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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Contents

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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.

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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).

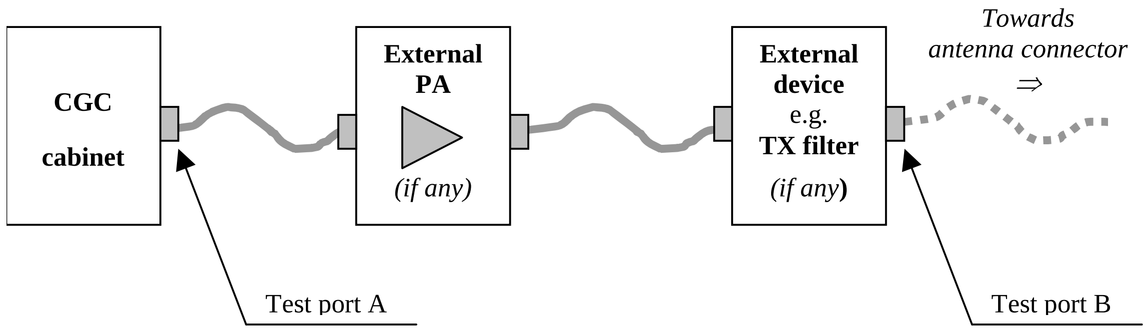

Figure 6.1: Transmitter test ports

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.

Table 6.2: Frequency error minimum requirement

CGC class	Accuracy
Wide Area CGC	±0,05 ppm
Medium Range CGC	±0,1 ppm
Local Area CGC	±0,1 ppm

6.4 Output power dynamics

Power control is used to limit the interference level. The transmitter uses a quality-based power control on the downlink.

Output power dynamics should be compliant with [3], Band I.

6.5 Output RF spectrum emissions

6.5.1 Occupied bandwidth

The occupied bandwidth is the width of a frequency band such that, below the lower and above the upper frequency limits, the mean powers emitted are each equal to a specified percentage β/2 of the total mean transmitted power. See also ITU-R Recommendation SM.328 [6].

The value of β/2 shall be taken as 0,5 %.

6.5.1.1 Minimum requirement

The occupied channel bandwidth shall be less than 5 MHz based on a chip rate of 3,84 Mcps.

6.5.2 Out of band emission

Out of band emissions are unwanted emissions immediately outside the channel bandwidth resulting from the modulation process and non-linearity in the transmitter but excluding spurious emissions. This out of band emission requirement is specified both in terms of a spectrum emission mask and adjacent channel power ratio for the transmitter.

6.5.2.1 Spectrum emission mask

The requirement shall be met by an CGC transmitting on a single RF carrier configured in accordance with the manufacturer's specification. Emissions shall not exceed the maximum level specified in tables 6.3 to 6.6 for the appropriate CGC maximum output power, in the frequency range from Δf = 2,5 MHz to Δf_{max} from the carrier frequency, where :

Table E. Δf is the separation between the carrier frequency and the nominal -3dB point of the measuring filter closest to the carrier frequency.

Table E. F_offset is the separation between the carrier frequency and the centre of the measuring filter.

Table E. f_offset_{max} is either 12,5 MHz or the offset to the S-UMTS Tx band edge as defined in clause 5.2, whichever is the greater.

Table E. Δf_{max} is equal to f_offset_{max} minus half of the bandwidth of the measuring filter.

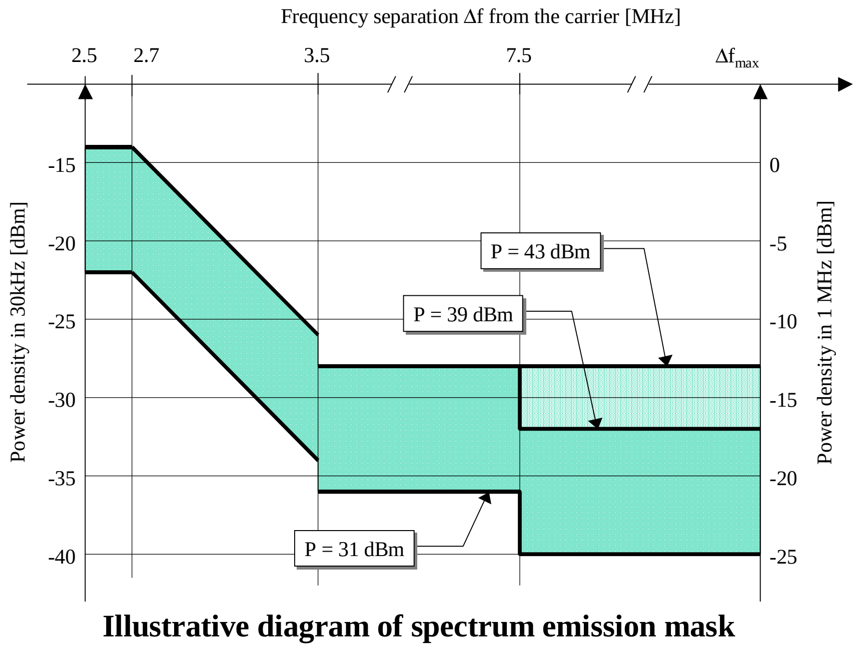

Figure 6.2: CGC Spectrum emission mask

Table 6.3: Spectrum emission mask values, CGC maximum output power P ≥ 43 dBm

Frequency offset of measurement filter -3 dB point, Δf	Frequency offset of measurement filter centre frequency, f_offset	Minimum requirement	Measurement bandwidth (see note)
2,5 MHz ≤ Δf < 2,7 MHz	2,515 MHz ≤ f_offset < 2,715 MHz	-14 dBm	30 kHz
2,7 MHz ≤ Δf < 3,5 MHz	2,715 MHz ≤ f_offset < 3,515 MHz	$-14dBm-15\cdot\left(\frac{f\_offset}{MHz}-2{,}715\right)dB$	30 kHz
(see note 2)	3,515 MHz ≤ f_offset < 4,0 MHz	-26 dBm	30 kHz
3,5 MHz ≤ Δf ≤ Δf_{max}	4,0 MHz ≤ f_offset < f_offset_{max}	-13 dBm	1 MHz

Table 6.4: Spectrum emission mask values, CGC maximum output power 39 ≤ P < 43 dBm

Frequency offset of measurement filter -3 dB point, Δf	Frequency offset of measurement filter centre frequency, f_offset	Minimum requirement	Measurement bandwidth (see note)
2,5 MHz ≤ Δf < 2,7 MHz	2,515 MHz ≤ f_offset < 2,715 MHz	-14 dBm	30 kHz
2,7 MHz ≤ Δf < 3,5 MHz	2,715 MHz ≤ f_offset < 3,515 MHz	$-14dBm-15\cdot\left(\frac{f\_offset}{MHz}-2{,}715\right)dB$	30 kHz
(see note 2)	3,515 MHz ≤ f_offset < 4,0 MHz	-26 dBm	30 kHz
3,5 MHz ≤ Δf < 7,5 MHz	4,0 MHz ≤ f_offset < 8,0 MHz	-13 dBm	1 MHz
7,5 MHz ≤ Δf ≤ Δf_{max}	8,0 MHz ≤ f_offset < f_offset_{max}	P - 56 dB	1 MHz

Table 6.5: Spectrum emission mask values, CGC maximum output power 31 ≤ P < 39 dBm

Frequency offset of measurement filter -3 dB point,Δf	Frequency offset of measurement filter centre frequency, f_offset	Minimum requirement	Measurement bandwidth (see note)
2,5 MHz ≤ Δf < 2,7 MHz	2,515 MHz ≤ f_offset < 2,715 MHz	P - 53 dB	30 kHz
2,7 MHz ≤ Δf < 3,5 MHz	2,715 MHz ≤ f_offset < 3,515 MHz	$P - 53\,dB - 15 \cdot \left(\frac{f\_offset}{MHz} - 2{,}715 \right) dB$	30 kHz
(see note 2)	3,515 MHz ≤ f_offset < 4,0 MHz	P - 65 dB	30 kHz
3,5 MHz ≤ Δf < 7,5 MHz	4,0 MHz ≤ f_offset < 8,0 MHz	P - 52 dB	1 MHz
7,5 MHz ≤ Δf ≤ Δf_{max}	8,0 MHz ≤ f_offset < f_offset_{max}	P - 56 dB	1 MHz

Table 6.6: Spectrum emission mask values, CGC maximum output power P < 31 dBm

Frequency offset of measurement filter -3 dB point, Δf	Frequency offset of measurement filter centre frequency, f_offset	Minimum requirement Band	Measurement bandwidth (see note)
2,5 MHz ≤ Δf < 2,7 MHz	2,515 MHz ≤ f_offset < 2,715 MHz	-22 dBm	30 kHz
2,7 MHz ≤ Δf < 3,5 MHz	2,715 MHz ≤ f_offset < 3,515 MHz	$-22dBm - 15 \cdot \left(\frac{f\_offset}{MHz} - 2{,}715 \right) dB$	30 kHz
(see note 2)	3,515 MHz ≤ f_offset < 4,0 MHz	-34 dBm	30 kHz
3,5 MHz ≤ Δf < 7,5 MHz	4,0 MHz ≤ f_offset < 8,0 MHz	-21 dBm	1 MHz
7,5 MHz ≤ Δf ≤ Δf_{max}	8,0 MHz ≤ f_offset < f_offset_{max}	-25 dBm	1 MHz

Notes for tables 6.3 to 6.6:

NOTE 1: As a general rule, the resolution bandwidth of the measuring equipment should be equal to the measurement bandwidth. However, to improve measurement accuracy, sensitivity and efficiency, the resolution bandwidth can be smaller than the measurement bandwidth. When the resolution bandwidth is smaller than the measurement bandwidth, the result should be integrated over the measurement bandwidth in order to obtain the equivalent noise bandwidth of the measurement bandwidth.

NOTE 2: This frequency range ensures that the range of values of f_offset is continuous.

6.5.2.2 Adjacent Channel Leakage power Ratio (ACLR)

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

The requirements shall apply whatever the type of transmitter considered (single carrier or multi-carrier). It applies for all transmission modes foreseen by the manufacturer's specification.

6.5.2.2.1 Minimum requirement

The ACLR shall be higher than the value specified in table 6.7.

Table 6.7: CGC ACLR

CGC adjacent channel offset below the first or above the last carrier frequency used	ACLR limit
5 MHz	45 dB
10 MHz	50 dB
15 MHz	50 dB

6.5.3 Spurious emissions

Spurious emissions are emissions which are caused by unwanted transmitter effects such as harmonics emission, parasitic emission, intermodulation products and frequency conversion products, but exclude out of band emissions. This is measured at the base station RF output port.

The requirements shall apply whatever the type of transmitter considered (single carrier or multiple-carrier). It applies for all transmission modes foreseen by the manufacturer's specification.

The requirements (except clause 6.5.3.5) apply at frequencies within the specified frequency ranges, which are more than 12,5 MHz below the first carrier frequency used or more than 12,5 MHz above the last carrier frequency used.

Unless otherwise stated, all requirements are measured as mean power (RMS).

6.5.3.1 Mandatory Requirements

The requirements of either category A (clause 6.5.3.1.1) or category B (clause 6.5.3.1.2) shall apply.

6.5.3.1.1 Spurious emissions (Category A)

The following requirements shall be met in cases where category A limits for spurious emissions, as defined in ITU-R Recommendation SM.329, are applied.

6.5.3.1.1.1 Minimum Requirement

The power of any spurious emission shall not exceed.

Table 6.8: CGC Mandatory spurious emissions limits, Category A

Band	Maximum level	Measurement Bandwidth	Note
9 kHz to 150 kHz	-13 dBm	1 kHz	See note 1
150 kHz to 30 MHz		10 kHz	See note 1
30 MHz to 1 GHz		100 kHz	See note 1
1 GHz to 12,75 GHz		1 MHz	See note 2
NOTE 1: Bandwidth as in ITU-R Recommendation SM.329, s4.1. NOTE 2: Upper frequency as in ITU-R Recommendation SM.329, s2.5 table 1.			

6.5.3.1.2 Spurious emissions (Category B)

The following requirements shall be met in cases where Category B limits for spurious emissions, as defined in ITU-R Recommendation SM.329, are applied.

6.5.3.1.2.1 Minimum Requirement

The power of any spurious emission shall not exceed.

Table 6.9: CGC Mandatory spurious emissions limits, operating band I, Category B

Band	Maximum Level	Measurement Bandwidth	Note
9kHz ↔ 150 kHz	-36 dBm	1 kHz	See note 1
150 kHz ↔ 30 MHz	- 36 dBm	10 kHz	See note 1
30 MHz ↔ 1 GHz	-36 dBm	100 kHz	See note 1
1GHz ↔ Fc1 - 60 MHz or 2 100 MHz *whichever is the higher*	-30 dBm	1 MHz	See note 1
Fc1 - 60 MHz or 2 100 MHz *whichever is the higher* ↔ Fc1 - 50 MHz or 2 100 MHz *whichever is the higher*	-25 dBm	1 MHz	See note 2
Fc1 - 50 MHz or 2 100 MHz *whichever is the higher* ↔ Fc2 + 50 MHz or 2 180 MHz *whichever is the lower*	-15 dBm	1 MHz	See note 2
Fc2 + 50 MHz or 2 180 MHz *whichever is the lower* ↔ Fc2 + 60 MHz or 2 180 MHz *whichever is the lower*	-25 dBm	1 MHz	See note 2
Fc2 + 60 MHz or 2 180 MHz *whichever is the lower* ↔ 12,75 GHz	-30 dBm	1 MHz	See note 3
NOTE 1: Bandwidth as in ITU-R Recommendation SM.329, section 4.1. NOTE 2: Specification in accordance with ITU-R Recommendation SM.329, section 4.3 and annex 7. NOTE 3: Bandwidth as in ITU-R Recommendation SM.329, section 4.1. Upper frequency as in ITU-R Recommendation SM.329, s2.5 table 1.			
Fc1: Centre frequency of emission of the first carrier transmitted by the CGC. Fc2: Centre frequency of emission of the last carrier transmitted by the CGC.			

6.5.3.2 Protection of the CGC receiver of own or different CGC

This requirement shall be applied in order to prevent the receivers of the CGCs being desensitized by emissions from an CGC transmitter. This is measured at the transmit antenna port for any type of CGC which has common or separate Tx/Rx antenna ports.

6.5.3.2.1 Minimum Requirement

The power of any spurious emission shall not exceed.

Table 6.10: Wide Area CGC Spurious emissions limits for protection of the CGC receiver

Operating Band	Band	Maximum Level	Measurement Bandwidth
I	1 980 MHz to 2 010 MHz	-96 dBm	100 kHz

Table 6.11: Medium Range CGC Spurious emissions limits for protection of the CGC receiver

Operating Band	Band	Maximum Level	Measurement Bandwidth
I	1 980 MHz to 2 010 MHz	-86 dBm	100 kHz

Table 6.12: Local Area CGC Spurious emissions limits for protection of the CGC receiver

Operating Band	Band	Maximum Level	Measurement Bandwidth
I	1 980 MHz to 2 010 MHz	-82 dBm	100 kHz

6.5.3.3 Co-existence with other systems in the same geographical area

These requirements may be applied for the protection of UE and/or CGC operating in other frequency bands in the same geographical area. The requirements may apply in geographic areas in which both S-UMTS and a system operating in another frequency band than the S-UMTS operating band are deployed. The system operating in the other frequency band may be GSM900, DCS1800, PCS1900, GSM850 and/or UMTS FDD operating in bands I to X.

6.5.3.3.1 Minimum Requirements

The power of any spurious emission shall not exceed the limits of Table 6.11 for an CGC where requirements for co-existence with the system listed in the first column apply.

Table 6.13: CGC Spurious emissions limits in geographic coverage area of systems operating in other frequency bands

System type operating in the same geographical area	Band for co-existence requirement	Maximum Level	Measurement Bandwidth
GSM900	921 MHz to 960 MHz	-57 dBm	100 kHz
	876 MHz to 915 MHz	-61 dBm	100 kHz
DCS1800	1 805 MHz to 1 880 MHz	-47 dBm	100 kHz
	1 710 MHz to 1 785 MHz	-61 dBm	100 kHz
PCS1900	1 930 MHz to 1 990 MHz	-47 dBm	100 kHz
	1 850 MHz to 1 910 MHz	-61 dBm	100 kHz
GSM850	869 MHz to 894 MHz	-57 dBm	100 kHz
	824 MHz to 849 MHz	-61 dBm	100 kHz
FDD Band I	2 110 MHz to 2 170 MHz	-52 dBm	1 MHz
	1 920 MHz to 1 980 MHz	-49 dBm	1 MHz
FDD Band II	1 930 MHz to 1 990 MHz	-52 dBm	1 MHz
	1 850 MHz to 1 910 MHz	-49 dBm	1 MHz
FDD Band III	1 805 MHz to 1 880 MHz	-52 dBm	1 MHz
	1 710 MHz to 1 785 MHz	-49 dBm	1 MHz
FDD Band IV	2 110 MHz to 2 155 MHz	-52 dBm	1 MHz
	1 710 MHz to 1 755 MHz	-49 dBm	1 MHz
FDD Band V	869 MHz to 894 MHz	-52 dBm	1 MHz
	824 MHz to 849 MHz	-49 dBm	1 MHz
FDD Band VI	860 MHz to 895 MHz	-52 dBm	1 MHz
	815 MHz to 850 MHz	-49 dBm	1 MHz
FDD Band VII	2 620 MHz to 2 690 MHz	-52 dBm	1 MHz
	2 500 MHz to 2 570 MHz	-49 dBm	1 MHz
FDD Band VIII	925 MHz to 960 MHz	-52 dBm	1 MHz
	880 MHz to 915 MHz	-49 dBm	1 MHz
FDD Band IX	1 844,9 MHz to 1 879,9 MHz	-52 dBm	1 MHz
	1 749,9 MHz to 1 784,9 MHz	-49 dBm	1 MHz
FDD Band X	2 110 MHz to 2 170 MHz	-52 dBm	1 MHz
	1 710 MHz to 1 770 MHz	-49 dBm	1 MHz

6.5.3.4 Co-existence with co-located and co-sited CGC/base stations

These requirements may be applied for the protection of other BS receivers when GSM900, DCS1800, PCS1900, GSM850 and/or FDD BS operating in Bands I to X are co-located with an CGC.

The requirements in this clause assume a 30 dB coupling loss between transmitter and receiver. If CGCs/BSs of different classes are co-sited, the coupling loss should be increased by the value as stated in TR 125 942 [10] clause 10.3 in tables 10.1 and 10.2.

6.5.3.4.1 Minimum Requirements

The power of any spurious emission shall not exceed the limits of table 6.14 for a Wide Area (WA) CGC where requirements for co-location with a BS type listed in the first column apply.

Table 6.14: CGC Spurious emissions limits for Wide Area CGC co-located with another BS

Type of co-located BS	Band for co-location requirement	Maximum Level	Measurement Bandwidth
Macro GSM900	876 MHz to 915 MHz	-98 dBm	100 kHz
Macro DCS1800	1 710 MHz to 1 785 MHz	-98 dBm	100 kHz
Macro PCS1900	1 850 MHz to 1 910 MHz	-98 dBm	100 kHz
Macro GSM850	824 MHz to 849 MHz	-98 dBm	100 kHz
WA UTRA FDD Band I	1 920 MHz to 1 980 MHz	-96 dBm	100 kHz
WA UTRA FDD Band II	1 850 MHz to 1 910 MHz	-96 dBm	100 kHz
WA UTRA FDD Band III	1 710 MHz to 1 785 MHz	-96 dBm	100 kHz
WA UTRA FDD Band IV	1 710 MHz to 1 755 MHz	-96 dBm	100 kHz
WA UTRA FDD Band V	824 MHz to 849 MHz	-96 dBm	100 kHz
WA UTRA FDD Band VI	815 MHz to 850 MHz	-96 dBm	100 kHz
WA UTRA FDD Band VII	2 500 MHz to 2 570 MHz	-96 dBm	100 KHz
WA UTRA FDD Band VIII	880 MHz to 915 MHz	-96 dBm	100 KHz
WA UTRA FDD Band IX	1 749,9 MHz to 1 784,9 MHz	-96 dBm	100 KHz

The power of any spurious emission shall not exceed the limits of table 6.15 for a Medium Range (MR) CGC where requirements for co-location with a BS type listed in the first column apply.

Table 6.15: CGC Spurious emissions limits for Medium Range CGC co-located with another BS

Type of co-located BS	Band for co-location requirement	Maximum Level	Measurement Bandwidth
Micro GSM900	876 MHz to 915 MHz	-91 dBm	100 kHz
Micro DCS1800	1 710 MHz to 1 785 MHz	-96 dBm	100 kHz
Micro PCS1900	1 850 MHz to 1 910 MHz	-96 dBm	100 kHz
Micro GSM850	824 MHz to 849 MHz	-91 dBm	100 kHz
MR UTRA FDD Band I	1 920 MHz to 1 980 MHz	-86 dBm	100 kHz
MR UTRA FDD Band II	1 850 MHz to 1 910 MHz	-86 dBm	100 kHz
MR UTRA FDD Band III	1 710 MHz to 1 785 MHz	-86 dBm	100 kHz
MR UTRA FDD Band IV	1710 MHz to 1 755 MHz	-86 dBm	100 kHz
MR UTRA FDD Band V	824 MHz to 849 MHz	-86 dBm	100 kHz
MR UTRA FDD Band VI	815 MHz to 850 MHz	-86 dBm	100 kHz
MR UTRA FDD Band VII	2 500 MHz to 2 570 MHz	-86 dBm	100 KHz
MR UTRA FDD Band VIII	880 MHz to 915 MHz	-86 dBm	100 KHz
MR UTRA FDD Band IX	1 749,9 MHz to 1 784,9 MHz	-86 dBm	100 KHz
MR UTRA FDD Band X	1 710 MHz to 1 770 MHz	-86 dBm	100 kHz

The power of any spurious emission shall not exceed the limits of table 6.16 for a Local Area (LA) CGC where requirements for co-location with a BS type listed in the first column apply.

Table 6.16: CGC Spurious emissions limits for Local Area CGC co-located with another BS

Type of co-located BS	Band for co-location requirement	Maximum Level	Measurement Bandwidth
Pico GSM900	876 MHz to 915 MHz	-70 dBm	100 kHz
Pico DCS1800	1 710 MHz to 1 785 MHz	-80 dBm	100 kHz
Pico PCS1900	1 850 MHz to 1 910 MHz	-80 dBm	100 kHz
Pico GSM850	824 MHz to 849 MHz	-70 dBm	100 kHz
LA UTRA FDD Band I	1 920 MHz to 1 980 MHz	-82 dBm	100 kHz
LA UTRA FDD Band II	1 850 MHz to 1 910 MHz	-82 dBm	100 kHz
LA UTRA FDD Band III	1 710 MHz to 1 785 MHz	-82 dBm	100 kHz
LA UTRA FDD Band IV	1 710 MHz to 1 755 MHz	-82 dBm	100 kHz
LA UTRA FDD Band V	824 MHz to 849 MHz	-82 dBm	100 kHz
LA UTRA FDD Band VI	815 MHz to 850 MHz	-82 dBm	100 kHz
LA UTRA FDD Band VII	2 500 MHz to 2 570 MHz	-82 dBm	100 KHz
LA UTRA FDD Band VIII	880 MHz to 915 MHz	-82 dBm	100 KHz
LA UTRA FDD Band IX	1 749,9 MHz to 1 784,9 MHz	-82 dBm	100 KHz
LA UTRA FDD Band X	1 710 MHz to 1 770 MHz	-82 dBm	100 kHz

6.5.3.5 Co-existence with services in adjacent frequency bands

This requirement may be applied for the protection in bands adjacent to bands S-UMTS as defined in clause 5.1 in geographic areas in which both an adjacent band service and S-UMTS are deployed.

6.5.3.5.1 Minimum requirement

The power of any spurious emission shall not exceed :

Table 6.17: CGC spurious emissions limits for protection of adjacent band services

Operating Band	Band	Maximum Level	Measurement Bandwidth
I	2 165 MHz to 2 170 MHz	$-30 + 3,4 \times (f - 2\ 165\ \text{MHz})$ dBm	1 MHz

6.6 Transmit intermodulation

The transmit intermodulation performance is a measure of the capability of the transmitter to inhibit the generation of signals in its non linear elements caused by presence of the wanted signal and an interfering signal reaching the transmitter via the antenna.

The transmit intermodulation level is the power of the intermodulation products when a WCDMA modulated interference signal is injected into the antenna connector at a mean power level of 30 dB lower than that of the mean power of the wanted signal. The frequency of the interference signal shall be +5 MHz, -5 MHz, +10 MHz, -10 MHz, +15 MHz and -15 MHz offset from the subject signal carrier frequency, but exclude interference frequencies that are outside of the allocated frequency band for S-UMTS downlink specified in clause 5.2.

6.6.1 Minimum requirement

The transmit intermodulation level shall not exceed the out of band emission or the spurious emission requirements of clauses 6.5.2 and 6.5.3 in the presence of a WCDMA modulated interference signal with a mean power level 30 dB lower than the mean power of the wanted signal.

6.7 Transmit modulation

Transmit modulation is specified in three parts, Frequency Error, Error Vector Magnitude and Peak Code Domain Error. These specifications are made with reference to a theoretical modulated waveform.

The theoretical modulated waveform is created by modulating a carrier at the assigned carrier frequency using the same data as was used to generate the measured waveform. The chip modulation rate for the theoretical waveform shall be exactly 3,84 Mcps. The code powers of the theoretical waveform shall be the same as the measured waveform, rather than the nominal code powers used to generate the test signal.

6.7.1 Transmit pulse shape filter

The transmit pulse-shaping filter is a root-raised cosine (RRC) with roll-off $\alpha = 0,22$ in the frequency domain. The impulse response of the chip impulse filter $RC_0(t)$ is:

$$RC_0(t) = \frac{\sin\left(\pi \frac{t}{T_C}(1-\alpha)\right) + 4\alpha \frac{t}{T_C}\cos\left(\pi \frac{t}{T_C}(1+\alpha)\right)}{\pi \frac{t}{T_C}\left(1-\left(4\alpha \frac{t}{T_C}\right)^2\right)}.$$

Where the roll-off factor $\alpha = 0,22$ and the chip duration:

$$T_c = \frac{1}{chiprate} \approx 0,26042\,\mu s\ .$$

6.7.2 Error Vector Magnitude

The Error Vector Magnitude is a measure of the difference between the reference waveform and the measured waveform. This difference is called the error vector. Both waveforms pass through a matched Root Raised Cosine filter with bandwidth 3,84 MHz and roll-off $\alpha = 0,22$. Both waveforms are then further modified by selecting the frequency, absolute phase, absolute amplitude and chip clock timing so as to minimize the error vector. The EVM result is defined as the square root of the ratio of the mean error vector power to the mean reference power expressed as a %. The measurement interval is one timeslot as defined by the CPICH (when present) otherwise the measurement interval is one timeslot starting with the beginning of the SCH.

6.7.2.1 Minimum requirement

The Error Vector Magnitude shall not be worse than 17,5 % when the CGC is transmitting a composite signal using only QPSK modulation.

The Error Vector Magnitude shall not be worse than 12,5 % when the CGC is transmitting a composite signal that includes 16QAM modulation.

6.7.3 Peak code Domain error

The Peak Code Domain Error is computed by projecting the error vector (as defined in clause 6.7.2) onto the code domain at a specified spreading factor. The Code Domain Error for every code in the domain is defined as the ratio of the mean power of the projection onto that code, to the mean power of the composite reference waveform. This ratio is expressed in dB. The Peak Code Domain Error is defined as the maximum value for the Code Domain Error for all codes. The measurement interval is one timeslot as defined by the CPICH (when present) otherwise the measurement interval is one timeslot starting with the beginning of the SCH.

6.7.3.1 Minimum requirement

The peak code domain error shall not exceed -33 dB at spreading factor 256.

6.7.4 Time alignment error in Tx Diversity

In Tx Diversity, signals are transmitted from two antennas. These signals shall be aligned. The time alignment error in Tx Diversity is specified as the delay between the signals from the two diversity antennas at the antenna ports.

6.7.4.1 Minimum Requirement

The time alignment error in Tx Diversity shall not exceed 1/4 T_c.

7 Gateway Receiver characteristics

7.1 General

The receiver characteristics are specified at the Test port A connector.

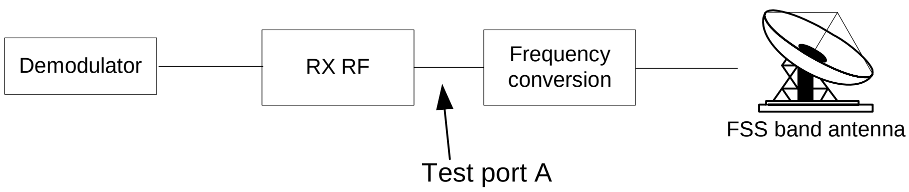

Figure 7.1: Receiver test ports

7.2 Reference sensitivity level

Void.

7.3 Dynamic range

Void.

7.4 Adjacent Channel Selectivity (ACS)

Adjacent channel selectivity (ACS) is a measure of the receiver ability to receive a wanted signal at is assigned channel frequency in the presence of an adjacent channel signal at a given frequency offset from the centre frequency of the assigned channel. ACS is the ratio of the receiver filter attenuation on the assigned channel frequency to the receiver filter attenuation on the adjacent channel(s).

The interference signal is offset from the wanted signal by the frequency offset Fuw. The interference signal shall be a W-CDMA signal as specified in annex C.

7.4.1 Minimum requirement

The BER shall not exceed 0,001 for the parameters specified in table 7.1.

Table 7.1: Adjacent channel selectivity

Parameter		Unit
Data rate	4,75	kbit/s
Wanted signal mean power	-116	dBm
Interfering signal mean power	-52	dBm
Fuw offset (Modulated)	5	MHz

7.5 Blocking characteristics

Void.

7.6 Intermodulation characteristics

Void.

7.7 Spurious emissions

The spurious emissions power is the power of emissions generated or amplified in a receiver that appear at the port A antenna connector. The requirements apply to all gateways with separate RX and TX antenna port. The test shall be performed when both TX and RX are on with the TX port terminated.

7.7.1 Minimum requirement

The power of any spurious emission shall not exceed.

Table 7.2: General spurious emission minimum requirement

Band	Maximum level	Measurement Bandwidth	Note
30 MHz to 1 GHz	-57 dBm	100 kHz	
1 GHz to 12,75 GHz	-47 dBm	1 MHz	With the exception of frequencies between 12,5 MHz below the first carrier frequency and 12,5 MHz above the last carrier frequency used.

Table 7.3: Additional spurious emission requirements

Operating Band	Band	Maximum level	Measurement Bandwidth	Note
I	1 980 MHz to 2 010 MHz	-78 dBm	3,84 MHz	

8 Complementary Ground Component Receiver characteristics

CGC receiver characteristics should be compliant with [3], Band I.

9 CGC Performance requirement

9.1 General

Performance requirements for the Space Segment are specified for the measurement channels defined in Annex A and the propagation conditions in annex B. The requirements only apply to those measurement channels that are supported by the space segment.

The Eb/No used in this clause is defined as:

$$E_b / N_o = \frac{E_c}{N_o} \cdot \frac{L_{chip}}{L_{\inf}}.$$

Where:

E_c is the received total energy of DPDCH and DPCCH per PN chip at satellite antenna from all paths.

N_o is the total one-sided noise power spectral density due to all noise sources.

L_{chip} is the number of chips per frame.

$L_{\inf}$ is the number of information bits in DTCH excluding CRC bits per frame.

9.2 Demodulation of DCH in static propagation conditions

Both satellite gateway and CGC receiver should comply with the demodulation of DCH in static propagation conditions.

The performance requirement of DCH in static propagation conditions is determined by the maximum Block Error Ratio (BLER) allowed when the receiver input signal is at a specified E_b/N_0 limit.

9.2.1 Minimum requirement

The BLER should not exceed the limit for the E_b/N_0 specified in table 9.1.

Table 9.1: DCH requirements in static conditions

Measurement channel	Received E_b/N_0	Required BLER
1,2 kbit/s	7,4 dB	$< 10^{-2}$
4,75 kbit/s	7 dB	$< 10^{-2}$
64 kbit/s	3,5 dB	$< 10^{-2}$
144 kbit/s	2,9 dB	$< 10^{-2}$
384 kbit/s	2,9 dB	$< 10^{-2}$

9.3 Demodulation in multi-path fading conditions

The performance requirement of DCH in multipath fading is determined by the maximum Block Error Ratio (BLER) allowed when the receiver input signal is at a specified E_b/N_0 limit.

9.3.1 Combined satellite and CGC

In combined satellite and CGC propagation conditions S-case 1, the BLER should not exceed the limit for the E_b/N_0 specified in table 9.2.

Table 9.2: DCH requirements in S-case 1 propagation conditions

Measurement channel	Received E_b/N_0	Required BLER
1,2 kbit/s	16,1 dB	$< 10^{-2}$
4,75 kbit/s	18,4 dB	$< 10^{-2}$
64 kbit/s	14,3 dB	$< 10^{-2}$
144 kbit/s	13,5 dB	$< 10^{-2}$
384 kbit/s	15,9 dB	$< 10^{-2}$

In combined satellite and CGC propagation conditions S-case 2, the BLER should not exceed the limit for the E_b/N_0 specified in table 9.3.

Table 9.3: DCH requirements in S-case 2 propagation conditions

Measurement channel	Received E_b/N_0	Required BLER
1,2 kbit/s	13,6 dB	$< 10^{-2}$
4,75 kbit/s	14,3 dB	$< 10^{-2}$
64 kbit/s	10,7 dB	$< 10^{-2}$
144 kbit/s	10,2 dB	$< 10^{-2}$
384 kbit/s	10,9 dB	$< 10^{-2}$

In combined satellite and CGC propagation conditions S-case 3, the BLER should not exceed the limit for the E_b/N_0 specified in table 9.4.

Table 9.4: DCH requirements in S-case 3 propagation conditions

Measurement channel	Received E_b/N_0	Required BLER
1,2 kbit/s	11 dB	$< 10^{-2}$
4,75 kbit/s	10 dB	$< 10^{-2}$
64 kbit/s	5,8 dB	$< 10^{-2}$
144 kbit/s	5,3 dB	$< 10^{-2}$
384 kbit/s	1,5 dB	$< 10^{-2}$

In combined satellite and CGC propagation conditions S-case 4, the BLER should not exceed the limit for the E_b/N_0 specified in table 9.5.

Table 9.5: DCH requirements in S-case 4 propagation conditions

Measurement channel	Received E_b/N_0	Required BLER
1,2 kbit/s	10,7 dB	$< 10^{-2}$
4,75 kbit/s	11,2 dB	$< 10^{-2}$
64 kbit/s	6,9 dB	$< 10^{-2}$
144 kbit/s	7 dB	$< 10^{-2}$
384 kbit/s	6,7 dB	$< 10^{-2}$

In combined satellite and CGC propagation conditions S-case 5, the BLER should not exceed the limit for the E_b/N_0 specified in table 9.6.

Table 9.6: DCH requirements in S-case 5 propagation conditions

Measurement channel	Received E_b/N_0	Required BLER
1,2 kbit/s	9,9 dB	$< 10^{-2}$
4,75 kbit/s	10,3 dB	$< 10^{-2}$
64 kbit/s	5,6 dB	$< 10^{-2}$
144 kbit/s	5,2 dB	$< 10^{-2}$
384 kbit/s	6,7 dB	$< 10^{-2}$

In combined satellite and CGC propagation conditions S-case 6, the BLER should not exceed the limit for the E_b/N_0 specified in table 9.7.

Table 9.7: DCH requirements in S-case 6 propagation conditions

Measurement channel	Received E_b/N_0	Required BLER
1,2 kbit/s	13,3 dB	$< 10^{-2}$
4,75 kbit/s	11,7 dB	$< 10^{-2}$
64 kbit/s	7,2 dB	$< 10^{-2}$
144 kbit/s	7,2 dB	$< 10^{-2}$
384 kbit/s	7,6 dB	$< 10^{-2}$

9.3.2 CGC only

In case of signal reception at CGC without reception at satellite (i.e. no combination of CGC and satellite reception at earth station), which means propagation environment fully terrestrial, 3GPP DCH requirements apply as specified in TS 125 104 [3].

9.4 Performance requirement for RACH

Performance requirements for RACH consists of two parts: preamble detection and message demodulation. Requirements for these are in clauses 9.4.1 and 9.4.2, respectively.

9.4.1 Performance requirement for preamble detection

The requirements are specified for a Probability of false alarm Pfa (false detection of the preamble when the preamble was not sent) less than 10^{-3} and a probability of detection Pd more than 0.99. Only 1 signature is used and it is known by the receiver.

Table 9.8: Ec/No preamble requirement

Environment	Speed	Ec/No for Pd ≥ 0,99
AWGN	0 km/h	-23,6 dB

9.4.2 Demodulation of RACH message

The performance measure is required Eb/N0 for block error rate (BLER) of 10^{-1} and 10^{-2}. Both measurement channels have TTI=20 ms. Payloads are 168 bits and 360 bits. Channel coding is rate 1/2 convolutional coding.

9.4.2.1 Demodulation in Static Propagation Condition

Table 9.9: Required Eb/N0 for static propagation

Transport Block size TB and TTI in frames	E_b/N_0 for required BLER < 10^{-2}
168 bits, TTI = 20 ms	6,4 dB
360 bits, TTI = 20 ms	5,9 dB

9.4.2.2 Demodulation in Multi-path fading, combined satellite and CGC

Table 9.10: Required Eb/N0 for combined satellite and CGC

Transport Block size TB and TTI in frames	E_b/N_0 for required BLER < 10^{-2}					
	S-case1	S-case2	S-case3	S-case4	S-case5	S-case6
168 bits, TTI = 20 ms	17,5 dB	13,4 dB	9 dB	10,1 dB	8,9 dB	8,2 dB
360 bits, TTI = 20 ms	17,1 dB	13,1 dB	8,3 dB	9,4 dB	10,5 dB	9,8 dB

9.4.2.3 Demodulation in Multi-path fading, CGC

In case of signal reception at CGC without reception at satellite (i.e. no combination of CGC and satellite reception at Earth station), which means propagation environment fully terrestrial, 3GPP RACH requirements apply as specified in TS 125 104 [3].

Annex A (normative): Measurement channels

A.1 UL reference measurement channel (1,2 kbit/s)

The parameters for the 1,2 kbit/s data service are specified in table A.1 and the channel coding is shown in figure A.1.

Table A.1a: UL reference measurement channel physical parameters (1,2 kbit/s)

Parameter	Unit	Level
Information bit rate	kbit/s	1,2
DPDCH	kbit/s	15
DPCCH	kbit/s	15
DPCCH Slot Format #i	-	0
DPCCH/DPDCH power ratio	dB	-4,4
TFCI	-	On
Repetition	%	233

Table A.1b: UL reference measurement channel, transport channel parameters (1,2 kbit/s)

Parameters	DTCH	DCCH
Transport Channel Number	1	1
Transport Block Size	96	0
Transport Block Set Size	96	0
Transmission Time Interval	80 ms	-
Type of Error Protection	Convolutional coding	-
Coding Rate	1/3	-
Rate Matching attribute	256	-
Size of CRC	16	-

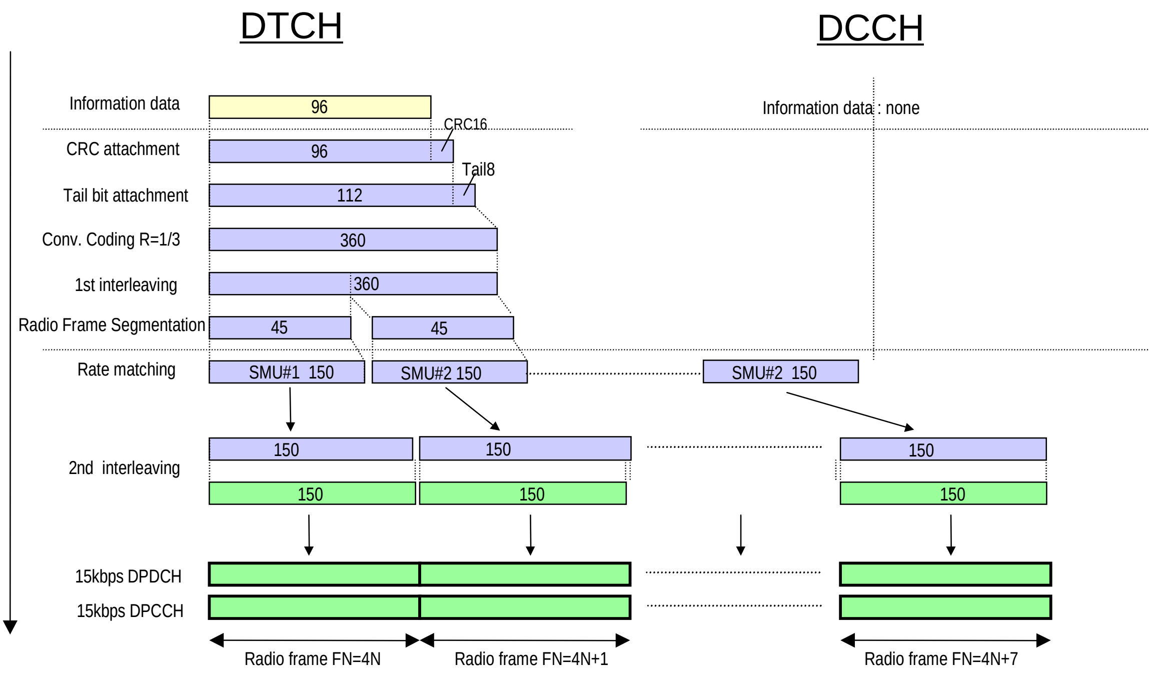

Figure A.1: Channel coding for the UL reference measurement channel (1,2 kbit/s)

A.2 UL reference measurement channel (4,75 kbit/s)

The parameters for the 4,75 kbit/s UL reference measurement channel are specified in tables A.2 and A.3. The channel coding for information is shown in figure A.2.

Table A.2: UL reference measurement channel physical parameters (4,75 kbit/s)

Parameter	Unit	Level
Information bit rate	kbit/s	4,75
DPDCH	kbit/s	30
DPCCH	kbit/s	15
DPCCH Slot Format #i	-	1
DPCCH/DPDCH power ratio	dB	-2,7
TFCI	-	On
Repetition	%	45

Table A.3: UL reference measurement channel, transport channel parameters (4,75 kbit/s)

Parameters	DTCH	DCCH
Transport Channel Number	1	2
Transport Block Size	95	30
Transport Block Set Size	95	30
Transmission Time Interval	20 ms	40 ms
Type of Error Protection	Convolutional coding	Convolutional coding
Coding Rate	1/3	½
Rate Matching attribute	256	256
Size of CRC	16	16

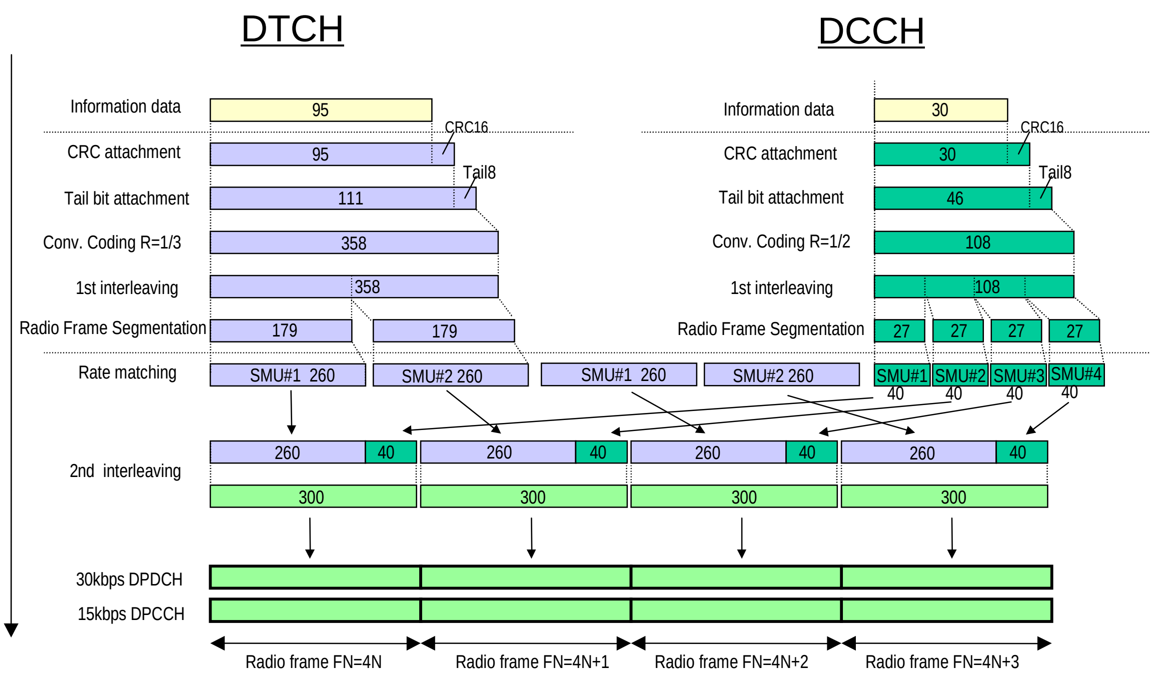

Figure A.2: Channel coding for the UL reference measurement channel (4,75 kbit/s)

A.3 UL reference measurement channel (64 kbit/s)

The parameters for the UL reference measurement channel for 64 kbit/s are specified in table A.4 and the channel coding is detailed in figure A.3.

Table A.4: UL reference measurement channel (64kbit/s)

Parameter	Level	Unit
Information bit rate	64	kbit/s
DPCH	240	kbit/s
Power control	Off	
TFCI	On	
Repetition	19	%

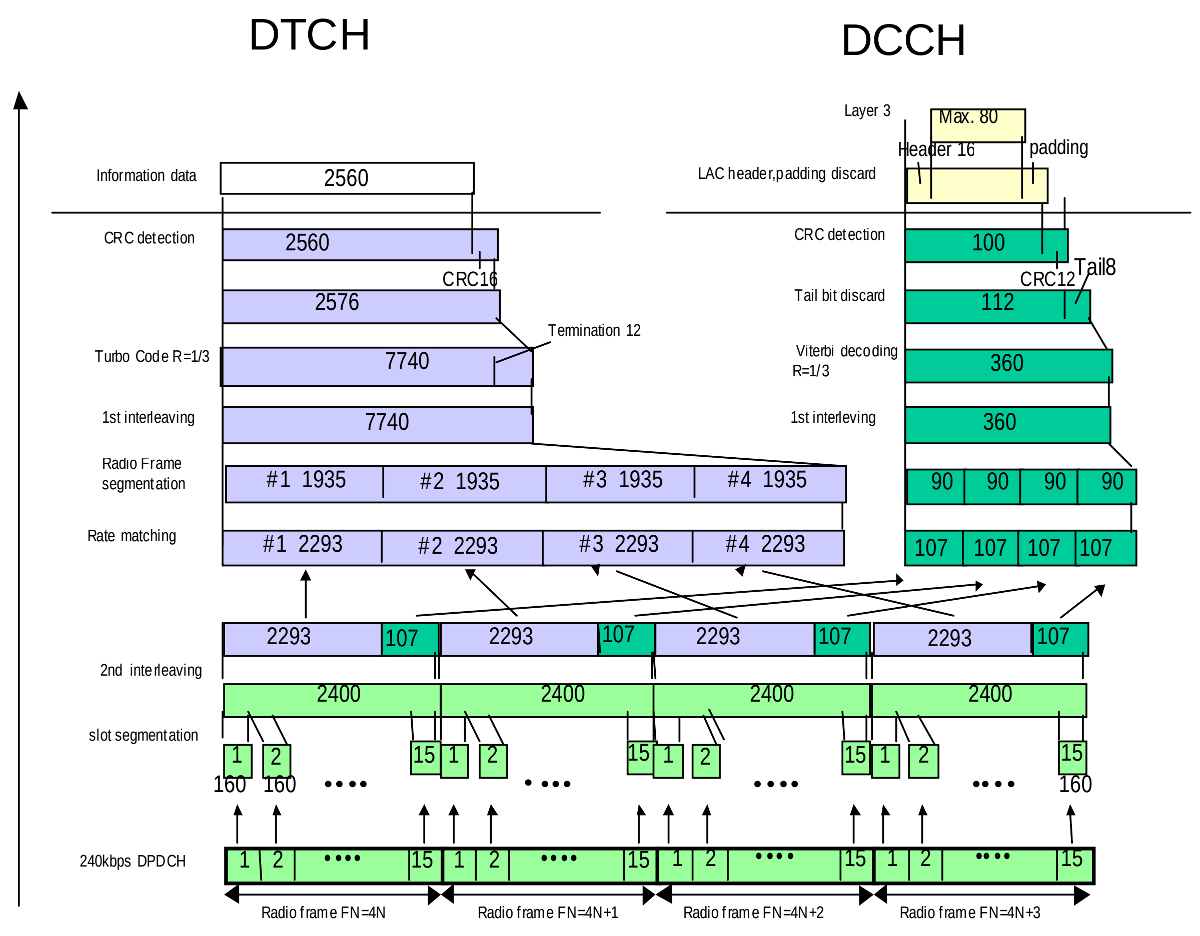

Figure A.3: Channel coding for the UL reference measurement channel (64 kbit/s)

A.4 UL reference measurement channel (144 kbit/s)

The parameters for the UL reference measurement channel for 144 kbit/s are specified in table A.5 and the channel coding is detailed in figure A.4.

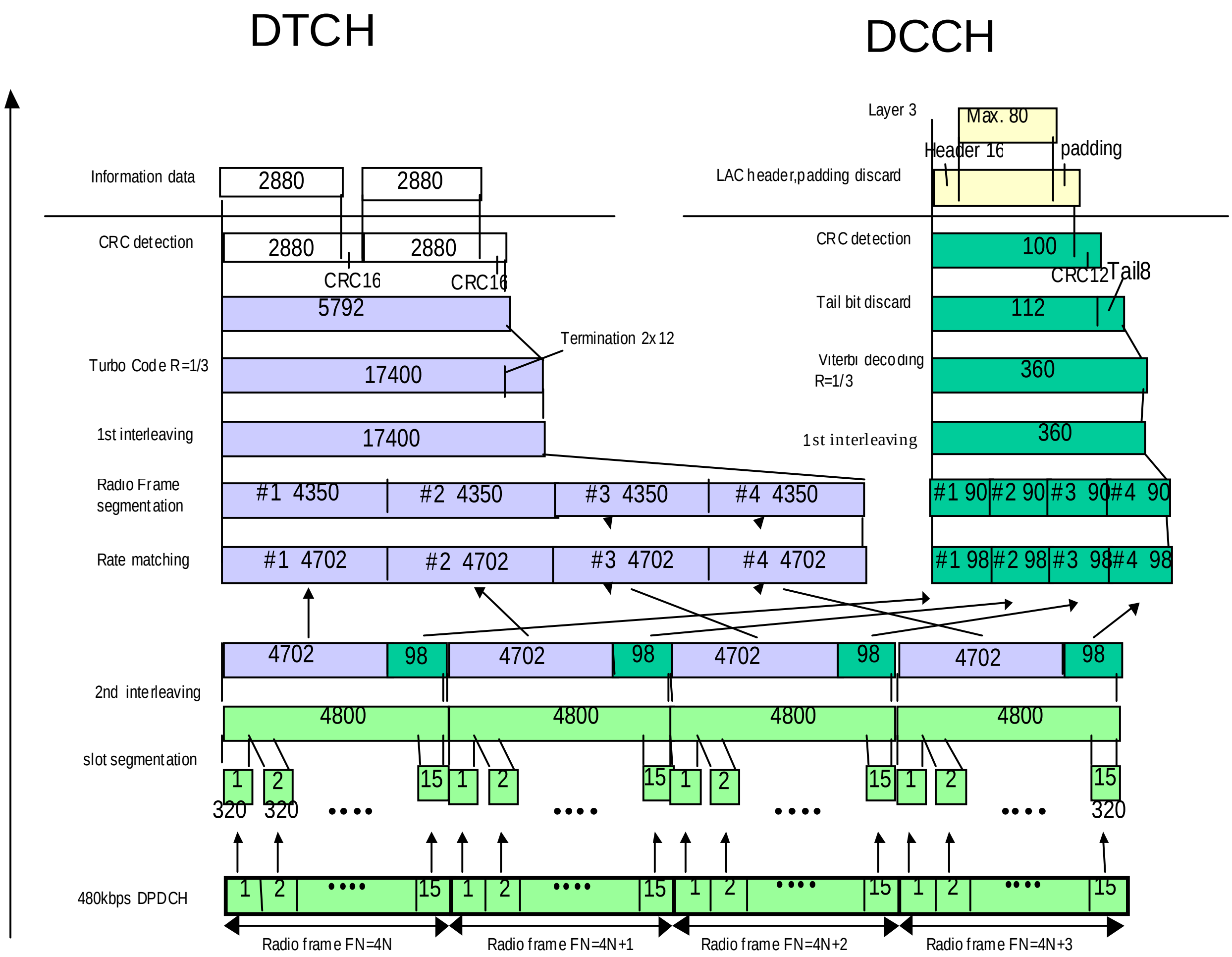

Figure A.4: Channel coding for the UL reference measurement channel (144 kbit/s)

Table A.5: UL reference measurement channel (144 kbit/s)

Parameter	Level	Unit
Information bit rate	144	kbps
DPCH	480	kbps
Power control	Off	
TFCI	On	
Repetition	8	%

A.5 UL reference measurement channel (384 kbit/s)

The parameters for the UL reference measurement channel for 384 kbit/s are specified in table A.6 and the channel coding is detailed in figure A.5.

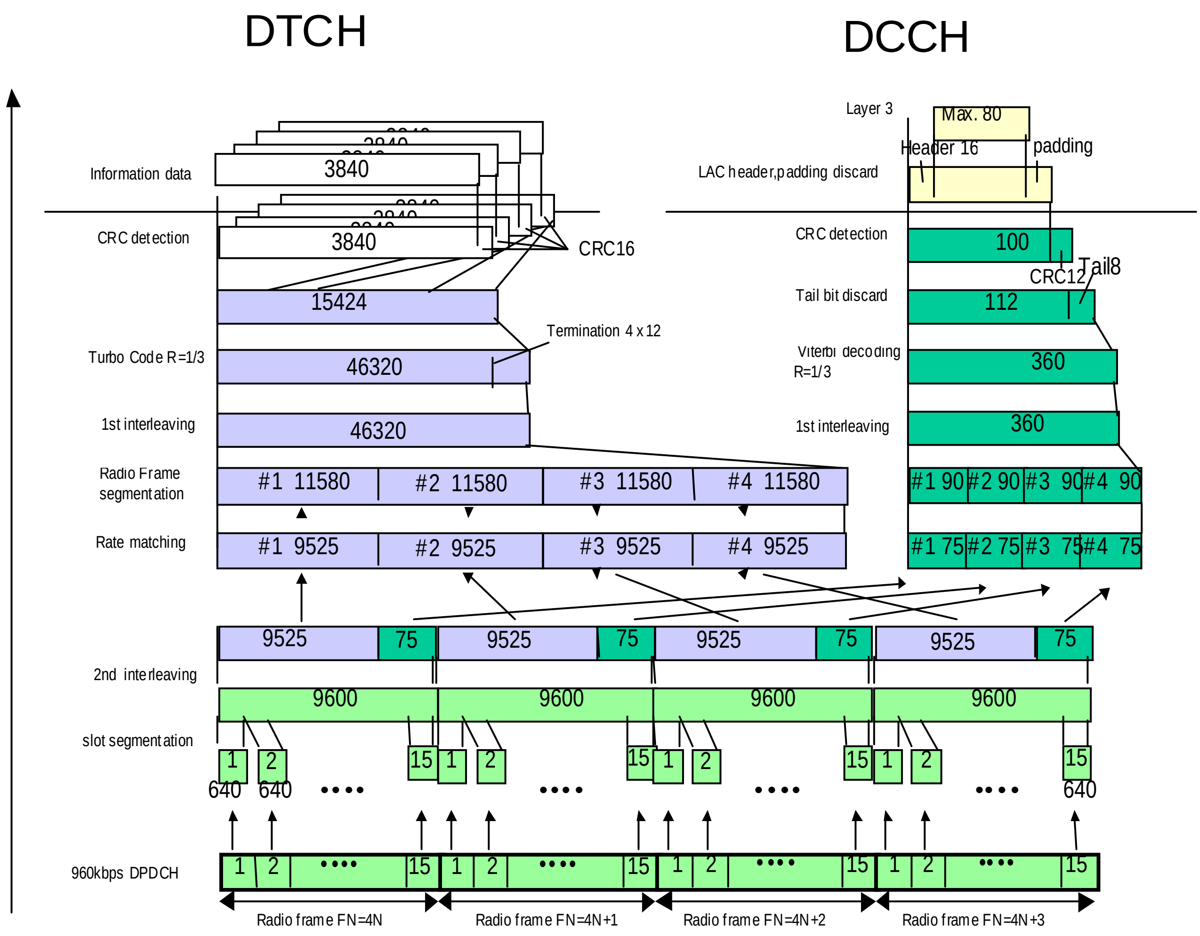

Figure A.5: Channel coding for the UL reference measurement channel (384 kbit/s)

Table A.6: UL reference measurement channel (384kbit/s)

Parameter	Level	Unit
Information bit rate	384	kbps
DPCH	960	kbps
Power control	Off	
TFCI	On	
Puncturing	17.7	%

A.6 Reference measurement channels for UL RACH

The parameters for the UL RACH reference measurement channels are specified in table A.7.

Table A.7: Reference measurement channels for UL RACH

Parameter			Unit
RACH	CRC	16	bits
	Channel Coding	Rate ½ conv. Coding	
	TTI	20	ms
	TB size	168, 360	bits
	Rate Matching	Repetition	
	Number of diversity antennas	2	
	Preamble detection window size	Satellite constellation dependant	chips
	Ratio of preamble power and total message power	0	dB
Power ratio of RACH Control/Data TB = 168		-2,69	dB
Power ratio of Control/Data TB = 360		-3,52	dB

Annex B (normative): Propagation conditions

B.1 Static propagation condition

The propagation for the static performance measurement is an Additive White Gaussian Noise (AWGN) environment. No fading or multi-paths exist for this propagation model.

B.2 Multi-path fading propagation conditions

Tables B.2 to B.3 show propagation conditions that are used for the performance measurements in satellite multi-path fading environment.

Table B.1: Channel model A (10 % delay spread values); Rural

Tap number	Relative tap delay value (ns)	Tap amplitude distribution	Parameter of amplitude distribution (dB)	Average amplitude with respect to free space propagation	Rice factor (dB)	Doppler spectrum
1	0	LOS: Rice NLOS: Rayleigh	10 log *c* 10 log P_m	0,0 -7,3	10 -	Rice Classic
2	100	Rayleigh	10 log P_m	-23,6	-	Classic
3	180	Rayleigh	10 log P_m	-28,1	-	Classic

Table B.2: Channel model B (50 % delay spread values); Sub-urban

Tap number	Relative tap delay value (ns)	Tap amplitude distribution	Parameter of amplitude distribution (dB)	Average amplitude with respect to free space propagation	Rice factor (dB)	Doppler spectrum
1	0	LOS: Rice NLOS: Rayleigh	10 log *c* 10 log P_m	0,0 -9,5	7 -	Rice Classic
2	100	Rayleigh	10 log P_m	-24,1	-	Classic
3	250	Rayleigh	10 log P_m	-25,1	-	Classic

Table B.3: Channel model C (90 % delay spread values); Urban

Tap number	Relative tap delay value (ns)	Tap amplitude distribution	Parameter of amplitude distribution (dB)	Average amplitude with respect to free space propagation	Rice factor (dB)	Doppler spectrum
1	0	LOS: Rice NLOS: Rayleigh	10 log *c* 10 log P_m	0,0 -12,1	3 -	Rice Classic
2	60	Rayleigh	10 log P_m	-17,0	-	Classic
3	100	Rayleigh	10 log P_m	-18,3	-	Classic
4	130	Rayleigh	10 log P_m	-19,1	-	Classic
5	250	Rayleigh	10 log P_m	-22,1	-	Classic

Table B.4 shows propagation conditions that are used for the performance measurements in multi-path fading combined satellite and CGC environments.

Table B.4: Combined satellite and CGC propagation environments

S-Case 1 speed 3km/h		S-Case 2 speed 3 km/h		S-Case 3 speed 120 km/h		S-Case 4 speed 250 km/h		S-Case 5 speed 120 km/h		S-Case 6 speed 250 km/h	
Relative Delay [ns]	Average Power [dB]	Relative Delay [ns]	Average Power [dB]	Relative Delay [ns]	Average Power [dB]	Relative Delay [ns]	Average Power [dB]	Relative Delay [ns]	Average Power [dB]	Relative Delay [ns]	Average Power [dB]
0	0	0	0	0	0	0	0	0	-3	0	-3
1 042	-10	1 042	0	260	-3	260	-3	260	-3	260	-3
		26 563	0	521	-6	521	-6	521	-9	521	-9
				781	-9	781	-9	1 042	-3	1 042	-3
								1 302	-3	1 302	-3
								1 562	-3	1 562	-3
								1 823	0	1 823	0
								2 083	0	2 083	0

Annex C (normative): Characteristics of the W-CDMA interference signal

The W-CDMA interference signal shall be a DPCH containing the DPCCH and one DPDCH. The data content for each channelization code shall be uncorrelated with each other and to the wanted signal and spread and modulated according to clause 4 of TS 101 851-3-1 [2]. Further characteristics of DPDCH and DPCCH are specified in table C.1.

Table C.1: Characteristics of the W-CDMA interference signal

Channel	Bit Rate	Spreading Factor	Channelization Code	Relative Power
DPDCH	240 kbit/s	16	4	0 dB
DPCCH	15 kbit/s	256	0	-5,46 dB

NOTE: The DPDCH and DPCCH settings are chosen to simulate a signal with realistic Peak to Average Ratio.

Annex D (informative): Typical Satellite Transmitter characteristics

D.1 General

Unless otherwise stated, the satellite transmitter characteristics are specified at the satellite antenna port.

D.2 Satellite output power

Void.

D.3 Frequency Error

Frequency error is the measure of the difference between the actual satellite transmit frequency and the assigned frequency. It is recommended the same source is used for RF frequency and data clock generation.

D.3.1 Minimum requirement

It is recommended the modulated carrier frequency of the satellite is accurate to ±0,01 ppm observed over a period of one timeslot.

D.4 Output power dynamics

Power control is under control of the gateway. It is used to limit both satellite and UE transmit power as well as the interference level.

D.4.1 Inner loop power control in the downlink

Inner loop power control in the downlink is the ability of the gateway to adjust the satellite transmitter output power of a code channel in accordance with the corresponding TPC symbols received in the uplink.

D.4.1.1 Power control steps

The power control step is the required step change in the code domain power of a code channel in response to the corresponding power control command. The combined output power change is the required total change in the DL transmitted power of a code channel in response to multiple consecutive power control commands corresponding to that code channel.

D.4.1.1.1 Minimum requirement

It is recommended the gateway have the capability of setting the satellite inner loop code domain power with a step sizes of 0,5 dB, 1 dB, 1,5 dB and 2 dB.

D.4.2 Power control dynamic range

The power control dynamic range is the difference between the maximum and the minimum code domain power of a code channel for a specified reference condition. Transmit modulation quality is to be maintained within the whole dynamic range as specified in clause D.8.

D.4.2.1 Minimum requirements

Following minimum performance requirement are recommended for Down Link (DL) power control dynamic range:

Maximum code domain power: satellite maximum output power - 3 dB or greater.

Minimum code domain power: satellite maximum output power - 28 dB or less.

D.4.3 Total power dynamic range

The total power dynamic range is the difference between the maximum and the minimum output power for a specified reference condition.

NOTE: The upper limit of the dynamic range is the satellite maximum output power. The lower limit of the dynamic range is the lowest minimum power from the satellite when no traffic channels are activated.

D.4.3.1 Minimum requirement

The Down Link (DL) total power dynamic range is 18 dB or greater.

D.4.4 Primary CPICH power

Primary CPICH power is the code domain power of the Common Pilot Channel. Primary CPICH power is indicated on the BCH. CPICH power accuracy is defined as the maximum deviation between the Primary CPICH code domain power indicated on the BCH and the Primary CPICH code domain power measured at the TX antenna port.

D.4.4.1 Minimum requirement

It is recommended primary CPICH code domain power is within ±2,1 dB of the Primary CPICH code domain power indicated on the BCH.

D.5 Output RF spectrum emissions

D.5.1 Occupied bandwidth

The occupied bandwidth is the width of a frequency band such that, below the lower and above the upper frequency limits, the mean powers emitted are each equal to a specified percentage $\beta/2$ of the total mean transmitted power. See also ITU-R Recommendation SM.328 [6].

The recommended value of $\beta/2$ is 0,5 %.

D.5.2 Out of band emission

Out of band emissions are unwanted emissions immediately outside the channel bandwidth resulting from the modulation process and non-linearity in the transmitter but excluding spurious emissions. This out of band emission requirement is specified both in terms of a spectrum emission mask and adjacent channel power ratio for the transmitter.

D.5.2.1 Spectrum emission mask

The recommended spectrum emission mask is defined for a satellite transmitting on a single RF carrier configured in accordance with the manufacturer's specification. Emissions does not exceed the maximum level specified in table D.1 in the frequency range from Δf = 2,5 MHz to Δf_{max} from the carrier frequency, where :

Table E. Δf is the separation between the carrier frequency and the nominal -3dB point of the measuring filter closest to the carrier frequency.

Table E. F_offset is the separation between the carrier frequency and the centre of the measuring filter.

Table E. f_offset_{max} is either 1,5 MHz or the offset to the S-UMTS Tx band edge as defined in clause 5.2, whichever is the greater.

Table E. Δf_{max} is equal to f_offset_{max} minus half of the bandwidth of the measuring filter.

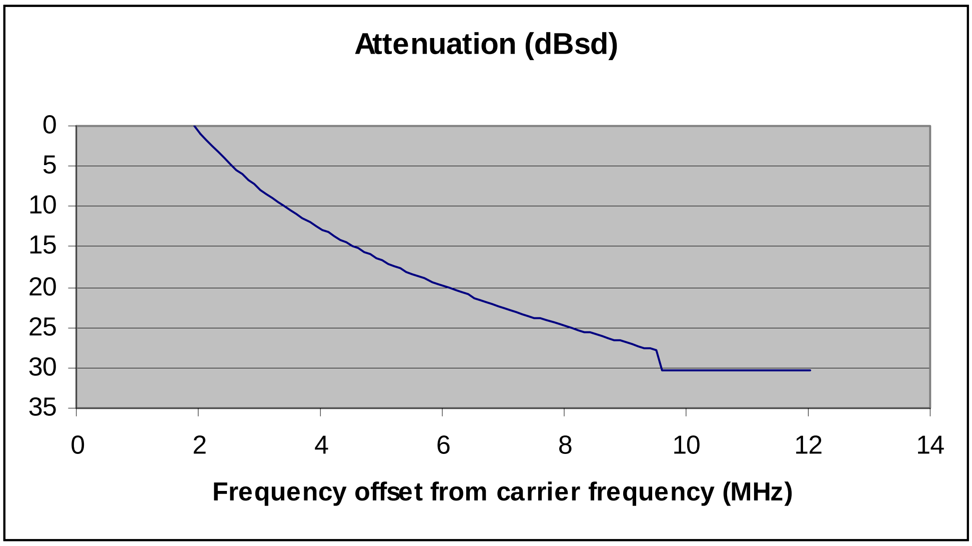

Figure D.1: Satellite Spectrum emission mask

Table D.1: Satellite spectrum emission mask values outside MSS band

Frequency band (MHz)	Satellite EIRP
2 010 to 2 169,52	15,5
2 169,52 to 2 170	X - $40Log\left(\frac{2\ 170 - f(MHz)}{1,92} + 1\right)$
2 200 to 2 207,68	X - $40Log\left(\frac{f(MHz) - 2\ 200}{1,92} + 1\right)$

Table D.2: Satellite spectrum emission mask values in MSS band

Frequency offset of measurement filter -3 dB point, Δf	Frequency offset of measurement filter centre frequency, f_offset	Minimum requirement Band I	Measurement bandwidth (see note 2)
2,5 MHz ≤ Δf < 2,7 MHz	2,515 MHz ≤ f_offset < 2,715 MHz	-16 dBm	30 kHz
2,7 MHz ≤ Δf < 3,5 MHz	2,715 MHz ≤ f_offset < 3,515 MHz	$-16dBm - 15\cdot\left(\frac{f\_offset}{MHz} - 2,715\right)dB$	30 kHz
	3,515 MHz ≤ f_offset < 4,0 MHz	-26 dBm	30 kHz
3,5 MHz ≤ Δf ≤ Δf_{max}	4,0 MHz ≤ f_offset < f_offset_{max}	-13 dBm	1 MHz

D.5.2.2 Adjacent Channel Leakage power Ratio (ACLR)

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

The recommended requirements apply whatever the type of transmitter considered (single carrier or multi-carrier). It applies for all transmission modes foreseen by the manufacturer's specification.

D.5.2.2.1 Minimum requirement

It is recommended the ACLR is higher than the value specified in table D.3.

Table D.3: Satellite ACLR

Satellite adjacent channel offset below the first or above the last carrier frequency used	ACLR limit
5 MHz	19 dB
10 MHz	34 dB
15 MHz	40 dB

D.5.3 Spurious emissions

Spurious emissions are emissions which are caused by unwanted transmitter effects such as harmonics emission, parasitic emission, intermodulation products and frequency conversion products, but exclude out of band emissions. This is measured at the satellite RF output port.

The recommended requirements apply whatever the type of transmitter considered (single carrier or multiple-carrier). It applies for all transmission modes foreseen by the manufacturer's specification.

The recommended requirements apply at frequencies within the specified frequency ranges, which are more than 12,5 MHz below the first carrier frequency used or more than 12,5 MHz above the last carrier frequency used.

Unless otherwise stated, all recommended requirements are measured as mean power (RMS).

D.5.3.1 Minimum requirements

It is recommended the power of any spurious emission do not exceed.

Table D.4: Spurious emissions limits

Band	Maximum level	Measurement Bandwidth	Note
9 kHz to 150 kHz	-13 dBm	1 kHz	See note 1
150 kHz to 30 MHz		10 kHz	See note 1
30 MHz to 1 GHz		100 kHz	See note 1
1 GHz to 12,75 GHz		1 MHz	See note 2
NOTE 1: Bandwidth as in ITU-R Recommendation SM.329, s4.1. NOTE 2: Upper frequency as in ITU-R Recommendation SM.329, s2.5 table 1.			

D.6 Transmit intermodulation

The transmit intermodulation performance is a measure of the capability of the transmitter to inhibit the generation of signals in its non linear elements caused by presence of the wanted signal and an interfering signal reaching the transmitter via the antenna.

The transmit intermodulation level is the power of the intermodulation products when a WCDMA modulated interference signal is injected into the antenna connector at a mean power level of 30 dB lower than that of the mean power of the wanted signal. The frequency of the interference signal is +5 MHz, -5 MHz, +10 MHz, -10 MHz, +15 MHz and -15 MHz offset from the subject signal carrier frequency, but exclude interference frequencies that are outside of the allocated frequency band for S-UMTS downlink specified in clause 5.2.

D.6.1 Minimum requirement

It is recommended the transmit intermodulation level do not exceed the out of band emission or the spurious emission requirements of clauses D.5.2 and D.5.3 in the presence of a WCDMA modulated interference signal with a mean power level 30 dB lower than the mean power of the wanted signal.

D.7 Transmit modulation

Transmit modulation is specified in three parts, Frequency Error, Error Vector Magnitude and Peak Code Domain Error. These specifications are made with reference to a theoretical modulated waveform.

The theoretical modulated waveform is created by modulating a carrier at the assigned carrier frequency using the same data as was used to generate the measured waveform. The chip modulation rate for the theoretical waveform is exactly 3,84 Mcps. The code powers of the theoretical waveform is the same as the measured waveform, rather than the nominal code powers used to generate the test signal.

D.7.1 Transmit pulse shape filter

The transmit pulse-shaping filter is a Root-Raised Cosine (RRC) with roll-off α = 0,22 in the frequency domain. The impulse response of the chip impulse filter $RC_0(t)$ is:

$$RC_0(t) = \frac{\sin\left(\pi \frac{t}{T_C}(1-\alpha)\right) + 4\alpha \frac{t}{T_C} \cos\left(\pi \frac{t}{T_C}(1+\alpha)\right)}{\pi \frac{t}{T_C}\left(1-\left(4\alpha \frac{t}{T_C}\right)^2\right)}$$

Where the roll-off factor α = 0,22 and the chip duration:

$$T_c = \frac{1}{chiprate} \approx 0{,}26042\,\mu s$$

D.7.2 Error Vector Magnitude

The Error Vector Magnitude is a measure of the difference between the reference waveform and the measured waveform. This difference is called the error vector. Both waveforms pass through a matched Root Raised Cosine filter with bandwidth 3,84 MHz and roll-off α = 0,22. Both waveforms are then further modified by selecting the frequency, absolute phase, absolute amplitude and chip clock timing so as to minimize the error vector. The EVM result is defined as the square root of the ratio of the mean error vector power to the mean reference power expressed as a %. The measurement interval is one timeslot as defined by the CPICH (when present) otherwise the measurement interval is one timeslot starting with the beginning of the SCH. The requirement is valid over the total power dynamic range as specified in clause D.4.3.

D.7.2.1 Minimum requirement

It is recommended the Error Vector Magnitude do not be worse than 17,5 % when the satellite is transmitting a composite signal using only QPSK modulation.

D.7.3 Peak code Domain error

The Peak Code Domain Error is computed by projecting the error vector (as defined in clause D.8.2) onto the code domain at a specified spreading factor. The Code Domain Error for every code in the domain is defined as the ratio of the mean power of the projection onto that code, to the mean power of the composite reference waveform. This ratio is expressed in dB. The Peak Code Domain Error is defined as the maximum value for the Code Domain Error for all codes. The measurement interval is one timeslot as defined by the CPICH (when present) otherwise the measurement interval is one timeslot starting with the beginning of the SCH.

D.7.3.1 Minimum requirement

It is recommended the peak code domain error do not exceed -33 dB at spreading factor 256.

Annex E (informative): Gateway Performance requirement

E.1 General

Performance requirements for the Space Segment are specified for the measurement channels defined in Annex A and the propagation conditions in annex B. The requirements recommended hereafter only apply to those measurement channels that are supported by the space segment.

The Eb/No used in this clause is defined as:

$$E_b / N_o = \frac{E_c}{N_o} \cdot \frac{L_{chip}}{L_{\inf}}$$

Where:

E_c is the received total energy of DPDCH and DPCCH per PN chip at satellite antenna from all paths.

N_o is the total one-sided noise power spectral density due to all noise sources.

L_{chip} is the number of chips per frame.

$L_{\inf}$ is the number of information bits in DTCH excluding CRC bits per frame.

E.2 Demodulation of DCH in static propagation conditions

It is recommended both satellite gateway and CGC receiver comply with the demodulation of DCH in static propagation conditions.

The performance requirement of DCH in static propagation conditions is determined by the maximum Block Error Ratio (BLER) allowed when the receiver input signal is at a specified E_b/N_0 limit.

E.2.1 Minimum requirement

It is recommended the BLER do not exceed the limit for the E_b/N_0 specified in table E.1.

Table E.1: DCH requirements in static conditions

Measurement channel	Received E_b/N_0	Required BLER
1,2 kbit/s	7,4 dB	$< 10^{-2}$
4,75 kbit/s	7 dB	$< 10^{-2}$
64 kbit/s	3,5 dB	$< 10^{-2}$
144 kbit/s	2,9 dB	$< 10^{-2}$
384 kbit/s	2,9 dB	$< 10^{-2}$

E.3 Demodulation in multi-path fading conditions

The performance requirement of DCH in multipath fading is determined by the maximum Block Error Ratio (BLER) allowed when the receiver input signal is at a specified E_b/N_0 limit.

E.3.1 ITU Models A, B, C

It is recommended satellite gateway receiver comply with the demodulation of DCH in ITU models A, B and C.

E.3.1.1 Minimum requirement - LOS

It is recommended in ITU A LOS propagation conditions, the BLER do not exceed the limit for the E_b/N_0 specified in table E.2.

Table E.2: DCH requirements in ITU A LOS propagation conditions

Measurement channel	**Received E_b/N_0**		**Required BLER**
	UE speed		
	3 km/h	250 km/h	
1,2 kbit/s	9,1 dB	9,8 dB	$< 10^{-2}$
4,75 kbit/s	8,2 dB	8,6 dB	$< 10^{-2}$
64 kbit/s	4,5 dB	4,6 dB	$< 10^{-2}$
144 kbit/s	3,9 dB	4 dB	$< 10^{-2}$
384 kbit/s	4,1 dB	3,9 dB	$< 10^{-2}$

It is recommended in ITU B LOS propagation conditions, the BLER do not exceed the limit for the E_b/N_0 specified in table E.3.

Table E.3: DCH requirements in ITU B LOS propagation conditions

Measurement channel	**Received E_b/N_0**		**Required BLER**
	UE speed		
	3 km/h	250 km/h	
1,2 kbit/s	9,2 dB	10 dB	$< 10^{-2}$
4,75 kbit/s	8,5 dB	8,8 dB	$< 10^{-2}$
64 kbit/s	4,8 dB	4,9 dB	$< 10^{-2}$
144 kbit/s	4,2 dB	4,3 dB	$< 10^{-2}$
384 kbit/s	4,7 dB	4,2 dB	$< 10^{-2}$

It is recommended in ITU C LOS propagation conditions, the BLER do not exceed the limit for the E_b/N_0 specified in table E.4.

Table E.4: DCH requirements in ITU C LOS propagation conditions

Measurement channel	**Received E_b/N_0**		**Required BLER**
	UE speed		
	3 km/h	250 km/h	
1,2 kbit/s	9,8 dB	10,6 dB	$< 10^{-2}$
4,75 kbit/s	9,3 dB	9,5 dB	$< 10^{-2}$
64 kbit/s	5,7 dB	5,6 dB	$< 10^{-2}$
144 kbit/s	5 dB	5,1 dB	$< 10^{-2}$
384 kbit/s	6,2 dB	5,2 dB	$< 10^{-2}$

E.3.1.2 Minimum requirement - NLOS

It is recommended in ITU A NLOS propagation conditions, the BLER do not exceed the limit for the E_b/N_0 specified in table E.5.

Table E.5: DCH requirements in ITU A, B, C NLOS propagation conditions

Measurement channel	Received E_b/N_0		Required BLER
	UE speed		
	3 km/h	50 km/h	
1,2 kbit/s	18 dB	10,4 dB	$< 10^{-2}$
4,75 kbit/s	20,6 dB	12,4 dB	$< 10^{-2}$
64 kbit/s	16,3 dB	7,9 dB	$< 10^{-2}$
144 kbit/s	15,7 dB	7,4 dB	$< 10^{-2}$
384 kbit/s	18,8 dB	11,8 dB	$< 10^{-2}$

It is recommended in ITU B NLOS propagation conditions, the BLER do not exceed the limit for the E_b/N_0 specified in table E.6.

Table E.6: DCH requirements in ITU B NLOS propagation conditions

Measurement channel	Received E_b/N_0		Required BLER
	UE speed		
	3 km/h	50 km/h	
1,2 kbit/s	17,2 dB	10,4 dB	$< 10^{-2}$
4,75 kbit/s	19,5 dB	12,3 dB	$< 10^{-2}$
64 kbit/s	15,2 dB	7,8 dB	$< 10^{-2}$
144 kbit/s	14,6 dB	7,2 dB	$< 10^{-2}$
384 kbit/s	17,4 dB	11,3 dB	$< 10^{-2}$

It is recommended in ITU C NLOS propagation conditions, the BLER should not exceed the limit for the E_b/N_0 specified in table E.7.

Table E.7: DCH requirements in ITU C NLOS propagation conditions

Measurement channel	Received E_b/N_0		Required BLER
	UE speed		
	3 km/h	50 km/h	
1,2 kbit/s	15,1 dB	10 dB	$< 10^{-2}$
4,75 kbit/s	17 dB	11,1 dB	$< 10^{-2}$
64 kbit/s	13,3 dB	6,9 dB	$< 10^{-2}$
144 kbit/s	12,6 dB	6,4 dB	$< 10^{-2}$
384 kbit/s	14,5 dB	9,6 dB	$< 10^{-2}$

E.3.2 Aeronautical

It is recommended both satellite gateway and CGC receiver comply with the demodulation of DCH in aeronautical propagation conditions.

It is recommended in aeronautical propagation conditions, the BLER do not exceed the limit for the E_b/N_0 specified in table E.8.

Table E.8: DCH requirements in aeronautical condition

Measurement channel	Received E_b/N_0	Required BLER
1,2 kbit/s	11,6 dB	$< 10^{-2}$
4,75 kbit/s	8,5 dB	$< 10^{-2}$
64 kbit/s	4,4 dB	$< 10^{-2}$
144 kbit/s	3,9 dB	$< 10^{-2}$
384 kbit/s	3,7 dB	$< 10^{-2}$

E.5 Performance requirement for RACH

Performance requirements for RACH consists of two parts: preamble detection and message demodulation. Requirements for these are in clauses E.5.1 and E.5.2, respectively.

E.5.1 Performance requirement for preamble detection

The requirements are specified for a Probability of false alarm Pfa (false detection of the preamble when the preamble was not sent) less than 10^{-3} and a probability of detection Pd more than 0,99. Only 1 signature is used and it is known by the receiver.

Table E.9: Ec/No preamble requirement

Environment	Speed	Ec/No for Pd ≥ 0,99
AWGN	0 km/h	-23,6 dB
		LOS / NLOS
ITU Model A	3 km/h	-22 dB / -12,5 dB
	50 km/h	-23 dB / -19,5 dB
	120 km/h	-23,5 dB / -19 dB
	200 km/h	-23,5 dB / -18,5 dB
ITU Model B	3 km/h	-21,5 dB / -12,5 dB
	50 km/h	-22,5 dB / -19,5 dB
	120 km/h	-23 dB / -19 dB
	200 km/h	-23 dB / -18 dB
ITU Model C	3 km/h	-20 dB / -11,5 dB
	50 km/h	-21 dB / -19 dB
	120 km/h	-21,5 dB / -18 dB
	200 km/h	-21,5 dB / -17,5 dB

E.5.2 Demodulation of RACH message

The recommended performance measure is required Eb/N0 for block error rate (BLER) of 10^{-1} and 10^{-2}. Both measurement channels have TTI = 20 ms. Payloads are 168 bits and 360 bits. Channel coding is rate 1/2 convolutional coding.

E.5.2.1 Demodulation in Static Propagation Condition

Table E.10: Required Eb/N0 for static propagation

Transport Block size TB and TTI in frames	E_b/N_0 for required BLER < 10^{-2}
168 bits, TTI = 20 ms	6,4 dB
360 bits, TTI = 20 ms	5,9 dB

E.5.2.2 Demodulation in Multi-path fading, ITU models A, B, C

E.5.2.2.1 Minimum requirements - LOS

Table E.11: Required Eb/N0 for ITU A, B, C; LOS

Transport Block size TB and TTI in frames	E_b/N_0 for required BLER < 10^{-2}		
	ITU A	ITU B	ITU C
168 bits, TTI = 20 ms	7,5	7,8	8,7
360 bits, TTI = 20 ms	6,9	7,2	8,2

E.5.2.2.2 Minimum requirements - NLOS

Table E.12: Required Eb/N0 for ITU A, B, C; NLOS; 3 km/h

Transport Block size TB and TTI in frames	E_b/N_0 for required BLER < 10^{-2}		
	ITU A	ITU B	ITU C
168 bits, TTI = 20 ms	19,9 dB	18,6 dB	16,4 dB
360 bits, TTI = 20 ms	19,5 dB	18,2 dB	16,1 dB

Table E.13: Required Eb/N0 for ITU A, B, C; NLOS; 50 km/h

Transport Block size TB and TTI in frames	E_b/N_0 for required BLER < 10^{-2}		
	ITU A	ITU B	ITU C
168 bits, TTI = 20 ms	12,1 dB	11,7 dB	10,4 dB
360 bits, TTI = 20 ms	11,5 dB	11,1 dB	9,9 dB

Table E.14: Required Eb/N0 for ITU A, B, C; NLOS; 120 km/h

Transport Block size TB and TTI in frames	E_b/N_0 for required BLER < 10^{-2}		
	ITU A	ITU B	ITU C
168 bits, TTI = 20 ms	10,2 dB	10 dB	9,3 dB
360 bits, TTI = 20 ms	9,8 dB	9,6 dB	8,8 dB

Table E.15: Required Eb/N0 for ITU A, B, C; NLOS; 250 km/h

Transport Block size TB and TTI in frames	E_b/N_0 for required BLER < 10^{-2}		
	ITU A	ITU B	ITU C
168 bits, TTI = 20 ms	11,2 dB	11 dB	10,4 dB
360 bits, TTI = 20 ms	10,7 dB	10,5 dB	9,7 dB

E.5.2.5 Demodulation in Multi-path fading, Aeronautical

Table E.16: Required Eb/N0 for Aeronautical propagation

Transport Block size TB and TTI in frames	E_b/N_0 for required BLER < 10^{-2}
168 bits, TTI = 20 ms	7,4 dB
360 bits, TTI = 20 ms	6,8 dB

Annex F (informative): Bibliography

- ETSI TS 101 851-1-1: "Satellite Earth Stations and Systems (SES); Satellite Component of UMTS/IMT-2000; Part 1: Physical channels and mapping of transport channels into physical channels; Sub-part 1: G-family (S-UMTS-G25.211)".

- ETSI TS 101 851-4-1: "Satellite Earth Stations and Systems (SES); Satellite Component of UMTS/IMT-2000; Part 4: Physical layer procedures; Sub-part 1: G-family (S-UMTS-G 25.214)".

Annex G (informative): Document History

V0.0.1	September 2004	Creation. Performances results from TR 102 058
V0.0.2	March 2007	Added : IMR power classes, IMR and satellite transmitter characteristics, gateway receiver characteristics, uplink measurement channels 1.2 and 4.75 kbps,
V0.0.3	May 2007	Revision as requested at S-UMTS#32 see Su32TD11. Abbreviations completed. Version for approval at S-UMTS#33 meeting.
V0.0.4	May 2007	Revision of Annex D : requirements are recommended values
V0.0.5	June 2007	SES comments
V0.0.6	June 2007	Further SES comments
V0.0.7	June 2007	Figure A1 updated following comments from SES

History

Document history		
V2.1.1	January 2008	Publication