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Transmission and Multiplexing (TM); Sub STM1 digital radio-relay systems operating in the 13 GHz, 15 GHz and 18 GHz frequency bands

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Contents

Foreword

This draft European Telecommunication Standard (ETS) has been prepared by the Transmission and Multiplexing (TM) Technical Committee of the European Telecommunications Standard Institute (ETSI) and is now submitted for the Public Enquiry phase of the ETSI standards approval procedure.

This draft ETS contains the minimum technical requirements to ensure compatibility of products and conformance with radio regulations across ETSI member states. Radio terminals from different manufacturers are not required to interwork at radio frequency (i.e. no common air interface).

This draft ETS defines the requirements of radio terminal and radio relay equipment and associated interfaces. The requirements for multiplex, network management and antenna/feeder equipment may be addressed elsewhere.

Proposed transposition dates	
Date of latest announcement of this ETS (doa):	3 months after ETSI publication
Date of latest publication of new National Standard or endorsement of this ETS (dop/e):	6 months after doa
Date of withdrawal of any conflicting National Standard (dow):	6 months after doa

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1 Scope

This European Telecommunication Standard (ETS) specifies the minimum performance parameters for terrestrial fixed services radio communications equipment, as given below, for operation in the 13 GHz, 15 GHz and 18 GHz frequency bands (12,75 to 13,25 GHz, 14,50 to 15,35 GHz and 17,70 to 19,70 GHz).

This ETS covers equipment for the transmission of sub Synchronous Transport Module level-1 (STM-1) digital signals with a VC3 payload capacity. The standardisation of sub STM-1 radio systems for 13 GHz, 15 GHz and 18 GHz bands has been prepared to ensure the compatibility with the existing plesiochronous and the new synchronous systems concerning frequency plans and performance. The architecture and functional aspects should be in accordance with CCIR Recommendation 750 [9] and transmission characteristics and performance requirements in accordance with CCIR Recommendation 751 [10].

The application of these digital radio-relay systems is anticipated to be for point-to-point links in local, regional and national networks, mobile base station connections and customer access links. Consideration has to be given to special requirements of the local network, e.g. simple towers with less space for antenna, different network structures with high density nodes.

The systems considered shall operate in these networks having regard for existing hop lengths, which are considered to be normally up to about 15 km for the 18 GHz band, 20 km for the 15 GHz band and 30 km or more for the 13 GHz band.

Systems considered in this standard should be able to respect performance objectives, i.e. CCIR Recommendations 634 [5], 557 [3], 696 [7], 697 [8], ITU-T Recommendation G.821 [20], ITU-T Recommendation G.826 [21].

The parameters to be specified fall into two categories:

a) those that are required to provide compatibility between RF channels occupied by different sources of equipment on the same route connected either to:

   - separate antennas; or to
   - separate polarisation of the same antenna;

b) parameters defining the transmission quality of the proposed system.

The standardisation deals with Intermediate Frequency (IF), Radio Frequency (RF) and baseband characteristics relevant to sub STM-1 Synchronous Digital Hierarchy (SDH) transmission. Spurious emissions and Electro Magnetic Compatibility (EMC) requirements are also included in this ETS.

2 Normative references

This ETS incorporates by dated or updated reference, provisions from other publications. These normative references are cited at the appropriate place in the text and the publications are listed hereafter. For dated references, subsequent amendments to, or revisions of, any of these publications apply to this ETS only when incorporated in it by amendment or revision. For undated references, the latest edition of the publication referred to applies.

[1] CCIR Recommendation 403: "Intermediate-frequency characteristics for interconnection of analogue radio-relay systems".

[2] CCIR Recommendation 497: "Radio frequency channel arrangements for radio relay systems operating in the 13 GHz frequency band."

[3] CCIR Recommendation 557: "Availability objective for radio relay systems over a hypothetical reference circuit and hypothetical reference digital path".

[4] CCIR Recommendation 595: "Radio-frequency channel arrangements for radio-relay systems operating in the 18 GHz frequency band".

[5] CCIR Recommendation 634: "Error performance objectives for real digital radio-relay links forming part of a high grade circuit within an integrated services digital network".

[6] CCIR Recommendation 636: "Radio-frequency channel arrangements for radio-relay systems operating in the 15 GHz band".

[7] CCIR Recommendation 696: "Error performance and availability objectives for hypothetical reference digital sections utilizing digital radio-relay systems forming part or all of the medium grade portion of an ISDN connection"

[8] CCIR Recommendation 697: "Error performance and availability objectives for the local grade portion at each end of an ISDN connection utilizing digital radio-relay systems"

[9] CCIR Recommendation 750: "Architectures and functional aspects of radio-relay systems for SDH-based networks".

[10] CCIR Recommendation 751: "Transmission characteristics and performance requirements of radio-relay systems for SDH-based networks".

[11] CCITT Recommendation G.703: "Physical/electrical characteristics of hierarchical digital interfaces".

[12] ITU-T Recommendation G.707: "Synchronous digital hierarchy bit rates".

[13] ITU-T Recommendation G.708: "Network node interface for the synchronous digital hierarchy".

[14] ITU-T Recommendation G.709: "Synchronous multiplexing structure".

[15] ITU-T Recommendation G.773: "Protocol suites for Q interfaces for management of transmission systems".

[16] ITU-T Recommendation G.781: "Structure of Recommendations on multiplexing equipment for the synchronous digital hierarchy (SDH) (General aspects of digital transmission equipment; terminal equipment)".

[17] ITU-T Recommendation G.782: "Types and general characteristics of synchronous digital hierarchy (SDH) (General aspects of digital transmission equipment; terminal equipment)".

[18] ITU-T Recommendation G.783: "Characteristics of synchronous digital hierarchy (SDH) equipment functional blocks (General aspects of digital transmission equipment; terminal equipment)".

[19] ITU-T Recommendation G.784: "Synchronous digital hierarchy (SDH) management".

[20] ITU-T Recommendation G.821: "Error performance of an international digital connection forming part of an integrated services digital network".

[21] ITU-T Recommendation G.826: "Error performance parameters and objectives for international, constant bit-rate digital paths at or above the primary rate".

[22] ITU-T Recommendation G.957: "Optical interfaces for equipments and systems relating to the synchronous digital hierarchy".

[23] ETS 300 019: "Equipment Engineering (EE); Environmental conditions and environmental tests for telecommunications equipment".

[24] prETS 300 385 (1994): "Radio Equipment and Systems (RES); EMC standard for digital fixed radio links and ancillary equipment with data rates at around 2 Mbit/s and above".

[25] prETS 300 132: "Equipment Engineering (EE); Power supply interface at the input to telecommunications equipment".

[26] ETS 300 174 (1992): "Network Aspects (NA); Digital coding of component television signals for contribution quality applications in the range 34-45 Mbit/s".

[27] CENELEC EN 60950 (1992): "Safety of information technology equipment, including electrical business equipment".

[28] IEC 835 Part 2 (1993): "Measurements on terrestrial radio relay systems - Section 4: Transmitter/Receiver including modulator/demodulator."

[29] IEC 835 Part 2 (1993): "Measurements on terrestrial radio relay systems - Section 8: Adaptive equalizer."

3 Abbreviations and symbols

3.1 Abbreviations

For the purposes of this ETS the following abbreviations apply.

ATPC	Automatic Transmit Power Control
BB	BaseBand
BER	Bit Error Ratio
CW	Carrier Wave
IF	Intermediate Frequency
IF/RF	Intermediate Frequency/Radio Frequency
L.O.	Local Oscillator
NNI	Network Node Interface
PRBS	Pseudo-Random Binary Sequence
QAM	Quadrature Amplitude Modulation
RF	Radio Frequency
RSL	Receive Signal Level
SDH	Synchronous Digital Hierarchy
SOH	Section OverHead
SRL	Spectrum Reference Level
STM-1	Synchronous Transport Module
TM	Transmission and Multiplex
TMN	Telecommunications Management Network
TX	Transmitter
RX	Receiver
VSWR	Voltage Standing Wave Ratio
XPD	Cross-Polar Discrimination

3.2 Symbols

For the purposes of this ETS the following symbols apply.

dB	decibel
dBm	decibel relative to 1 mW
GHz	GigaHertz
km	kilometre
Mbit/s	Mega-bit per second
MHz	Megahertz
ns	nanosecond
ppm	parts per million

4 General characteristics

4.1 Frequency bands and channel arrangements

The frequency bands covered by this ETS are the 12,75 to 13,25 GHz, 14,5 to 15,35 GHz and the 17,7 to 19,7 GHz fixed service bands.

The channelling arrangement proposed for the 13 GHz frequency band is a co-channel plan with 28 MHz adjacent channel spacing according to CCIR Recommendation 497 [2].

The channelling arrangements for the 15 GHz frequency band is a plan with 14 MHz adjacent channel spacing in an alternated or interleaved arrangement. The separation of the innermost transmit and receive channel centre frequencies will be equal to N x 28 MHz (N = integer) and greater than 84 MHz (see CCIR Recommendation 636 [6]).

The channelling arrangements for the 18 GHz frequency band is a plan with 27.5 MHz adjacent channel co-polar spacing according to the CCIR Recommendation 595 [4].

4.2 Types of installation

Both indoor and partially outdoor installations are considered.

4.2.1 Environmental conditions

The equipment shall be required to meet either the environmental conditions set out in ETS 300 019, Part 1-3 (Classification of environmental conditions: Stationary use at weatherprotected locations) and Part 1-4 (Classification of environmental conditions: Stationary use at non-weatherprotected locations) [23], which define weatherprotected and non-weatherprotected locations, classes and test severities, or one of the conditions listed in subclause 4.2.1.2.

4.2.1.1 Equipment within weather protected locations

The most important climatic parameters for the five classes defined are given in table 1.

Table 1

Climatic class	3.1	3.2	3.3	3.4	3.5
High air temperature (ºC)	+40	+45	+55	+70	+40
Low air temperature (ºC)	+5	-5	-25	-40	-40
High relative humidity (%)	85	95	100	100	100
Low relative humidity (%)	5	5	10	10	10
Air movement (m/s)	5	5	5	5	5
Solar radiation (W/m²)	700	700	1 120	1 120	-

For equipment designed for stationary use in weatherprotected locations (indoor installation), only classes 3.1 or 3.2 shall apply (see ETS 300 019, Part 1-3 [23]).

4.2.1.2 Equipment for non-weather protected locations

This type of equipment is generally described as "outdoor" equipment. Class 4.1 or extended class 4.1E parameters should be applied. Class 4.1 applies to many ETSI countries and class 4.1E applies to them all. The most important climatic parameters values are given in table 2.

Table 2

Climatic class	4.1	4.1E
High air temperature (ºC)	+40	+45
Low air temperature (ºC)	-33	-45
High relative humidity (%)	100	100
Low relative humidity (%)	15	8
Air movement (m/s)	+50	+50
Solar radiation (W/m²)	1 120	1 120

It should be noted that radio cabinets supplied with a system will be "weather protected" including full protection against precipitation and wind. Climatic classes 3.3, 3.4 and 3.5 (subclause 4.2.1.1) may, therefore, also be applicable to equipment in outdoor locations.

The operation of the outdoor equipment in accordance with Class 4.1E shall not be mandatory for all ETSI members.

Some ETSI members may also decide to apply one of the non-standard specifications given in table 3:

Table 3

High air temperature (ºC)	+40	+50
Low air temperature (ºC)	-20	-30
High relative humidity (%)	90	90
Low relative humidity (%)	5	5
Air movement (m/s)	+50	+50
Solar radiation (W/m²)	1120	1120

4.3 Electromagnetic compatibility conditions

Equipment shall operate under the conditions specified in relevant standard produced by ETSI (ETS 300 385 [24]).

4.4 Mechanical requirements

The mechanical dimensions for indoor installations shall be in agreement with ETS 300 119 [23].

For outdoor installation each outdoor unit shall be weather proof or weather protected.

The outdoor unit shall be separable from the antenna.

The separate units of the equipment shall be so designed that they can be easily handled by one man. The weight of a single unit shall not exceed 15 kg.

4.5 Power supply

The equipment shall operate from any of the supply voltages within the ranges specified in ETS 300 132 [13]. For DC systems, the positive pole of the battery will be earthed at the source.

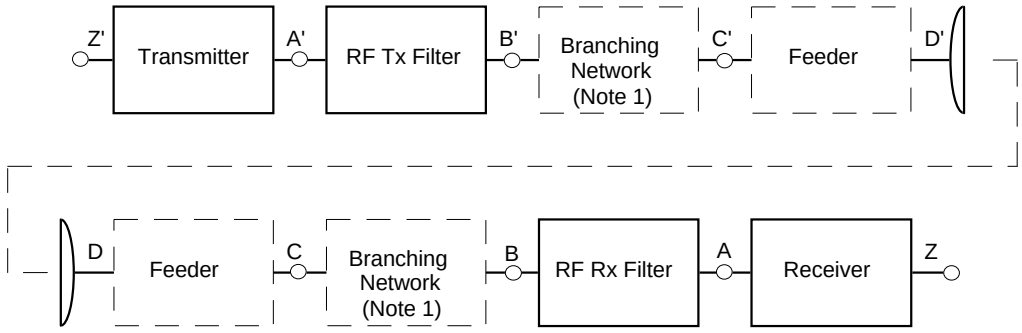
NOTE: Some countries may require to use a primary supply of 24 V DC or 110 V AC, which is not covered by ETS 300 132 [25].

4.6 Telecommunications Management Network (TMN) interface

A TMN interface required by a user shall follow ETSI TM2 and TM3 Standards and be in accordance with ITU-T Recommendations G.784 [19], G.773 [15] and CCIR Recommendation 750 [9].

4.7 Block diagram

The system block diagram is shown in figure 1. The intersection points are for reference only and not necessarily for measurement purposes nor do they indicate a specific design structure.



NOTE 1: Points B and C, B' and C' may coincide.

NOTE 2: The branching network does not include the RF filtering. In outdoor equipment, the branching network may be implemented by a common TX-RX duplexer.

Figure 1: Block diagram

4.8 Safety considerations

Maximum radiated power density under normal operating conditions shall be in accordance with current World Health Organisation figures.

Equipment design quality objectives shall be in accordance with EN 60950 [27] safety requirements.

4.9 Lightning protection

Lightning discharge protection shall be applied at the relevant points of outdoor equipment to safeguard against damage to equipment. Detailed requirements for lightning protection are under study.

5 Baseband characteristics

5.1 Synchronous Digital Hierarchy (SDH)

The SDH baseband interface shall be a network node interface (NNI) at the STM-1 level in accordance with CCITT Recommendation G.703 [11], ITU-T Recommendation G.707 [12], G.708 [13], G.709 [14], G.781 [16], G.782 [17], G.783 [18], G.784 [19] and G.957 [22] (with possible simplifications under study in ETSI TM3 and TM4) and CCIR Recommendation 750 [9].

Two versions of the STM-1 interface are possible:

- a CMI electrical interface (CCITT Recommendation G.703 [11] and ITU-T Recommendation G.708 [13]);

- optical interface (ITU-T Recommendation G.957 [22]).

The use of reserved bytes contained in the Section Overhead (SOH), and their termination shall be in accordance with CCIR Recommendation 750 [9].

5.2 Plesiochronous Digital Hierarchy (PDH)

The following optional baseband interfaces are required at the PDH level in accordance with CCITT Recommendation G.703 [9]:

a) 2 Mbit/s;
b) 34 Mbit/s.

For digital video applications (ETS 300 174 [26] covering VC2-5c concatenation) an interface at 45 Mbit/s in accordance with ITU-T Recommendation G.703 [9] (clause 5) may be required.

6 Transmitter characteristics

6.1 Output power

The value of output power (nominal and tolerance), referred to point B' shall not exceed +30 dBm.

Administrations and operators may require specific output power ranges.

For indoor installation, the tolerance value around the nominal value is $\pm$ 1 dB

For the outdoor installation, the tolerance value is +2 / -1 dB.

A means to vary the transmitter output power (for frequency co-ordination purposes) may be required.

In the case of STM-1 interface, the measurement of output power shall be carried out using an STM-1 test signal, to be defined.

In the case of PDH signals, the measurement of output power shall be carried out with the carrier modulated by a pseudo-random bit sequence of length 2^{23} - 1 for the 34 Mbit/s interface and a length of 2^{15} -1 for the 2 Mbit/s interface.

6.2 Automatic Transmit Power Control (ATPC)

ATPC is an optional feature; information on ATPC is given in an informative annex (see subclause 9.2).

6.3 RF spectrum masks

The spectrum masks is shown in figure 2. The spectrum mask shall be verified directly by measurement (referenced to point B').

The mask shall be measured with a modulating baseband signal. In the case of a PDH interface, a PRBS 2^{23} - 1 for 34 Mbit/s interface and a length of 2^{15} -1 for 2 Mbit/s interface, shall be used. In the case of a SDH interface, a STM-1 test signal shall be defined.

The peak of the transmitter spectrum at the channel centre frequency, excluding any residual carrier, is set to the 0 dB Spectrum Reference Level (SRL). The mask is measured with an transmit output power equal to the nominal value and it shall be met in all ATPC conditions.

The mask does not include frequency tolerance.

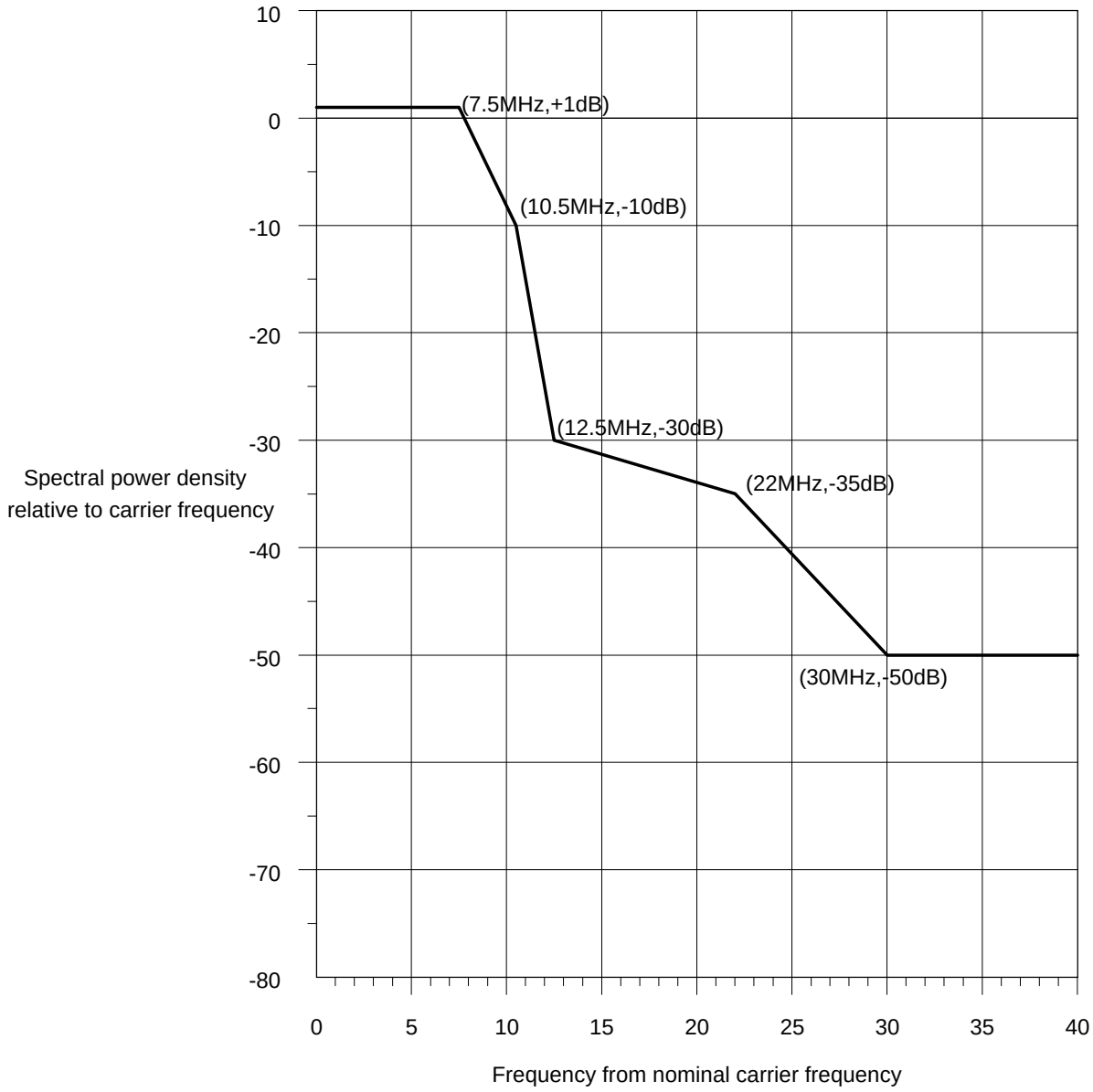


Figure 2: Spectral power density for 13 GHz, 15 GHz and 18GHz

The spectrum analyser settings for measuring the RF spectrum mask detailed in figure 2 are shown in table 4 below:

Table 4: Spectrum analyser settings

Parameter	Setting
IF Bandwidth	100 kHz
Total sweep width	200 MHz
Total scan time	Automatic
Video filter bandwidth	0,3 kHz

6.4 Spectral lines at the symbol rate

The RF spectrum mask, shall not apply to the spectral lines at the symbol rate.

The power level of these spectral lines at a distance from the channel centre frequency equal to the symbol rate shall be less than -20 dBm (reference point B').

6.5 Spurious emissions

Spurious emissions are defined as emissions at frequencies which are outside the necessary bandwidth and the level of which may be reduced without affecting the corresponding transmission of information. Spurious emissions include harmonic emissions, parasitic emissions, intermodulation products and frequency conversion products, but exclude emissions which result from the modulation process. The necessary bandwidth is defined as twice the transmitted symbol rate.

It is necessary to define spurious emissions from transmitters for two reasons:

a) to limit interference into systems operating wholly externally to the Sub-STM-1 system channel plan;

b) to limit local interference within the Sub-STM-1 system where transmitters and receivers are directly connected via the filter and branching systems.

This leads to two sets of spurious emission limits where the specific limits given for "internal" interference are required to be no greater than the "external" level limits.

6.5.1 Spurious emissions - external

The frequency range in which the spurious emission specifications apply is 30 MHz to 40 GHz. The limit values measured at point C' are:

- 30 MHz to 21,2 GHz ≤ -60 dBm;

- 21,2 GHz to 40 GHz ≤ -30 dBm.

6.5.2 Spurious emissions - internal

The levels of the spurious emissions from the transmitter, referenced to point B' are specified below in table 5.

Table 5: Spurious emission limits - internal

Spurious emission frequency relative to channel assigned frequency.	Specification limit	Controlling factor
The level of all spurious signals (including L.O., ± IF, ± 2 x IF)	≤ -90 dBm	If spurious signal frequency falls within receiver half band.
The level of all spurious signals (including L.O., ± IF, ± 2 x IF)	≤ -45 dBm	If spurious signal frequency falls within transmitter half band.
The level of all spurious signals (including L.O., ± IF, ± 2 x IF)	≤ -70 dBm	If spurious signal frequency falls within receiver half band. For digital systems without branching networks (i.e. with duplexer) or on different polarization

6.6 Radio frequency tolerance

Maximum radio frequency tolerance shall not exceed ± 30 ppm. This limit includes both long term ageing and short term effects (e.g. environmental factors).

7 Receiver characteristics

7.1 Local oscillator frequency tolerance

Maximum local oscillator frequency tolerance shall not exceed ± 30 ppm. This limit includes both long term ageing and short term effects (e.g. environmental factors).

7.2 Receiver image rejection

The receiver image rejection shall be ≥ 90 dB.

7.3 Spurious emissions

Spurious emissions are defined as emissions at frequencies which are outside the necessary bandwidth and the level of which may be reduced without affecting the corresponding transmission of information. Spurious emissions include harmonic emissions, parasitic emissions, intermodulation products and frequency conversion products, but exclude emissions which result from the modulation process. The necessary bandwidth is defined as twice the transmitted symbol rate.

It is necessary to define spurious emissions from receivers for two reasons:

a) to limit interference into systems operating wholly externally to the Sub-STM-1 system channel plan;
b) to limit local interference within the Sub-STM-1 system where transmitters and receivers are directly connected via the filter and branching systems.

This leads to two sets of spurious emission limits where the specific limits given for 'internal' interference are required to be no greater than the "external" level limits.

7.3.1 Spurious emissions - external

The frequency range in which the spurious emission specifications apply is 30 MHz to 40 GHz. The limit values measured at point C are:

30 MHz to 21,2 GHz ≤ -60 dBm;

21,2 GHz to 40 GHz ≤ -30 dBm.

7.3.2 Spurious emissions - internal

For spurious emissions at the local oscillator frequency provisional limits of ≤ -110 dBm shall apply (referenced to point B).

7.4 Input level range

The input level range for a Bit Error Ratio (BER) of ≤ 10^{-3} shall extend from the upper limit of -17 dBm or more to the limit specified for BER=10^{-3} in subclause 8.2

The input level range for a BER ≤ 10^{-10} shall extend from the upper limit of -21 dBm or more to the limit specified for BER = 10^{-10} in subclause 8.2

These limits apply without interference and are referenced to point B of figure 1.

8 System characteristics

8.1 Equipment background BER

Equipment background BER is measured under simulated operating conditions over an artificial hop without interference with a signal level at point B which is between 15 dB and 40 dB above the lower limit for receiver input level which gives BER = 10^{-3}.

In a measurement period of 24 hours the number of bit errors shall be less than 10.

8.2 BER as a function of receiver input level

The reference point for the definition of the BER curve as a function of receiver input level is point B.

Receiver BER thresholds (dBm) referred to point B for BER = 10-3/10-6/10-10 shall be equal to or lower than those stated in the following table 6:

Table 6: Receiver sensitivity

BER	Receiver sensitivity 13 GHz	Receiver sensitivity 15 GHz	Receiver sensitivity 18 GHz
10^{-3}	- 77 dBm	- 76 dBm	- 76 dBm
10^{-6}	- 74 dBm	- 73 dBm	- 73 dBm
10^{-10}	- 71 dBm	- 70 dBm	- 70 dBm

8.3 Interference sensitivity

All receive signal levels and Signal Interference (S/I) measurements shall be referred to point B of the block diagram in figure 1.

8.3.1 Co-channel interference sensitivity

The limits of the co-channel interference sensitivity shall be as given in figure 3.

8.3.1.1 Method of testing co-channel interference sensitivity

For a receiver operating at 10^{-3} and 10^{-6} BER threshold given in table 6 in absence of interference signal, the introduction of a single like interferer at the co-channel frequency at a level given in table 7 shall not result in a reduction of the threshold level greater than the limits reported in table 7.

The limits of co-channel interference shall be as given in table 7, giving maximum S/I values for 1 dB and 3 dB degradation of the 10^{-6} and 10^{-3} BER limits as given in figure 3.

Table 7: Co-channel interference sensitivity

BER	10^{-3}		10^{-6}	
Threshold degradation	1 dB	3 dB	1 dB	3 dB
Channel spacing (MHz)	S/I	S/I	S/I	S/I
0	26 dB	22 dB	30 dB	26,5 dB

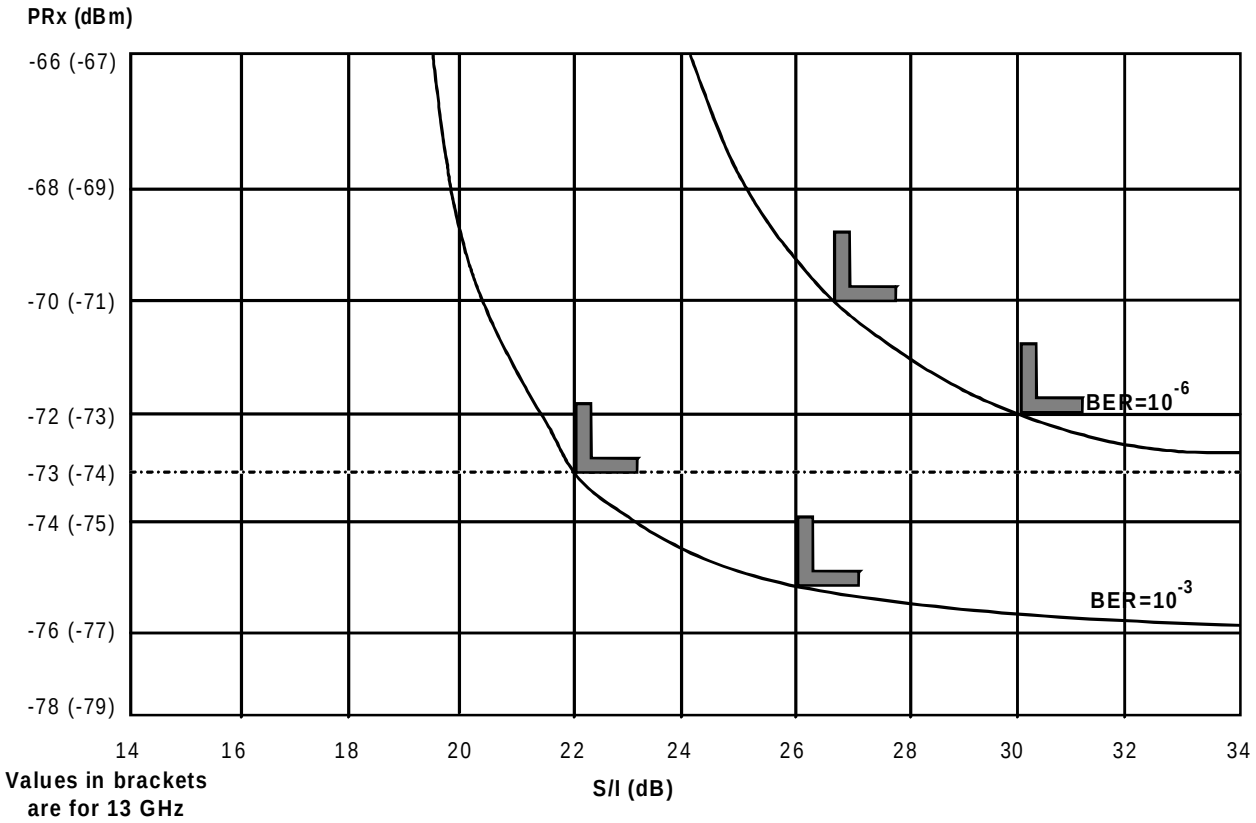


Figure 3: Co-channel digital interference mask for sub STM-1, 13 GHz, 15 GHz and 18 GHz

8.3.2 Adjacent channel sensitivity

The limit of the adjacent channel (at 28 or 27.5 MHz channel spacing respectively in the 13 or 18 GHz frequency band and at 14 MHz channel spacing in the 15 GHz frequency band) sensitivity shall be as given in figures 4 and 5 respectively.

8.3.2.1 Method of testing adjacent channel (at 28/27,5 MHz channel spacing respectively in the 13 or 18 GHz frequency band) interference sensitivity

For a receiver operating at 10^{-3} and 10^{-6} BER threshold given in table 6 in absence of interference signal, the introduction of a single like interferer at the adjacent-channel frequency at a level given in table 8 shall not result in a reduction of the threshold level greater than the limits reported in table 8.

The limits of adjacent channel interference shall be as given in table 8, giving maximum S/I values for 1 dB and 3 dB degradation of the 10^{-6} and 10^{-3} BER limits as given in figure 4.

Table 8: Adjacent-channel Interference Sensitivity

BER	10^{-3}		10^{-6}	
Threshold degradation	1 dB	3 dB	1 dB	3 dB
Channel spacing (MHz)	S/I	S/I	S/I	S/I
28/27,5	-14 dB	-18 dB	-10 dB	-13,5 dB

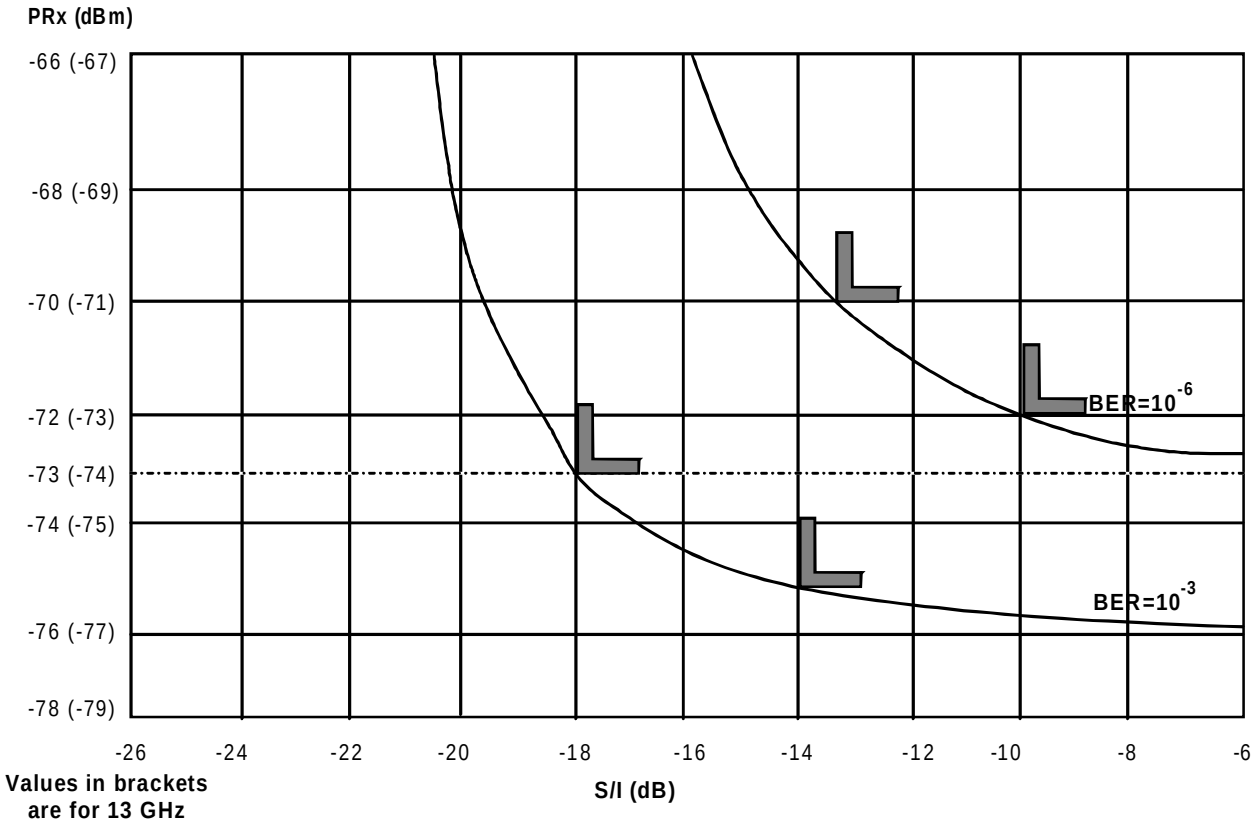


Figure 4: Adjacent channel digital iterference mask for sub STM 13 GHz to 18 GHz (28,0 to 27,5 MHz channel spacing)

8.3.2.2 Method of testing adjacent channel (at 14 MHz channel spacing in the 15 GHz frequency band) interference sensitivity

For a receiver operating at 10^{-3} and 10^{-6} BER threshold given in table 6 in absence of interference signal, the introduction of a single like interferer at the adjacent-channel frequency at a level given in table 9 shall not result in a reduction of the threshold level greater than the limits reported in table 9.

The limits of adjacent channel interference shall be as given in table 9 , giving maximum S/I values for 1 dB and 3 dB degradation of the 10^{-6} and 10^{-3} BER limits as given in figure 5.

Table 9: Adjacent-channel interference sensitivity

BER	10^{-3}		10^{-6}	
Threshold degradation	1 dB	3 dB	1 dB	3 dB
Channel spacing (MHz)	S/I	S/I	S/I	S/I
14	14 dB	10 dB	18 dB	14,5 dB

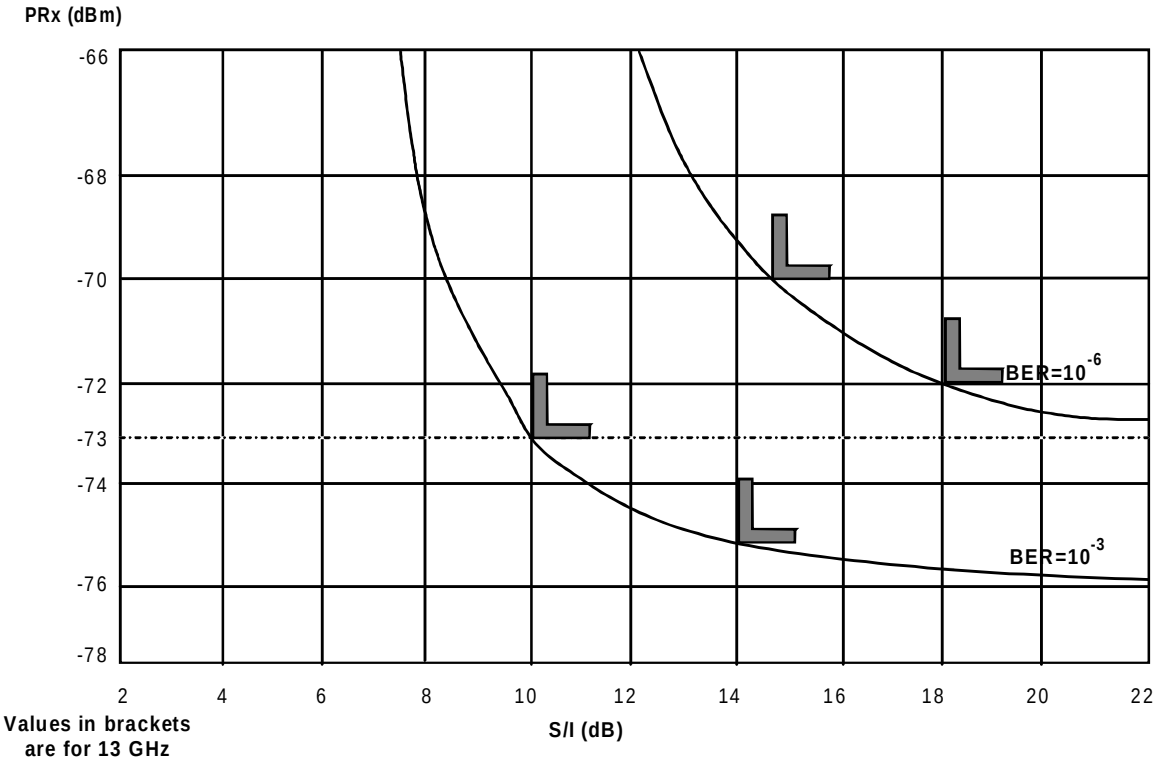


Figure 5: Adjacent channel digital iterference mask for sub STM-1 15 GHz (14 MHz channel spacing)

8.3.3 Carrier Wave (CW) spurious interference

For a receiver operating at the 10^{-6} BER threshold given in table 6, the introduction of a CW interferer at a level of +30 dB, with respect to the "Wanted" signal at any frequency in the range 1 GHz to 40 GHz, excluding frequencies either side of the wanted frequency by up to twice the co-polar channel spacing, shall not result in a BER greater than 10^{-5}.

This test is designed to identify specific frequencies at which the receiver may have a spurious response: e.g. image frequency, harmonics of the receive filter etc. The test is not intended to imply a relaxed specification at all out-of-band frequencies.

8.4 Distortion sensitivity

Rainfall is the main propagation factor in the 13 GHz, 15 GHz and 18 GHz bands limiting performance. Powerful equalisers to compensate propagation distortion are not considered essential in some applications. The relevant parameters for distortion sensitivity signatures are given below.

For two path propagation with a delay of 6,3 nS and a BER of 10^{-3} the width of the signature shall not exceed 11 MHz relative to the assigned channel centre frequency, the depth shall not be less than 22 dB.

For two path propagation with a delay of 6,3 nS and a BER of 10^{-6} the width of the signature shall not exceed 13 MHz relative to the assigned channel centre frequency, the depth shall not be less than 20 dB.

These limits are both valid for minimum and non-minimum phase cases. They shall also be verified by the loss-of-synchronisation and re-acquisition of synchronisation signatures (see IEC 835 Part 2 Sect. 4 [28] and 8 [29]). In the 18 GHz band these limits are not mandatory.

Annex A (informative):

A.1 Branching/feeder/antenna requirement

The parameters and values given below are used as a basis for the system performance characteristics given in this ETS and are provided for guidance.

A.1.1 Antenna/Equipment/Feeder flanges

When wave guides are required, standard IEC flanges should be used for the frequency bands in question.

A.1.2 Cross-Polar Discrimination (XPD)

The antenna XPD value within the 1 dB beamwidth should not be less than 30 dB.

A.1.3 Intermodulation products

Each intermodulation product caused by different transmitters linked at point C' to a measurement test set with a return loss higher than 23 dB is assumed to be less than -110 dBm referenced to point B for transmitter output power levels up to 20 dBm per transmitter.

A.1.4 Interport isolation

Not less than 40 dB.

A.1.5 Return loss

Minimum return loss measured in the direction toward the antenna circulator at point C or C' should be 26 dB; this limit applies to 12,75 to 13,25 GHz, 14,5 to 15,35 GHz and 17,7 to 19,7 GHz depending on the utilized. frequency band.

For partially outdoor equipment using a duplexer, the minimum return loss at point C' or C in the direction toward the duplexer should be 20 dB; this limit applies in a frequency band equal to 10 MHz referred to the nominal Tx and Rx channels centre frequencies.

The minimum return loss of the feeder/antenna system connected to indoor systems should be considered not less than 26 dB. This limit applies to 12,75 to 13,25 GHz, 14,5 to 15,35 GHz and 17,7 to 19,7 GHz depending on the utilized frequency band.

For partially outdoor systems the antenna return loss should be considered better than 20 dB. The measurement shall be referred to point C/C' towards the antenna.

A.2 Automatic Transmit Power Control (ATPC)

ATPC may be useful in some circumstances, e.g.:

- to reduce digital to digital distant interference between hops which re-use the same frequency;

- to improve compatibility with digital systems at nodal stations;

- to increase system gain as a countermeasure against rainfall attenuation.

ATPC is an optional feature which is aimed at driving the Tx Power Amplifier output level from a proper minimum calculated to facilitate the radio network planning. Additionally, this figure is used in case of normal propagation up to a maximum value which fulfils all the specifications defined in this ETS.

ATPC may also be used to increase the output power above the nominal level up to the maximum level specified by administrations and operators during fading conditions. This can be useful because in frequency ranges above 13 GHz the main limiting factors are given by non selective fading events.

The ATPC range is defined as the power interval from the maximum (including tolerances) output power level to the lowest transmitter output power level (at point B') with ATPC.

The ATPC range should not exceed 15 dB. In any case the lowest transmitter output power level should not be less than +5 dBm, this may result in a reduced ATPC range.

A.3 Cross-Polar Interference Canceller (XPIC)

In the case of a system using CCDP, hop lengths above which the use of XPIC is required, should be examined for the different European climatic zones.

History

Document history	
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