control Process will control all the channels used in one spot beam. However, more than one control process per beam is allowed. Each of these Bearer Control Processes is identified by a BCt-ID, which is transmitted in the forward link Bulletin Board Signalling Data Unit (SDU).

5 Bearer Control Services

5.1 Bearer Control Service Access Points

5.1.0 General

The internal architecture of the Bearer Control Process for the UE side is shown in simplified form in Figure 5.1. The diagram shows both control plane and user plane. The functionality is broadly categorized into control functions provided by the BCt Manager (BCtM) entity and data transfer functions provided by the UE BCt entity. A more detailed description of the internal architectural entities is provided in clause 3.

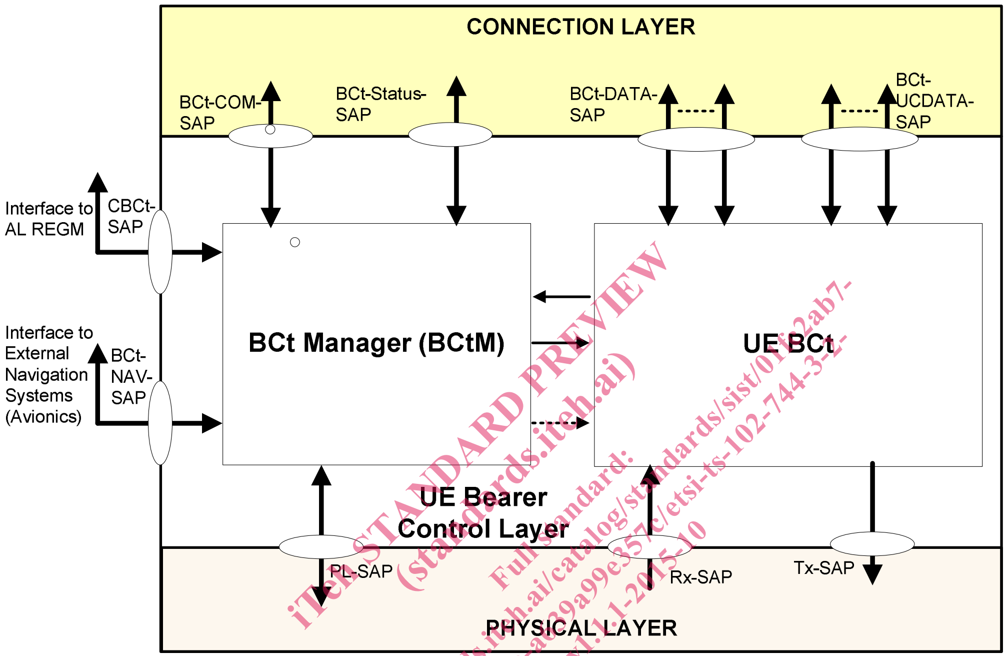

Figure 5.1: Bearer Control Layer Service Access Points (UE Side)

5.1.1 Services provided to Upper Layers

The Bearer Control Layer provides media access functions to the upper layers (Bearer Connection Layer and Adaptation Layer) via the following service access points (SAP).

- CBCt-SAP: providing services to AL related to initiation of PSAB discovery procedures, providing GPS position for reporting purposes and delivery of System Information.
- BCt-COM-SAP: providing services to AL related to common signalling procedures.
- STATUS-SAP: providing services to Bearer Connection Layer entities for control of the user-plane operation.
- BCt-DATA-SAP: providing data transport services to Bearer Connection Layer (BCn) for acknowledged and unacknowledged mode connections.
- BCt-UCDATA-SAP: providing data transport services to Bearer Connection Layer (BCn) for transparent mode connections.

5.1.2 Services Expected from the Lower Layers

The Bearer Control Layer relies on the Physical Layer for transmitting and receiving Bearer Control Protocol Data Units (PDUs) to its peer entity at the RNC side.

Three Service Access Points, namely the Physical Layer SAP (PL-SAP), Receive SAP (Rx-SAP) and Transmit SAP (Tx-SAP) are referenced in the present document. The detailed definition of primitives for these SAPs is implementation specific and therefore not specified further in the present document.

5.1.3 Services Expected from External Entities

The BCt-NAV-SAP interface is used to obtain geographical location and other navigational information from an external navigational sub-system. This external sub-system may be internal to the mobile terminal (typically the case for portable, maritime and land-vehicular mobile terminals), or may be provided by an external navigational sub-system (typically the case for aeronautical mobile terminals).

5.2 Bearer Control Layer Service Primitives

5.2.1 Data Transfer Service Access Points

5.2.1.1 BCt-DATA-SAP Primitives and Parameters

The BCt-DATA-SAP is used for the transfer of the Acknowledged Mode and Numbered Mode data between Bearer Connection and Control layer. The BCt-DATA-SAP primitives are shown in Table 5.1.

Table 5.1: BCt-DATA-SAP Primitives

Primitive	Direction	Parameters
BCt_TxDATA_REQ	To BCt	BCnID, DataSize, BCnPDU
BCt_TxDATA_IND	To BCn	DataSize, FinalSegRetxAllowedFlag
BCt_RxDATA_IND	To BCn	BCnID, DataSize, BCnPDU

The BCt_TxDATA_IND primitive is used to indicate to the Connection layer the capacity available for a specific connection in the current frame. The data handler (AM_DH or NUM_DH) in the connection layer will respond by sending the address (BCnID) and data (BCnPDU) to be sent using the BCt_TxDATA_REQ signal. On the receive side, received BCnPDUs are delivered to the Connection Layer using the BCt_RxDATA_IND primitive. The FinalSegRetxAllowedFlag is used to signal to the connection layer entity that it may use this payload to carry a retransmitted final data segment rather than a poll frame if the final data segment is sufficient to be accommodated within the offered DataSize. The FinalSegRetxAllowedFlag shall be set to TRUE if the return bearer is using either Controlled Random Access Mode or Shared Reservation Access Mode.

5.2.1.2 BCt-UCDATA-SAP Primitives and Parameters

The BCt-UCDATA-SAP is used for the transfer of the Transparent Mode data between Bearer Connection and Control layer. The BCt-UCDATA-SAP primitives are shown in Table 5.2.

Table 5.2: BCt-UCDATA-SAP Primitives

Primitive	Direction	Parameters
BCt_TxUCDATA_REQ	To BCt	BCnID, DataSize, BCnPDU
BCt_TxUCDATA_IND	To BCn	DataSize
BCt_RxUCDATA_IND	To BCn	BCnID, DataSize, BCnPDU, [errflg]

The BCt_TxUCDATA_IND primitive is used to indicate the capacity available for a specific connection in the current frame to the Connection layer. The data handler (TM_DH or UN_DH) in the connection layer will respond by sending the address (BCnID) and data (BCnPDU) to be sent using the BCt_TxUCDATA_REQ signal. On the receive side, received BCnPDUs are delivered to the Connection Layer using the BCt_RxUCDATA_IND primitive. If delivery of erroneous PDUs is requested, then any PDU with a failed CRC shall be marked with the error flag errflg.

5.2.2 Navigational Interface Service Access Points

5.2.2.1 BCt-NAV-SAP (Maritime and Land-Mobile Class UE Only)

The BCt-Nav-SAP is used by the BCtM to obtain geographical location and other navigational information from a navigational subsystem external to the Bearer Control layer. The BCt-Nav-SAP primitives for Portable, Maritime and Land Mobile UE are shown in Table 5.3.

Table 5.3: BCt-Nav-SAP Primitives (Portable, Maritime and Land Mobile UE)

Primitive	Direction	Parameters
CBCt_POS_REQ	From BCt	
CBCt_POS_CNF	To BCt	3D GPS Position (x,y,z or Lat,Long, Altitude)
CBCt_POS_IND	To BCt	3D GPS Position (x,y,z or Lat,Long, Altitude)
CBCt_VELOCITY_REQ (Optional)	From BCt	
CBCt_VELOCITY_CNF (Optional)	To BCt	Velocity vector of UE (v_x, v_y, v_z or compass direction, speed)
CBCt_VELOCITY_IND (Optional)	To BCt	Velocity vector of UE (v_x, v_y, v_z or compass direction, speed)
CBCt_ORIENTATION_REQ	From BCt	
CBCt_ORIENTATION_CNF	To BCt	UE orientation pitch, tilt, roll
CBCt_POINTING_IND	From BCt	Direction of boresight antenna gain relative to UE

The purpose of the interface is to ensure that the position information maintained by the Bearer Control information is accurate to 1 500 metres for the purpose of maintaining adequate return channel transmit timing.

The information may be either presented periodically by the external navigational subsystem using the CBCt_POS_IND primitive; or the external navigation subsystem may be polled by the BCtM entity using CBCt_POS_REQ primitive, to request an up-to-date position which will be provided within the CBCt_POS_CNF primitive.

The parameters contained in the CBCt_POS_IND primitive and the CBCt_POS_CNF primitive shall be used by BCtM for the dual purposes of:

1) Adjusting the return channel transmit timing mechanisms

2) Reporting location to the Adaptation Layer via the CBCt_SAP

If supported, the parameters contained in the CBCt_VELOCITY_CNF primitive may also be forwarded to the Adaptation Layer via the CBCt_POSITION_CNF on the CBCt_SAP to improve the timeliness of UE-initiated spot-beam selection and handover mechanisms.

The CBCt_ORIENTATION_REQ/ CONF primitives support the provision of attitude information to the BCt and are mainly applicable to mobile terminals, and are used to assist with rapid pointing of directional antenna subsystems.

5.2.2.2 BCt_NAV_SAP Interface with avionics (Aeronautical Class UE Only)

The aeronautical UE shall be able to access regular updates of position and velocity from the avionics in order to be able to perform spot-beam selection and compensation for Doppler frequency offset, but the specifics of the interface are implementation-dependent.

For aeronautical UE, the BCt-Nav-SAP is used by the BCtM to exchange navigational and control information with an external navigational subsystem. For aeronautical subsystems, the interface towards the external navigational subsystem is typically supported via an ARINC-429 interface. The BCt-Nav-SAP primitives for Aeronautical UE are shown in Table 5.4.