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European Standard (Telecommunications series)

Electromagnetic compatibility and Radio spectrum Matters (ERM); Product family emission standard for wire-line telecommunication networks

Reference

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Contents

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Foreword

This European Standard (Telecommunications series) has been produced by ETSI Technical Committee Electromagnetic compatibility and Radio spectrum Matters (ERM), and is now submitted for the Public Enquiry phase of the ETSI standards Two-step Approval Procedure.

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

Introduction

The present document specifies limits and methods of measurement for disturbance emissions emanating from wire-line telecommunication networks. These limits and methods of measurement address disturbance emissions occurring in and along wire-line telecommunication networks under normal operation conditions.

1 Scope

The present document specifies limits and methods of measurement for disturbance emissions emanating from wire-line telecommunication networks as defined in clause 3, including their in-house extensions, installed and operated as intended.

The present document covers the frequency range 9 kHz to 400 GHz. To date, it specifies limits and methods of measurement for conducted and radiated disturbances from telecommunication networks in the frequency range 150 kHz to 1 GHz. The assessment of a network needs to be performed only in the frequency ranges where limits are defined.

The limits set in the present document do not apply to wanted emissions from radio transmitters.

The emission requirements have been selected so as to ensure that disturbances generated by a network, or parts thereof, operating normally do not exceed a level that could prevent other apparatus from operating as intended. Fault conditions of the network are not taken into account. Not all disturbance phenomena have been included for testing purposes in the present document but only those considered as relevant for the network covered by the present document. These test requirements represent essential electromagnetic compatibility emission requirements.

NOTE: In special cases, situations will arise where the levels specified in the present document will not offer adequate protection; for example where a sensitive receiver is used in close proximity to a network. In these instances, special mitigation measures may have to be employed.

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.

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

[1] CENELEC EN 50083-2: "Cable networks for television signals, sound signals and interactive services - Part 2: Electromagnetic compatibility for equipment".

[2] CENELEC EN 55013: "Sound and television broadcast receivers and associated equipment - Radio disturbance characteristics - Limits and methods of measurement".

[3] CENELEC EN 55022: "Information technology equipment - Radio disturbance characteristics - Limits and methods of measurement".

[4] ETSI EN 300 386: "Electromagnetic compatibility and Radio spectrum Matters (ERM); Telecommunication network equipment; ElectroMagnetic Compatibility (EMC) requirements".

[5] ETSI EN 301 489 (all parts): "Electromagnetic compatibility and Radio spectrum Matters (ERM); ElectroMagnetic Compatibility (EMC) standard for radio equipment and services".

[6] CISPR 16-1: "Specification for radio disturbance and immunity measuring apparatus and methods - Part 1: Radio disturbance and immunity measuring apparatus".

[7] CENELEC EN 55016-4-2:2004: "Specification for radio disturbance and immunity measuring apparatus and methods - Part 4-2: Uncertainties, statistics and limit modelling - Uncertainty in EMC measurements".

3 Definitions and abbreviations

3.1 Definitions

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

disturbance field strength: field strength produced at a given location by an electromagnetic disturbance, measured under specified conditions (IEC - IEV 161-04-02)

electromagnetic disturbance: any electromagnetic phenomenon that may degrade the performance of a device, equipment or system, or adversely affect living or inert matter (IEC - IEV 161-01-05)

emission: phenomenon by which electromagnetic energy emanates from a source (IEC - IEV 161-01-08)

radio (frequency) disturbance: electromagnetic disturbance having components within the radio frequency range (IEC - IEV 161-01-13)

measurement distance: The measurement distance is taken as a straight line rectangular from the telecommunication cable tract (or its projection to the floor level), from the boundary of the premises, office, or flat, or from the exterior wall of the building hosting the network concerned, to the measuring antenna reference point. This reference point can be:

- the centre of the coil of a loop antenna used for measurements of the magnetic component of electromagnetic fields; or
- the balun, in case of a broadband dipole, or the reference point of a logarithmic-periodical or horn antenna referred to for calibration purposes.

wire-line telecommunication network: combination of equipment and passive devices (network cables, connectors) interconnected together (see figure 1 of EN 302 262) to constitute the wire-line part of an electronic communications network

electronic communications network: means transmission systems and, where applicable, switching or routing equipment and other resources which permit the conveyance of signals by wire, by radio, by optical or by other electromagnetic means, including satellite networks, fixed (circuit- and packet-switched, including Internet) and mobile terrestrial networks, electricity cable systems, to the extent that they are used for the purpose of transmitting signals, networks used for radio and television broadcasting, and cable TV networks, irrespective of the type of information conveyed

network cable: cable infrastructure (transmission line) used to connect together telecom installations, systems and telecom terminal equipment

NOTE: The network cable may also include in-premises extension cables.

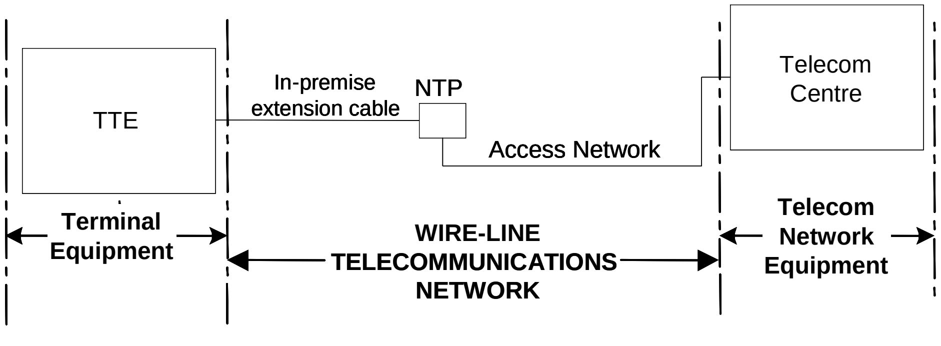

Figure 1: Diagram showing alignment of definitions to a typical wire-line telecommunications network

3.2 Abbreviations

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

CENELEC	European Committee for Electrotechnical Standardization
CISPR	International Special Committee on Radio Interference
EMC	ElectroMagnetic Compatibility
ETSI	European Telecommunications Standards Institute
IEC	International Electrotechnical Committee
IEV	International Electrotechnical Vocabulary
ITE	Information Technology Equipment
NTP	Network Termination Point
TTE	Telecom Terminal Equipment
TV	Television

4 Assessment procedure for telecommunication networks

The whole or part of the telecommunication network is deemed to be compliant to the present standard:

- If all equipment directly connected to the network or part thereof meets the emission requirements defined in the applicable EMC product standard (see Annex A) taking the properties of the network cable type into account; or
- If the network meets the requirements specified in clause 4.1.

4.1 Network requirements

4.1.1 Applicability

Emission measurements shall either be performed on real operating networks installed in the field or on a representative reference network. The assessment can be made either on a complete network or over a given part of it.

Measurements are not required within equipment enclosures, in telecommunication centres or in industrial areas.

4.1.2 Limits below 30 MHz

The telecommunication network shall meet the limits specified in table 1 according to the measurement method specified in clause 5.2 and using the measurement procedure defined in clause 7.

Table 1: Limits of conducted common-mode (asymmetric mode) disturbances on wire-line telecommunications network cables

Frequency range (MHz)	Current limits (dB(µA))		Measurement bandwidth
	Quasi-peak	Average	
0,15 to 0,5	40 to 30 (see note)	30 to 20 (see note)	9 kHz
0,5 to 30	30	20	9 kHz
NOTE: In the frequency range 0,15 MHz to 0,5 MHz, the limit decreases linearly with the logarithm of frequency.			

4.1.3 Limits above 30 MHz

The telecommunication network shall meet the radiated limits specified in table 2 according to the measurement method specified in clause 5.3. The normalization to the reference measurement distance shall be as defined in clause 6.1.2. The measurement procedure defined in clause 7 shall be used.

In the case of rooms or buildings where both telecommunication networks **and** their connected equipment are used, measurements shall be made only outside those rooms or buildings.

Table 2: Limits of radiated disturbances from wire-line telecommunications networks above 30 MHz

Frequency range (MHz)	Quasi-Peak Field strength limit (dB(μV/m))	Reference measurement distance	Measurement bandwidth
30 to 230	30	10 m	120 kHz
230 to 1 000	37	10 m	120 kHz
NOTE: The lower limit shall apply at the transition frequency.			

5 Disturbance emission measurement methods

5.1 General arrangements

In order to get the highest readings of disturbances it shall be ensured that the part of the telecommunication network being assessed operates at maximum wanted signal levels typical for this site and in the mode that results in maximum RF disturbance field strength levels consistent with normal operation. If the system is interactive, measurements shall also be performed in the presence of both the upstream and downstream signals.

5.2 Conducted measurements below 30 MHz

For conducted disturbance emission measurements in the frequency range 150 kHz to 30 MHz, a suitable current probe in accordance with CISPR 16-1 [6] clause 5.2.1 is required.

A suitable current probe shall be clamped at the cable at a mechanically accessible point. Subsequently, the common-mode current conducted at the relevant network cable shall be measured. For the assessment of this current, the limits specified in table 1 apply.

The measurement of conducted emissions on telecommunications networks in the frequency range up to 30 MHz may become complicated due to the presence of a variety of high-level wanted RF emissions from radio services.

In view of this it may be necessary to restrict the measurements to the frequency ranges (called quiet frequencies) where the background noise and any ambient signals are below the applicable disturbance emission limits. Where possible this margin should be greater than 6 dB. This should be done without altering the current probe position and ideally with the electronic communications network switched off.

5.3 Radiated measurements above 30 MHz

In the frequency range 30 MHz to 1 GHz the electric field component of the radiated disturbance emission shall be measured.

The electric component of radiated disturbance emissions shall be measured as electric field strength (in dB(μV/m)) at the reference measurement distance.

For disturbance emission measurements in the frequency range 30 MHz to 1 GHz a calibrated measuring system in accordance with CISPR 16-1 [6], consisting of a radio disturbance measuring receiver (or a suitable spectrum analyser) in conjunction with an associated broadband dipole, a logarithmic-periodical antenna, or a horn antenna, or similar linearly polarized antenna, each suitable for measurement of electric components of the electromagnetic field, and an antenna mast is required.

In the frequency range from 30 MHz to 1 GHz, a measuring bandwidth of 120 kHz and a quasi-peak detector shall be used.

Set the measuring receiver or spectrum analyser to the measuring frequency and type of detector required and perform the measurements. At the specified measurement location and measuring point(s), the direction, height, and polarization (horizontal and vertical) of the measuring antenna shall be varied in order to determine the maximum RF disturbance field strength. The electrical component of the disturbance field strength shall be determined by observing the indication of the measuring receiver over a period of approximately 15 s and subsequent recording of its maximum indication. Any short duration isolated peaks shall be ignored.

If the antenna and the telecommunication network are located at the same level, then the antenna height shall be varied between 1 m and 4 m in order to determine the maximum field strength. In varying the antenna height, the antenna shall not be positioned closer than 0,5 m to reflecting objects (e.g. walls, ceilings, metallic structures, etc.). The antenna height variation may be restricted owing to local conditions (see figure 3).

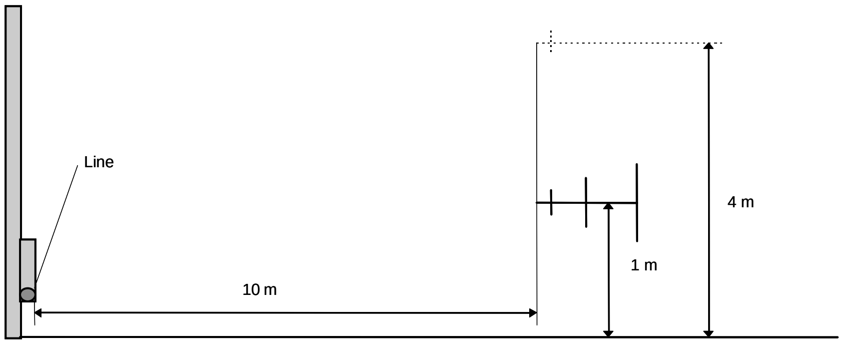

Figure 3: Antenna height variation

If, e.g. in case of an outdoor measurement, the antenna support is not at the same level as the network cable, then the antenna shall be varied in height resulting in a variation range comparable to that detailed in the previous paragraph.

The measurement of electric fields radiated from telecommunication networks in the frequency range above 30 MHz may become complicated due to the presence of a variety of high-level wanted RF emissions from radio services.

In view of this it may be necessary to restrict the measurements to the frequency ranges (called quiet frequencies) where the background noise and any ambient signals are below the applicable disturbance emission limits. Where possible this margin should be greater than 6 dB. This should be done without altering the antenna position and ideally with the telecommunication network switched off.

If the network cannot be switched off, then the following alternative may be used:

- orientate the antenna for minimum coupling to the network emission and check that the background noise and any ambient signals are below the applicable disturbance emission limits, where possible this margin should be greater than 6dB;

- orientate the antenna for maximum coupling and then increase the measurement distance and check that there is a reduction in the measured field strength in accordance with clause 6.1.

The quiet frequencies or frequency ranges identified shall be used to measure the disturbance emission. The background noise levels on each of these frequencies shall be assessed subjectively. Using the measuring bandwidth and detector specified, the highest disturbance field strength level (in dB(µV/m)) observed over a period of 15 s shall be recorded. Any short duration isolated peaks should be ignored.

If local restrictions require a reduction of the measurement distance to less than the reference measurement distance, the actual measurement distance may be reduced provided it is not less than 1 m to the network to be assessed. In case of outdoor measurements, it may also be necessary to use a measurement distance that is larger than the reference distance.

If the actual measurement distance deviates from the reference distance, then the obtained measurement results shall be normalized to the reference distance. For that normalization, the method specified in clause 6.1 shall be used.

6 Processing of obtained measuring results

6.1 Normalization of measured field strengths to the reference measurement distance for measurements made in accordance with clauses 5.2 to 5.3

6.1.1 Graphical method

If possible, graphical normalization should be used.

During measurements of disturbance field strengths, local restrictions in space (appearing e.g. during indoor measurements) may require a reduction of the measuring distance to less than the reference measurement distance. The actual measurement distance may be smaller than the reference distance, but not closer than 1 m to the cable to be assessed. In the case of outdoor measurements, it may also be necessary to use a measurement distance which is larger than the reference distance.

If a measurement distance greater or smaller than the reference measurement distance needs to be used, then three different and accessible measuring points located along the measuring axis shall be chosen. The distance between these points should be as large as possible. At each point, the level of the disturbing field strength shall be measured. The local conditions and measurability of the disturbance field strength will be the determining factors.

The measurement results shall then be plotted in a diagram showing the field strength levels in dB(μA/m) or dB(μV/m) versus the logarithm of the measurement distance. The line interconnecting the measurement results represents the slope in field strength along the measuring axis. If this slope cannot be determined, then additional measuring points shall be chosen. The field strength level at the reference measurement distance can be read from the diagram using the straight prolongation of the interconnecting line.

6.1.2 Calculation method

This method is only applicable at frequencies above 30 MHz.

If it is not possible to measure at different measuring distances and the measurement distance refers to the outer wall of a building or the border of the premises, the measurement results shall be converted to the reference distance using equation (6.1.2).

$$E_{\text{std}} = E_{\text{mea}} + n \cdot 20 \log \frac{d_{\text{mea}}}{d_{\text{std}}} \qquad (6.1.2)$$

Where:

- $\boldsymbol{E_{std}}$: electric field strength normalized to the reference measurement distance in dB(μV/m) for comparison with the emission limit;
- $\boldsymbol{E_{mea}}$: electric field strength reading obtained at the actual measurement distance in dB(μV/m);
- $\boldsymbol{d_{mea}}$: actual measurement distance in m;
- $\boldsymbol{d_{std}}$: reference measuring distance in m.

Exponent ***n*** accommodates the difference between the actual measuring distance and the true distance to the telecommunication network, cable, or tract. It shall be chosen as follows:

- for 30 m ≤ $\boldsymbol{d_{mea}}$ a factor of $\boldsymbol{n} = 1$ shall be used;

- for 10 m ≤ $\boldsymbol{d}_{mea}$ < 30 m a factor of $\boldsymbol{n}$ = 0,8 shall be used;
- for 3 m ≤ $\boldsymbol{d}_{mea}$ < 10 m a factor of $\boldsymbol{n}$ = 0,6 shall be used.

If possible for the measurement of the electric field strength, a measurement distance closer than 3 m should not be used. If, however, the actual measurement distance is in the range of 1 m, then the measured value of the disturbance field strength may be normalized to the reference measurement distance using an exponent of $\boldsymbol{n}$ = 0,6.

Normalization of measurement results by calculation is not permitted if, at the measurement location, the true distance to the telecommunication network cable is not known.

6.2 Correction of measurement results due to near field conditions

Measurement results for the magnetic or electric disturbance field strength obtained by means of the measuring system described in clause 5.3 do not need any related subsequent correction, even if measured under near field conditions.

6.3 Treatment of measurement uncertainty

Compliance with the limits in the present document is based on the results of the compliance measurement not taking into account measurement instrumentation uncertainty. However, the estimate of the measurement instrumentation uncertainty shall be calculated and both the measurement results and the calculated uncertainty shall appear in the test report.

Information in tables 3 and 4 can be used to determine this uncertainty (ref.: EN 55016-4-2:2004 [7]). In order to determine the total measuring uncertainty the contribution of each component used during the measurements shall be summed up. This calculated total value shall be recorded in the test report.

6.3.1 Definitions and symbols

6.3.1.1 General symbols

X_i	input quantity
x_i	estimate of X_i
$u(x_i)$	standard uncertainty of x_i
c_i	sensitivity coefficient
y	result of a measurement, (the estimate of the measurand), corrected for all recognized significant systematic effects
$u_c(y)$	(combined) standard uncertainty of y
k	coverage factor
U	expanded uncertainty of y

6.3.1.2 Measurands

V	Voltage, in dB(μV)
E	Electric field strength, in dB(μV/m)
I	Current, in dB(μA)

6.3.1.3 Input quantities

V_r	Receiver voltage reading, in dB(μV)
L_c	Attenuation of the connection between the receiver and the current probe or antenna, in dB
L_{CP}	Current probe transfer impedance, in dB
AF	Antenna factor, in dB(/m)
δV_{sw}	Correction for receiver sine wave voltage inaccuracy, in dB
δV_{pa}	Correction for imperfect receiver pulse amplitude response, in dB

δV_{pr}	Correction for imperfect receiver pulse repetition rate response, in dB
δV_{nf}	Correction for the effect of the receiver noise floor, in dB
δM	Correction for the error caused by mismatch, in dB
δAF_f	Correction for antenna factor interpolation error, in dB
δAF_h	Correction for the difference between the antenna factor variation with height, and the variation with height of the antenna factor of a reference dipole, in dB
δA_{dir}	Correction for antenna directivity, in dB
δA_{ph}	Correction for antenna phase centre location, in dB
δA_{cp}	Correction for antenna cross-polarization response, in dB
δA_{bal}	Correction for antenna unbalance, in dB

6.3.2 Measurement instrumentation uncertainty

The measurement instrumentation uncertainty shall be evaluated for those measurements addressed in the following clauses, taking into consideration each of the quantities listed there. The standard uncertainty $u(x_i)$ in decibels and the sensitivity coefficient c_i shall be evaluated for the estimate x_i of each quantity. The combined standard uncertainty $u_c(y)$ of the estimate y of the measurand shall be calculated as:

$$u_c(y) = \sqrt{\sum_i c_i^2 \; u^2(x_i)}$$

The expanded measurement instrumentation uncertainty U_{lab} for a test laboratory shall be calculated as:

$$U_{lab} = 2 \; u_c(y)$$

and shall be stated in the test report.

NOTE: The coverage factor k = 2 yields approximately a 95 % level of confidence for the near-normal distribution typical of most measurement results.

6.3.2.1 Quantities to be considered for radiated disturbance measurements of electric field strength

- Receiver reading
- Attenuation of the connection between antenna and receiver
- Antenna factor
- Receiver sine-wave voltage accuracy
- Receiver pulse amplitude response
- Receiver pulse response variation with repetition frequency
- Receiver noise floor
- Mismatch effects between antenna port and receiver
- Antenna factor frequency interpolation
- Antenna factor variation with height
- Antenna directivity
- Antenna phase centre
- Antenna cross-polarization response
- Antenna balance

Definitions of measurement uncertainty terms, and information on the evaluation and expression of the uncertainty of measurement are available in EN 55016-4-2:2004 [7].

The measurand *E* is calculated as:

$$E = V_r + L_c + AF + \delta V_{sw} + \delta V_{pa} + \delta V_{pr} + \delta V_{nf} + \delta M + \delta AF_f + \delta AF_h + \delta A_{dir} + \delta A_{ph} + \delta A_{cp} + \delta A_{bal} + \delta SA + \delta d + \delta h$$

Table 3: Radiated disturbances from 30 MHz to 200 MHz using a biconical antenna at a distance of 3 m, 10 m, or 30 m

Input quantity	X_i	Uncertainty of x_i		$u(x_i)$	c_i	$c_i\ u(x_i)$
		dB	Probability distribution function	dB		dB
Receiver reading	V_r	±0,1	k = 1	0,10	1	0,10
Attenuation: antenna-receiver	L_c	±0,1	k = 2	0,05	1	0,05
Biconical antenna factor	AF	±2,0	k = 2	1,00	1	1,00
Receiver corrections:						
- Sine wave voltage	δV_{sw}	±1,0	k = 2	0,50	1	0,50
- Pulse amplitude response	δV_{pa}	±1,5	Rectangular	0,87	1	0,87
- Pulse repetition rate response	δV_{pr}	±1,5	Rectangular	0,87	1	0,87
- Noise floor proximity	δV_{nf}	±0,5	k = 2	0,25	1	0,25
Mismatch: antenna-receiver	δM	+0,9/-1,0	U-shaped	0,67	1	0,67
Biconical antenna corrections:						
- AF frequency interpolation	δAF_f	±0,3	Rectangular	0,17	1	0,17
- AF height deviations	δAF_h	±0,3	Rectangular	0,17	1	0,17
Directivity difference:						
- at 3 m	δA_{dir}	+1,0/-0,0	Rectangular	0,29	1	0,29
- or 10 m	δA_{dir}	+1,0/-0,0	Rectangular	0,29	1	0,29
- or 30 m	δA_{dir}	+0,5/-0,0	Rectangular	0,14	1	0,14
Phase centre location:						
- at 3 m	δA_{ph}	±0,0		0,00	1	0,00
- or 10 m	δA_{ph}	±0,0		0,00	1	0,00
- or 30 m	δA_{ph}	±0,0		0,00	1	0,00
Cross-polarization	δA_{cp}	±0,0		0,00	1	0,00
Balance	δA_{bal}	±0,9	Rectangular	0,52	1	0,52

Hence: $2\ u_c(E)$ = 5,06 dB at a separation of 3 m;

5,04 dB at a separation of 10 m;

5,02 dB at a separation of 30 m.

Table 4: Radiated disturbances from 200 MHz to 1 GHz using a log-periodic antenna at a distance of 3 m, 10 m, or 30 m

Input quantity	X_i	Uncertainty of x_i dB	Probability distribution function	$u(x_i)$ dB	c_i	$c_i\, u(x_i)$ dB
Receiver reading	V_r	±0,1	k = 1	0,10	1	0,10
Attenuation: antenna-receiver	L_c	±0,1	k = 2	0,05	1	0,05
Log-periodic antenna factor	AF	±2,0	k = 2	1,00	1	1,00
Receiver corrections:						
- Sine wave voltage	δV_{sw}	±1,0	k = 2	0,50	1	0,50
- Pulse amplitude response	δV_{pa}	±1,5	Rectangular	0,87	1	0,87
- Pulse repetition rate response	δV_{pr}	±1,5	Rectangular	0,87	1	0,87
- Noise floor proximity	δV_{nf}	±0,5	K = 2	0,25	1	0,25
Mismatch: antenna-receiver	δM	+0,9/-1,0	U-shaped	0,67	1	0,67
Log-periodic antenna corrections:						
- AF frequency interpolation	δAF_f	±0,3	Rectangular	0,17	1	0,17
- AF height deviations	δAF_h	±0,3	Rectangular	0,17	1	0,17
- Directivity difference:						
- at 3 m	δA_{dir}	+1,0/-0,0	Rectangular	0,29	1	0,29
- or 10 m	δA_{dir}	+1,0/-0,0	Rectangular	0,29	1	0,29
- or 30 m	δA_{dir}	+0,5/-0,0	Rectangular	0,14	1	0,14
Phase centre location:						
- at 3 m	δA_{ph}	±1,0	Rectangular	0,58	1	0,58
- or 10 m	δA_{ph}	±0,3	Rectangular	0,17	1	0,17
- or 30 m	δA_{ph}	±0,1	Rectangular	0,06	1	0,06
Cross-polarization	δA_{cp}	±0,9	Rectangular	0,52	1	0,52
Balance	δA_{bal}	±0,0		0,00	1	0,00

Hence: 2 uc(E) = 5,19 dB at a separation of 3 m;

5,06 dB at a separation of 10 m;

5,02 dB at a separation of 30 m.

6.3.2.2 Quantities to be considered for conducted disturbance measurements of common mode current

- Receiver reading
- Attenuation of the connection between current probe and receiver
- Current probe transfer impedance
- Receiver sine-wave voltage accuracy
- Receiver pulse amplitude response
- Receiver pulse response variation with repetition frequency
- Receiver noise floor
- Mismatch effects between current probe and receiver

The measurand *I* is calculated as:

$$I = V_r + L_c - L_{cp} + \delta V_{sw} + \delta V_{pa} + \delta V_{pr} + \delta V_{nf} + \delta M$$

Table 5: Disturbance measurement of common mode current from 150kHz to 30 MHz

Input quantity	X_i	Uncertainty of x_i dB	Probability distribution function	$u(x_i)$ dB	c_i	$c_i\, u(x_i)$ dB
Receiver reading	V_r	±0,1	k = 1	0,10	1	0,10
Attenuation: current probe-receiver	L_c	±0,1	k = 2	0,05	1	0,05
Current probe transfer impedance	L_{ac}	±3,0	k = 2	1,50	1	1,50
Receiver corrections:						
Sine wave voltage	δV_{sw}	±1,0	k = 2	0,50	1	0,50
Pulse amplitude response	δV_{pa}	±1,5	Rectangular	0,87	1	0,87
Pulse repetition rate response	δV_{pr}	±1,5	Rectangular	0,87	1	0,87
Noise floor proximity	δV_{nf}	±0,0		0,00	1	0,00
Mismatch: current probe-receiver	δM	+0,7/-0,8	U-shaped	0,53	1	0,53

7 Network measurement procedure

Pre-measurements shall be carried out on the network under investigation in order to identify the normal operating conditions that give rise to the maximum emissions. The operating conditions identified during the pre-measurements shall be used to make the final measurements.

7.1 Measurements on real operating networks

In order to find the sources of maximum emission, pre-measurements shall be taken at a minimum of six locations selected as relevant for the network topology being used. It is recommended to perform at least three measurements in each of these six areas.

For technically integrated portions of networks that are not mechanically continuous each portion shall by treated as a separate network in its own right.

A description of the selected parts together with a justification of its relevance shall be documented in the test report.

7.2 Measurements on representative networks

For tests on a representative reference network, the user of the standard shall provide in the test report a description of this reference network together with a justification of its relevance.

NOTE: A reference network may be either a laboratory model network or a representative field network.

Annex A (informative): Examples of EMC product standards that include network emission requirements

Examples of EMC product standards that directly or indirectly include limits of the levels of the injected signals into connected networks:

- EN 55022 [3] for ITE equipment not covered more specifically by another standard from this list;
- EN 300 386 [4] for telecommunication network equipment;
- The EN 301 489 series [5] for radio equipment;
- EN 55013 [2] for radio and television receivers;
- EN 50083-2 [1] for cable TV equipment.

Annex B (informative): Bibliography

ETSI TR 101 651: "ElectroMagnetic Compatibility and Radio Spectrum Matters (ERM); Classification of the electromagnetic environment conditions for equipment in telecommunication networks".

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".

CISPR 16-2: "Specification for radio disturbance and immunity measuring apparatus and methods - Part 2: Methods of measurement of disturbances and immunity".

IEC 60050-161: "International Electrotechnical Vocabulary. Chapter 161: Electromagnetic compatibility".

IEV 161-04-02: "Medical electrical equipment - General requirements for safety - Collateral standard: Electromagnetic compatibility - Requirements and tests".

IEV 161-01-05: "Electromagnetic compatibility (EMC) - Environment - Compatibility levels for low-frequency conducted disturbances and signalling in public medium-voltage power supply systems".

IEV 161-01-13: "Cabled distribution systems for television and sound signals - Electromagnetic compatibility for equipment".

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