EUROPEAN TELECOMMUNICATION STANDARD

ETS 300 198

April 1994

Source: ETSI TC-TM

Reference: DE/TM-04003

ICS: 33.080

Key words: Transmission, radio, video

Transmission and Multiplexing (TM); Parameters for radio relay systems for the transmission of digital signals and analogue video signals operating at 23 GHz

ETSI

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Contents

Foreword

This European Telecommunication Standard (ETS) has been produced by the Transmission and Multiplexing (TM) Technical Committee of the European Telecommunications Standards Institute (ETSI).

This ETS specifies the minimum performance parameters for radio equipment operating in the frequency range 21,2 GHz to 23,6 GHz as specified in Clause 1.

Annex A provides details of documents which are informative references to this ETS.

Other standards cover radio communications equipment not listed in the scope.

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1 Scope

This European Telecommunication Standard (ETS) covers the minimum performance parameters for terrestrial fixed services radio communications equipment as given below, in the frequency band 21,2 GHz to 23,6 GHz.

This ETS specifies the performance criteria for the different equipment groups.

The equipment groups are:

- digital signals;

- analogue video signals.

2 Normative references

This ETS incorporates by dated and undated reference, provisions from other publications. These normative references are cited at the appropriate places 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 637 (1991): "Radio-frequency channel arrangements for analogue and digital radio-relay systems in the 21,1 to 23,6 GHz frequency band".

[2] ETS 300 019: "Equipment Engineering (EE); Environmental conditions and environmental tests for telecommunications equipment Part 1-1: Classification of environmental conditions Storage".

[3] prETS 300 132-1: "Equipment Engineering (EE); Power supply interface at the input to telecommunications equipments Part 1: Interfaces operated by alternating current "AC"". (DE/EE-02001.1)

[4] prETS 300 132-2: "Equipment Engineering (EE); Power supply interface at the input to telecommunications equipments Part 2: Interfaces operated by direct current "DC"". (DE/EE-02001.2)

[5] CCITT Recommendation G.703 (1991): "Physical/electrical characteristics of hierarchical digital interfaces".

[6] CCITT Recommendation G.707 (1991): "Synchronous digital hierarchy bit rates".

[7] CCITT Recommendation G.708 (1991): "Network node interface for the synchronous digital hierarchy".

[8] CCITT Recommendation G.709 (1991): "Synchronous multiplexing structure".

[9] CCITT Recommendation G.781 (1990): "Structure of Recommendations on multiplexing equipment for synchronous digital hierarchy (SDH)".

[10] CCITT Recommendation G.782 (1990): "Types and general characteristics of synchronous digital hierarchy (SDH) multiplexing equipment".

[11] CCITT Recommendation G.783 (1990): "Characteristics of synchronous digital hierarchy (SDH) multiplexing equipment functional blocks".

[12] CCITT Recommendation G.784 (1990): "Synchronous digital hierarchy (SDH) management".

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

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

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

3 Abbreviations

For the purposes of this ETS, the following abbreviations apply.

AC	Alternating Current
BER	Bit Error Ratio
C/I	Carrier/Interference
DC	Direct Current
RF	Radio Frequency
RSL	Receive Signal Level
SDH	Synchronous Digital Hierarchy
TMN	Telecommunications Management Network

4 General characteristics (digital and analogue)

4.1 Frequency bands and channel arrangements

4.1.1 Frequency band

a) Frequency band shall be 21,2 GHz to 23,6 GHz.

b) Channel plan: the channel plan shall be in accordance with CCIR Recommendation 637 [1] with a basic raster of 3,5 MHz.

4.1.2 Co-polar channel spacing for systems operating on different antennas

For systems operating on the same antenna, see subclause 4.3, a).

Table 1: Digital systems

Minimum bit rate (Mbit/s)	2	2	2 x 2	8	8	34	34	140/155
Channel spacing (MHz)	3,5	7	3,5	7	14	28	56	112

NOTE: 34 Mbit/s bit rate in 56 MHz channel spacing is used for transportable, temporary and emergency links.

Table 2: Analogue systems

Video baseband (MHz)	<3,5	<6	<10	<14
Channel spacing (MHz)	28	56	56	56

4.1.3 Transmit/receive centre gap

The centre gap shall be taken as a multiple of the basic raster distance of 3,5 MHz, and shall not be less than 56 MHz.

4.1.4 Transmit/receive duplex frequency separation

The transmitter receiver duplex frequency separation shall not be less than 252 MHz and should be in accordance with local administrations frequency planning rules.

4.2 Performance prediction and objectives (for reference only)

Systems considered in this ETS should be able to meet CCIR medium grade performance objectives given in CCIR Recommendation 696 [14] Class 4 and local grade performance objectives of CCIR Recommendation 697 [15].

The dominant fading mechanism is rain attenuation; performance prediction methods should be based on the latest issue of the following CCIR Recommendations:

Recommendation 453: "The formula for the radio refractive index";

Recommendation 530: "Propogation data and prediction methods required for the design of terrestrial line-of-sight systems";

Recommendation 837: "Characteristics of precipitation for propogation modelling";

Recommendation 838: "Specific attenuation model for rain for use in prediction methods";

Recommendation 840: "Attenuation due to clouds and fog".

4.3 Compatibility requirements between systems

a) It is envisaged that systems will normally be required to operate on common hops using either separate antennas or on separate polarisation's on the same antenna.

b) There should be no requirement to operate transmitting equipment from one manufacturer with receiving equipment from another, or to multiplex different manufacturers equipment on the same polarisation of the same antenna.

4.4 Types of installation

The equipment may comprise both radio relay units in weather protected locations and outdoor units with the Radio Frequency (RF) assemblies likely to be located close to the antenna in order to minimise feeder losses.

4.4.1 Environmental conditions

The equipment shall be required to meet either the environmental conditions set out in ETS 300 019 [2], which defines weather protected and non-weather protected locations, classes and test severities, or one of the conditions listed in subclause 4.4.1.2.

4.4.1.1 Equipment within weather protected locations

The most important climatic parameters for the five classes are given in table 3.

Table 3

Climatic class	3.1	3.2	3.3	3.4	3.5
High air temperature (°C)	+ 40	+ 45	+ 55	+ 70	+ 40
Low air temperature (°C)	+ 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/m^2)	700	700	1 120	1 120	-

Climatic classes 3.1 and 3.2 apply to equipment designed for temperature controlled locations or partially temperature controlled locations respectively. This type of equipment is generally described as "indoor" equipment.

The use of radio-relay equipment covering climatic classes 3.3 (non-temperature controlled locations), 3.4 (sites with heat trap) and 3.5 (sheltered locations) is not mandatory.

4.4.1.2 Equipment for non-weather protected locations

This type of equipment is generally described as "outdoor" equipment. Class 4.1 or extended class 4.1 E parameters should be applied. Class 4.1 applies to many of the ETSI countries and class 4.1 E applies to them all. The most important parameter values are given in table 4.

Table 4

Climatic class	4.1	4.1E
High air temperature (°C)	+ 40	+ 45
Low air temperature (°C)	- 33	- 45
High relative humidity (%)	100	100
Low relative humidity (%)	15	8
Air movement (m/s)	50	50
Solar radiation (W/m^2)	1 120	1 120

It should be noted that radio cabinets supplied with a system will give their own "weather protection" including full protection against precipitation and wind. Climatic classes 3.3, 3.4 and 3.5 (subclause 4.4.1.1) may, therefore, also be applicable for "outdoor" locations.

Some ETSI members may also decide to apply one of the non-standard specifications given in table 5.

Table 5

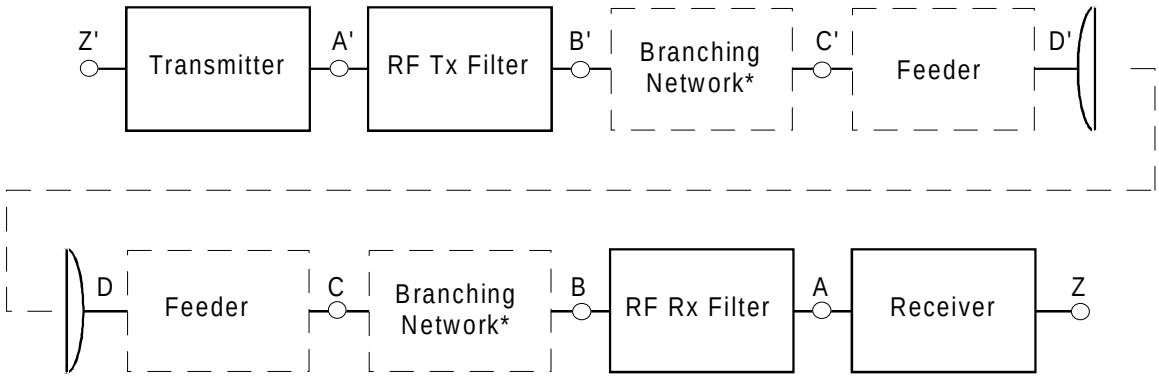
High air temperature (°C)	+ 40	+ 50
Low air temperature (°C)	- 20	- 30
High relative humidity (%)	90	90
Low relative humidity (%)	5	5
Air movement (m/s)	50	50
Solar radiation (W/m^2)	1 120	1 120

4.4.2 Electromagnetic compatibility

Under study.

4.5 System diagram

The system diagram is shown in figure 1, as follows:



NOTE 1: For the purpose of defining the measurement points, the branching network does not include a hybrid.

NOTE 2: Points B and C, B' and C' may coincide.

Figure 1: System diagram

4.6 General characteristics

The following characteristics are desirable:

- tuning facilities;
- flexibility for repeated installation;
- wayside traffic facilities;
- transmitter identification;
- maintenance facilities;
- performance monitoring facilities.

4.7 Telecommunications Management Network (TMN) interface

A TMN interface required by a user should be in accordance with CCITT Recommendations G.784 [12] and G.773.

4.8 Branching / feeder / antenna requirements

a) Three antenna radiation pattern envelopes are given in figures 2 to 4. Any of these may be chosen according to local licensing and interference requirements.

b) Antenna flange/equipment feeder flange. When flanges are required, IEC type UBR/PBR 220 should be used.

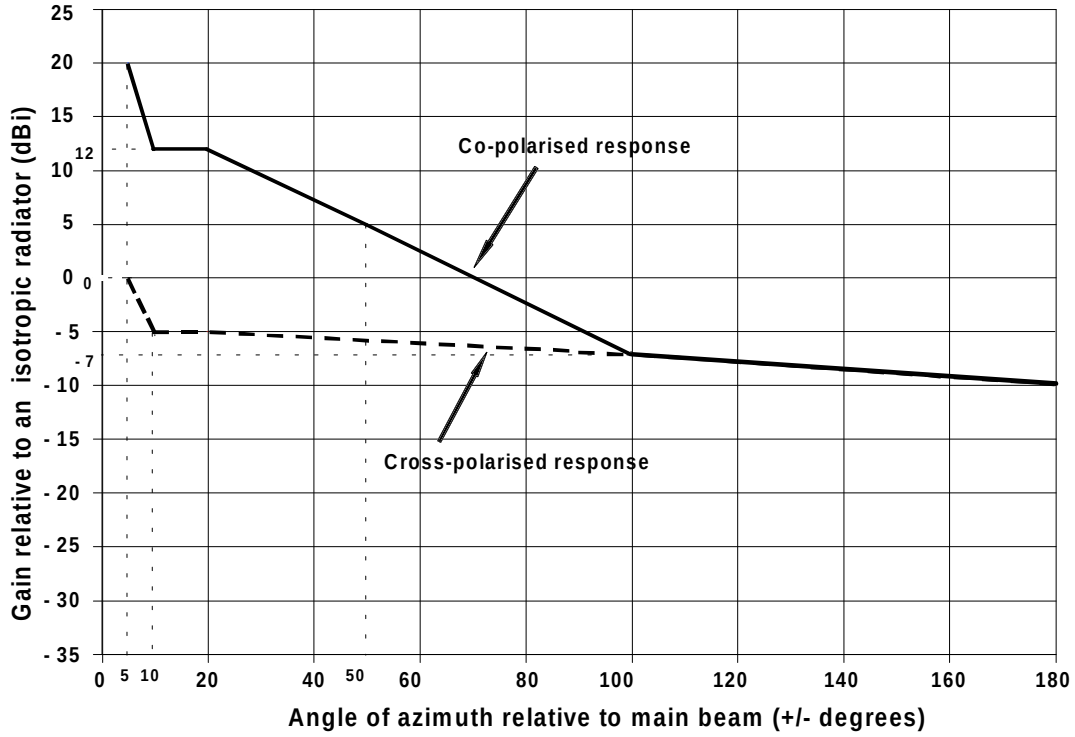


Figure 2: Antenna radiation pattern for 23 GHz systems (under test conditions)

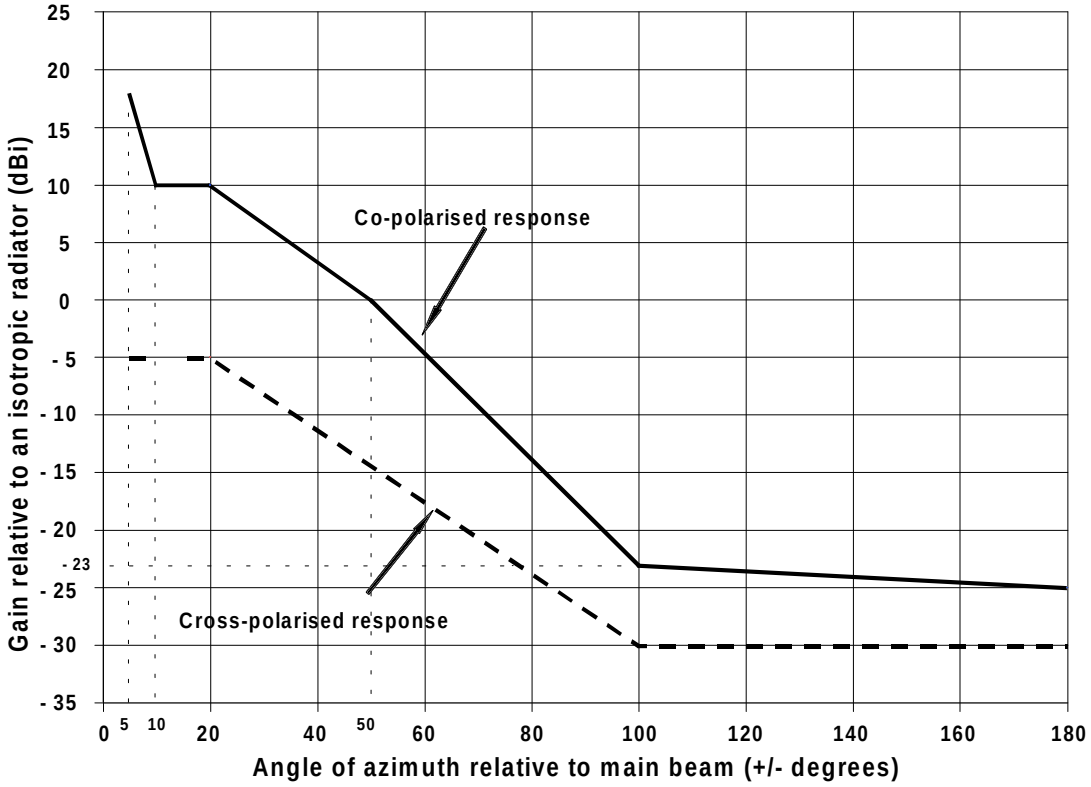


Figure 3: Antenna radiation pattern for 23 GHz systems (under test conditions)

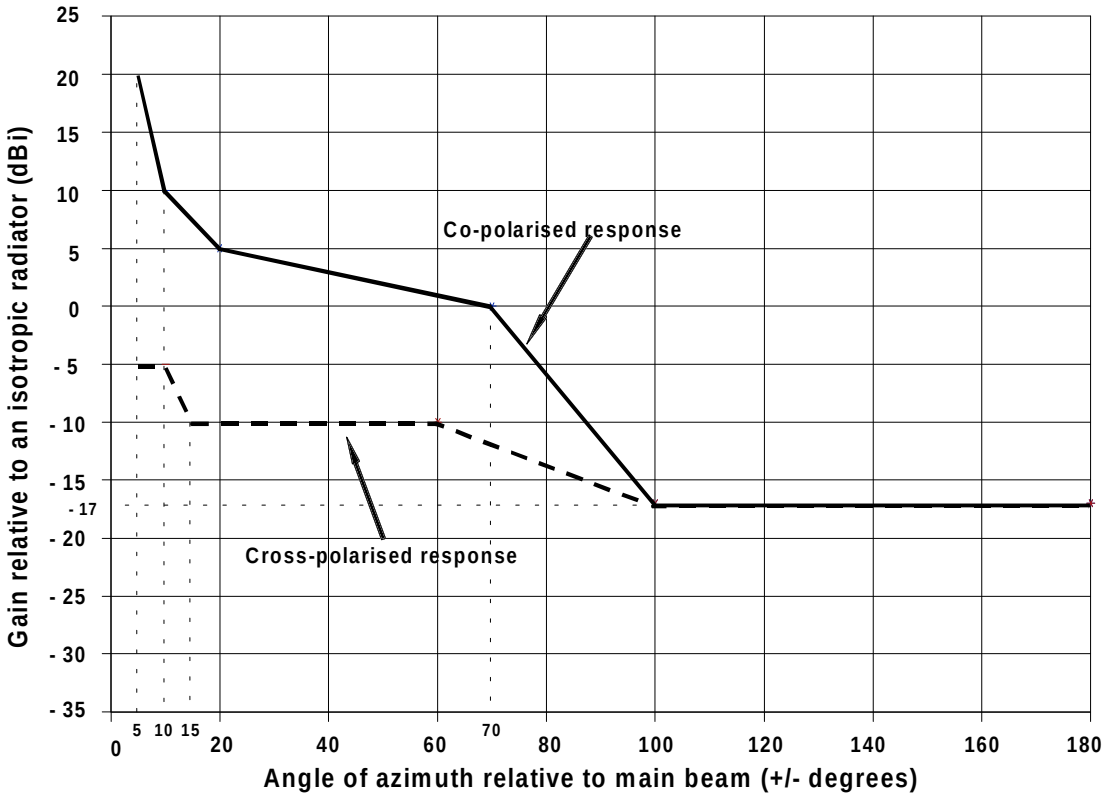


Figure 4: Antenna radiation pattern for 23 GHz systems (under test conditions)

4.9 Mechanical requirement

The following parameters should be taken into account in the design of equipment incorporating an external unit:

a) maximum weight of external unit;

b) size of external unit for wind loading considerations;

c) maximum weight of replaceable units;

d) ease of access to replaceable units.

4.10 Power supply

The equipment shall operate from a power supply within the ranges specified in ETS 300 132-1 [3] and ETS 300 132-2 [4].

ETS 300 132-1 [3] and ETS 300 132-2 [4] specify the tolerances as given below:

- for 48 V DC nominal: 40,5 ... 57 V DC;
- for 60 V DC nominal: 50 ... 72 V DC;
- for 230 V AC nominal: 207 ... 253 V AC/50 Hz ± 2 Hz.

For DC systems, the positive pole of the battery should be earthed.

NOTE: Some countries may require to use a primary supply of 24 V DC.

4.11 Safety considerations

Maximum radiated power density under normal operating conditions should be in accordance with current world health organisation figures.

5 Parameters for digital systems

5.1 Transmission capacity

BIT RATES: 2 Mbit/s, 8 Mbit/s, 34 Mbit/s, 140 Mbit/s, 155 Mbit/s (STM-1). System rates configured as n-times 2 Mbit/s are also considered.

5.2 Applications

2 Mbit/s - 155 Mbit/s point-to-point local and regional networks, mobile base station connections, subscriber access links (including transportable and off-shore use).

5.3 Baseband parameters

5.3.1 2 Mbit/s to 140 Mbit/s baseband interfaces

Baseband interfaces shall be in accordance with one of the applicable CCITT interfaces. Additional service channels or wayside traffic are not considered in this ETS.

5.3.2 Synchronous Digital Hierarchy (SDH) baseband interface

In accordance with CCITT Recommendations G.703 [5], G.707 [6], G.708 [7], G.709 [8], G.781 [9], G.782 [10], G.783 [11] and G.784 [12] with possible simplifications.

NOTE: This is under study in ETSI STCs TM3 and TM4.

5.4 Transmitter characteristics

5.4.1 Tx power range

Maximum output power shall be up to 1 Watt at point C' of the system diagram (see figure 1).

5.4.2 Transmitter output power tolerance

The output power tolerance shall be within:

± 3 dB: classes 3.3 to 3.5 (as defined in subclause 4.4.1.1) and all classes as defined in subclause 4.4.1.2.

± 2 dB: classes 3.1 and 3.2 (as defined in subclause 4.4.1.1).

5.4.3 RF spectrum mask

The equipment shall comply with the appropriate digital RF power spectrum mask from those given in figures 5 to 12. The 0 dB level shown on the spectrum masks relates to the peak of the modulated spectrum disregarding residual carrier. All spectrum masks include a ± 20 ppm allowance for frequency stability.

NOTE: Spectrum analyser settings for RF power spectrum measurements should be as given in table 6.

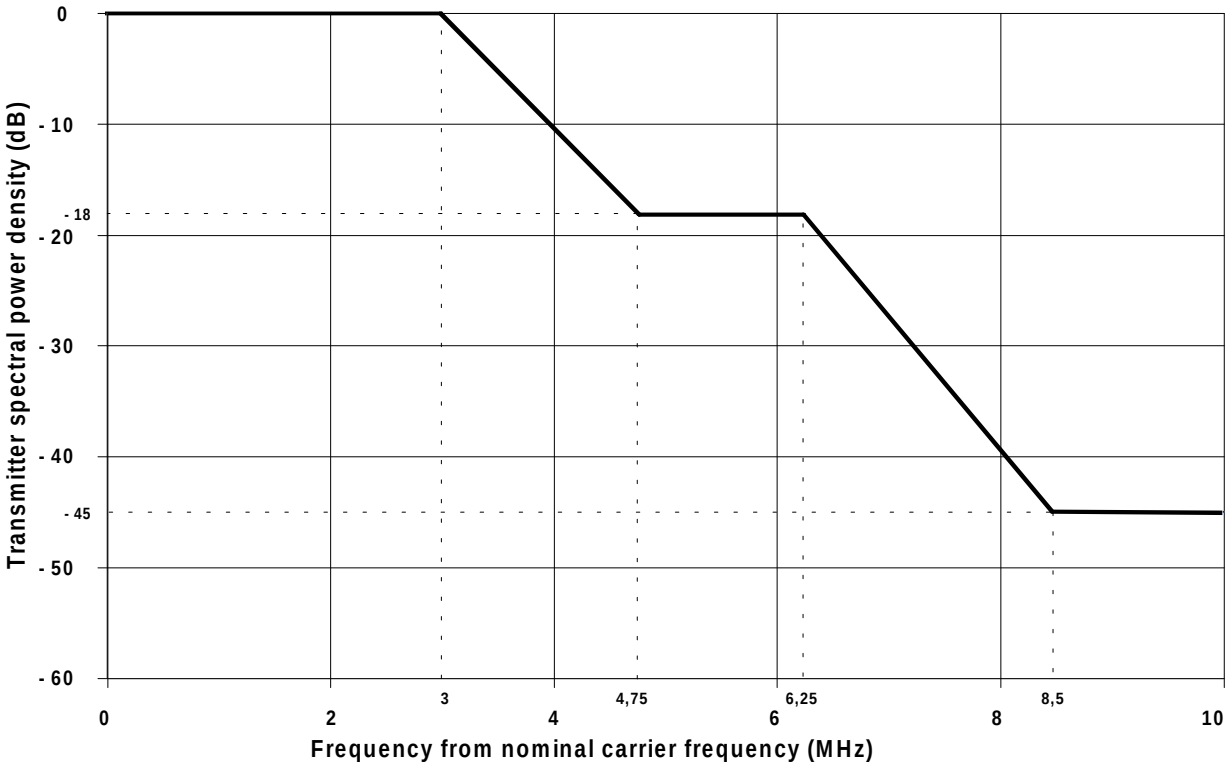


Figure 5: Limits of spectral power density for minimum system rate of 2 Mbit/s (7 MHz channel spacing - referred to nominal centre frequency (fo))

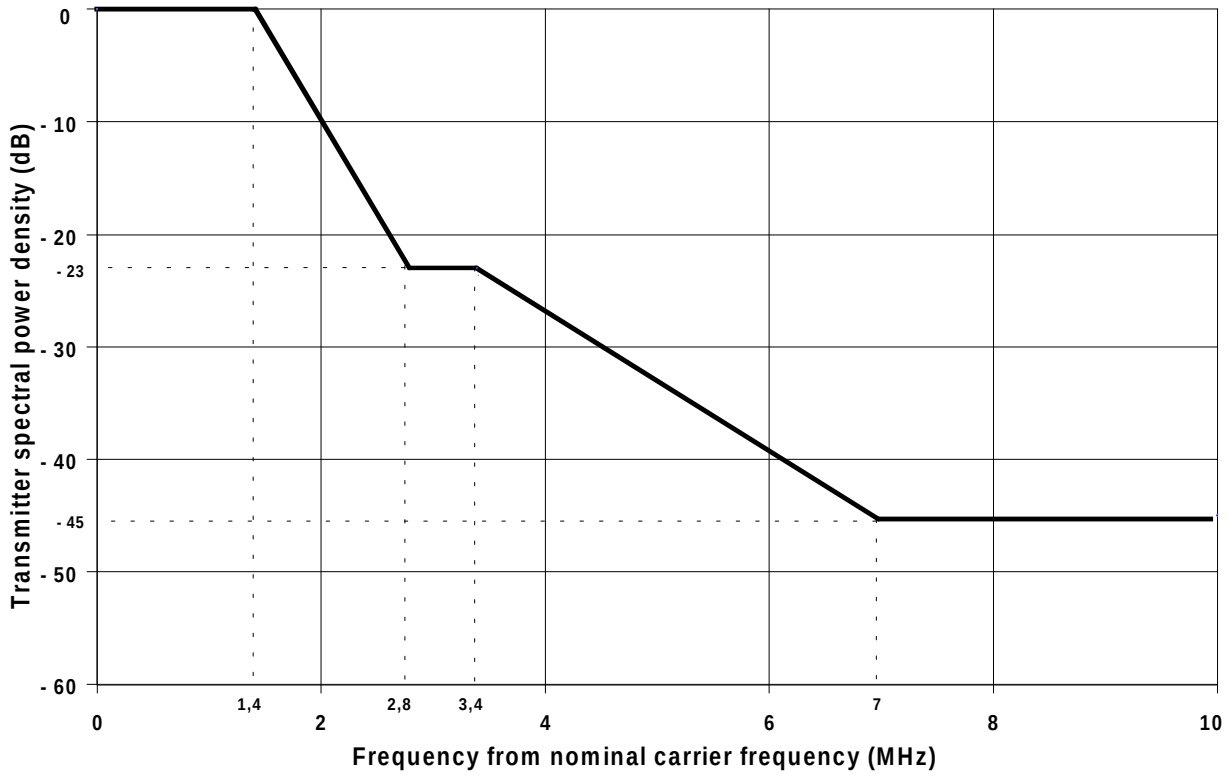


Figure 6: Limits of spectral power density for minimum system rate of 2x2 Mbit/s (3,5 MHz channel spacing - referred to nominal centre frequency (fo))

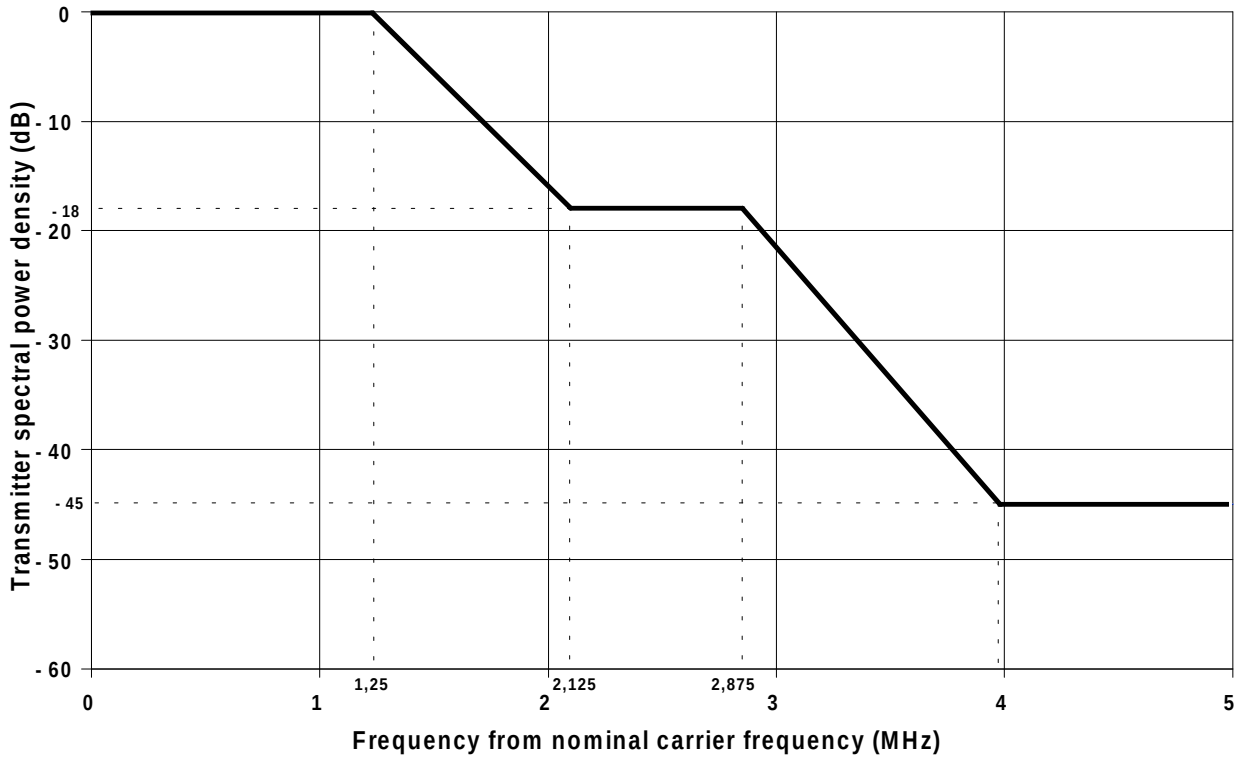


Figure 7: Limits of spectral power density for minimum system rate of 2 Mbit/s (3,5 MHz channel spacing - referred to nominal centre frequency (fo))

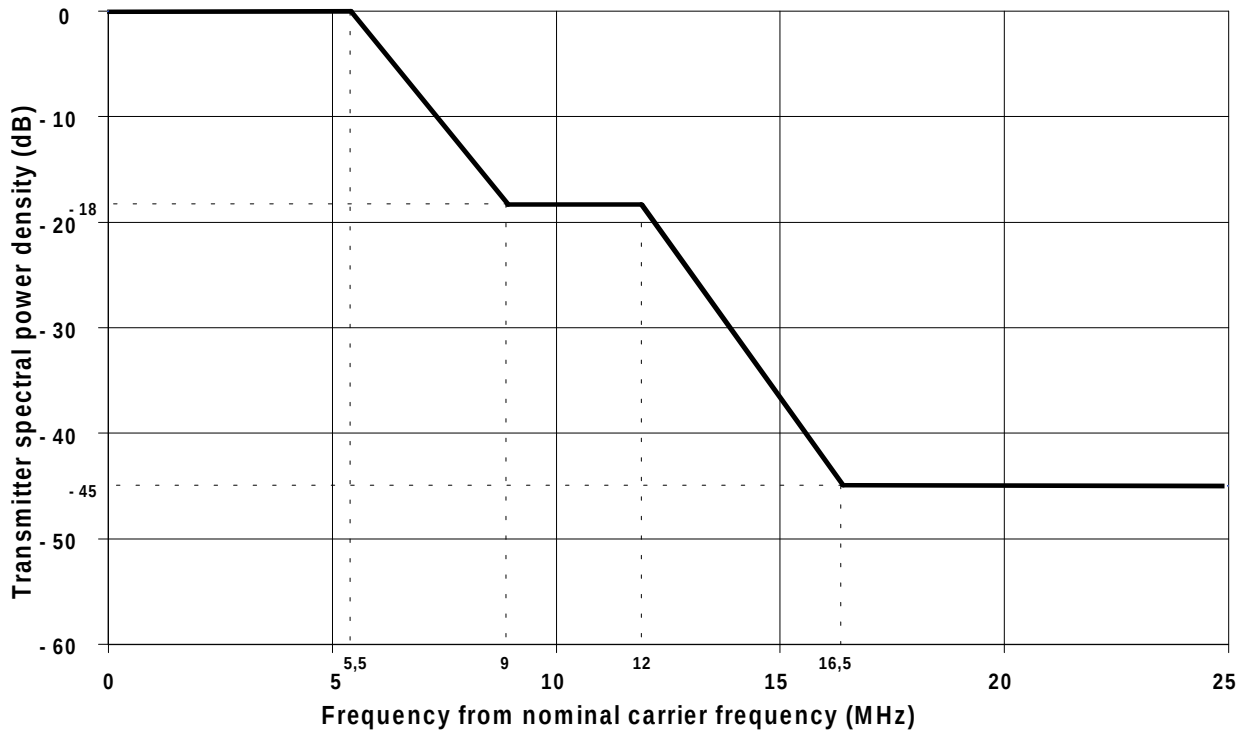


Figure 8: Limits of spectral power density for minimum system rate of 8 Mbit/s (14 MHz channel spacing - referred to nominal centre frequency (fo))

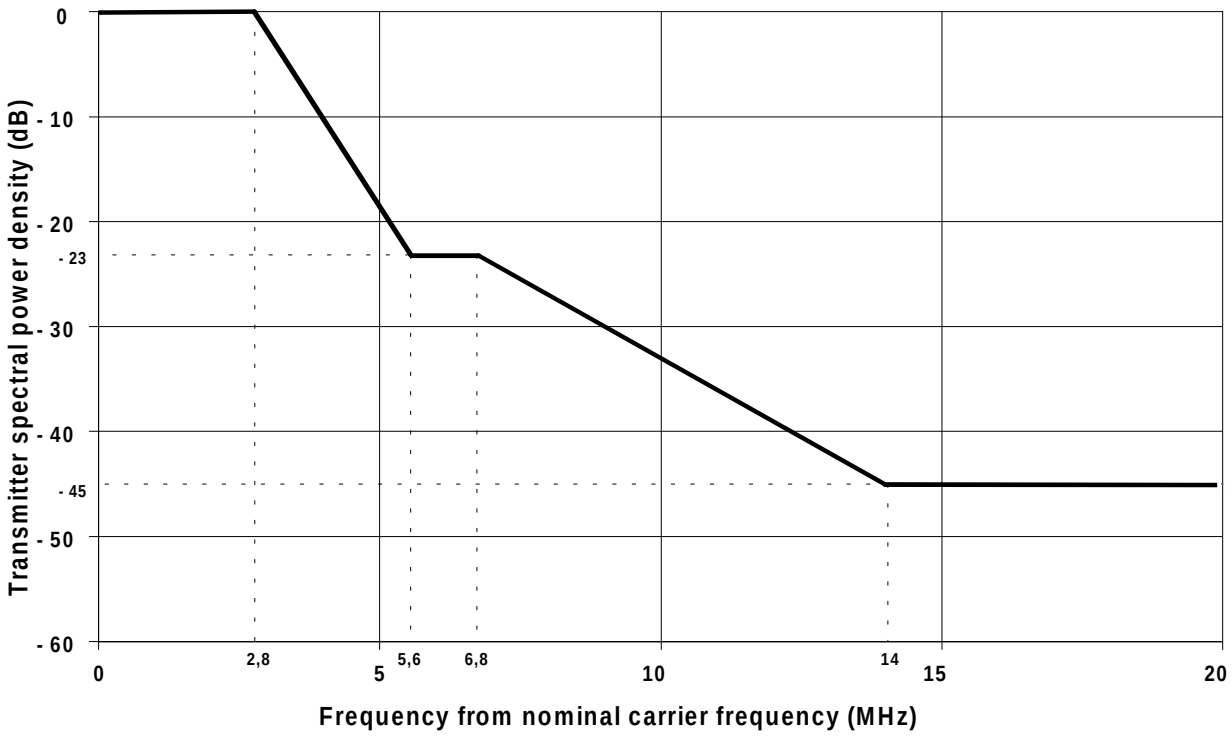


Figure 9: Limits of spectral power density for minimum system rate of 8 Mbit/s (7 MHz channel spacing - referred to nominal centre frequency (fo))

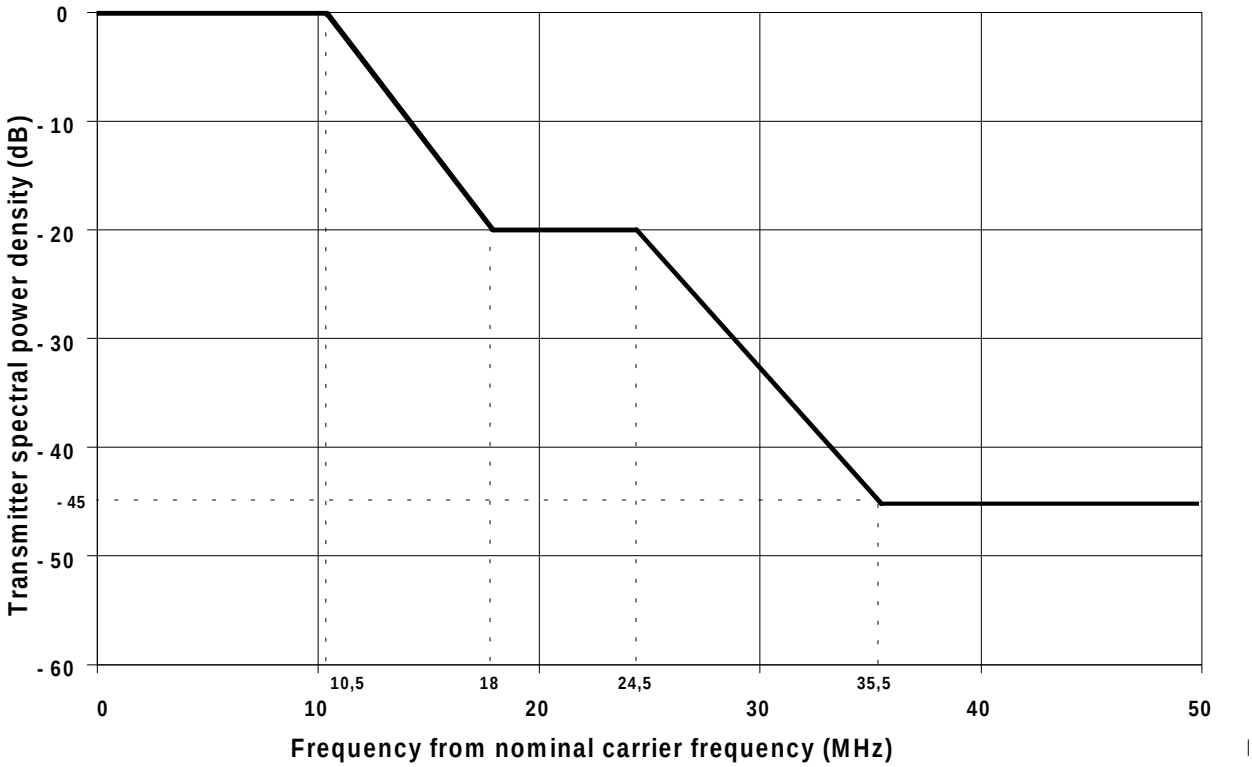


Figure 10: Limits of spectral power density for minimum system rate of 34 Mbit/s (28 MHz channel spacing - referred to nominal centre frequency (fo))

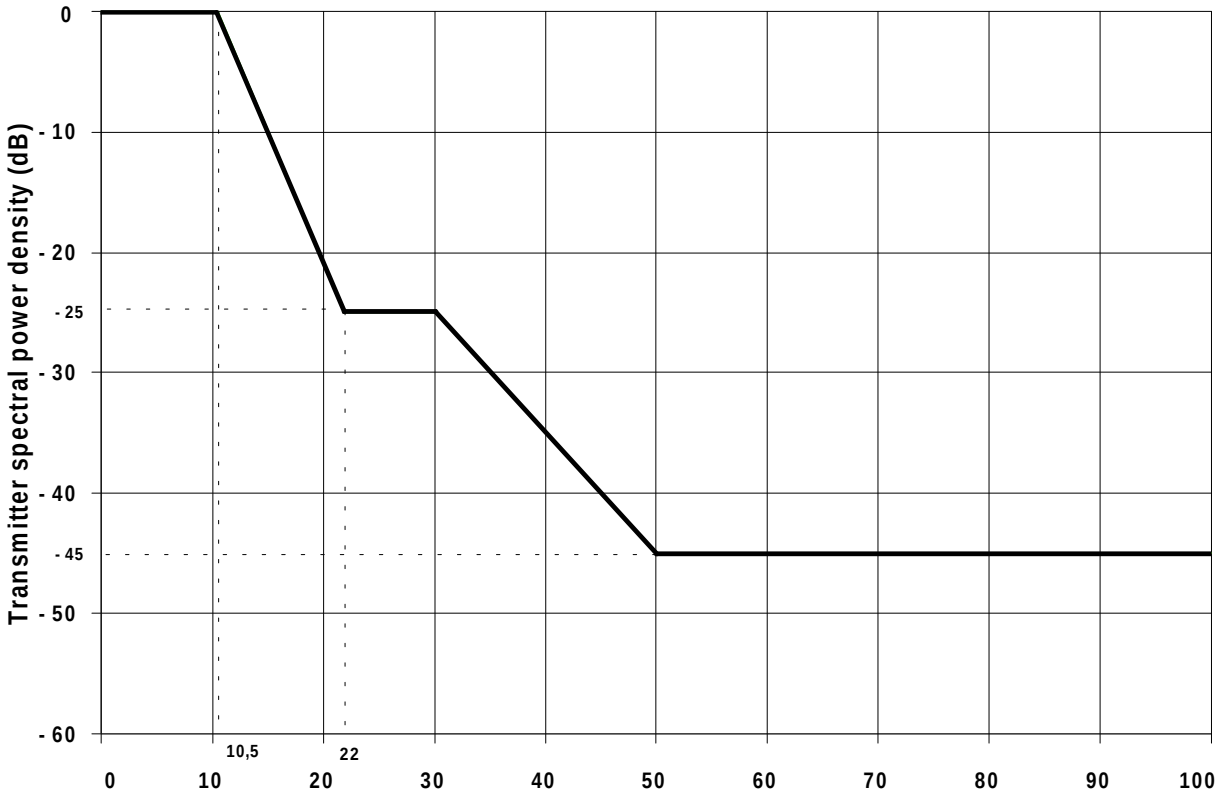


Figure 11: Limits of spectral power density for minimum system rate of 34 Mbit/s (56 MHz channel spacing - referred to nominal centre frequency (fo))

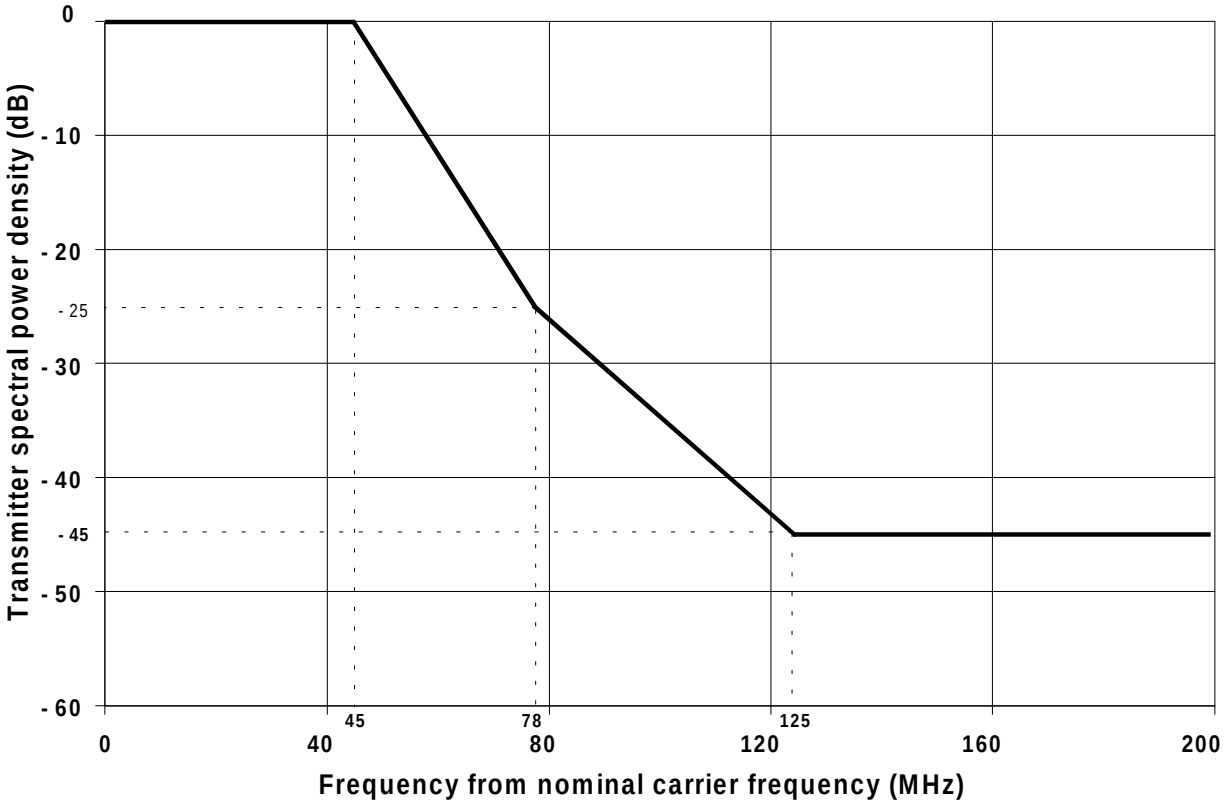


Figure 12: Limits of spectral power density for minimum systems rate of 140/155 Mbit/s (referred to nominal centre frequency (fo))

Table 6

Channel spacing (MHz)	3,5	7	14	28	56	112
IF bandwidth (kHz)	30	30	30	100	100	300
Total sweep width (MHz)	20	50	100	200	200	500
Total scan time (s)	20	20	50	20	20	20
NOTE: The video filter bandwidth = 0,3 kHz.						

5.4.4 Spurious emissions

The frequency range in which the spurious emissions specifications apply is 30 MHz to 55 GHz. The limit values measured at point C' are:

30 MHz to 21,2 GHz - 90 dBW;

21,2 GHz to 55 GHz - 60 dBW.

NOTE 1: Spurious emissions are 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.

NOTE 2: The lower frequency limit for type testing of spurious emission and received spurious response rejection shall be half the waveguide cut-off frequency, subject to the input/output waveguide being not less than two cut-off wavelengths long.

NOTE 3: Definitions and methods of measurement for integrated equipment where the antenna port is not accessible are under study.

NOTE 4: The lower frequency limit for spurious emission conformance testing and receiver spurious response rejection shall be half the waveguide cut-off frequency subject to the input/output waveguide being not less than two cut-off wavelengths long.

5.4.5 RF frequency tolerance

RF frequency tolerances are included in the spectrum masks (see figures 5 to 12). A maximum RF frequency tolerance of ± 20 ppm shall apply.

5.5 Receiver characteristics

5.5.1 Input level range

The input level range for a Bit Error Ratio, BER < 10^{-3} shall extend from the upper limit of - 50 dBW to the lower threshold for BER = 10^{-3}, measured at point C.

5.5.2 Spurious emissions

The frequency range, in which the spurious emissions specifications apply is 30 MHz to 55 GHz. The limit values measured at point C shall be:

30 MHz to 21,2 GHz - 90 dBW;

21,2 GHz to 55 GHz - 60 dBW.

NOTE: See NOTES 1, 2, 3 and 4 in subclause 5.4.4.

5.6 System performance

5.6.1 BER performance

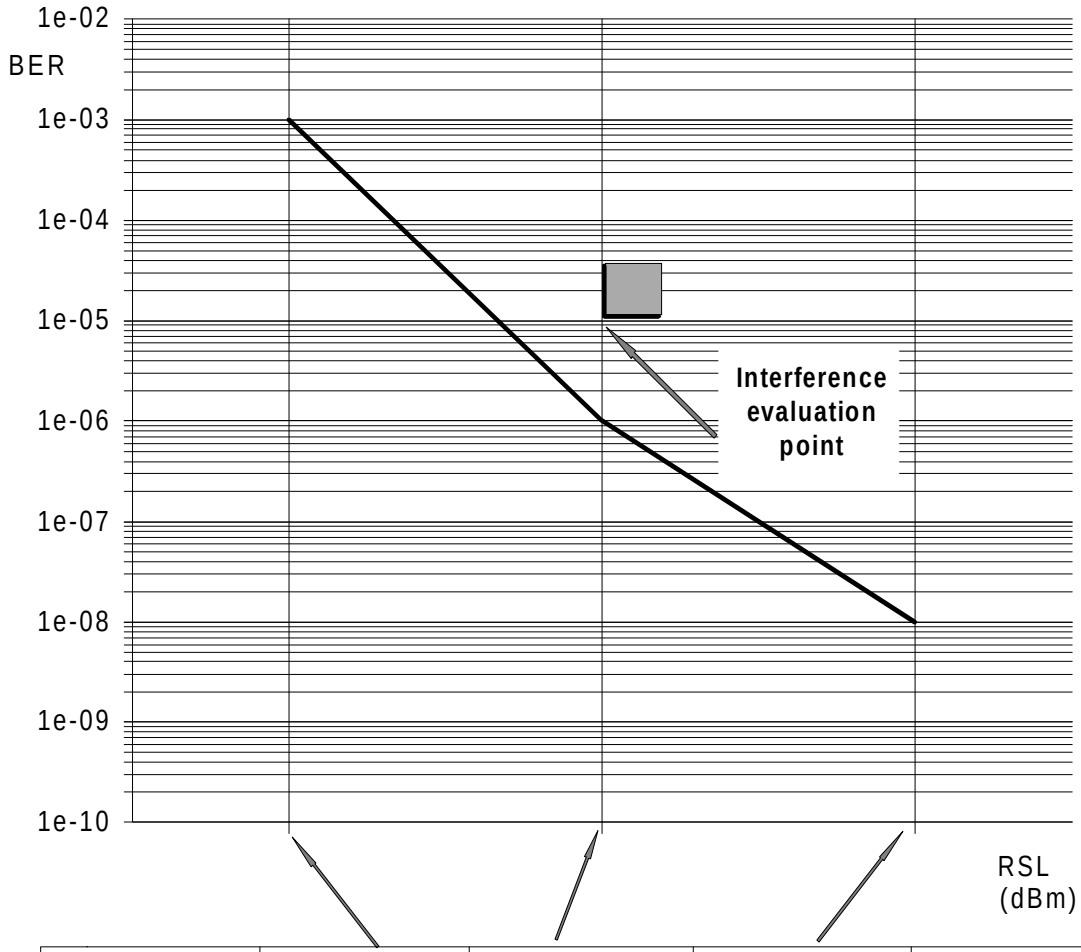
BER versus receive signal power level should be referred to point C of the system diagram (see figures 1 and 13).

5.6.2 Equipment background BER

The equipment background BER level range under simulated operating conditions without interference is measured with a signal level at point C which is between 15 dB and 40 dB above the level which gives BER = 10^{-3}. The measurement period should be not less than 15 hours (all measurements are made at the system bit rate).

For systems less than 34 Mbit/s: BER <10^{-10}.

For systems of 34 Mbit/s and above: BER <10^{-11}.



Bit rate	BER 1e-3	BER 1e-6	BER 1e-8	Channel spacing
2 Mbit/s	- 80	- 75	- 71	7 MHz
8 Mbit/s	- 77	- 72	- 68	14 MHz
2 Mbit/s	- 87	- 82	- 78	3,5 MHz
2x2 Mbit/s	- 85	- 80	- 76	3,5 MHz
8 Mbit/s	- 82	- 77	- 73	7 MHz
34 Mbit/s	- 76	- 71	- 67	28 MHz
34 Mbit/s	- 76	- 71	- 67	56 MHz
140/155 Mbit/s	- 70	- 65	- 61	112 MHz

Figure 13: BER versus Receive Signal Level (RSL)

5.6.3 Interference sensitivity

All receive signal levels and Carrier/Interference (C/I) measurements should be referred to point C of the system diagram (see figure 1).

a) Co-channel interference.

For a receiver operating at the 10^{-6} BER threshold, given in figure 13 for system rates of 2 - 155 Mbit/s, introduction of a like-modulated co-channel interferer at C/I of 23 dB shall not result in a BER greater than 10^{-5}.

b) Adjacent channel interference.

For a receiver operating at the 10^{-6} BER threshold given in figure 13, introduction of a like-modulated adjacent channel interferer at the level and frequency separation given in table 7 shall not result in a BER greater than 10^{-5}.

Table 7: Adjacent channel interference levels

Bit rate (Mbit/s)	Separation of wanted and interfering signal (MHz)		Interference level (carrier/interference (dB))	
	Co-polar	Cross polar	Co-polar	Cross polar
2	7/3,5	3,5/1,75	0	28
2 x 2	3,5	1,75	0	28
8	14/7	7/3,5	0	28
34	28	14	0	28
34	56	28	0	28
140/155	112	56	0	28

NOTE: Regulatory administrations may wish to vary the value of C/I for co-polar or adjacent channel interference. Values of C/I are typically in the range 0 to -3 dB.

c) CW spurious interference.

For a receiver operating at the 10^{-6} BER threshold given in figure 13, introduction of a CW interferer at a level of +30 dB, with respect to the "wanted" signal and at any frequency in the range 1 GHz to 55 GHz, excluding frequencies either side of the "wanted" frequency by up to twice the relevant 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.

5.6.4 Distortion sensitivity

Distortion sensitivity is not likely to be significant for short hop operation. Signatures for systems are not required.

6 Parameters for wide band analogue systems

6.1 Transmit/receive capacity

The following video baseband bandwidths may be used:

a) up to 3,5 MHz;

b) up to 6 MHz;

c) up to 10 MHz;

d) up to 14 MHz.

These may have sub-carriers associated with them.

It is recognised that sub-carriers shall be used to carry four distinct traffic types:

- CW (e.g. continuity pilot);
- low frequency analogue (e.g. audio);
- wide band analogue (e.g. secondary video);
- data (e.g. 2 Mbit/s CCITT Recommendation G.703 [5]).

6.2 Applications

Point-to-point TV (broadcast quality).

Point-to-point TV (surveillance).

Point-to-point wide band (radar remoting).

6.3 Baseband parameters

6.3.1 Video interfaces

Level: nominally 1 V peak-to-peak.

Impedance: 75 Ω unbalanced.

Minimum return loss: 26 dB.

6.3.2 Audio interface (if applicable)

Level: 0 to 6 dBu (peak level +9 dBm to +15 dBm).

Impedance: input 600 Ω symmetric, output < 50 Ω symmetric.

Minimum return loss: 20 dB.

6.3.3 Digital interface (if applicable)

For CCITT bit rates the interface should conform to CCITT Recommendation G.703 [5].

6.3.4 IF interface (if applicable)

Characteristics shall be in accordance with CCIR Recommendation 403 [13].

6.3.5 Baseband performance

In view of varied and numerous potential applications for analogue links, it is not practical to specify the overall performance characteristics for individual applications.

As an example, some sample performance parameters are given in table 8 applicable to an analogue hop carrying a PAL video signal together with an audio channel.

Table 8: An example of some performance parameters for a video and an audio channel

Video:	
Signal to noise - continuous weighted	60 dB
Noise - periodic	- 60 dB
Baseband frequency response	± 1 dB
Baseband group delay	20 ns
Differential phase	± 2°
Differential gain	± 2%
linear wave form distortion	2%
Audio:	
Frequency response	± 1 dB
Total harmonic distortion	0,5%
Noise - weighted	60 dBqOps

NOTE: All measurements are made at 40 dB above the receiver threshold as defined in subclause 6.6.1.

The absolute performance characteristics for broadcast quality video and audio channels are available in the relevant CCIR (CMTT) or CCITT Recommendations.

6.4 Transmitter characteristics

6.4.1 Transmitter power range

Maximum output power shall be up to 1 Watt at point C' of the system diagram (see figure 1).

6.4.2 Transmitter output power tolerance

The output power tolerance shall be within:

± 3 dB: classes 3.3 to 3.5 (as defined in subclause 4.4.1.1); and all classes as defined in subclause 4.4.1.2;

± 2 dB: classes 3.1 and 3.2 (as defined in subclause 4.4.1.1).

6.4.3 Radiated spectrum

6.4.3.1 Spectrum masks

The radiated spectrum of the composite wide band signal shall fall within the spectrum masks given in figures 14 and 15 as appropriate. The 0 dB reference level shown on the spectrum masks shall be set to the level of the unmodulated carrier. These masks shall be met under environmental conditions specified in subclause 4.4.1. Masks include an allowance for frequency stability.

NOTE: Spectrum analyser settings for RF power spectrum measurements should be as given in table 9.

Table 9: Spectrum analyser settings

Video baseband bandwidth (MHz)	< 3,5 MHz	< 14 MHz
IF bandwidth (kHz)	30	30
Total sweep width (MHz)	100	100
Video filter bandwidth (kHz)	0,3	0,3
Recommended scan time (s)	50	40

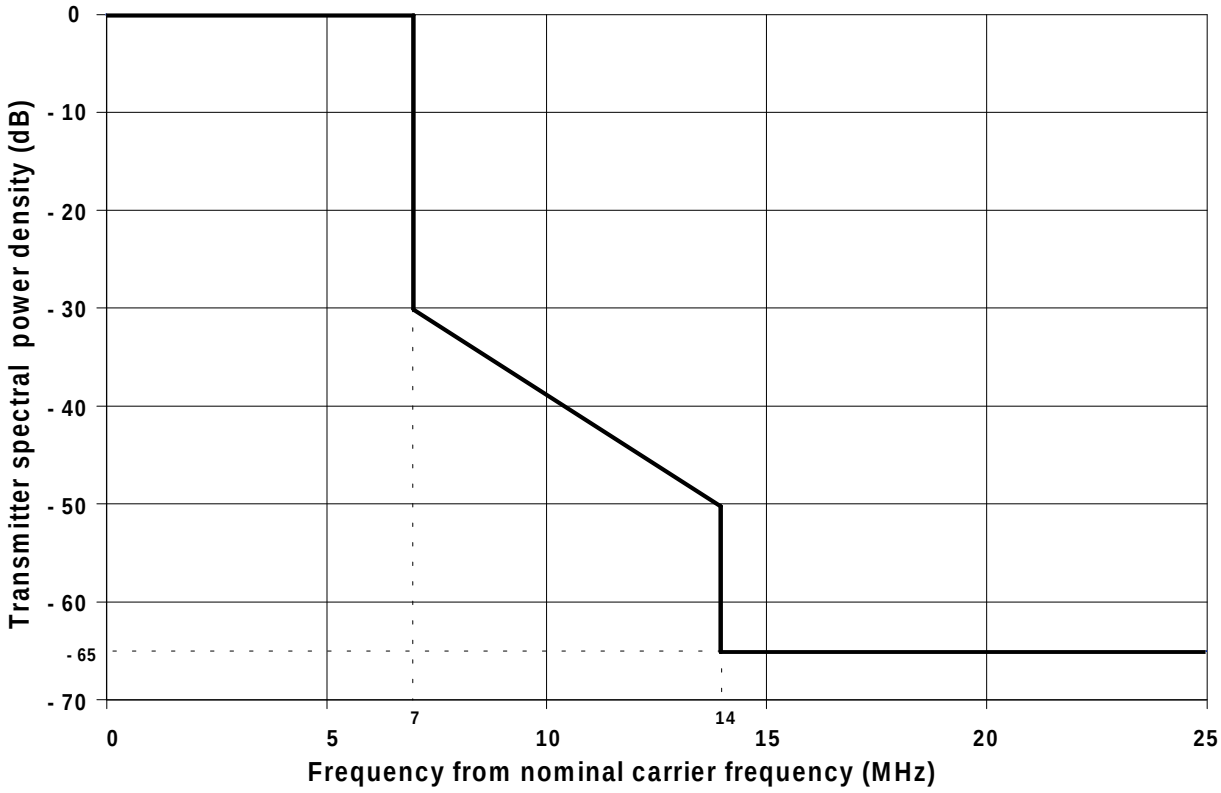


Figure 14: Limits of spectral power density for video basebands up to 3,5 MHz (using channel spacing of 28 MHz - referred to nominal centre frequency (fo))

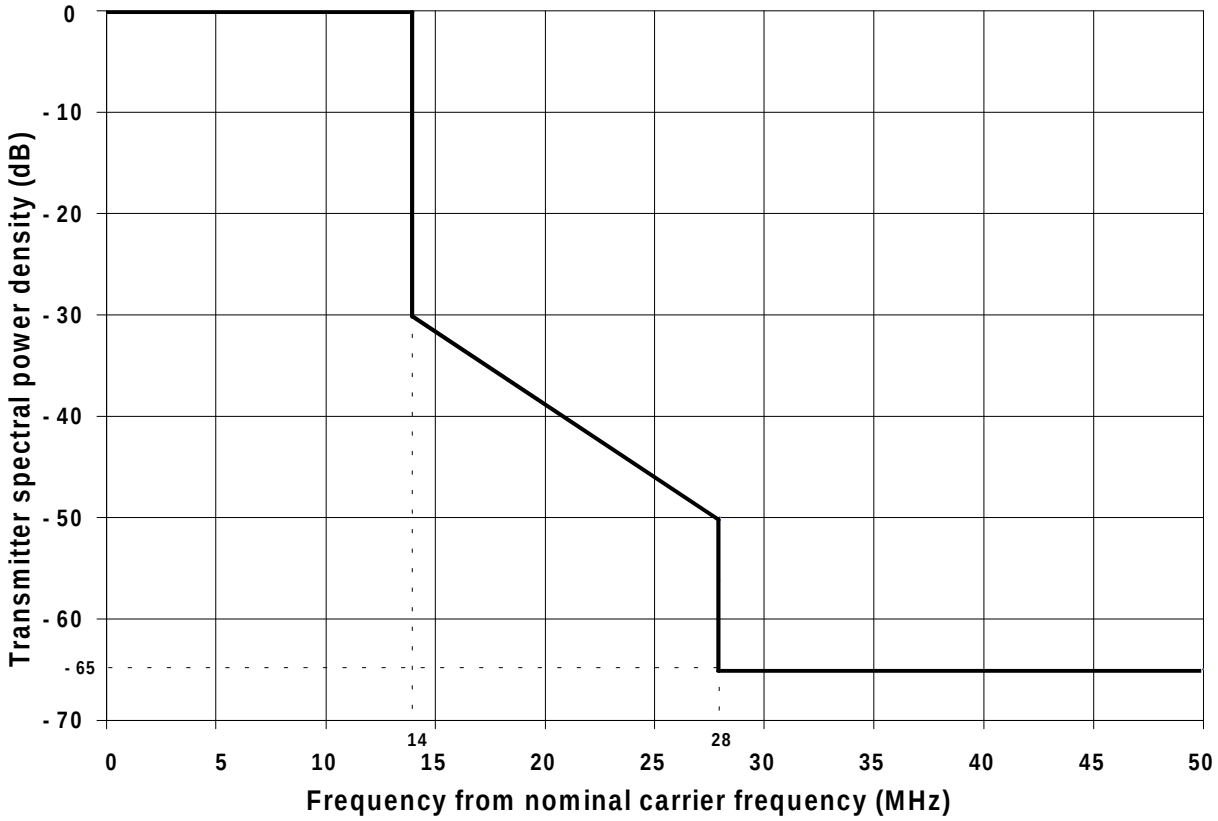


Figure 15: Limits of spectral power density for video basebands up to 14 MHz (using channel spacing of 56 MHz - referred to nominal centre frequency (fo))

6.4.3.2 Frequency deviation

See table 10.

a) Primary video.

The primary video may be defined as that traffic not carried on a sub-carrier. No limit applies to the frequency deviation of the primary traffic.

b) Sub-carrier deviation of the main carrier.

The maximum sub-carrier deviation for each type of traffic is given in table 10 and these limits should apply both when the sub-carrier is modulated or unmodulated.

Table 10: Transmitter characteristics-maximum frequency deviations of the main carrier

Video baseband	< 3,5 MHz	<6 MHz	<10 MHz	<14 MHz
Channel spacing:				
Co-polar	28 MHz	56 MHz	56 MHz	56 MHz
Cross polar	14 MHz	28 MHz	28 MHz	28 MHz
Maximum frequency deviation of the main carrier:				
Primary video sub-carriers	No limit	No limit	No limit	No limit
CW (pilot)	0,6 MHz	1 MHz	1 MHz	-
Narrow band analogue (audio)	0,6 MHz	2 MHz	2 MHz	-
Wide band analogue (video)	-	4 MHz	4 MHz	-
Digital	-	2 MHz	2 MHz	-
Spectrum mask	figure 14	figure 15	figure 15	figure 15

6.4.4 Spurious emissions

The frequency range in which the spurious emissions specifications apply is 30 MHz to 55 GHz. The limit values shall be:

30 MHz to 21,2 GHz - 90 dBW;

21,2 GHz to 55 GHz - 60 dBW.

NOTE 1: Spurious emissions are 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.

NOTE 2: The lower frequency limit for conformance testing of spurious emission and received spurious response rejection shall be half the waveguide cut-off frequency, subject to the input/output waveguide being not less than two cut-off wavelengths long.

NOTE 3: Definitions and methods of measurement for integrated equipment where the antenna port is not accessible are under study.

NOTE 4: The lower frequency limit for spurious emission conformance testing and receiver spurious response rejection shall be half the waveguide cut-off frequency subject to the input/output waveguide being not less than two cut-off wavelengths long.

6.4.5 RF frequency tolerance

RF frequency tolerances are included in the spectrum masks (figures 14 and 15). The maximum tolerances under any conditions shall be:

± 100 ppm for video baseband up to 3,5 MHz;

± 150 ppm for video baseband up to 6 MHz and up to 10 MHz.

6.5 Receiver characteristics

All levels are referred to point C on the system diagram (see figure 1).

6.5.1 Input level range

From - 50 dBW to receive threshold as defined in subclause 6.6.1.

6.5.2 Spurious emissions

The frequency range in which the spurious emissions specifications apply is 30 MHz to 55 GHz. The limit values shall be:

30 MHz to 21,2 GHz - 90 dBW;

21,2 GHz to 55 GHz - 60 dBW.

NOTE: See NOTES 1, 2, 3 and 4 in subclause 6.4.4.

6.5.3 Noise figure

The receiver noise figure shall not exceed 12 dB.

6.6 Transmit/receive performance

6.6.1 Receiver threshold

The receiver threshold is defined as the receive signal level referred to point C of the system diagram, (see figure 1) at which a certain minimum performance is reached. In view of the wide variety of equipment types to be found in practice, it is not proposed to state limits for this parameter. However, in order to specify meaningful interference limits, it is necessary to use the measured receiver threshold as a baseline.

The signal/un-weighted noise ratio shall be measured at each output port (video, audio, etc.) as a function of Receive Signal Level (RSL). The receiver threshold shall be defined as the receiver level at which the relationship between the receive signal level and the output signal/noise ratio deviates by 3 dB. It is recognised that for a composite video signal (incorporating modulated sub-carriers) the threshold shall be different for each output signal; the receiver threshold in this case should be taken as the highest receive signal level at which any of the output signals reaches the FM threshold.

6.6.2 Interference sensitivity

a) Co-channel interference.

For planning purposes, it should be assumed that the level of co-channel interference into the wide band analogue channel shall not exceed - 125 dBW.
It should also be recognised that the degradation in performance caused by this interference shall depend on a number of equipment characteristics (e.g. deviation, receiver noise performance, etc.) and, therefore, it is not proposed to set limits on this parameter. However, it is desirable to measure and record the co-channel interference level.

b) Adjacent channel interference.

For a receiver operating with a "wanted" signal whose level is 9 dB above the receiver threshold measured in subclause 6.6.1, the introduction at point C of a like modulated interferer at the level and frequency separation given in table 11 shall not result in a degradation of the output signal/noise ratio of more than 1 dB.

Table 11: Adjacent channel separation and interference levels

Video baseband	Separation of "wanted" and interfering signal (MHz)		Interference level (carrier/interference (dB))	
	Co-polar	Cross polar	Co-polar	Cross polar
< 3,5 MHz	28	14	0	28
< 6 MHz	56	28	0	28
< 10 MHz	56	28	0	28
< 14 MHz	56	28	0	28

c) CW spurious interference.

For a receiver operating with a "wanted" signal whose level is 9 dB above the receiver threshold measured in subclause 6.6.1, the introduction at point C of a CW interferer at a level of + 30 dB with respect to the "wanted" signal and at any frequency from 30 MHz, excluding frequencies either side of the "wanted" signal by up to twice the relevant co-polar spacing, shall not result in a degradation of any output signal/noise of more than 1 dB.

Annex A (informative): Bibliography

The following documents are informative references to this ETS.

CCITT Recommendation G.773: "Protocol suites for Q-interfaces for management of transmission systems".

CCIR Recommendation 453: "The formula for the radio refractive index".

CCIR Recommendation 530: "Propogation data and prediction methods required for the design of terrestrial line-of-sight systems".

CCIR Recommendation 837: "Characteristics of precipitation for propogation modelling".

CCIR Recommendation 838: "Specific attenuation model for rain for use in prediction methods".

CCIR Recommendation 840: "Attenuation due to clouds and fog".

CCIR Report 1053: "Error performance and availability objectives for digital radio-relay systems used in the local-grade portion of an ISDN connection".

ETR 035: "Equipment Engineering (EE); Environmental engineering Guidance and terminology".

History

Document history	
April 1994	First Edition
January 1996	Converted into Adobe Acrobat Portable Document Format (PDF)