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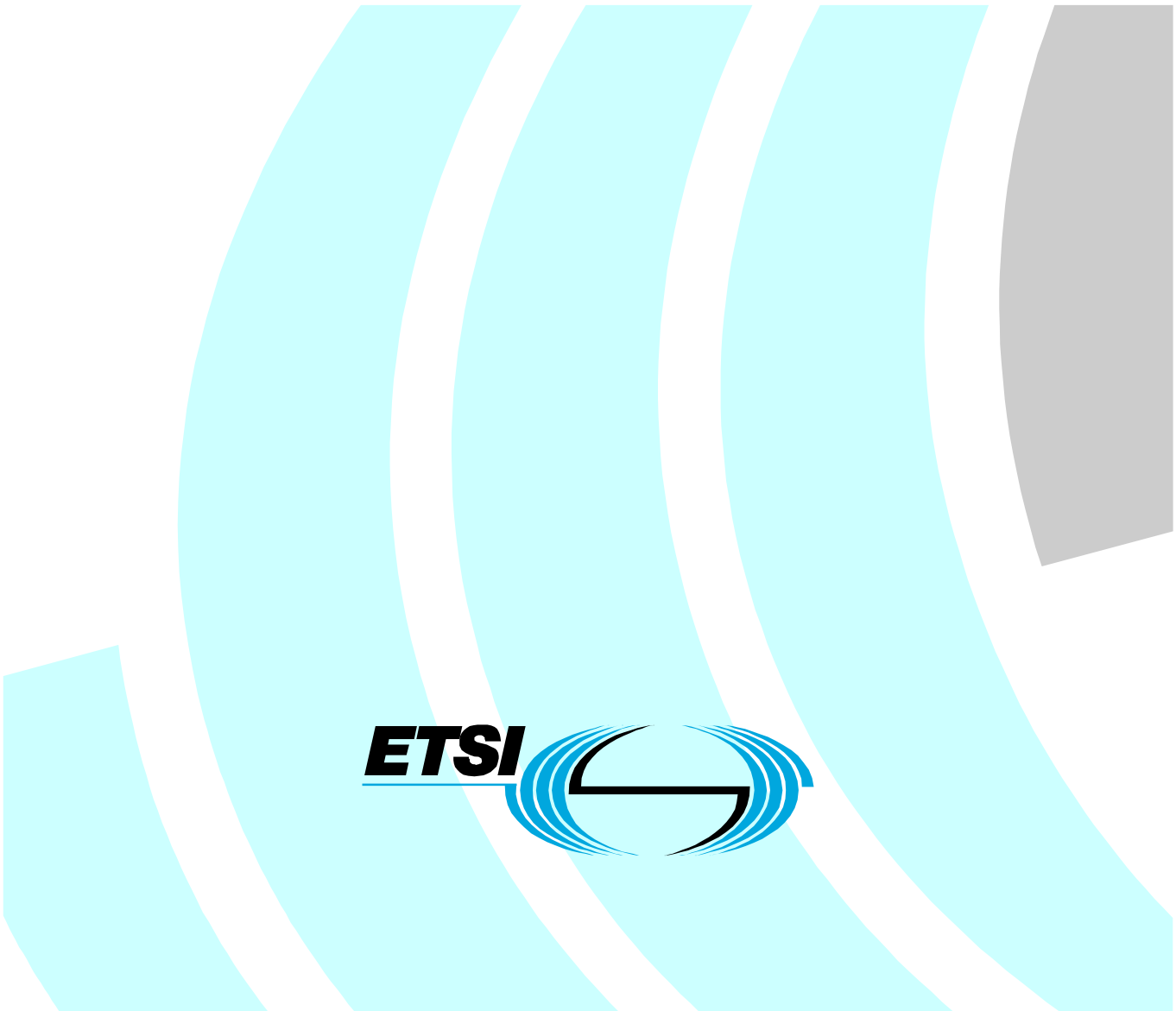
ETSI Standard

Electromagnetic compatibility and Radio spectrum Matters (ERM); Wireless digital video links operating above 1,3 GHz; Specification of typical receiver performance parameters for spectrum planning



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Foreword

This ETSI Standard (ES) has been produced by ETSI Technical Committee Electromagnetic compatibility and Radio spectrum Matters (ERM), and is now submitted for the ETSI standards Membership Approval Procedure.

1 Scope

The present document applies to wireless video links equipment operating above 1,3 GHz.

The present document specifies the reference receiver performance parameters, not covered by EN 302 064-1 [1], which are required for the purpose of spectrum planning and methods of investigation including resolving interference issues. These parameters play an important role in the frequency planning and the respective compatibility analysis performed by responsible national administrations.

The present document should be regarded as a living document and is intended to be updated in the light of new developments and innovation. Manufacturers are encouraged to provide receiver parameters of their products for inclusion within future revisions. It is hoped that by this method typical values can be provided for each proposed modulation system.

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.
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Referenced documents which are not found to be publicly available in the expected location might be found at http://docbox.etsi.org/Reference.

[1] ETSI EN 302 064-1: "Electromagnetic compatibility and Radio spectrum Matters (ERM); Wireless Video Links (WVL) operating in the 1,3 GHz to 50 GHz frequency band; Part 1: Technical characteristics and methods of measurement".

[2] ETSI TR 100 028 (all parts): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics".

3 Definitions and abbreviations

3.1 Definitions

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

frequency range: range of operating frequencies over which the equipment can be adjusted

operating frequency: nominal frequency at which the equipment can be operated; this is also referred to as the operating centre frequency

Quasi-Error-Free (QEF): (DVB-T) is defined as BER 2×10^{-4} after Viterbi decoding, which virtually eliminates errors following the Reed-Solomon decoder

3.2 Abbreviations

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

BER	Bit Error Rate
COFDM	Coded Orthogonal Frequency Division Multiplex
DVB-T	Digital Video Broadcast Terrestrial
FER	Frame Error Rate
QEF	Quasi-Error-Free
RF	Radio Frequency
Rx	Receiver

4 Receiver performance parameters

4.1 Introduction

The purpose of the present document is to provide additional information on receiver performance parameters which are not included in a product harmonized standard. This additional information can be used for spectrum planning, methods of investigation and resolving interference issues.

4.2 Applicability overview

Table 1 indicates the parameters which are considered applicable for the various technologies that are covered by the present document. Table 1 will be periodically updated in line with the knowledge of new modulation schemes and corresponding receiver parameters.

Table 1: Applicability overview

System	Rx sensitivity	Blocking or desensitization	Adjacent channel selectivity
DVB-T COFDM	Yes	Yes	Yes

4.3 Receiver parameter definitions

4.3.1 Rx sensitivity

The receiver sensitivity is the minimum power level at the receiver RF input produced by a carrier at the nominal frequency of the receiver, modulated with the normal modulation (clause 5.1.2) which will, without interference, produce after demodulation a data signal with either a specified Bit Error Rate (BER) or a Frame Error Rate (FER).

4.3.2 Blocking or desensitization

Blocking is a measure of the capability of the receiver to receive a wanted modulated signal without exceeding a given degradation due to the presence of an unwanted signal outside the wanted band at frequencies other than those of the spurious responses declared.

4.3.3 Adjacent channel selectivity

The adjacent channel selectivity is a measure of the capability of the receiver to receive a wanted modulated signal without exceeding a given degradation due to the presence of an unwanted signal that differs in frequency from the wanted signal by an amount equal to the adjacent channel separation for which the equipment is intended.

For digital video links based on COFDM, the adjacent channel is entered 5 MHz, 10 MHz or 20 MHz away depending on the declared bandwidth.

4.4 Reference values

4.4.1 DVB-T COFDM systems

The minimum receiver sensitivity shall not be less than the reference values as stated in table 2.

The blocking level, for any frequency within the specified ranges, shall be better than the values given in table 2, except at frequencies on which spurious responses are found.

The adjacent channel selectivity shall not be less than the values as stated in table 2.

Table 2: Reference values

Modulation	Code rate	QEF (note)	Receiver sensitivity
QPSK	1/2	3,1	-93 dBm
QPSK	2/3	4,9	-91 dBm
QPSK	3/4	5,9	-90 dBm
QPSK	5/6	6,9	-89 dBm
QPSK	7/8	7,7	-88 dBm
16-QAM	1/2	8,8	-87 dBm
16-QAM	2/3	11,1	-85 dBm
16-QAM	3/4	12,5	-84 dBm
16-QAM	5/6	13,5	-83 dBm
16-QAM	7/8	13,9	-82 dBm
64-QAM	1/2	14,4	-82 dBm
64-QAM	2/3	16,5	-80 dBm
64-QAM	3/4	18,0	-78 dBm
64-QAM	5/6	19,3	-77 dBm
64-QAM	7/8	20,1	-76 dBm
Blocking (All modes)		40 dB	
Adjacent channel selectivity		30 dB	
NOTE: Required C/N in a Gaussian channel for BER = 2E-4 after Viterbi, QEF after Reed-Solomon			

5 Recommended methods of measurement

5.1 Test conditions

All tests described in the present document need only be performed under normal test conditions.

5.1.1 Normal test conditions

5.1.1.1 Normal temperature and humidity

The normal temperature and humidity conditions for tests shall be any convenient combination of temperature and humidity within the following ranges:

- temperature: +15°C to +35°C;
- relative humidity: 20 % to 75 %.

5.1.1.2 Normal power source

5.1.1.2.1 Mains voltage

The normal test voltage for equipment to be connected to the mains shall be the nominal mains voltage. For the purpose of the present document, the nominal voltage shall be the voltage(s) for which the equipment was designed.

The frequency of the test power source corresponding to the AC mains shall be between 49 Hz and 51 Hz.

5.1.1.2.2 Lead-acid battery power sources used on vehicles

When radio equipment is intended for operation from the usual, alternator fed lead-acid battery power source used on vehicles, then the normal test voltage shall be 1,1 times the nominal voltage of the battery.

5.1.1.2.3 Other power sources

For operation from other power sources or types of battery (primary or secondary), the nominal test voltage shall be as stated by the equipment manufacturer.

5.1.2 Normal modulation

The manufacturer shall describe the modulation to be used by the signal generator(s) during the measurements described in the present document. This modulation should be representative of normal use of the equipment. The same modulation shall be used for all measurements on the same equipment.

5.2 Test arrangements

Radiated RF power measurements are imprecise and therefore conducted measurements are recommended.

Equipment used for testing may be provided with a suitable connector for conducted RF measurements. Where this is not possible, a suitable test fixture shall be used. Alternatively, radiated measurements shall be performed.

Plug-in radio devices may be tested together with a suitable test jig and/or typical host equipment.

5.3 Minimum Rx sensitivity

5.3.1 Method of measurement

The measurement procedure shall be as follows:

a) an input signal with a frequency equal to the nominal frequency (±20 ppm) of the receiver, using normal modulation (clause 5.1.2), shall be applied to the receiver input;

b) depending on the type of system, the bit pattern of the modulating signal or the frame packets shall be compared to those obtained from the receiver after demodulation to calculate the Bit Error Rate (BER), or the Frame Error Rate (FER) in case the frame packets contain means for detecting frame errors;

c) the level of the input signal to the receiver is adjusted until the stated maximum Bit Error Ratio (BER) or Frame Error Rate (FER) is met;

d) the maximum usable sensitivity is the mean level of the input signal to the receiver.

The minimum receiver sensitivity may vary with the data rate. Therefore the above procedure may need to be repeated for the different data rates of the equipment.

5.4 Blocking or desensitization

This measurement method can be used for all types of equipment specified in table 1.

Two signal generators A and B shall be connected to the receiver via a combining network, either:

a) via a test fixture to the integrated or dedicated receiver antenna; or

b) directly to the permanent or temporary receiver antenna connector.

Signal generator A shall be at the frequency of the edge channel of the operating band (see below) of the receiver, with normal modulation (clause 5.1.2) of the wanted signal.

Signal generator B, shall be unmodulated and be adjusted to test frequencies above and below the channel edges as specified below.

Initially signal generator B shall be switched off and using signal generator A the level which still gives sufficient response shall be established. The output level of generator A shall then be increased by 3 dB.

Signal generator B is then switched on and adjusted until the wanted criteria are met.

The frequency for signal generator B shall be at the following frequencies:

- With generator A tuned to the highest channel of the operating band, generator B shall be tuned in turn to +5 MHz, +10 MHz, +20 MHz and +50 MHz from the upper band edge.
  The tests shall be repeated with generator A tuned to the lowest channel of the operating band, generator B shall be tuned in turn to -5 MHz, -10 MHz, -20 MHz and -50 MHz from the lower band edge.

- Frequencies at which spurious responses are found should be ignored.

The blocking or desensitization is the ratio in dB between the level of the unwanted signal (generator B) and the level of the wanted signal (generator A).

5.5 Adjacent channel selectivity

5.5.1 General

This parameter is applicable for equipment where specific carrier frequencies or a channelization is specified.

5.5.2 Method of measurement

This measurement shall be conducted under normal conditions.

Two signal generators A and B shall be connected to the receiver via a combining network, either:

a) via a test fixture to the integrated or dedicated receiver antenna; or

b) directly to the permanent or temporary receiver antenna connector.

Signal generator A shall be at the nominal frequency of the receiver, with normal modulation (clause 5.1.2) of the wanted signal. Signal generator B shall be modulated using normal modulation (clause 5.1.2) and shall be adjusted to the adjacent channel frequency above that of the wanted signal.

Initially signal generator B shall be switched off and using signal generator A the level that still gives sufficient response shall be established. The output level of generator A, shall then be increased by 3 dB.

Signal generator B is then switched on and adjusted until the wanted criteria are met.

The measurements shall be repeated for the adjacent channel below the wanted signal.

The adjacent channel selectivity is the ratio in dB between the level of the unwanted signal (generator B) and the level of the wanted signal (generator A).

6 Interpretation of measurement results

The interpretation of the results for the measurements described in the present document shall be as follows:

- the measured value will be compared to the corresponding reference value;

- the measurement uncertainty value for the measurement of each parameter shall be noted;

- the recorded value of the measurement uncertainty shall be, for each measurement, equal to or lower than the figures in table 3.

For the test methods, according to the present document, the measurement uncertainty figures shall be calculated in accordance with TR 100 028 [2] and shall correspond to an expansion factor (coverage factor) k = 1,96 or k = 2 (which provide confidence levels of respectively 95 % and 95,45 % in the case where the distributions characterizing the actual measurement uncertainties are normal (Gaussian)).

Table 3 is based on such expansion factors.

Table 3: Maximum measurement uncertainty

Parameter	Uncertainty
radio frequency	$\pm 1 \times 10^{-7}$
RX sensitivity	±3 dB
2-signal measurements	±4 dB
temperature	±1°C
humidity	±5 %
DC and low frequency voltages	±3 %

Annex A (informative): Bibliography

ECC/REC 02-01: "Specification of Reference Receiver Performance Parameters".

History

Document history		
V1.1.1	August 2003	Membership Approval Procedure MV 20031003: 2003-08-05 to 2003-10-03