

**Transmission and Multiplexing (TM);
Fixed radio link equipment for the transmission
of analogue video signals operating
in the frequency bands 24,25 GHz to 29,50 GHz
and 31,0 GHz to 31,8 GHz**



Reference

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Foreword

This European Standard (Telecommunications series) has been produced by ETSI Technical Committee Transmission and Multiplexing (TM), and is now submitted for the ETSI standards One-step Approval Procedure.

This new version extends the present document to cover also the frequency bands in the range 31,0 GHz to 31,8 GHz. The specific antenna radiation patterns have been removed from the present document and replaced with a reference to the appropriate EN 300 833 [18] and EN 301 215-4 [19].

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

1 Scope

The present document covers the minimum technical requirements for terrestrial analogue radio relay systems operating in bands in the frequency range 24,25 GHz to 29,5 GHz and 31,0 GHz to 31,8 GHz.

Such systems are intended to be used for Point-to-Point (P-P) connections and video distribution (Point-to-Multipoint (P-MP)).

Typical applications include:

- a) TV of contribution quality;
- b) TV of distribution quality;
- c) TV of surveillance quality;
- d) Radar signals remoting.

Use of the 31 GHz band is restricted to analogue security video systems in the present document.

Safety aspects are outside the mandate of ETSI and they will not be considered in the present document.

The requirements and limits given in the present document are relevant to all environmental conditions for the chosen climatic class.

The minimum performance parameters for digital radio relay equipment operating in the range 24,5 GHz to 29,5 GHz are set out in EN 300 431 [12] while those for systems operating in the range 31,0 GHz to 31,3 GHz and 31,5 GHz to 31,8 GHz are given in EN 300 197 [15].

The 31,0 GHz to 31,3 GHz band is available in some countries and included in CEPT Report 25 [17].

All emissions are prohibited in the band 31,3 GHz to 31,5 GHz (see footnote S5.340 in ITU Radio Regulations [20]). Therefore this band is not available for FS systems. The levels of unwanted emissions from FS systems falling into the band 31,3 GHz to 31,5 GHz are, at the time of writing, being discussed under Agenda item 1.8.2 of WRC 03.

It should be noted that the band 31,5 GHz to 31,8 GHz, available for FS in some Countries under the provision of footnote S5.546 of the ITU Radio Regulations [20], is also allocated to passive services, including the Earth Exploration Satellite Service (EESS passive).

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 and/or edition number or version number) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies.

[1] CEPT Recommendation T/R 13-02: "Preferred channel arrangements for fixed services in the range 22,0 - 29,5 GHz".

[2] ITU-R Recommendation F.748: "Radio-frequency channel arrangements for radio-relay systems operating in the 25, 26 and 28 GHz bands".

[3] ETSI ETS 300 019 (all parts): "Electrical Equipment (EE); Environmental conditions and environmental tests for telecommunications equipment".

- [4] ETSI EN 301 489-1: "Electromagnetic compatibility and Radio spectrum Matters (ERM); ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 1: Common technical requirements".
- [5] ETSI EN 301 489-4: "Electromagnetic compatibility and Radio spectrum Matters (ERM); ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 4: Specific conditions for fixed radio links and ancillary equipment and services".
- [6] IEC 60154 (all parts): "Flanges for waveguides".
- [7] ETSI ETS 300 132-1: "Equipment Engineering (EE); Power supply interface at the input to telecommunications equipment; Part 1: Operated by alternating current (ac) derived from direct current (dc) sources".
- [8] ETSI EN 300 132-2: "Environmental Engineering (EE); Power supply interface at the input to telecommunications equipment; Part 2: Operated by direct current (dc)".
- [9] ITU-T Recommendation J.61: "Transmission performance of television circuits designed for use in international connections".
- [10] ITU-T Recommendation J.21: "Performance characteristics of 15 kHz-type sound-programme circuits - Circuits for high quality monophonic and stereophonic transmissions".
- [11] ITU-R Recommendation F.403: "Intermediate-frequency characteristics for the interconnection of analogue radio-relay systems".
- [12] ETSI EN 300 431: "Fixed Radio Systems; Point-to-point equipment; Parameters for radio system for the transmission of digital signals operating in the frequency range 24,50 GHz to 29,50 GHz".
- [13] ITU-R Recommendation F.1191-1: "Bandwidths and unwanted emissions of digital radio-relay systems".
- [14] CEPT/ERC Recommendation 74-01: "Spurious emissions".
- [15] ETSI EN 300 197: "Fixed Radio Systems; Point-to-point equipment; Parameters for radio systems for the transmission of digital signals operating at 32 GHz and 38 GHz".
- [16] ERC/DEC(00)09: "ERC Decision of 10 March 1999 on the use of the band 27,5 - 29,5 GHz by the fixed service and uncoordinated Earth stations of the fixed-satellite service (Earth-to-space)".
- [17] ERC Report 25: "Frequency band 29,7 MHz to 105 GHz and associated European table of frequency allocations and utilisations".
- [18] ETSI EN 300 833: "Fixed Radio Systems; Point-to-point Antennas; Antennas for point-to-point fixed radio systems operating in the frequency band 3 GHz to 60 GHz".
- [19] ETSI EN 301 215-4: "Fixed Radio Systems; Point to Multipoint Antennas; Antennas for point-to-multipoint fixed radio systems in the 11 GHz to 60 GHz band; Part 4: Multipoint Multimedia Wireless system in 30 GHz to 40,5 GHz".
- [20] ITU Radio Regulations.

3 Symbols and abbreviations

3.1 Symbols

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

dB	deciBel
dBc	deciBel relative to mean carrier power
dB _i	deciBel relative to an isotropic radiator
dBm	deciBel relative to 1 mW
dBW	deciBel relative to 1 W
GHz	GigaHertz
km	kilometre
Mbit/s	Mega-bits per second
MHz	MegaHertz
ppm	parts per million
ns	nanosecond
mW	milliWatt
W	Watt

3.2 Abbreviations

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

C/N	Carrier to Noise ratio
CW	Continuous Wave
IF	Intermediate Frequency
PAL	Phase Alternation Line
P-MP	Point-to-MultiPoint
P-P	Point-to-Point
RF	Radio Frequency
S/N	Signal to Noise ratio
XPD	Cross-Polar Discrimination

4 General characteristics

4.1 Frequency bands and channel arrangements

4.1.1 Channel plan

For the frequency range is 24,25 GHz to 29,50 GHz, the channel arrangements shall align with those given in CEPT Recommendation T/R 13-02 [1] which is in accordance with ITU-R Recommendation F.748 [2]. Frequency assignment, in the 27,5 GHz to 29,5 GHz band, should be in accordance with the Decision ERC/DEC(00)09 [16].

The 31,0 GHz to 31,3 GHz band is available in some countries and included in CEPT Report 25 [17]. Moreover the band 31,5 GHz to 31,8 GHz may be used on a national basis (see footnote S5.546 of the Radio Regulations). Therefore, the present document covers also the bands 31,0 GHz to 31,3 GHz and 31,5 GHz to 31,8 GHz provided that the channel arrangement is based on 28 MHz channel spacing.

NOTE: Channel arrangements for the band 31,0 GHz to 31,3 GHz are currently under development within CEPT.

4.1.2 Co-polar channel spacing

Table 1

Video baseband	up to 10 MHz (31 GHz band only)	up to 10 MHz (standard frequency deviation) (31 GHz band excluded)	up to 10 MHz (wide frequency deviation) (31 GHz band excluded)
Channel spacing	28 MHz	35 MHz (see note)	42 MHz (see note)
NOTE: These channel spacing may be obtained, in the band 24,5 GHz to 29,5 GHz by aggregating 3,5/7 MHz channels, in agreement with the administration concerned.			

4.2 Compatibility requirements between systems

Equipment conforming to the present document is not guaranteed to operate together across the radio interface (mid-air compatibility) with similar equipment provided by another manufacturer.

4.3 Environmental conditions

The equipment shall meet the environmental conditions set out in ETS 300 019 [3] which defines weather protected and non-weather protected locations, classes and test severities.

4.3.1 Equipment within weather protected locations

Equipment intended for operation within temperature controlled locations or partially temperature controlled locations shall meet the requirements of ETS 300 019 [3] classes 3.1 and 3.2 respectively.

Optionally, the more stringent requirements of ETS 300 019 [3] classes 3.3 (non-temperature controlled locations), 3.4 (sites with heat trap) and 3.5 (sheltered locations) may be applied.

4.3.2 Equipment for non-weather protected locations

Equipment intended for operation within non-weather protected locations shall meet the requirements of ETS 300 019 [3], class 4.1 or 4.1E.

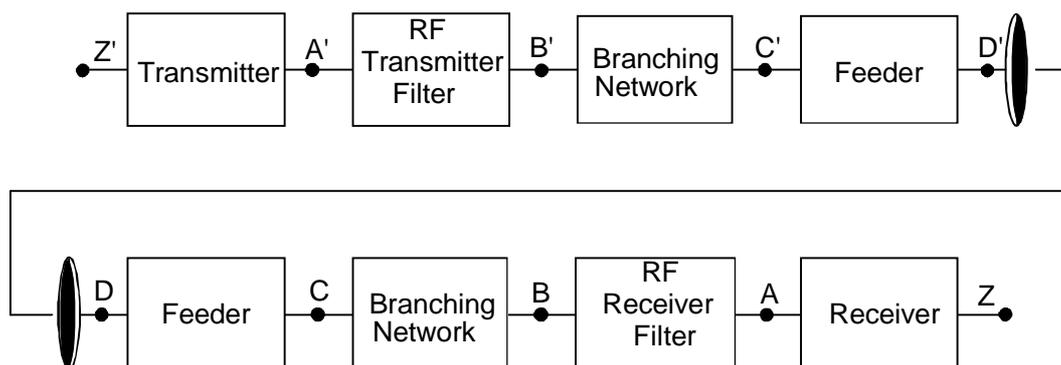
Class 4.1 applies to many European countries and class 4.1E applies to all European countries.

Weather protected equipment conforming to classes 3.3, 3.4 and 3.5, together with an enclosure or cabinet may fulfil the requirements for operating in a non-weather protected environment, but this is outside the scope of the present document.

4.4 Electromagnetic compatibility

Equipment shall operate under the conditions specified in EN 301 489 parts 1 [4] and 4 [5] for fixed radio links and ancillary equipment.

4.5 System block diagram



NOTE 1: The points listed above are reference points only.

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

Figure 1: System block diagram

4.6 Branching/feeder/antenna requirements

4.6.1 Antenna radiation patterns

See EN 300 833 [18] and EN 301 215-4 [19].

4.6.2 Waveguide flanges

Where integral antennas are not used, one of the following flange types, defined in IEC 60154 [6] shall be used:

- UBR/PBR/CBR 260, may be used in the frequency range 24,25 GHz to 29,5 GHz;
- UBR/PBR/CBR 220, may be used in the frequency range 24,25 GHz to 26,5 GHz;
- UBR/PBR/CBR 320, may be used from 26,5 GHz to 29,5 GHz and from 31,0 GHz to 31,8 GHz.

4.6.3 Antenna Cross-Polar Discrimination (XPD)

See EN 300 833 [18] and EN 301 215-4 [19]

4.7 Power supply

The power supply interface shall be in accordance with ETS 300 132-1 [7] and EN 300 132-2 [8].

5 Baseband characteristics

5.1 Transmit/receive capacity

A video baseband bandwidth of up to 10 MHz may be used. This may have subcarriers associated with it.

It is recognized that subcarriers will be used to carry four distinct traffic types:

- Continuous Wave (CW) (e.g. continuity pilot);
- low frequency analogue (e.g. audio);

- wideband analogue (e.g. secondary video);
- digital signals.

5.2 Baseband parameters

5.2.1 Video interfaces

The video interface shall be in accordance with ITU-T Recommendation J.61 [9].

5.2.2 Audio interface

If an audio interface is implemented, then it shall be in accordance with ITU-T Recommendation J.21 [10].

5.2.3 IF interface

If an IF interface is implemented, then it shall be in accordance with ITU-R Recommendation F.403 [11].

6 Transmitter characteristics

6.1 Transmitter power range

Transmitter output power at point C' of the system block diagram (see figure 1) shall be in the range +5 dBm to +27 dBm.

Regulatory administrations may define sub-ranges within the above range.

NOTE: At WARC 92, an amendment was made to the ITU Radio Regulations [20] for this band, adding footnote 2504A which states: "As far as practical, sites for transmitting stations in fixed or mobile services, employing maximum values of equivalent isotropic radiated power (e.i.r.p.) density exceeding 24 dBW in any 1 MHz band in the frequency range 25,25 GHz to 27,50 GHz should be selected so that the direction of maximum radiation of any antenna will be at least 1,5° from the geostationary-satellite orbit, taking into account the effect of atmospheric refraction. The provisions of No. 2504A shall apply until such time as the ITU-R has made a recommendation on the e.i.r.p. density limits which should apply in the band".

6.2 Transmitter output power tolerance

The tolerance of the output power shall be within:

- nominal output power ± 3 dB for systems operating within non-weather protected locations;
- nominal output power ± 2 dB for systems operating within weather protected locations.

6.3 Radiated spectrum

6.3.1 Frequency deviation

With the limited system gain available in this band, predominantly due to economic limits on the transmit power available, relatively narrow frequency deviations (e.g. 8 MHz peak to peak) will have rather low ranges. Wide deviation systems (e.g. 16 MHz peak to peak for Phase Alternation Line (PAL) video signals) can provide lower receiver threshold levels and thus result in longer ranges being obtained. The present document includes three spectral masks, one for standard frequency deviation systems and one for wide frequency deviation systems operating in the range 24,25 GHz to 29,5 GHz and a third for systems operating at 31 GHz.

The frequency deviation of the primary traffic and sub-carriers shall be limited to a level that will ensure that the spectrum masks are not exceeded when the carrier is modulated with the relevant standard test signals. For television, this shall be 100 % colour bars.

NOTE: The mask also contains the maximum allowable centre frequency tolerance and this should be taken into consideration when setting up the deviation.

6.3.2 Spectrum masks

The radiated spectrum of the composite wideband signal shall fall within the spectrum masks given in figure 2a (standard frequency deviation) and in figure 2b (wide frequency deviation) for systems operating in the range 24,25 GHz to 29,5 GHz, or figure 2c (for systems operating in the 31 GHz band). The masks take into account an allowance for short-term frequency tolerance.

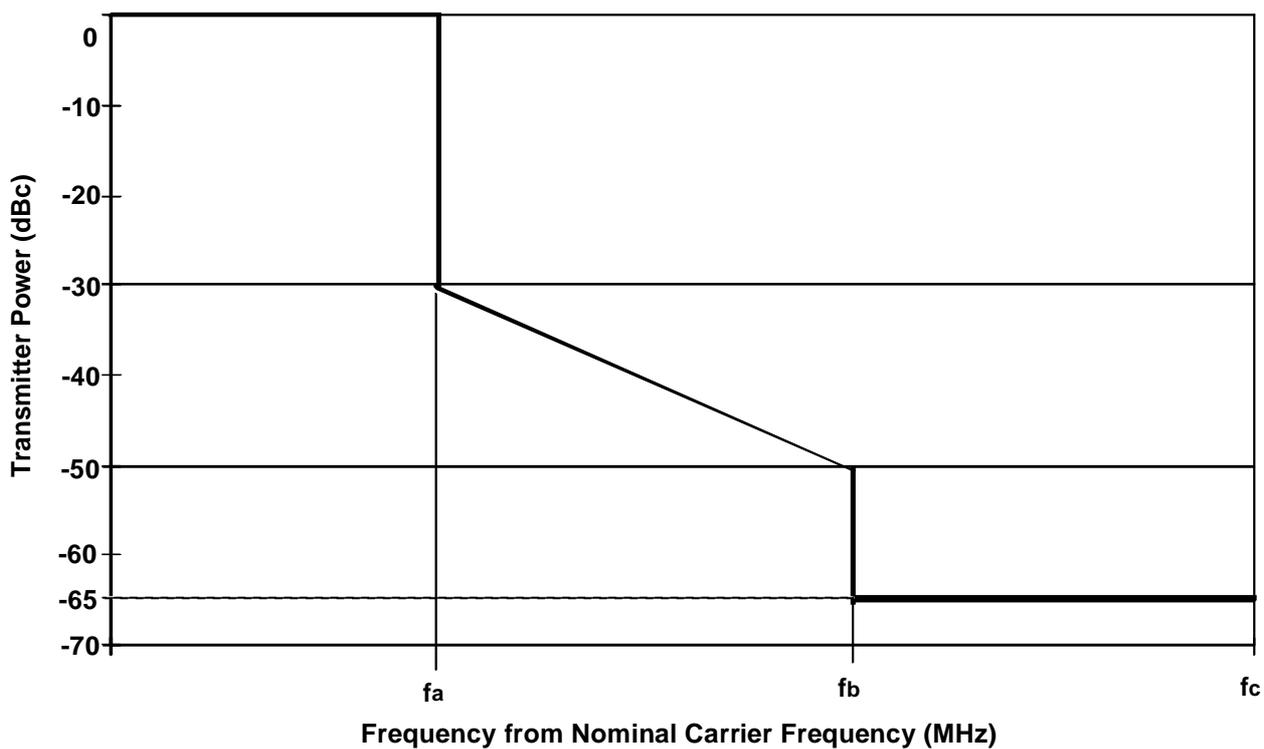
NOTE: Spectrum analyser settings for RF power spectrum measurements should be as shown in table 2 (for figures 2a and 2b) and table 3 (for figure 2c).

Table 2: Spectrum analyser settings with respect to figures 2a and 2b

RF centre frequency	Transmitter carrier frequency
IF bandwidth	30 kHz
Total sweep width	210 MHz
Amplitude scale	Logarithmic, 10 dB/division
Video filter	300 Hz
Total scan time	Auto

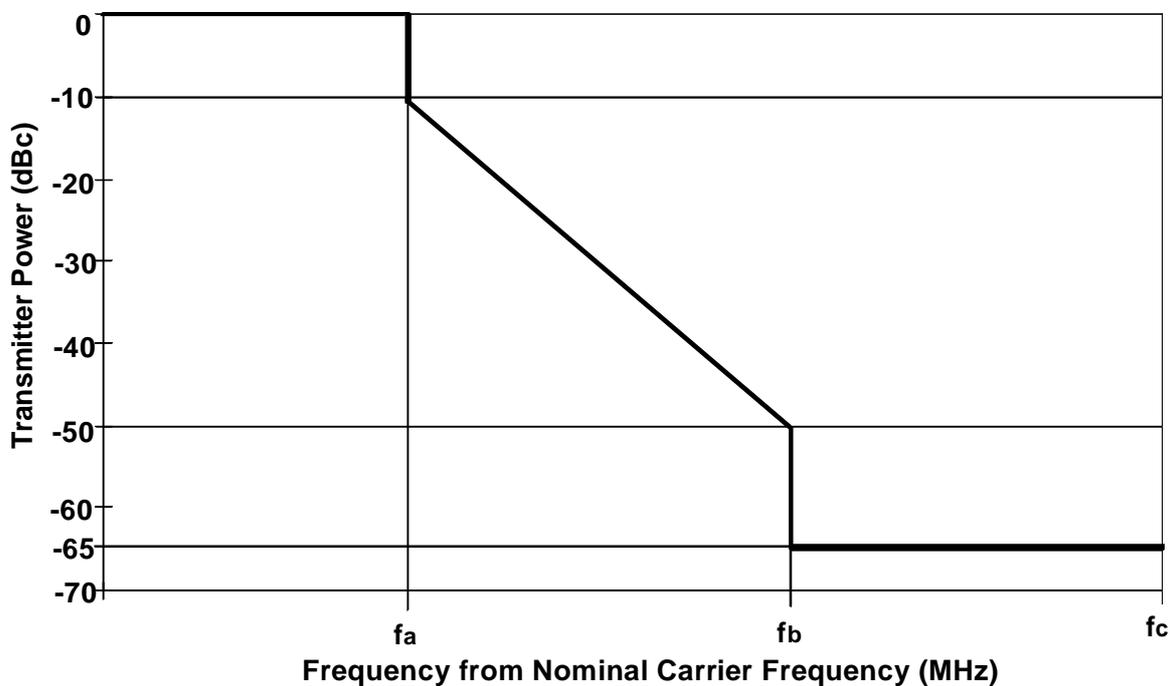
Table 3: Spectrum analyser settings with respect to figure 2c

RF centre frequency	Transmitter carrier frequency
Channel spacing	28 MHz
IF bandwidth	30 kHz
Total sweep width	140 MHz
Total scan time (s)	Auto
Video filter	300 Hz



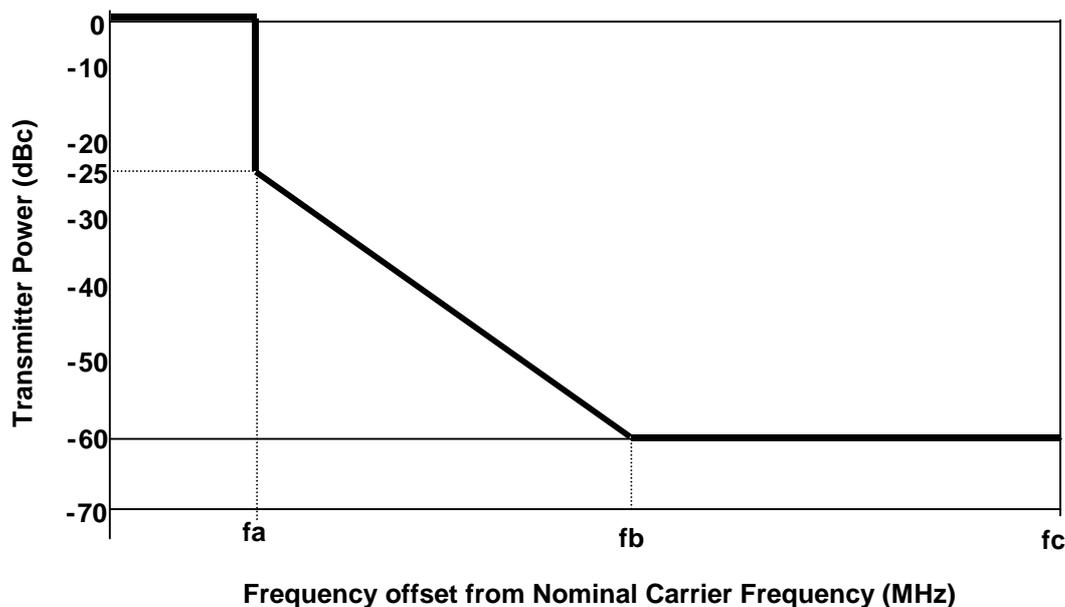
Baseband	f_a	f_b	f_c	Channel spacing
Up to 10 MHz	10,5 MHz	21 MHz	87,5 MHz	35 MHz

Figure 2a: Limits of spectral power density for video, standard frequency deviation



Baseband	f_a	f_b	f_c	Channel spacing
10 MHz	15 MHz	28 MHz	105 MHz	42 MHz

Figure 2b: Limits of spectral power density for video, wide frequency deviation



Baseband	f_a	f_b	f_c	Channel spacing
10 MHz	8 MHz	28 MHz	70 MHz	28 MHz

Figure 2c: Limits of Spectral Power Density for video in the 31 GHz band

6.4 Spurious emissions

According to ITU-R Recommendation F.1191-1 [13], and CEPT/ERC Recommendation 74-01 [14], the external spurious emissions are defined as emissions at frequencies which are outside the nominal carrier frequency $\pm 250\%$ of the relevant channel separation.

The limits of these emissions shall conform to CEPT/ERC Recommendation 74-01 [14].

6.5 Radio frequency tolerance

Radio frequency tolerances are included in the spectrum masks. Short-term radio frequency tolerance shall be less than ± 20 ppm.

7 Receiver characteristics

All levels are referenced to point C on the block diagram shown in figure 1.

7.1 Input level range

The input level range shall extend from the upper limit of -20 dBm to the limit specified in clause 7.4.

7.2 Spurious emissions

The limits of these emissions shall conform to CEPT/ERC Recommendation 74-01 [14].

7.3 Noise figure

The receiver noise figure shall not exceed 11 dB.

7.4 Receiver sensitivity

The receiver sensitivity is defined as the receive signal level referred to point C of the system block diagram (see figure 1) at which a certain minimum performance is reached. The receiver sensitivity which corresponds to ITU-R picture quality grade 5 shall not be worse than -56 dBm for standard frequency deviation equipment in all frequency bands covered by the present document and -70 dBm for wide frequency deviation equipment operating in the range 24,25 GHz to 29,5 GHz.

8 System performance

8.1 Performance characteristics

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

The receiver sensitivities given in clause 7.4 for ITU-R picture quality grade 5 are based on the Carrier to Noise (C/N) ratios given in table 5. Other picture grades for a typical wide deviation system can be obtained at lower thresholds, as shown in table 4.

Table 4: Typical minimum C/N requirements for different picture qualities

Picture quality	Minimum video Signal to Noise (S/N) ratio (dB)	Minimum Carrier to Noise (C/N) ratio (dB)
Grade 5	48	18
Grade 4	42	12
Grade 3	38	8

8.2 Interference sensitivity

a) Co-channel interference:

The IF C/N ratio shall be measured for a receiver operating with a wanted signal, the level of which at the receiver input port shall be the reference sensitivity input level given in clause 7.4. The value of that C/N ratio shall not be less than the value given in table 5.

Table 5: Specified C/N ratios

Video bandwidth (MHz)	C/N ratio (dB)
Up to 10 MHz, standard frequency deviation (all bands)	32
Up to 10 MHz, wide frequency deviation (24,25 GHz to 29,5 GHz only)	18

An interfering test signal shall then be added, the frequency of which shall also be at the nominal frequency of the wanted signal and at a level of -97 dBm. The IF C/N ratio of the wanted signal shall again be measured. The IF C/N shall not be less than the C/N ratio given in table 6 minus 1 dB.

b) Adjacent channel interference:

For a receiver operating with a wanted signal of nominal level, the introduction at point C of a like modulated interferer at the level and frequency separation given in table 6 shall not result in a degradation of the output signal/noise ratio of more than 1 dB.

Table 6: Adjacent channel separation and interference levels

Separation of wanted and interfering signal (MHz)	Interference level (carrier/interference) (dB)
28	0
35	0
42	0

c) CW spurious interference:

For a receiver operating with a wanted signal at the level of sensitivity given in clause 7.4, 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 up to 60 GHz, 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 S/N of more than 1 dB.

History

Document history		
Edition 1	March 1997	Publication as ETS 300 632
V1.2.1	February 2002	One-step Approval Procedure OAP 20020607: 2002-02-06 to 2002-06-07