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Satellite Component of UMTS/IMT-2000;
High Level Analysis of 3GPP Release 1999 Documents;
Part 3: Radio Access Network aspects**



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Foreword

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

The present document is part 3 of a multi-part deliverable covering the High Level Analysis of 3GPP Release 1999 Documents Applicable to the Satellite Component of UMTS/IMT2000, as identified below:

- Part 1: "Introduction";
- Part 2: "Services and Architecture aspects";
- Part 3: "Radio Access Network aspects";**
- Part 4: "Core Network aspects";
- Part 5: "Terminal aspects".

Introduction

The present document is dedicated to the Radio Access Network (RAN). It is composed of four main clauses. Clause 4 is an overall presentation of the structure of the present document. Clause 5 is dedicated to the series 25. In clause 6, recommendations are provided.

1 Scope

The present document has been developed by the Technical Committee Satellite Earth stations and Systems (TC SES) to highlight the applicability for the satellite component of UMTS/IMT2000 of the deliverables (Technical Specifications, Technical Reports) produced by 3GPP for release 1999.

2 References

For the purposes of this Technical Report (TR) the following references apply:

- [1] 3GPP TS 23.041: "Technical realization of Cell Broadcast Service (CBS)".
 - [2] 3GPP TR 23.930: "Iu Principles".
 - [3] 3GPP TS 25.301: "Radio Interface Protocol Architecture".
 - [4] 3GPP TS 25.401: "UTRAN Overall Description".
 - [5] 3GPP TS 25.410: "UTRAN Iu Interface: General Aspects and Principles".
 - [6] 3GPP TS 25.413: "UTRAN Iu Interface RANAP Signalling".
 - [7] 3GPP TS 25.415: "UTRAN Iu Interface User Plane Protocols".
 - [8] 3GPP TS 25.419: "UTRAN Iu Interface: Service Area Broadcast Protocol SABP".
 - [9] 3GPP TS 25.420: "UTRAN Iur Interface General Aspects and Principles".
 - [10] 3GPP TS 25.430: "UTRAN Iub Interface: General Aspects and Principles".
 - [11] 3GPP TR 25.931: "UTRAN Functions, Examples on Signalling Procedures".
 - [12] 3GPP TS 23.122: "NAS Functions related to Mobile Station (MS) in idle mode".
-

3 Definitions and abbreviations

3.1 Definitions

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

ALCAP: generic name for the transport signalling protocols used to set-up and teardown transport bearers.

3.2 Abbreviations

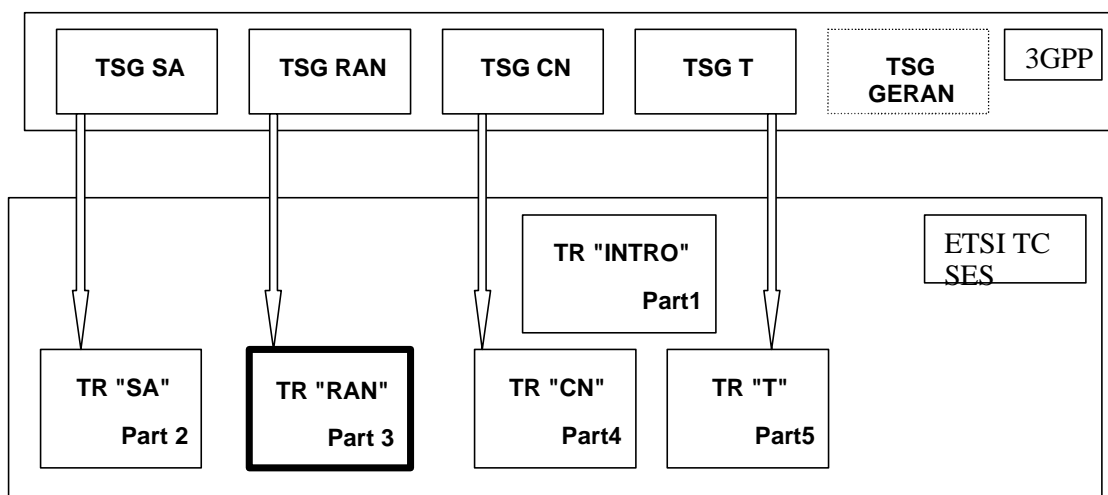
For the purposes of the present document, the following abbreviations apply:

3GPP	3 rd Generation Partnership Project
ALCAP	Access Link Control Application Part
BS	Base Station
CPCH	Common Packet Channel
FDD	Frequency Division Duplex
FER	Frame Error Rate
FFS	For Further Study
IETF	Internet Engineering Task Force
MAC	Medium Access Control
RAN	Radio Access Network
RF	Radio Frequency

RLC	Radio Link Control
RNC	Radio Network Controller
RRC	Radio Resource Control
SABP	Service Area Broadcast Protocol
SAP	Service Access Point
SCCP	Signalling Connection Control Part
SCH	Synchronization Channel
SCTP	Simple Control Transmission Protocol
SIR	Signal to Interference Ratio
TDD	Time Division Duplex
TFC	Transport Frame Combination
TFCI	Transport Frame Combination Indicator
UMTS	Universal Mobile Telephone Service
UTRA	UMTS Terrestrial Radio Access
UTRAN	UMTS Terrestrial Radio Access Network

4 Structure of the Technical Report

To take full advantage of the work undertaken in 3GPP, the volumes of the present document are based on the overall organization of the standardization activities in 3GPP. This is depicted in the following figure:



The present document is dedicated to the Technical Specifications under responsibility of TSG RAN.

5 Serie

5.1 N° 25.101 UE Radio Transmission and Reception (FDD)

5.1.1 Content

This document establishes the minimum RF characteristics of the FDD mode of UTRA for the User Equipment (UE).

5.1.2 Interest for S-UMTS Uu Interface

The document structure is directly usable in order to specify:

- Frequency bands used.
- UE transmitter characteristics, such as output power, frequency stability, spurious emissions, intermodulation, etc.
- UE receiver characteristics, such as receiver sensitivity, maximum input power, etc.
- Down-link performance requirements for several reference measurement channels and propagation conditions.
- Definition itself of the measurement channels and the propagation conditions.

Although the general frame can be kept, significant effort is to be made in order to provide:

- New values for the relevant transmitter and receiver parameters.
- A convenient set of measurement channels (data rates) and propagation channels describing effectively the satellite environment.
- Performance requirements themselves for these channels, including conditions of hand-over and compressed mode. These values depend heavily on the frame structure used (interleaving, rate matching, pilot/power control/TFC overhead,...), so they would in turn be influenced by eventual changes in frame structure from 3GPP.
- (Eventual) adaptation of the diversity mode to multiple satellite visibility.

A possibility worthwhile considering would be a division of the document in two parts, one for the RF characteristics, and another for the performance requirements in the down-link.

Finally, the performance for the High Penetration Paging Channel should be included here.

5.2 N° 25.104 UTRA (BS) Radio Transmission and Reception (FDD)

5.2.1 Content

This document establishes the Base Station minimum RF characteristics of the FDD mode of UTRA.

5.2.2 Interest for S-UMTS Uu Interface

This document is likely to be split in two parts, one corresponding to the Gateway requirements, and other for the Satellite characteristics. Additionally, the decision on the use of bent-pipe or regenerative satellites would have a fundamental impact in the description for both elements.

This document structure can be used in order to specify:

- Frequency bands used.
- Gateway/Satellite transmitter characteristics, such as output power, frequency stability, spurious emissions, intermodulation, etc.
- Gateway/Satellite receiver characteristics, such as receiver sensitivity, maximum input power, etc.
- Up-link performance requirements for several reference measurement channels and propagation conditions.
- Definition itself of the measurement channels and the propagation conditions.

Additionally, more effort is to be made in order to provide:

- Appropriate values for the relevant transmitters and receivers parameters.
- A convenient set of measurement channels (data rates) and propagation channels describing effectively the satellite environment.

Performance requirements themselves for these channels, including conditions of hand-over and compressed mode. These values depend heavily on the frame structure used (interleaving, rate matching, pilot/power control/TFC overhead, ...), so they would in turn be influenced by eventual changes in frame structure from 3GPP.

Introduction of diversity (multiple satellite visibility) in the performance requirements.

A possibility worthwhile considering would be a further division of the document in two parts, one for RF characteristics, and another for the performance requirements in the up-link.

5.3 N° 25.133 Requirements for Support of Radio Resource Management (FDD)

5.3.1 Content

This document specifies requirements for support of Radio Resource Management for FDD. These requirements include requirements on measurements in UTRAN and the UE as well as requirements on node dynamical behaviour and interaction, in terms of delay and response characteristics.

5.3.2 Interest for S-UMTS Uu Interface

This document is intended to specify the relevant RF performance requirements to perform Radio Resource Management. As such, the values are scenario-dependant, so that they should be re-estimated for the relevant satellite scenarios.

In particular, the following issues are considered (although still with many holes to be filled):

- Idle mode tasks: RF cell selection and re-selection, location registration.
- Connection mobility: hand-over, cell updating.
- RRC connection control.
- Power management: outer and inner power control loops (steps, dynamic range, requirements).
- Timing: synchronization, transmit and reception timing.
- Measurement performance requirements (accuracy).

The RRC operations themselves are described elsewhere.

5.4 N° 25.201 Physical Layer – General Description

5.4.1 Content

This specification gives a general description of the physical layer of the UTRA radio interface. It also describes the document structure of the 3GPP physical layer specifications, i.e. TS 25.200 series. The TS 25.200 series specifies the Uu point for the 3G mobile system, and defines the minimum level of specifications required for basic connections in terms of mutual connectivity and compatibility.

5.4.2 Interest for S-UMTS Uu Interface

This document gives a high-level description of the physical layer of the UTRA radio interface. The only relevant difference to be expected in the satellite component is the absence of TDD mode, and subsequently of all the documents which specify it. Apart from this point, it is directly applicable.

5.5 N° 25.211 Physical channels and mapping of transport channels onto physical channels (FDD)

5.5.1 Content

This document describes the characteristics of the Layer 1 transport channels and physical channels in the FDD mode of UTRA. The main objectives of the document are to be a part of the full description of the UTRA Layer 1, and to serve as a basis for the drafting of the actual technical specification (TS).

5.5.2 Interest for S-UMTS Uu Interface

The transport channels in the FDD mode of the UTRA can be largely re-used for the satellite adaptation. That includes the Dedicated Channels and most of the Common Channels, namely the Broadcast Channel, the Forward Access Channel, the Random Access Channel and the Down-link Shared Channel. Obviously their physical counterparts can also be re-used.

The main differences expected in the satellite adaptation are:

- Diversity operation, as used in UTRA, is not extendable to the satellite environment. However, multi-path transmission can be achieved by exploiting the multiple satellite visibility. In this case, feasibility of space/time coding along the different satellite paths is to be studied.

- Power control operation cannot be performed on a slot-by-slot basis, due to the increased round-trip-time. A command each frame (10 ms) is enough to track the slow power changes.
- Timing relation between the physical channels. The larger delays and delay spread among users lead to different timing offsets between channels, and make synchronization between them more difficult. As their physical operation is based on these timing relations, their exact feasibility in a satellite environment should be assessed.
- Packet transmission needs to be re-thought.
- A low-rate high-power paging channel is required for the satellite environment.
- Implementation of new physical channels for broadcast/multicast operation, something missing in the current terrestrial system. Broadcast/multicast data transmission has not been fully tackled yet by 3GPP, so changes in the terrestrial system are expected as well; some co-operation could prove convenient in order not to duplicate efforts.
- Framing details could accordingly change.

5.6 N° 25.212 Multiplexing and channel coding (FDD)

5.6.1 Content

This specification describes the characteristics of the Layer 1 multiplexing and channel coding in the FDD mode of UTRA.

5.6.2 Interest for S-UMTS Uu Interface

This document can be used to specify the multiplexing of transport channels, rate matching, channel coding and interleaving operations. As these functions do not need any specific adaptation to the satellite environment, they can be used "as they are".

A minor point is the power control, which, if sent only once per frame, ought to be encoded in order to reduce the amount of wrong commands. In this case, a combined TFCI/TPC scheme, for instance, can be employed.

In this document operation of compressed mode is described. In principle, this mode could be kept for the satellite environment, as it would prove convenient for some measurements to be provided by the physical layer.

5.7 N° 25.213 Spreading and modulation (FDD)

5.7.1 Content

This document describes spreading and modulation for UTRA Physical Layer FDD mode.

5.7.2 Interest for S-UMTS Uu Interface

This document can be re-used to describe the power weighting, spreading and modulation of physical channels for the satellite adaptation.

A high degree of re-usability of information can be expected: the same spreading structure can be kept, with identical channelization and scrambling codes, both for the up- and the down-link. Similarly, the same modulation scheme is easily re-used.

However, some minor points have to be raised:

- Random Access acquisition is probably not suitable to the satellite environment, so that longer preambles should be used.
- Up-link Common Packet Channel is not directly applicable, and the corresponding Acquisition Indicator Channel neither.

- As synchronization procedures are expected to be different, the definition of the Synchronization Channel (SCH) could change accordingly.
- Down-link data short scrambling codes can be used if forward link multi-user detection is envisaged.
- A high-power paging channel should be included.

5.8 N° 25.214 Physical layer procedures (FDD)

5.8.1 Content

This document specifies and establishes the characteristics of the physical layer procedures in the FDD mode of UTRA.

5.8.2 Interest for S-UMTS Uu Interface

Depending on the nature of the satellite, i.e., bent-pipe or regenerative payload, the synchronization and power control schemes could be adapted with minor changes or would have to be re-done.

In the synchronization part, both satellite and beam acquisition are to be done, with the additional point of satellite diversity.

Power control commands are likely to be less frequent for the satellite environment. Its operation in both compressed mode and diversity mode has to be studied.

Random Access operation will be different, in terms of acquisition, acknowledgement and involved delays. More radically, up-link shared channel (CPCH) is to be re-thought, as is packet mode in general.

The eventual procedures for broadcast/multicast mode could also be included here. So far, they are absent in the 3GPP documents.

Finally, the proposed terrestrial diversity schemes need adaptation to the satellite system. They can, for instance, just be deleted, or used to exploit the satellite diversity by means of space/time coding.

5.9 N° 25.215 Physical layer measurements (FDD)

5.9.1 Content

This 3GPP TS contains the description and definition of the measurements for FDD done at the UE and network in order to support operation in idle mode and connected mode.

In this clause the general measurement control concept of the higher layers is briefly described to provide an understanding on how L1 measurements are initiated and controlled by higher layers.

L1 provides with the measurement specifications a toolbox of measurement abilities for the UE and the UTRAN. These measurements can be differentiated in different measurement types: intra-frequency, inter-frequency, inter-system, traffic volume, quality and internal measurements.

5.9.2 Interest for S-UMTS Uu Interface

In order to control the Radio Resource, some information will have to be exchanged between the UE and the USRAN. Typical examples are FER, SIR, interference power, transmit power, etc. This is to be specified in a Radio Resource Controller Protocol, and supported by the corresponding physical layer measurements, specified in turn in the present document. Lacking any further refinement, the present document could be taken as a basis, adding eventual functionalities necessary in the satellite environment.

In order to support hand-over with other systems, a UE could, upon higher layer commands, monitor cells on other frequencies (UTRA FDD, TDD, GSM). If these frequencies are deemed close to the operating ones, some kind of compressed mode will prove necessary, to allow the UE to perform measurements during these transmission gaps. Should the UE be equipped with dual receivers, that can perform independent measurements through a "monitoring branch" receiver, operating independently from the normal receiver branch, no down-link compressed mode would be needed.

5.10 N° 25.301 Radio Interface protocol architecture

5.10.1 Content

This document provides an overview and overall description of the UE-UTRAN radio interface protocol architecture as agreed within the 3GPP TSG RAN working group 2.

5.10.2 Interest for S-UMTS Uu Interface

First of all, the overall protocol structure is introduced. It is split in three protocol layers: physical layer (L1), data link layer (L2) and network layer (L3). Layer 2 is split into Medium Access Control (MAC), Radio Link Control (RLC), Packet Data Convergence Protocol (PDCP) and Broadcast/Multicast Control (BMC). Layer 3 and RLC are divided in Control (C-) and User (U-) planes. The lower sub-layer of Layer 3 C-plane is the Radio Resource Control; the next sub-layer provides "Duplication avoidance", to avoid loss of data during changes in the Iu connection point; it terminates in the CN; higher layer signalling such as Mobility Management and Call Control are assumed to belong to the non-access stratum.

A high level description of the different layer services and functions follows. This is directly re-usable for the satellite-based system. In Layer 1 and 2 mentions to TDD mode should be removed, and consequently the functions and services associated. Mentions to CPCH should be put in hold as well, its feasibility for the satellite case not being very clear.

5.11 N° 25.302 Services provided by the physical layer

5.11.1 Content

This document is a technical specification of the services provided by the physical layer of UTRA to upper layers.

5.11.2 Interest for S-UMTS Uu Interface

This document gives a very general overview of the physical layer. It can be highly re-used in order to:

- Define formally the interactions of Layer 1 with higher layers (MAC, RRC).
- Model L1 from a high level point of view.
- Describe the possible transport format configurations for data transfer.
- Determine which are the possible simultaneous physical channel combinations.
- Define the measurements to be performed by the physical layer and later provided to higher layers.
- Describe the possible transport formats.

As in other documents, mentions to TDD mode should be deleted.

5.12 N° 25.303 UE functions and inter-layer procedures in connected mode

5.12.1 Content

This document describes all procedures that assign, reconfigure and release radio resources. Included are e.g. procedures for transitions between different states and substates, handovers and measurement reports. The emphasis is on showing the combined usage of both peer-to-peer messages and interlayer primitives to illustrate the functional split between the layers, as well as the combination of elementary procedures for selected examples. The peer-to-peer elementary procedure descriptions are described in the related protocol descriptions /1, 2, 3/ and they are thus not within the scope of this document.

5.12.2 Interest for S-UMTS Uu Interface

The mode covered is the connected mode, that is, with RRC connection. It describes the RRC establishment and release procedures, the radio bearer procedures, data transfer, RRC mobility control and paging. This document can be directly mapped to a satellite environment, taking into account the eventual differences in hand-over, measurements, up-link common packet channel (CPCH) and broadcast/multicast.

The detailed analysis of all procedures included in the referenced document goes beyond the purpose of the present document.

5.13 N° 25.304 UE Procedures in Idle Mode and Procedures for Cell Reselection in Connected Mode

5.13.1 Content

This document specifies the overall idle mode process for the UE and the functional division between the non-access stratum and access stratum in the UE. The non-access stratum part is specified in 3GPP TS 23.122[12] and the access stratum part in this document. The UE is in idle mode when there is no RRC connection. In addition, the UTRAN has no own information about the individual idle mode UEs, and can only address e.g. all UEs in a cell or all UEs monitoring a specific paging occasion. This document applies to UEs that support at least UTRA and possibly also other radio access technologies, for instance GSM.

In addition to the specification of the idle mode process, there is a specification of the cell selection and reselection procedures applicable to UEs in connected mode in some cases.

5.13.2 Interest for S-UMTS Uu Interface

The specific procedure for cell selection and re-selection are likely to be different in S-UMTS.

5.14 N° 25.321 Medium Access Control (MAC) protocol specification

5.14.1 Content

This document specifies the MAC protocol. The specification describes the MAC architecture, the MAC entities, the channel structure, the services provided to upper layers, the MAC functions, the services expected from the physical layer, the elements for layer-to-layer communication including primitives between MAC and RLC the elements for peer-to-peer communication the protocol data units formats and the parameters elementary procedures.

5.14.2 Interest for S-UMTS Uu Interface

The proposed MAC specification could be kept with a few changes:

- Deletion of mentions to TDD mode.
- Re-assessment of shared/common channels, particularly CPCH.
- Extension of broadcast/multicast related functions.

5.15 N° 25.322 Radio Link Control (RLC) Protocol Specification

5.15.1 Content

This document specifies the RLC protocol. The features included in Release '99 are transparent mode, unacknowledged mode and acknowledged mode. For futures releases hybrid ARQ will be considered.

5.15.2 Interest for S-UMTS Uu Interface

A high degree of applicability to S-UMTS can be expected.

5.16 N° 25.323 Packet Data Convergence Protocol (PDCP) protocol

5.16.1 Content

This document provides the description of the Packet Data Convergence Protocol (PDCP). PDCP provides its services to the Non Access Stratum at the UE or the relay at the Radio Network Controller (RNC). PDCP uses the services provided by the Radio Link Control (RLC) sublayer. The main functions of PDCP are compression of redundant Network PDU control information (header compression) and transfer of packet data protocol user data using services provided by RLC protocol.

5.16.2 Interest for S-UMTS Uu Interface

Full applicability to S-UMTS is possible. The protocol described does not depend on specific radio access technology, so that solutions appropriate for UTRA would be good as well for S-UMTS.

5.17 N° 25.324 Radio interface for broadcast/multicast services

5.17.1 Content

This document provides the description of the Broadcast/Multicast Control Protocol (BMC). This protocol adapts broadcast and multicast services on the radio interface.

5.17.2 Interest for S-UMTS Uu Interface

The broadcast/multicast capabilities of UTRA are still to be done to great extent, ranging from the radio interface till the services provided. As these services are expected to be of great importance in S-UMTS, a parallel study to that in 3GPP would prove convenient.

5.18 N° 25.331 Radio Resource Control (RRC) protocol specification

5.18.1 Content

This document describes the Radio Resource Control protocol for the UE-UTRAN radio interface.

5.18.2 Interest for S-UMTS Uu Interface

This is a 500-long page document with an exhaustive description of the RRC protocol. A detailed analysis is beyond the present document's scope.

5.19 N° 25.401 UTRAN Overall Description

5.19.1 Content

This document describes the overall architecture of the UTRAN, including internal interfaces and assumptions on the radio and Iu interfaces.

5.19.2 Interest for S-UMTS Iu Interface

clause 5: *UMTS General Architecture* and clause 6 *UTRAN Architecture*: apply easily to S-UMTS Iu for definition of Control Plane and User Plane. clause 6.1 defines the UTRAN identifiers, these shall be read through to determine whether other identifiers could be useful for S-UMTS and be passed from UE or UTRAN towards Core Network.

clause 6: *UTRAN architecture*: proposes an architecture inside RNS (=RNC+Node B) distribution of the Iu, Iur and Iub interfaces between each component of the UTRAN. This architecture shall be studied in order to be sure it is compliant with the USRAN.

clause 7: *Functions description*: some clauses are FFS for S-UMTS Iu.

clause 7.2.1: *Function related to overall system access control*. Are the broadcast/admission control parameters cited for UTRAN useful and/or sufficient for USRAN?

clause 7.2.3: *Function related to handover*: especially for Handover decision, macro-diversity and inter-segment/system (inter RNS) HO. Does the distribution of decision, control, execution between the different URAN entities applies to S-UMTS cases? Are the measurements proposed sufficient to decide a HO in a S-UMTS system?

clause 7.2.4: *Function related to RR Management and control*: some messages are directly transferred from the NAS (*Non Access Stratum*) through the AS (*Access Stratum*) over Iu interface. Are there some messages specific to Satellite which could be in this case (e.g. Mobility Management messages)?

clause 8: *Mobility Management*.

NOTE: Location based services are FFS.

clause 8.2: *Mobility Handling*. Is the cell level mobility the only mobility type to be handled in URAN? Are there other kinds of mobility for S-UMTS? Where should these be handled?

clause 12: *UTRAN Performances Requirements (delay...)*: This clause is void in the 3GPP specification.

5.20 N° 25.402 Synchronization in UTRAN Stage 2

5.20.1 Content

This document constitutes the stage 2 specification of different synchronization mechanisms in UTRAN and on Uu.

5.20.2 Interest for S-UMTS Uu interface

The document provides the stage 2 specification of the Radio Interface Synchronization, both for FDD and TDD modes. In FDD this synchronization is needed so that the UE receive radio frames synchronously from different cells, reducing UE buffers. However, it was already pointed out that due to the expected huge cell size in mobile satellite, operation mode will not be able to rely in this synchronization. The same applies to the even stronger requirements for TDD mode, considered not apt for mobile satellite. There is an interesting and useful clause on Counters and Parameters needed for synchronization within a cell, to ease MAC state changes.

5.21 N° 25.410 UTRAN Iu Interface: General Aspects and Principles

5.21.1 Content

This document is an introduction to the UMTS 25.41x series of Technical Specifications that define the Iu interface for the interconnection of Radio Network Controller (RNC) component of the UMTS Terrestrial Radio Access Network (UTRAN) to the Core Network of the UMTS system.

5.21.2 Interest for S-UMTS Iu interface

The functions and functional split (between CN and RAN) of the Iu interface are defined. A model of a USRAN is needed in order to assure that no additional function is needed for S-UMTS on the Iu interface (radio resource control, handover, etc).

The protocols on the Iu interface are divided in Transport Network Layer and Radio Network Layer. The Transport Network Layer relies on existing standard ATM technology. There is no need for changing the Transport Network Layer between the CN and the USRAN if it is to be supported over terrestrial telecommunications infrastructure. Protocols on the Radio Network Layer are defined specifically for UMTS. A more detailed analysis shall be devoted to the Radio Network Layer on all planes: control plane [6], user plane [7] and service area broadcast plane [8].

5.22 N° 25.411 UTRAN Iu Interface Layer 1

5.22.1 Content

This document specifies the standards allowed to implement Layer 1 on the I_u interface.

The specification of transmission delay requirements and O&M requirements are not in the scope of this document. In the following 'Layer 1' and 'Physical Layer' are assumed to be synonymous.

5.22.2 Interest for S-UMTS Iu interface

This document is applicable also to satellite component of UMTS. Most of the physical layers supported by ATM are listed. All of them are terrestrial. However, the support of intervening transport networks (PDH, SDH, radio links) shall not be prevented if the layer 1 functionalities are covered: interface to physical medium, cell delineation, line clock extraction capability, layer 1 alarms extraction and generation, in-sequence delivery, transmission quality control.

5.23 N° 25.412 UTRAN Iu Interface Signalling Transport

5.23.1 Content

This document specifies the standards for Signalling Transport to be used across Iu Interface. Iu Interface is a logical interface between the RNC and the UTRAN Core Network. This document describes how the RANAP signalling messages are transported over Iu.

5.23.2 Interest for S-UMTS Iu interface

This document is applicable also to satellite component of UMTS. The signalling bearer for the Circuit Switched Domain is based on broadband signalling system No. 7 (see clause 5.2). The SAP provides the SCCP primitives.

In the Packet Switched Domain the SAP also provides the SCCP primitives. However, the standard allows operators to choose one out of two protocol stacks for the transport of SCCP messages (see clause 5.3): one based on broadband signalling system No. 7 and one based on SCTP (Simple Control Transmission Protocol developed by the IETF for the purpose of transporting various signalling protocols over IP networks).

5.24 N° 25.413 UTRAN Iu Interface RANAP Signalling

5.24.1 Content

This document specifies the radio network layer signalling protocol called Radio Access Network Application Part (RANAP) for the Iu interface. RANAP supports the functions of Iu interface by signalling procedures defined in this document. RANAP is developed in accordance to the general principles stated in [2], [5] and [4].

5.24.2 Interest for S-UMTS Iu interface

The functional behaviour of the RNC is specified exactly and completely in order to define the set of elementary procedures of the RANAP.

Two separate activities are needed in the frame of S-UMTS:

A model of the USRAN with examples on the signalling procedures is needed in order to check that no additional functions (see clause 7) are needed over the Iu interface (radio resource control, handover, etc.). A similar document for the UTRAN is [11].

Analyse current elementary procedures (see clause 8) and verify their suitability in the USRAN scenario (i.e. setting of timers, availability of information elements, etc.).

5.25 N° 25.414 UTRAN Iu Interface Data Transport and Transport Signalling

5.25.1 Content

This document specifies the standards for user data transport protocols and related signalling protocols to establish user plane transport bearers over the UTRAN Iu interface.

5.25.2 Interest for S-UMTS Iu interface

This document is applicable also to satellite component of UMTS. No changes are needed:

- In the circuit switched domain, ATM Adaptation Layer 2 (AAL2) over ATM is used on the user plane and AAL2 signalling (Q.2630.1) on the control plane.
- In the packet switched domain, GPRS Tunnelling Protocol (GTP-U) over UDP over IP over AAL5 over ATM is used on the user plane. No protocol is needed on the control plane (i.e. no ALCAP is needed for setting-up and tearing down transport bearers).
- In the broadcast domain, TCP over IP over AAL5 over ATM is used on the user plane and no protocol on the control plane (i.e. no ALCAP needed).

5.26 N° 25.415 UTRAN Iu Interface User Plane Protocols

5.26.1 Content

This document defines the Radio Network Layer user plane protocol being used over the Iu interface.

5.26.2 Interest for S-UMTS Iu interface

This protocol is used to convey user data associated to Radio Access Bearers between the Core Network Access Node and the RNC. When used in transparent mode, the data is transparently sent to the radio interface protocols of the RNC. When operating in a support mode, it offers some procedure control functions between the Core Network Access Node and the RNC (e.g. rate control, time alignment, etc...).

This protocol is part of the Iu interface specification and is directly applicable to the S-UMTS Iu interface.

5.27 N° 25.419 UTRAN Iu Interface: Service Area Broadcast Protocol SABP

5.27.1 Content

This document specifies the Service Area Broadcast Protocol (SABP) between the Cell Broadcast Centre (CBC) and the Radio Network Controller (RNC). It fulfils the CBC - RNC communication requirements specified in [1] and is defined over the Iu-BC – reference point.

5.27.2 Interest for S-UMTS Iu interface

This protocol offers the set of procedures needed to support the broadcast of messages from the CBC to one or more Service Areas in the RNC (write message, replace message, obtain current permissible bandwidth available for broadcast, message status query, end broadcasting, restart and error indication).

This protocol shall be directly applicable to the S-UMTS Iu interface.

5.28 N° 25.420 UTRAN Iur Interface General Aspects and Principles

5.28.1 Content

This document is an introduction to the TSG RAN TS 25.42x series of UMTS Technical Specifications that define the Iur Interface. It is a logical interface for the interconnection of two Radio Network Controller (RNC) components of the UMTS Terrestrial Radio Access Network (UTRAN) for the UMTS system.

5.28.2 Interest for S-UMTS Iu interface

This 25.42x series specify a logical interface (Iur) between two RNCs within the UTRAN (i.e. between the Serving RNS and the Drift RNS). The interface supports radio application related signalling and transport of data streams between RNSs. A similar interface could be envisaged in the implementation of the USRAN (e.g. to provide direct connectivity between a Satellite-RNS and a Terrestrial-RNS or between two Satellite-RNSs).

This interface has no interest for the S-UMTS Iu interface, but shall be of help when modelling the USRAN or for auxiliary functions (e.g. for interfacing different gateways).

5.29 N° 25.430 UTRAN Iub Interface General Aspects and Principles

5.29.1 Content

This document is an introduction to the TSG RAN TS 25.43x series of UMTS Technical Specifications that define the Iub Interface. The Iub interface is a logical interface for the interconnection of Node B and Radio Network Controller (RNC) components of the UMTS Terrestrial Radio Access Network (UTRAN) for the UMTS system.

5.29.2 Interest for S-UMTS Iu interface

This document provides a logical interface (Iub) between a RNC and a Node B. The Iub interface supports radio application related signalling and transport of data streams between RNC and Node B.

This interface has no interest for the S-UMTS Iu interface. The Iub will be of help when modelling the USRAN, which shall be seen as a concatenation of the Iu-Iub-Uu interfaces.

5.30 N° 25.931 UTRAN Functions, Examples on Signalling Procedures

5.30.1 Content

This document describes the UTRAN functions by means of signalling procedure examples (Message Sequence Charts). The signalling procedure examples show the interaction between the UE, the different UTRAN nodes and the CN to perform system functions. This gives an overall understanding of how the UTRAN works in example scenarios.

5.30.2 Interest for S-UMTS

The same exercise is proposed for an S-UMTS USRAN in order to give a good understanding of how a USRAN works (NAS connection establishment and release, RRC connection establishment and release, RAB establishment and release, soft and hard hand-over). USRAN functions shall be analysed here by means of signalling procedures.

6 Recommendations

6.1 Further studies

In this clause, the list of technical aspects for which additional studies are required is provided. They are given according to the series number.

6.2 N° 25.211 and 25.214

At the physical layer the following issues need to be further studied:

- compressed mode;
- handovers (soft-handovers);
- acquisition: common pilot channel (CPICH), synchronization channel (SCH);
- packet mode operation: RACH (slotted ALOHA), DSCH, and possible uplink packet modes.

6.3 N° 25.321, 25.322 and 25.331

The radio interface protocols (MAC, RLC and RRC) are defined only formally by using elementary procedures, messages, information elements and timers. This provides a protocol formal specification but no implementation details. The performance of specific implementation (MAC, ARQ, etc.) in satellite environment has to be evaluated.

6.4 N° 25.324

The Broadcast service in the radio interface is not in a very mature state in Release 99.

6.5 N° 25.401 and 25.413

An important number of functions are mapped onto elementary procedures, messages, information elements and timers on the Iu interface. However, the interaction between UE, UTRAN and CN is not shown on the Iu flows. In order to assess the integration of the satellite access network into the core network it will be convenient to perform some performance analysis at functional level, i.e. by using specific satellite scenarios. The following documents could be used to define a reference USRAN functional model: [3], [4], [5], [9], [10] and [11].

History

Document history		
V1.1.1	July 2001	Publication