ETSI TS 101 851-6-1 V2.1.1 (2008-01)

Technical Specification

Satellite Earth Stations and Systems (SES);
Satellite Component of UMTS/IMT-2000;
Part 6: Ground stations and space segment radio transmission and reception;
Sub-part 1: G-family (S-UMTS-G 25.104)

Reference
DTS/SES-00278

Keywords
FDD, IMT-2000, radio, satellite, UMTS, WCDMA

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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 specifying the Satellite Radio Interface referenced as SRI Family G at ITU-R, in the frame of the modification of ITU-R Recommendation M.1457-5 [7]. This modification has been approved at ITU-R SG8 meeting in November 2005.

The present document is part 6, sub-part 1 of a multi-part deliverable covering Satellite Earth Stations and Systems (SES); Satellite Component of UMTS/IMT-2000; G-family, as identified below:

Part 1: "Physical channels and mapping of transport channels into physical channels";

Part 2: "Multiplexing and channel coding";

Part 3: "Spreading and modulation";

Part 4: "Physical layer procedures";

Part 5: "UE Radio Transmission and Reception";

Part 6: "Ground stations and space segment radio transmission and reception";

Sub-part 1: "G-family (S-UMTS-G 25.104)".

Introduction

S-UMTS stands for the Satellite component of the Universal Mobile Telecommunication System. S-UMTS systems will complement the terrestrial UMTS (T-UMTS) and inter-work with other IMT-2000 family members through the UMTS core network. S-UMTS will be used to deliver 3rd generation Mobile Satellite Services (MSS) utilizing either low (LEO) or medium (MEO) earth orbiting, or geostationary (GEO) satellite(s). S-UMTS systems are based on terrestrial 3GPP specifications and will support access to GSM/UMTS core networks.

NOTE 1: The term T-UMTS will be used in the present document to further differentiate the Terrestrial UMTS component.

Due to the differences between terrestrial and satellite channel characteristics, some modifications to the terrestrial UMTS (T-UMTS) standards are necessary. Some specifications are directly applicable, whereas others are applicable with modifications. Similarly, some T-UMTS specifications do not apply, whilst some S-UMTS specifications have no corresponding T-UMTS specification.

Since S-UMTS is derived from T-UMTS, the organization of the S-UMTS specifications closely follows the original 3rd Generation Partnership Project (3GPP) structure. The S-UMTS numbers have been designed to correspond to the 3GPP terrestrial UMTS numbering system. All S-UMTS specifications are allocated a unique S-UMTS number as follows:

S-UMTS-n xx.yyy

Where:

- The numbers xx and yyy correspond to the 3GPP-numbering scheme.
- n (n=A, B, C, etc.) denotes the family of S-UMTS specifications.

An S-UMTS system is defined by the combination of a family of S-UMTS specifications and 3GPP specifications, as follows:

- If an S-UMTS specification exists it takes precedence over the corresponding 3GPP specification (if any). This precedence rule applies to any references in the corresponding 3GPP specifications.

NOTE 2: Any references to 3GPP specifications within the S-UMTS specifications are not subject to this precedence rule. For example, an S-UMTS specification may contain specific references to the corresponding 3GPP specification.

- If an S-UMTS specification does not exist, the corresponding 3GPP specification may or may not apply. The exact applicability of the complete list of 3GPP specifications shall be defined at a later stage.

1 Scope

The present document specifies the satellite, gateway and Complementary Ground Components (CGCs) minimum RF characteristics and ground station performance of S-UMTS interface G.

2 References

References are either specific (identified by date of publication and/or edition number or version number) or non-specific.

- For a specific reference, subsequent revisions do not apply.
- Non-specific reference may be made only to a complete document or a part thereof and only in the following cases:
  - if it is accepted that it will be possible to use all future changes of the referenced document for the purposes of the referring document;
  - for informative references.

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

For online referenced documents, information sufficient to identify and locate the source shall be provided. Preferably, the primary source of the referenced document should be cited, in order to ensure traceability. Furthermore, the reference should, as far as possible, remain valid for the expected life of the document. The reference shall include the method of access to the referenced document and the full network address, with the same punctuation and use of upper case and lower case letters.

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

2.1 Normative references

The following referenced documents are indispensable for the application of the present document. For dated references, only the edition cited applies. For non-specific references, the latest edition of the referenced document (including any amendments) applies.

[1] ETSI TS 101 851-2-1: "Satellite Earth Stations and Systems (SES); Satellite Component of UMTS/IMT-2000; Part 2: Multiplexing and channel coding; Sub-part 1: G-family (S-UMTS-G 25.212)".

[2] ETSI TS 101 851-3-1: "Satellite Earth Stations and Systems (SES); Satellite Component of UMTS/IMT-2000; Part 3: Spreading and modulation; Sub-part 1: G-family (S-UMTS-G 25.213)".

[3] ETSI TS 125 104: "Universal Mobile Telecommunications System (UMTS); Base Station (BS) radio transmission and reception (FDD) (3GPP TS 25.104)".

[4] IEC 60721-3-3: "Classification of environmental conditions - Part 3-3: Classification of groups of environmental parameters and their severities - Stationary use at weatherprotected locations".

[5] IEC 60 721-3-4: "Classification of environmental conditions - Part 3: Classification of groups of environmental parameters and their severities - Section 4: Stationary use at non-weatherprotected locations".

[6] ITU-R Recommendation SM.328: "Spectra and bandwidth of emissions".

2.2 Informative references

[7] ITU-R Recommendation M.1457-5: "Detailed specifications of the radio interfaces of International Mobile Telecommunications-2000 (IMT-2000)".

[8] ETSI TR 102 058: "Satellite Earth Stations and Systems (SES); Satellite Component of UMTS/IMT-2000; Evaluation of the W-CDMA UTRA FDD as a Satellite Radio Interface".

[9] ETSI TR 121 905: "Digital cellular telecommunications system (Phase 2+); Universal Mobile Telecommunications System (UMTS); Vocabulary for 3GPP Specifications (3GPP TR 21.905)".

[10] ETSI TR 125 942: "Universal Mobile Telecommunications System (UMTS); Radio Frequency (RF) system scenarios (3GPP TR 25.942)".

3 Definitions symbols and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in TS 101 851-2-1 [1] and the following apply.

Adjacent Channel Leakage power Ratio (ACLR): ratio of the RRC filtered mean power centred on the assigned channel frequency to the RRC filtered mean power centred on an adjacent channel frequency

Adjacent Channel Selectivity (ACS): measure of a receiver's ability to receive a W-CDMA signal at its assigned channel frequency in the presence of an adjacent channel signal at a given frequency offset from the centre frequency of the assigned channel

NOTE: ACS is the ratio of the receive filter attenuation on the assigned channel frequency to the receive filter attenuation on the adjacent channel(s).

Block Error Rate: error rate of the transport (data) blocks passed by the physical layer to MAC layer for a given transport channel (i.e. physical layer error rate)

Complementary Ground Component (CGC): ground-based infrastructure at fixed locations used to enhance satellite coverage in zones where communications with one or several space stations cannot be ensured with the required quality

Transmission Time Interval: interval of time over which a transport block is transmitted; multiple transport blocks may be transmitted in a transmission time interval per transport channel

3.2 Symbols

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

α	Roll-off factor
dBsd	decibels relative to the maximum value of power spectral density (psd) within the necessary bandwidth
E_b	Average energy per bit
E_c	Average energy per PN chip
F_{uw}	Frequency of unwanted signal

NOTE: This is specified in bracket in terms of an absolute frequency(s) or a frequency offset from the assigned channel frequency.

3.3 Abbreviations

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

ACLR	Adjacent Channel Leakage power Ratio
ACS	Adjacent Channel Selectivity
AWGN	Additive White Gaussian Noise
BCH	Broadcast CHannel
BER	Bit Error Ratio
BLER	BLock Error Ratio
BS	Base Station
CGC	Complementary Ground Component
CPICH	Common PIlot CHannel
CW	Continuous Wave (un-modulated signal)
DCCH	Dedicated Control CHannel
DCH	Dedicated CHannel
DL	Down Link (forward link)
DPCCH	Dedicated Physical Control CHannel
DPCH	Dedicated Physical CHannel
DPDCH	Dedicated Physical Data CHannel
DTCH	Dedicated Traffic CHannel
EIRP	Effective Isotropic Radiated Power
$EIRP_{RAT}$	Rated output EIRP
EVM	Error Vector Magnitude
FACH	Forward Access CHannel
LA	Local Area
LEO	Low Earth Orbit
LOS	Line Of Sight
MR	Medium Range
NLOS	No Line Of Sight
PPM	Parts Per Million
RACH	Random Access CHannel
RMS	Root Mean Square
RRC	Root-Raised Cosine
SCH	Synchronization CHannel (consisting of Primary and Secondary synchronization channels)
TFCI	Transport Format Combination Indicator
TPC	Transmit Power Control
UARFCN	USRA Absolute Radio Frequency Channel Number
UE	User Equipment
UL	Up Link (reverse link)
USRA	UMTS Satellite Radio Access
WA	Wide Area

4 General

4.1 Introduction

In the event of any conflict between the present specification and any applicable ETSI harmonized standard for CGC operating in the 1 980 MHz to 2 010 MHz (earth-to-space) and 2 170MHz to 2 200 MHz (space-to-earth) frequency bands, the Harmonized Standard shall take precedence.

4.2 Satellite EIRP Classes

Void.

4.3 Gateway EIRP classes

Void.

4.4 Complementary Ground Component EIRP

The requirements in the present document apply to Wide Area CGCs, Medium Range CGCs and Local Area CGC unless otherwise stated.

Wide Area CGCs are characterized by requirements derived from Macro Cell scenarios with a CGC to UE minimum coupling loss equal to 70 dB.

Medium Range CGCs are characterized by requirements derived from Micro Cell scenarios with a CGC to UE minimum coupling loss equal to 53 dB.

Local Area CGCs are characterized by requirements derived from Pico Cell scenarios with a CGC to UE minimum coupling loss equal to 45 dB.

4.5 Regional requirements

Void.

4.6 Environmental requirements

4.6.1 Satellite

Void.

4.6.2 Gateway

Void.

4.6.3 Complementary Ground Component

The CGC equipment shall fulfil all the requirements in the full range of environmental conditions for the relevant environmental class from the relevant IEC specifications [4] and [5].

Normally it should be sufficient for all tests to be conducted using normal test conditions except where otherwise stated.

5 Frequency bands and channel arrangement

5.1 Frequency bands

S-UMTS is designed to operate in the following paired bands.

Table. 5.1: Frequency bands

Operating Band	UL Frequencies UE transmit, satellite/CGC receive	DL frequencies UE receive, satellite/CGC transmit
I	1 980 MHz to 2 010 MHz	2 170 MHz to 2 200 MHz

5.2 Tx-Rx frequency separation

S-UMTS is designed to operate with the following TX-RX frequency separation.

Table 5.2: Tx-Rx frequency separation

Operating Band	TX-RX frequency separation
I	160 MHz

S-UMTS can support both fixed and variable transmit to receive frequency separation.

5.3 Channel arrangement

5.3.1 Channel spacing

The nominal channel spacing is 5 MHz, but this can be adjusted to optimize performance in a particular deployment scenario.

5.3.2 Channel raster

The channel raster is 200 kHz, which means that the centre frequency must be an integer multiple of 200 kHz. Channel number

The carrier frequency is designated by the USRA Absolute Radio Frequency Channel Number (UARFCN).

The UARFCN values are defined as follows.

Table5.3: UARFCN definition

	UARFCN	Carrier frequency [MHz]
Uplink	$N_u = 5 * F_{uplink}$	1 982,5 MHz ≤ F_{uplink} ≤ 2 007,5 MHz where F_{uplink} is the uplink frequency in MHz
Downlink	$N_d = 5 * F_{downlink}$	2 172,5 MHz ≤ $F_{downlink}$ ≤ 2 197,5 MHz where $F_{downlink}$ is the downlink frequency in MHz

5.3.3 UARFCN

The following UARFCN range shall be supported for each paired band.

Table 5.4: USRA Absolute Radio Frequency Channel Number

Operating Band	Uplink UE transmit, Space Segment receive	Downlink UE receive, Space Segment transmit
I	9 912 to 10 038	10 862 to 10 988

6 Complementary Ground Component Transmitter characteristics

6.1 General

Unless otherwise stated, the requirements in clause 6.1 assume transmission without diversity. In case of transmit diversity the requirements apply to each antenna connector separately, with the other one terminated. Unless otherwise stated, the requirements are unchanged.

Unless otherwise stated, the transmitter characteristics are specified at the CGC antenna connector (test port A) with a full complement of transceivers for the configuration in normal operating conditions. If any external apparatus such as a TX amplifier, a filter or the combination of such devices is used, requirements apply at the far end antenna connector (port B).

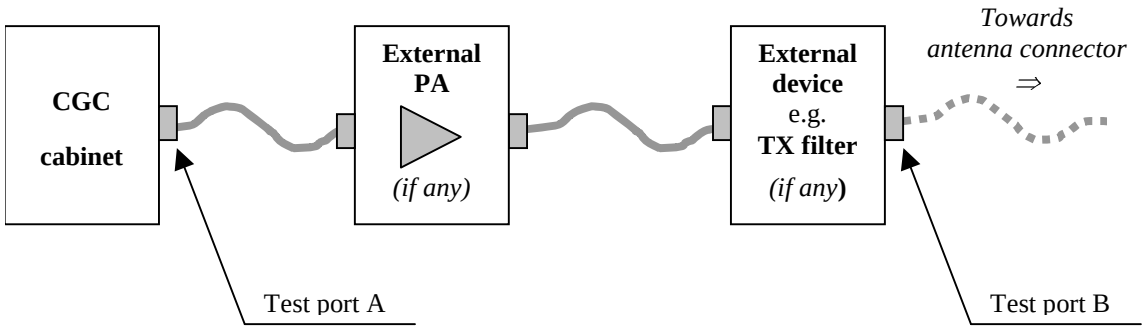

Figure 6.1: Transmitter test ports

6.2 CGC output EIRP

Rated EIRP, $EIRP_{RAT}$, of the CGC is the mean EIRP level per carrier that the manufacturer has declared to be available at the antenna output.

6.2.1 CGC maximum output EIRP

Maximum output EIRP, EIRPmax, of the CGC is the mean EIRP level per carrier measured at the antenna output in specified reference condition.

The rated output power, P_{RAT}, of the CGC shall be as specified in table 6.1.

Table 6.1: CGC rated output EIRP

CGC class	$EIRP_{RAT}$
Wide Area CGC	No upper limit
Medium Range CGC	≤ +43 dBm
Local Area CGC	≤ +24 dBm

6.2.1.1 Minimum requirement

In normal and extreme conditions, the CGC maximum output EIRP shall remain within +2,7 dB and -2,7 dB of the manufacturer's rated output power.

In certain regions, the minimum requirement for normal conditions may apply also for some conditions outside the range of conditions defined as normal.

6.3 Frequency error

Frequency error is the measure of the difference between the actual CGC transmit frequency and the assigned frequency. The same source shall be used for RF frequency and data clock generation.

6.3.1 Minimum requirement

The modulated carrier frequency of the CGC shall be accurate to within the accuracy range given in table 6.2 observed over a period of one timeslot.