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Universal Mobile Telecommunications System (UMTS);
UTRAN Iuant interface: Layer 1
(3GPP TS 25.461 version 15.3.0 Release 15)

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Contents

Foreword

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Version x.y.z

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Y the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.

z the third digit is incremented when editorial only changes have been incorporated in the document.

1 Scope

The present document specifies the standards allowed to implement layer 1 on the Iuant interface.

The specification of transmission delay requirements and O&M requirements are not in the scope of the present document.

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

[1] 3GPP TS 25.462: "UTRAN Iuant interface: Signalling transport".

[2] ISO/IEC 8482 (1993-12): "Information technology - Telecommunications and information exchange between systems - Twisted pair multipoint interconnections".

[3] TIA/EIA TSB89: "Application guidelines for TIA/EIA-485-A".

[4] 3GPP TS 25.101: "Technical Specification Group Radio Access Network; User Equipment (UE) radio transmission and reception (FDD)"

[5] 3GPP TS 36.101: "Evolved Universal Terrestrial Radio Access (E-UTRA); User Equipment (UE) radio transmission and reception"

[6] 3GPP TS 38.101: "NR; User Equipment (UE) radio transmission and reception (FDD)"

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the following terms and definitions apply:

On-Off-Keying: A modulation system in which a carrier is switched between two states, ON and OFF.

Common feeder cable: Feeder cable where some antenna line devices (e.g. RET, TMA) are connected via the same feeder cable.

3.2 Abbreviations

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

BS	Base Station
DC	Direct Current
DL	Downlink
FDD	Frequency Division Duplex
ISB	Idle-State Biasing
OOK	On-Off-Keying
RET	Remote Electrical Tilting
RF	Radio Frequency

TMA	Tower Mounted Amplifier
UE	User Equipment
UL	Uplink
UMTS	Universal Mobile Telecommunications System
UTRA	UMTS Terrestrial Radio Access

4 Iuant layer 1

4.1 General

There are two layer 1 options:

- RS485 option: A screened multicore cable, which supports a conventional RS485 serial multi-drop bus.
- Modem option: A connection to a RET and/or a TMA control unit by way of a coaxial cable which is shared with DC supply and RF signals.

Both layer 1 options support the connection of two-way serial data and DC power to the RET and/or TMA antenna device.

At least one of these two layer 1 options shall be supported.

The default data rate for both layer 1 options shall be 9.6 kbps. Higher data rates of 38.4 kbps for both layer 1 options and 115.2 kbps only for the RS485 layer 1 option may optionally be supported. Each unit communicates on one of the three data rates, but different units on the same interface may use different data rates.

After a reset, a secondary device shall alternate between supported data rates. When alternating between data rates, the data rate shall be held constant for 300 ms. After every correctly received device scan command (see TS 25.462 [1]) independent of whether it matches or not, at one of the supported data rates, that data rate shall be held constant for 1.5 seconds. After successful reception of an address assignment frame, the secondary device shall use that data rate until it is reset.

Data rates:

- 9.6 kbps ± 3 %
- 38.4 kbps ± 3 %
- 115.2 kbps ± 3 %

The format of the data octet shall be as shown in figure 4.1.1:

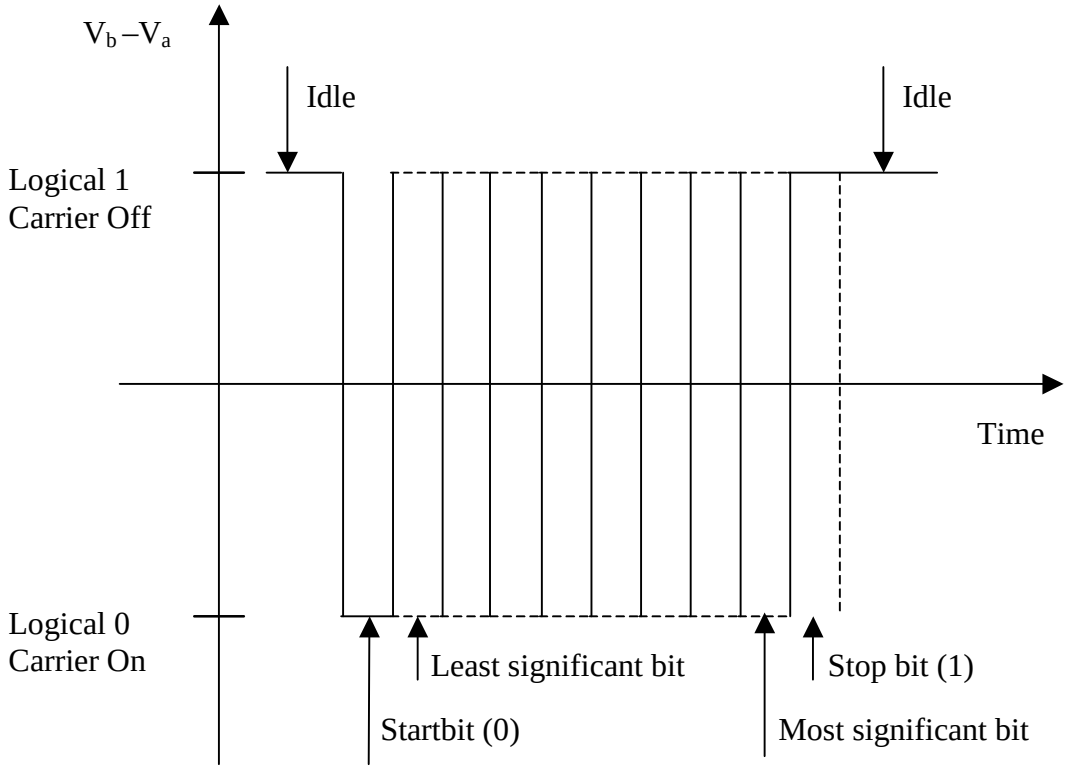


Figure 4.1.1: Format and order of transmitted data

4.2 RS485 option

This option is constituted by a two wire bi-directional multi-drop configuration conforming to ISO/IEC 8482 [2]. The mapping of mark/space to logical one and zero as referred to in ISO/IEC 8482 [2] shall be according to figure 4.1.1.

The use of ISB, also called idle-line failsafe in TIA/EIA TSB89 [3], is mandatory. The bias voltages shall be applied only by the primary device to any separate RS485 bus. The polarity of the idle-state bias is defined as a transmitted 1.

The RS485 transmitter shall be set to drive the bus before the first start bit is sent and held active until the last stop bit is sent. The RS485 transmitter shall stop driving the bus within 20 bit-times after the last stop bit is sent.

If an antenna modem is used ISB shall be implemented by the antenna modem.

4.3 Modem option

The connection to a RET and/or a TMA control unit by way of a coaxial cable which is shared with DC supply and RF signals is provided by two modems, a BS modem and an antenna modem. The BS modem shall be either connected to the antenna connector of the BS or integrated in the BS. It provides signal transmission to the antenna modem and signal reception from the antenna modem over the antenna feeder cable. The antenna modem is located between the antenna feeder cable and the antenna. Modem configurations and reference points for modem characteristics are specified in figure 4.3.1 and figure 4.3.2. Unless otherwise stated, requirements in this section apply to both BS modem and antenna modem.

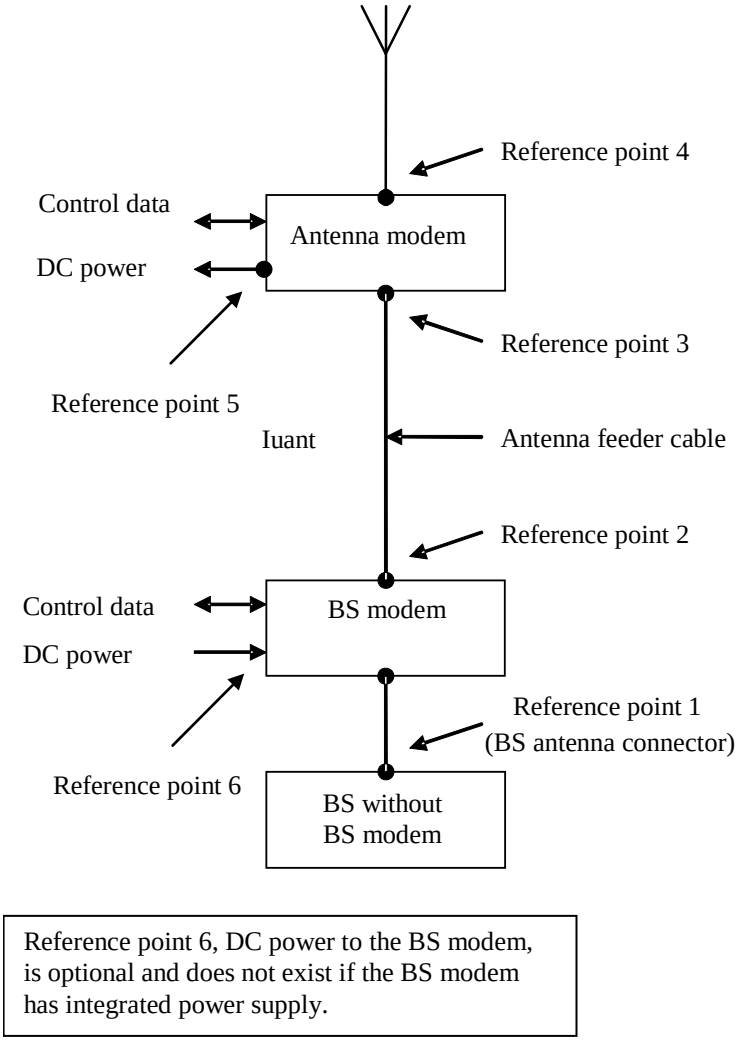


Figure 4.3.1: Modem configuration and modem reference points for a BS without BS modem

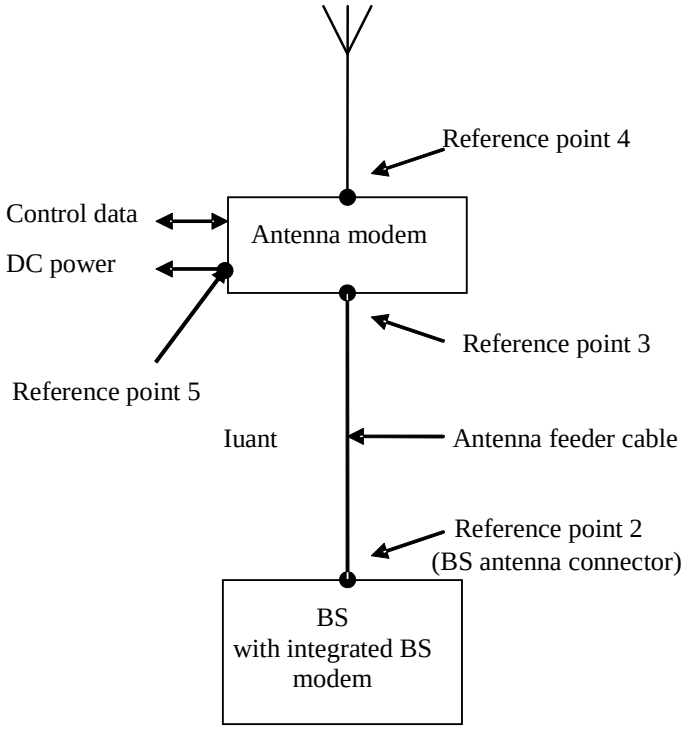


Figure 4.3.2: Modem configuration and modem reference points for a BS with integrated BS modem

4.3.1 Interference with existing systems

The modem circuit shall be capable of managing its transmitting characteristic according to subclause 4.3.5.

4.3.1.1 Carrier frequency and frequency stability

The following carrier frequency shall be used for this application:

2.176 MHz ± 100 ppm

4.3.1.2 Modem isolation and modem emissions

The external BS modem shall provide minimum attenuation according to figure 4.3.1.2.1 between reference point 2 and reference point 1 to protect the BS from emissions of the antenna modem.

External BS modem emissions at reference point 1 shall be attenuated at least according to the modem attenuation in figure 4.3.1.2.1 below the levels specified for the modem spectrum emission mask in subclause 4.3.4.2 to protect the BS from emissions of the BS modem.

The antenna modem shall provide minimum attenuation according to figure 4.3.1.2.1 between reference point 3 and reference point 4 to protect other radio systems from emission of the BS modem.

Antenna modem emissions at reference point 4 shall be attenuated at least according to the modem attenuation in figure 4.3.1.2.1 below the levels specified for the modem spectrum emission mask in subclause 4.3.4.2 to protect other radio systems from emission of the antenna modem.

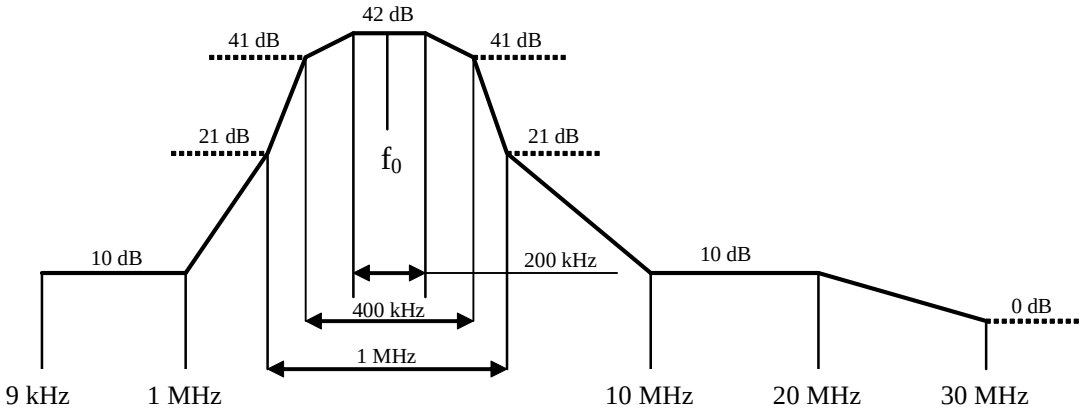


Figure 4.3.1.2.1: Modem attenuation

4.3.1.3 Modem intermodulation attenuation

The modem intermodulation attenuation is specified in terms of the power in intermodulation products of WCDMA modulated carriers present at reference point 1 or reference point 3.

For 2 downlink carriers of 43 dBm the power of third order intermodulation products in the UL operating bands for the external BS modem and antenna modem shall not exceed:

- – 130 dBm/100 kHz for frequencies < 1 GHz
- – 120 dBm/1 MHz for frequencies ≥ 1 GHz

NOTE: Using the modem with higher power than 43 dBm and or with more carriers than 2 carriers at 43dBm/carrier may increase intermodulation products and may degrade the receiver sensitivity of the BS if these intermodulation products fall at BS receive frequencies.

For the worst input configuration of power and number of carriers declared by the modem manufacturer the power of any intermodulation product for the external BS modem and antenna modem shall not exceed:

- – 98dBm/100kHz

In addition, for the worst input configuration of power and number of carriers declared by the modem manufacturer the power of fifth or higher order intermodulation products in the UL operating bands for the external BS modem and antenna modem shall not exceed:

- – 135 dBm/100 kHz for frequencies < 1 GHz
- – 125 dBm/1 MHz for frequencies ≥ 1 GHz

4.3.2 Recovery time

A minimum recovery time shall be allowed between receiving and transmitting messages on the bus. For this reason a minimum permitted response time is specified in subclause 4.5 in TS 25.462 [1].

4.3.3 Impedance

The modem transceiver shall provide constant impedance in both transmitting and receiving modes:

- Nominal impedance Z_0: 50 Ω;
- Return loss at modem carrier frequency ± 0.1 MHz > 10 dB;
- Return loss in external BS and antenna modem operating bands > 20 dB.

4.3.4 Modulator characteristics

4.3.4.1 Levels

ON-Level: +3 dBm ± 2 dB

OFF-Level: ≤ -40 dBm

4.3.4.2 Spectrum emission mask

The modem spectrum emission mask is specified in figure 4.3.4.2.1. Intermediate values may be obtained by linear interpolation between the points shown. The corresponding measurement bandwidths are specified in table 4.3.4.2.1. For modem configurations according to figure 4.3.1 the BS modem emissions shall not exceed the limits of the spectrum emission mask at reference point 2. For modem configurations according to figure 4.3.2 the BS with integrated BS modem emissions shall not exceed the limits of the spectrum emission mask at reference point 2 only for frequencies below 20 MHz. Antenna modem emissions shall not exceed the limits of the spectrum emission mask at reference point 3.

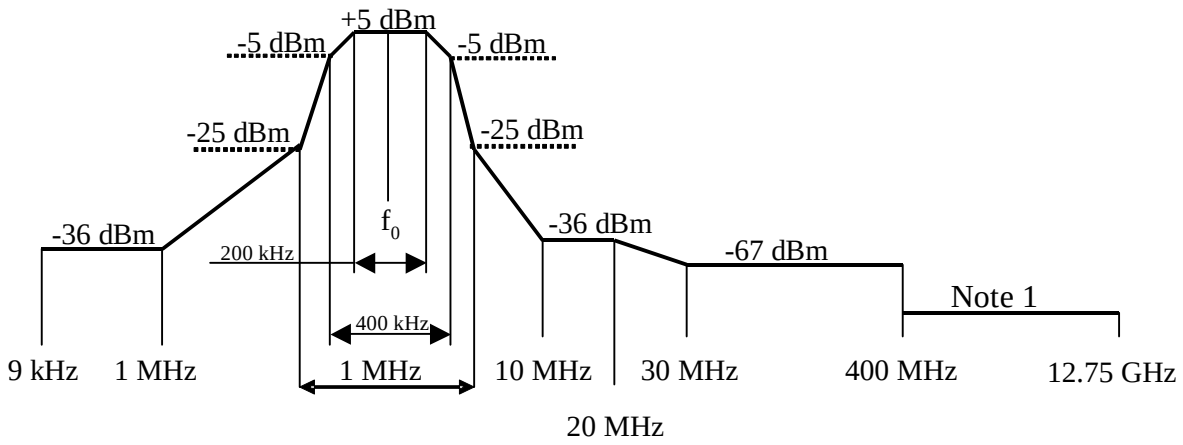


Figure 4.3.4.2.1: Modem spectrum emission mask.

Note 1: For frequencies <1GHz the general emission limit is -108dBm, except modem operating band UL frequencies where the emission limit is -135 dBm.
For frequencies ≥1GHz the general emission limit is -98dBm, except modem operating band UL frequencies where the emission limit is -125 dBm.

Table 4.3.4.2.1: Modem spectrum emission mask measurement bandwidth

Band	Measurement Bandwidth
9 kHz - 150 kHz	1 kHz
150 kHz - 30 MHz	10 kHz
30 MHz - 1 GHz	100 kHz
1 GHz - 12.75 GHz	1 MHz

4.3.5 Demodulator characteristics

The demodulator shall fulfil the requirement in subclause 4.3.6 for a carrier ON-Level within +5 dBm to -12 dBm and a carrier OFF-Level less than -18 dBm. The levels within –12 dBm to –18 dBm are undefined.

4.3.6 Duty cycle variation

In order to guarantee proper transmission of data bits through the processes of modulation and demodulation, the following limit shall be met for the duty cycle variation:

$\Delta DC_{SYSTEM} = |DC_{RX} - DC_{TX}| \leq 10\ \%$

Where: ΔDC_{SYSTEM} is the difference between the duty cycles of the transmitted and received bit streams,

DC_{TX} = Duty cycle for the input bit stream, and

DC_{RX} = Duty cycle for the output bit stream.

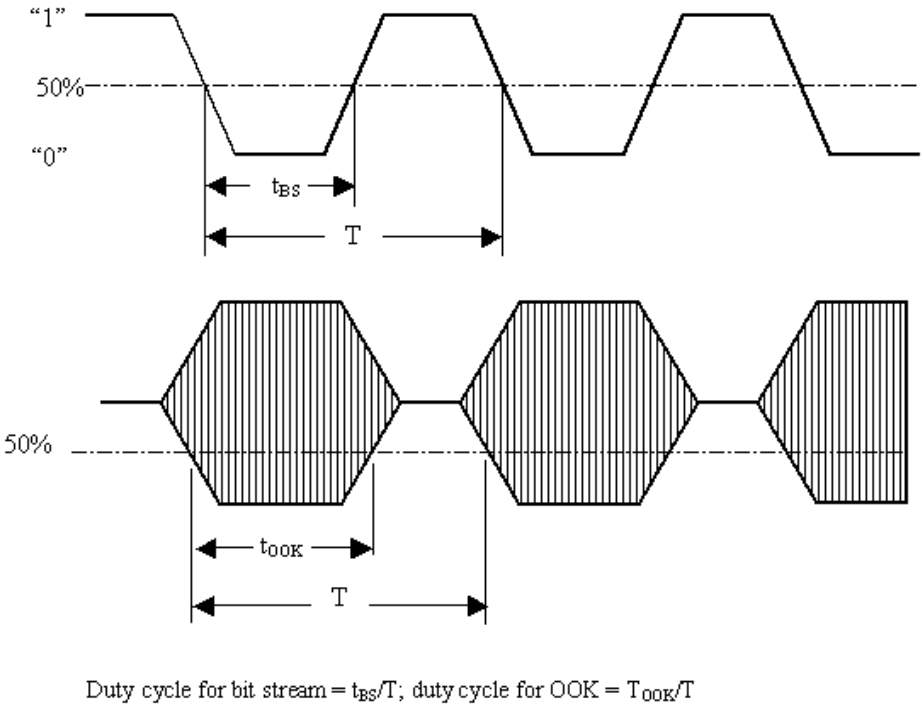


Figure 4.3.6.1: Duty cycles of the bit stream and OOK modulated subcarrier

For transmission through a coaxial cable, two converters are required, one from a bit stream to OOK (modulator) and one from OOK back to a bit stream (demodulator). Therefore half of the total duty cycle tolerance is available for each converter.

For an input bit stream with a duty ratio of 50 %, the cascaded modulator and demodulator shall provide an output bit stream with a duty ratio within the limits 40 % - 60 %, measured in each case at 0.5 times peak amplitude (see figure 4.3.6.1).

4.3.7 Operating bands

A UTRA/FDD BS, UTRA/TDD BS, E-UTRA BS, NR BS or antenna modem is designed to operate in one or several of the operating bands defined in 3GPP TS 25.101 [4], 3GPP TS 36.101 [5] and 3GPP TS 38.101 [6].

Table 4.3.7.1: Void

The operating bands of the BS modem or antenna modem shall be declared by the manufacturer.

4.3.8 Time delay and accuracy

The time delay in the operating bands shall be declared by the manufacturer with ± 1 ns accuracy. The time delay shall not exceed 30 ns. This requirement is only applicable to external BS modem and antenna modem.

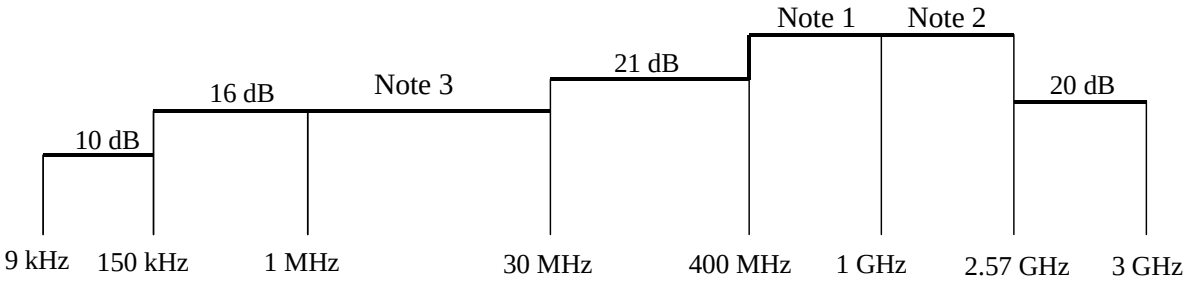
4.3.9 Insertion Loss

The insertion loss in the external BS modem or antenna modem operating band shall be ≤ 0.3 dB.

The actual insertion loss shall be declared by the manufacturer.

4.3.10 DC port isolation

The isolation between DC port and RF ports shall meet the minimum values in figure 4.3.10.1 and 4.3.10.2. Figure 4.3.10.1 is valid for antenna modems between reference point 5 and 4 as well as 5 and 3 and for BS modems without integrated power supply between reference point 6 and 2 as well as 6 and 1. Figure 4.3.10.2 is valid as additional requirement for antenna modems between reference point 5 and 3 and for BS modems without integrated power supply between reference point 6 and 2.



Note 1: 38 dB, except for UL and DL operating bands where it is 65 dB
Note 2: 38 dB, except for UL and DL operating bands where it is 65 dB
Note 3: 16 dB. Between reference point 5 and 3 as well as 6 and 2 see figure 4.3.10.2.

Figure 4.3.10.1: DC port isolation

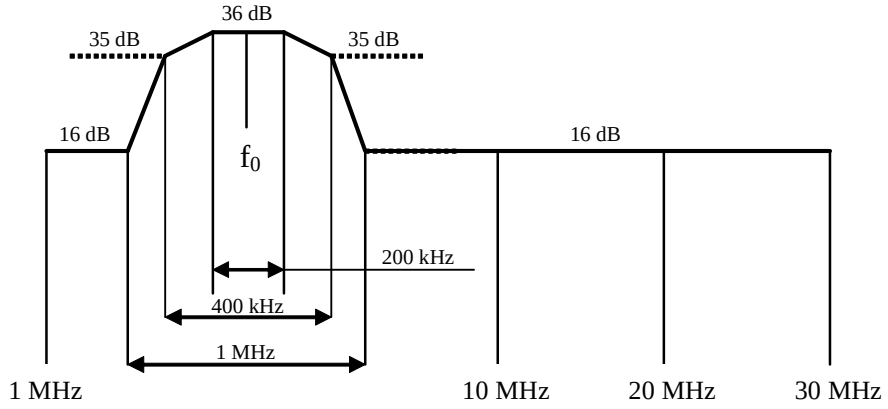


Figure 4.3.10.2: DC port isolation

4.3.11 RET control unit spurious emission

Void.

4.3.12 Control unit spurious emission

The control unit, or a combination of control units, shall not generate spurious emission, at reference point 5, above a level that will violate the spectrum emission mask requirement according to chapter 4.3.4.2. The DC port isolation according to chapter 4.3.10 shall be taken into account.

4.4 DC power supply

4.4.1 Power consumption

The DC supply requirements refers to reference points 3 and 5 in subclause 4.3.

BS modem and an antenna modem shall be able to operate with a DC supply voltage range of 10 V – 30 V.

Power consumption modes are specified in table 4.4.1.1. and table 4.4.1.2.

Table 4.4.1.1: Power consumption modes for RET

RET Power mode	Maximum power consumption
High	< 13 W
Low	< 2 W

Table 4.4.1.2: Power consumption modes for TMA

TMA Type	Maximum power consumption
Single Unit	< 7,5 W
Multi Unit (N)	< N * 7,5 W

BS modem and antenna modem maximum power consumption shall be < 2 W.

BS modem and antenna modem shall impose a voltage drop less than 2 V between reference point 3 and 5.

A Single Unit considers one RF amplifier in one TMA. A Multi Unit considers N RF amplifiers in equal or less than N TMAs.

4.4.2 Conducted emission

The levels of generated conducted noise and ripple on DC Power supply shall be within the limits given in table 4.4.2.1.

Table 4.4.2.1: Noise and ripple

Item	Limit	Frequency	Remarks
RET power mode High	70 mV_{pp}	0.15 - 30 MHz	Only one operating unit a time
RET power mode Low	20 mV_{pp}	0.15 - 30 MHz	
TMA	20 mV_{pp}	0.15 - 30 MHz	
Antenna modem, RF port	15 mV_{pp}	0.15 - 30 MHz	Generated Noise and Ripple at RF feeder (in RX mode)
Antenna modem, DC port	20 mV_{pp}	0.15 - 30 MHz	Allowed Noise and Ripple at external DC port (in TX mode)

All units connected to a DC supply bus shall exhibit full performance up to the limit of 112 mV_{pp} total noise and ripple within 0.15 - 30 MHz.

4.4.3 Power-up characteristics

A BS modem, antenna modem or RET/TMA control units shall have a power-up period of 3 s.

During the power-up period a BS modem, antenna modem or a RET control unit shall exhibit the circuit equivalent of a DC power consumer with a current consumption of maximum 400 mA in parallel with a capacitor of maximum 0.5 µF.

During the power-up period the TMA control unit shall exhibit the circuit equivalent of a DC power consumer with a current consumption of maximum 1A in parallel with a capacitor of maximum 0.5 µF.

After the power-up period, the unit shall be fully functional and the power consumption requirement as described in subclause 4.4.1 applies.

Annex A (normative): Test procedures

Test pattern

Spectrum mask and emission requirement shall be tested both with a consecutive series of "0" and an alternating sequence of "0" and "1".

Emission requirement below noise floor

As a general rule, the resolution bandwidth of the measuring equipment should be equal to the measurement bandwidth. However, to improve measurement accuracy and sensitivity when measuring close to or below the noise floor, the resolution bandwidth may 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.

Conversion between modulated and CW for IM measurement

The requirement for IM3 below 1 GHz shall be relaxed 15 dB and tested with CW interferers at the specified levels. The requirement for IM3 above 1 GHz shall be relaxed 5 dB and tested with CW interferers at the specified levels.

The requirement for IM5 or higher below 1 GHz shall be relaxed 10 dB and tested with CW interferers at the specified levels.

The requirement for IM5 or higher above 1 GHz shall be relaxed 0 dB and tested with CW interferers at the specified levels.

Example: A –130 dBm/100 kHz requirement below 1 GHz with two WCDMA-modulated carriers at 43 dBm is converted to a –115 dBm requirement with two CW carriers at 43 dBm.

Annex B (informative): Change history

TSG #	TSG Doc.	CR	Rev	Subject/Comment	New
TSG-RAN#25	RP-040344	_	_	presentation to TSG-RAN for information	1.0.0
TSG-RAN#25	RP-040344	_	_	approved at TSG-RAN#25 and placed under change control	6.0.0
26	RP-040444	1		DC power supply distribution	6.1.0
26	RP-040444	2	1	Improved demodulator characteristics specification	6.1.0
26	RP-040444	3	-	Requirements missing for when the RS485 bus shall not be driven by the secondary device	6.1.0
26	RP-040444	4	1	RET DC power consumption modes	6.1.0
26	RP-040444	5	-	Minor Corrections and editorial changes to 25.461	6.1.0
27	RP-050061	7	1	Minor Corrections and editorial changes to 25.461	6.2.0
27	RP-050061	8	1	Power consumption clarification of RET	6.2.0
27	RP-050061	9		Modem Operating Bands	6.2.0
27	RP-050061	10		Modem Return loss	6.2.0
27	RP-050061	11		Modem Time Delay and Accuracy	6.2.0
27	RP-050061	12		Modem Insertion Loss	6.2.0
28	RP-050237	13	1	DC power on sequence	6.3.0
28	RP-050237	15	-	BS Modem and RET Modem Filtering	6.3.0
28	RP-050237	16	-	BS Modem and RET modem spectrum emission mode	6.3.0
28	RP-050237	17	-	BS modem and RET modem return loss at modem frequency	6.3.0
28	RP-050237	18	-	Time delay clarification	6.3.0
28	RP-050226	19	-	Introduction of UMTS2600 requirements	7.0.0
29	RP-050438	21	1	Power-Up period clarifications	7.1.0
29	RP-050438	23		Insertion loss for RET	7.1.0
29	RP-050438	25		Testing for RET	7.1.0
29	RP-050438	27		Time delay for RET	7.1.0
29	RP-050438	29		Intermodulation attenuation for RET	7.1.0
29	RP-050438	31		BS and RET modem isolation	7.1.0
30	RP-050704	32	1	Introduction of UMTS 1700 requirements	7.2.0
30	RP-050703	33		Introduction of UMTS 900	7.2.0
30	RP-050689	35		Test Procedures	7.2.0
30	RP-050689	37		Correction to modem isolation and emission	7.2.0
30	RP-050689	39		correction of referencing	7.2.0
30	RP-050689	41	1	RET Control Unit spurious emission simplified version	7.2.0
34	RP-060704	42		Introduction of Band X (Extended UMTS 1.7/2.1 GHz)	7.3.0
35	RP-070058	44	1	Update of DC Power Supply Requirements	7.4.0
35	RP-070058	45		Tower Mounted Amplifier amendment	7.4.0
36	RP-070323	47		Word alignment of station-device	7.5.0
37	RP-070576	48		Introduction of UMTS1500 requirement	8.0.0
39	RP-080082	49	1	Introduction of UMTS 700 MHz (Bands XII XIV)	8.1.0
45	RP-090822	51		Introduction of E-UTRA operating bands	
	RP-090826	53	1	Introduction of the extended UMTS/LTE 800 MHz bands	9.0.0
46	RP-091185	54	1	Introduction of Extended UMTS/LTE1500 requirements for TS25.461	9.1.0
47	RP-100223	58		Introduction of UMTS/LTE in 800 MHz for Europe requirements in TS 25.461	9.2.0
49	RP-100912	59	-	Spectrum band definition additions for TDD 2600 MHz	10.0.0
50	RP-101361	59a	1	Introduction of L-band in TS 25.461	10.1.0
50	RP-101278	61	2	CR UMTS/LTE-3500 spectrum band definition additions for TDD Iuant interface to TS 25.461	10.1.0
50	RP-101334	66		Band XII channel arrangement correction on 25.461	10.1.0
SP-49	SP-100629			Clarification on the use of References (TS 21.801 CR#0030)	10.1.1
52	RP-110699	70		Add 2 GHz band LTE for ATC of MSS in North America to TS25.461 (Rel-10)	10.2.0
52	RP-110696	71		Add Expanded 1900 MHz Band for UTRA and LTE to TS25.461 (Rel-10)	10.2.0
52	RP-110685	73		Removal of unused references	10.2.0
54	RP-111733	76		Removal of references to operating bands i) and h)	10.3.0
03.2012				Creation of Rel-11 version based on v. 10.3.0	11.0.0
55	RP-120235	78		Addition of new Band 26 for E850	11.0.0
56	RP-120749	79	1	Introduction of E850_LB (Band 27) to TS 25.461	11.1.0
56	RP-120750	80	-	Introduction of Band 28	11.1.0
56	RP-120750	81	-	Introduction of Band 44	11.1.0
58	RP-121736	82	-	Introduction of band 22 in TS 25.461	11.2.0
58	RP-121735	83	1	Introduction of Band 29 into TS 25.461	11.2.0
62	RP-131903	84	1	Introduction of LTE 450 MHZ	12.0.0
62	RP-131904	85	1	Introduction of Band 30	12.0.0
64	RP-140900	87	-	Introduction of Band 32, XXXII	12.1.0
70	RP-152105	91	-	Introduction of band 65	13.0.0
70	RP-152106	92	-	Introduction of band 66	13.0.0
70	RP-152104	93	-	Introduction of band 67	13.0.0

TSG #	TSG Doc.	CR	Rev	Subject/Comment	New
70	RP-152107	94	1	Introduction of band 45 in 25.461	13.0.0
71	RP-160446	95	-	Introduction of Band 68 into 25.461	13.1.0
71	RP-160450	96	1	Introduction of Band 46 in TS 25.461	13.1.0
06/2016				Creation of Rel-14 version based on v. 13.1.0	14.0.0
72	RP-161040	97	1	Introduction of band 70	14.0.0
72	RP-161041	98	-	Introduction of 2.6GHz SDL band	14.0.0
74	RP-162335	100	-	Introduction of band 48	14.1.0

Change history							
Date	Meeting	Tdoc	CR	Rev	Cat	Subject/Comment	New version
09/2017	RP-77	RP-171976	0102	1	B	Introduction of Band 72	15.0.0
09/2017	RP-77	RP-171977	0104	-	B	Introduction of the FDD L-band (Band 74) into TS 25.461	15.0.0
09/2017	RP-77	RP-171978	0105	1	B	Introduction of the TDD L-band(Band 50 and Band 51)	15.0.0
09/2017	RP-77	RP-171980	0106	-	B	CR to 25.461: Introduction of Band 71 (600MHz FDD band for US)	15.0.0
09/2017	RP-77	RP-171979	0107	-	B	CR to 25.461: Introduction of B75 and B76	15.0.0
12/2017	RP-78	RP-172675	0101	3	B	CR to 25.461: Introduction of Band 49 (3.5 GHz LAA in US)	15.1.0
12/2017	RP-78	RP-172711	0108	-	B	Introduction of Band 73	15.1.0
03/2018	RP-79	RP-180471	0109	-	B	Introduction of band 85	15.2.0
03/2018	RP-79	RP-180470	0110	-	B	Introduction of the TDD 3.3-3.4GHz band (Band 52)	15.2.0
12/2018	RP-82	RP-182450	0112	1	F	Replace Band table with reference to RAN4 specifications	15.3.0

History

Document history		
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