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**Immunity requirements for telecommunication
network equipment**

Recommendation ITU-T K.43



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Immunity requirements for telecommunication network equipment

Summary

Recommendation ITU-T K.43 describes the immunity requirements for telecommunication network equipment in a given environment. Specific product family Recommendations supersede this Recommendation. This Recommendation includes immunity requirements in the frequency range of 150 kHz-80 MHz for conducted immunity and 80-2700 MHz for radiated immunity.

Source

Recommendation ITU-T K.43 was approved on 14 July 2009 by ITU-T Study Group 5 (2009-2012) under Recommendation ITU-T A.8 procedures.

FOREWORD

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Recommendation ITU-T K.43

Immunity requirements for telecommunication network equipment

1 Scope

This Recommendation specifies the immunity requirements for equipment used within the public telecommunication networks and for terminal equipment connected to such networks. This Recommendation is a product family Recommendation.

This Recommendation gives the minimum test levels applicable in a given environment. The requirements given in specific product family Recommendations supersede those given in this Recommendation.

This Recommendation is applicable to all equipment types:

- equipment in the telecommunication networks, including switching equipment, transmission equipment, radio equipment, power supply equipment, supervisory equipment and control equipment;
- terminal equipment connected to telecommunication networks, including telephone set, facsimile and PBX;
- terminal equipment that uses the LV AC network for telecommunications (i.e., PLT devices).

This Recommendation includes immunity requirements in the frequency range:

- 150 kHz-80 MHz for conducted immunity;
- 80-2700 MHz for radiated immunity.

Other frequency ranges are covered by other K series of ITU-T Recommendations, e.g., [b-ITU-T K.76] for the 9-150 kHz frequency range.

2 References

The following ITU-T Recommendations and other references contain provisions which, through reference in this text, constitute provisions of this Recommendation. At the time of publication, the editions indicated were valid. All Recommendations and other references are subject to revision; users of this Recommendation are therefore encouraged to investigate the possibility of applying the most recent edition of the Recommendations and other references listed below. A list of the currently valid ITU-T Recommendations is regularly published. The reference to a document within this Recommendation does not give it, as a stand-alone document, the status of a Recommendation.

- [ITU-T K.34] Recommendation ITU-T K.34 (2003), *Classification of electromagnetic environmental conditions for telecommunication equipment – Basic EMC Recommendation*.
- [IEC 60050-161] IEC 60050-161:1990, *International Electrotechnical Vocabulary. Chapter 161: Electromagnetic Compatibility*, plus Amendment 2 (1998).
- [IEC 61000-4-1] IEC 61000-4-1:2006, *Electromagnetic compatibility (EMC) – Part 4-1: Testing and measurement techniques – Overview of IEC 61000-4 series*.
- [IEC 61000-4-2] IEC 61000-4-2:2008, *Electromagnetic compatibility (EMC) – Part 4-2: Testing and measurement techniques – Electrostatic discharge immunity test*.
- [IEC 61000-4-3] IEC 61000-4-3:2008, *Electromagnetic compatibility (EMC) – Part 4-3: Testing and measurement techniques – Radiated, radio-frequency, electromagnetic field immunity test*.

- [IEC 61000-4-4] IEC 61000-4-4:2004, *Electromagnetic compatibility (EMC) – Part 4-4: Testing and measurement techniques – Electrical fast transient/burst immunity test.*
- [IEC 61000-4-5] IEC 61000-4-5:2005, *Electromagnetic compatibility (EMC) – Part 4-5: Testing and measurement techniques – Surge immunity test.*
- [IEC 61000-4-6] IEC 61000-4-6:2008, *Electromagnetic compatibility (EMC) – Part 4-6: Testing and measurement techniques – Immunity to conducted disturbances, induced by radio-frequency fields.*
- [IEC 61000-4-8] IEC 61000-4-8:2009, *Electromagnetic compatibility (EMC) – Part 4-8: Testing and measurement techniques – Power frequency magnetic field immunity test.*
- [IEC 61000-4-9] IEC 61000-4-9:2001, *Electromagnetic compatibility (EMC) – Part 4-9: Testing and measurement techniques – Pulse magnetic field immunity test.*
- [IEC 61000-4-10] IEC 61000-4-10:2001, *Electromagnetic compatibility (EMC) – Part 4-10: Testing and measurement techniques – Damped oscillatory magnetic field immunity test.*
- [IEC 61000-4-11] IEC 61000-4-11:2004, *Electromagnetic compatibility (EMC) – Part 4-11: Testing and measurement techniques – Voltage dips, short interruptions and voltage variations immunity tests.*
- [IEC 61000-4-29] IEC 61000-4-29:2000, *Electromagnetic compatibility (EMC) – Part 4-29: Testing and measurement techniques – Voltage dips, short interruptions and voltage variations on d.c. input power port immunity tests.*

3 Definitions

3.1 Terms defined elsewhere

This Recommendation uses the definitions in the International Electrotechnical Vocabulary, Chapter 161: Electromagnetic Compatibility ([IEC 60050-161]).

3.1.1 burst (of pulses or oscillations) (161-02-07): A sequence of a limited number of distinct pulses or an oscillation of limited duration.

3.1.2 continuous disturbance (161-02-11): Electromagnetic disturbance whose effects on a particular device or piece of equipment cannot be resolved into a succession of distinct effects.

3.1.3 discontinuous interference (161-02-13): Electromagnetic interference occurring during certain time intervals separated by interference-free intervals.

3.1.4 duration (of a pulse) (161-08-03): The interval of time between the first and last instants when the instantaneous value of a pulse reaches 50% of the pulse magnitude.

3.1.5 immunity (to a disturbance) (161-01-20): The ability of a device, equipment, or system to perform without degradation in the presence of an electromagnetic disturbance.

3.1.6 impulsive disturbance (161-02-09): Electromagnetic disturbance which, when incident on a particular device or piece of equipment, manifests itself as a succession of distinct pulses or transients.

3.1.7 period (IEC 61000-4-11): A unit of duration equal to one cycle of AC supply frequency.

3.1.8 pulse (161-02-02): An abrupt short-duration variation in a physical quantity followed by a rapid return to the initial value.

3.1.9 surge (voltage) (161-08-11): A transient voltage wave propagating along a line or a circuit and characterized by a rapid increase followed by a slower decrease of the voltage.

3.1.10 transient (adjective or noun) (161-02-01): Pertaining to or designating a phenomenon or a quantity that varies between two consecutive steady states during a time interval that is short compared with the time scale of interest.

3.2 Terms defined in this Recommendation

This Recommendation defines the following terms:

3.2.1 abnormal voltage range: Range of steady-state voltage over which the equipment will not be expected to maintain normal service, but will survive undamaged.

3.2.2 cable port: A point at which a conductor or a cable is connected to the equipment.

3.2.3 characteristic severity: A severity that has only a low probability (generally less than 1%) of being exceeded for a certain parameter in an environmental class. This term relates to duration, rate of occurrence, or location. It applies to environmental and immunity requirements.

3.2.4 coupling and decoupling networks: Coupling and decoupling networks (CDN) that terminate a cable with a common mode impedance to ground. The CDN shall not unduly affect the functional signals.

3.2.5 dwell time: Duration of the exposition to the amplitude modulated carrier at each frequency necessary for the EUT to be exercised and to respond.

3.2.6 enclosure port: The physical boundary of the equipment through which electromagnetic fields may radiate or impinge. For plug-in units, the physical boundary will be defined by the host equipment.

3.2.7 port: Particular interface of the specified equipment with the external electromagnetic environment (see Figure 1).

3.2.8 ports in telecommunication equipment (indoor port, outdoor port, enclosure port, DC power port, AC power port) – (see Figure 1; for enclosure port, see clause 3.2.6).

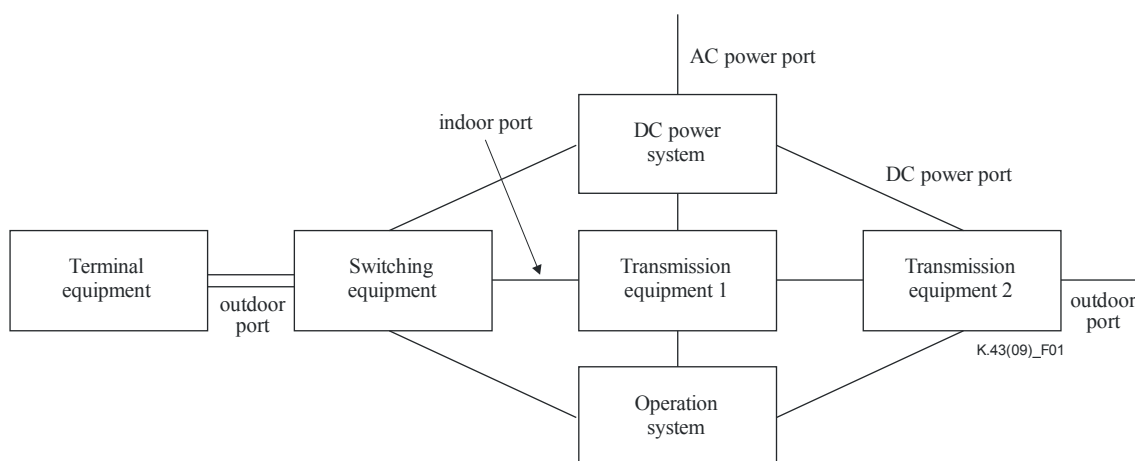


Figure 1 – Telecommunication ports

3.2.9 radio frequency (RF): The frequency range above 9 kHz.

3.2.10 shielding effectiveness: For a given external source, the ratio of electric or magnetic field strength at a point before and after the placement of the shield in question.

4 Abbreviations

This Recommendation uses the following abbreviations:

AC	Alternating Current
AE	Auxiliary Equipment
CDN	Coupling and Decoupling Network
CRT	Cathode Ray Tube
DC	Direct Current
EFT	Electrical Fast Transient
EMC	Electromagnetic Compatibility
ESD	Electrostatic Discharge
EUT	Equipment Under Test
LV	Low Voltage
PBX	Private Branch Exchange
PLT	Power Line Telecommunication
RF	Radio Frequency
VDU	Video Display Unit

5 Equipment configuration and general operation during test

This clause describes the general requirements for equipment configuration and operation during a test. Product-specific operating conditions will be specified in the relevant Recommendation.

5.1 Equipment configuration

All tests should be applied in the normal installation conditions. Power and signal distribution, grounding, interconnecting cabling and the physical placement of the equipment of a test system shall simulate the typical application and usage in so far as is practicable, and be in accordance with the relevant product specifications of the manufacturer. The configuration that tends to minimize its immunity shall be selected if it is known. Only configurations within the range of positions likely to occur in normal use need be considered.

The selected configuration shall be fully detailed and documented in the test report, together with the justification for selecting that particular configuration.

5.2 Equipment for operation

The exercising and auxiliary equipment shall be sufficiently decoupled from the EUT so that the immunity of such equipment does not significantly affect the test results.

Equipment like PLT modems will not permit the insertion of a CDN at the power line between the auxiliary modem and the modem under test. In cases where the relevant basic standard does not give an alternative coupling solution (such as a capacitive clamp), in the immunity tests both units shall be connected in parallel. This means that the disturbance will be applied to both units: hence some decoupling feature shall be present at the input to the auxiliary modem to provide some disturbance attenuation.

5.3 Laboratory environment

For all the tests, the test laboratory environment shall be the one defined in the corresponding basic standards (IEC Publications [IEC 61000-4-2], [IEC 61000-4-3], [IEC 61000-4-4], [IEC 61000-4-5], [IEC 61000-4-6], [IEC 61000-4-11] and [IEC 61000-4-29]). The electromagnetic environment of the test laboratory shall not influence the results.

5.4 Operation of equipment during tests

The immunity tests described shall be performed with the EUT connected to a power supply and operating in a manner that is as representative as possible to the intended operation. The tests shall be performed on fully operational, suitably configured and typically loaded production equipment, including hardware, software and firmware, for application in telecommunication networks.

The EUT shall demonstrate its ability to perform its intended function(s) before and after the tests are applied to demonstrate its immunity to malfunction and damage. Specific operating conditions for each product family will be specified in the relevant Recommendation.

6 Performance criteria

This clause defines general performance criteria. The requirements given in specific product family Recommendations supersede those given in this Recommendation.

The manufacturer has the obligation to express the performance criteria in terms that relate to the performance of his specific product when used as intended.

A functional description and a definition of performance criteria, during or as a consequence of the EMC testing, shall be provided by the manufacturer and noted in the test report, based on the following criteria.

6.1 Performance criterion A

The equipment shall continue to operate as intended. No degradation of performance or loss of function is allowed below a performance level specified by the manufacturer, when the equipment is used as intended. In some cases, the performance level may be replaced by a permissible loss of performance. If the minimum performance level or the permissible performance loss is not specified by the manufacturer, then either of these may be derived from the product description and documentation and what the user may reasonably expect from the equipment if used as intended.

6.2 Performance criterion B

After the test, the equipment shall continue to operate as intended. No degradation of performance is allowed after the application of the phenomena below a performance level specified by the manufacturer, when the equipment is used as intended. In some cases, the performance level may be replaced by a permissible loss of performance. During the test, degradation of performance or loss of function is, however, allowed. No change of actual operating state or stored data is allowed. If the minimum performance level or the permissible performance loss is not specified by the manufacturer, then either of these may be derived from the product description and documentation and what the user may reasonably expect from the equipment if used as intended.

6.3 Performance criterion C

Loss of function is allowed, provided the function is automatically recoverable or can be restored by the operation of the controls by the user in accordance with the manufacturer's instructions.

Functions and information protected by a battery backup shall not be lost.

7 Immunity: Test method

7.1 General conditions

Immunity testing in the laboratory is the only method accepted for demonstrating conformance to this Recommendation. The test methods listed below shall be used for the immunity tests.

The input and output interface of the equipment at which the tests are to be applied shall be identified by the manufacturer. The types of cables shall be as defined by the manufacturer. The shields of the cables are connected as defined by the manufacturer. When it is not possible to test every function of the equipment, the most critical mode of operation shall be selected. Wherever practical, testing shall be fully in accordance with the basic methods laid down by the IEC in its 61000-4-x series. In some cases, where this is not possible (e.g., testing to [IEC 61000-4-6] for a system with large cables for which no CDN exists), the test configuration can be modified on agreement between the manufacturer and the relevant network operator. Any modification shall be noted in the test report.

7.2 Particular conditions

7.2.1 ESD

Electrostatic discharge tests shall be performed in accordance with [IEC 61000-4-2].

Application of the discharge shall be carried out in accordance with subclause 8.3 of [IEC 61000-4-2]. For application to telecommunication equipment, the following additional guidance is given. When the EUT contains panels or doors, normal operation testing is first performed with the panels in place and the doors closed. When the equipment has doors that can be opened during normal operation, the doors are opened and discharges are made to the door edges and inner door surfaces. When components intended to be touched by the user, such as wrist-straps or control panels and cabinets of tape and disk drive units, are located behind a door or panels, they are to be tested with the door opened or the panels removed.

The discharges shall be applied to both the vertical and horizontal coupling planes for the indirect discharge test in accordance with [IEC 61000-4-2]. Indirect discharge tests shall be carried out under the same conditions as for direct discharge.

7.2.2 EFT/burst

Electrical fast transient tests shall be performed in accordance with [IEC 61000-4-4]; the test method is given in its clauses 6 and 7. The test procedure is given in its subclauses 8.1, 8.1.1, 8.1.2 and 8.2, together with the following changes or clarifications:

- When the EUT has more than one of the same port type, only one of each type shall be tested.
- A multi-conductor cable, such as a pair-conductor telecommunication cable, shall be tested by applying the test signal simultaneously to all conductors in the cable. The cable shall not be split or divided into groups of conductors for this test.
- Interface ports that are intended by the manufacturer to have short (no longer than 3 m) data cables connected to them shall not be tested.
- Because the EFT test signal or electromagnetic field from a generator may invade the AE and cause errors, the AE shall either be certified to withstand the invading EFT signals or shall be decoupled from the EFT by filters and/or a shielded chamber.

7.2.3 Surges

The surge immunity test for the AC supply line shall be performed in accordance to [IEC 61000-4-5].

7.2.4 Radiated electromagnetic fields

The continuous radiated RF immunity test shall be performed in the frequency range 80 MHz to 2700 MHz in accordance with [IEC 61000-4-3], with the following changes or clarifications:

- Although there is no precise technique for measuring the immunity of a large-scale EUT that is not adequately illuminated by a radiating antenna (i.e., the EUT is not contained within the 3 dB beam width of the radiating antenna), two methods are acceptable:
 - 1) Test each unit comprising the EUT separately. During the test, induce adequate test voltage in the lines connected to the unit.
 - 2) Apply partial illumination method; for a description of this method, refer to Annex H of [IEC 61000-4-3].
- The frequency step of the interfering signal applied and the dwell time shall be recorded in the test report.

NOTE – [IEC 61000-4-3] suggests that the maximum frequency step size shall not exceed 1% of the preceding frequency value and the dwell time shall, in no case, be less than 0.5 s.

7.2.5 Conducted signals

The continuous conducted RF immunity test shall be performed in the frequency range 150 kHz to 80 MHz in accordance with [IEC 61000-4-6], with the following changes or clarifications:

- Interface ports that are intended by the manufacturer to have short (no longer than 1 m) and separated signal cables and/or power cables connected to them shall not be tested.
- Typical specifications for the CDN used for this test are shown in Appendix I. A clamp injection can also be used. Rules for selecting the injection method can be found in [IEC 61000-4-6].

NOTE 1 – The appropriate pre-scan frequency step and test level are under study.

- The frequency step of the interfering signal applied and the dwell time shall be recorded in the test report.

NOTE 2 – [IEC 61000-4-6] suggests that the maximum frequency step size shall not exceed 1% of the preceding frequency value and the dwell time shall in no case be less than 0.5 s.

7.2.6 Voltage dips, short interruptions and voltage variations

Voltage dips, short interruptions and voltage variation tests shall be performed in accordance with [IEC 61000-4-11] for AC lines, and with [IEC 61000-4-29] for DC lines.

The abnormal voltage test simulates a DC power station failure; during this failure, the DC voltage submitted at the equipment is out of the specification.

When the equipment's DC input is designed to prevent the discharge of its capacitor or battery backup into a short circuit on the DC distribution system, testing to [IEC 61000-4-29] shall consider the high impedance case only. During the voltage dips test with a duration longer than 4 ms in some sensitive equipment, momentary and temporary interruption of the service may occur as a result of such transients. The duration of service interruption (equipment is not functioning as intended) due to the recovery of software shall be taken into account. More detailed information about the service interruption shall be provided by the manufacturer on the request of the operator.

8 Applicability

Tests shall be applied to the relevant ports of the equipment according to Tables 1 and 2. Tests shall only be carried out where the relevant port exists.

9 Test levels

The immunity test requirements for telecommunication network equipment are given on a port-by-port-basis.

The generic test levels and performance criteria for telecommunication network equipment are shown in Tables 1 and 2. Test levels and performance criteria can be set for specific equipment to achieve adequate reliability and quality of telecommunication equipment, according to the intended installation environmental conditions. The classification of electromagnetic environments for telecommunication equipment in [ITU-T K.34] shall be referred to in order to determine the specific test level.

For example, a lower immunity level can be selected if special measures are taken to achieve a low disturbance environment in the telecommunication centre. On the other hand, a higher immunity level or different performance criteria may be required for equipment providing high-priority services, or operating in a more severe electromagnetic environment such as outdoor locations.

Table 1 – Equipment for telecom centre

Environmental phenomena	Test levels	Units	Basic standard	Performance criteria	Remarks
<i>Enclosure port</i>					
Radiofrequency electromagnetic field	1	V/m	[IEC 61000-4-3]	A	80-800 MHz
	10				800-1000 MHz
	10				1400-2700 MHz
Electrostatic discharge	4	kV	[IEC 61000-4-2]	B	Contact and air discharge
<i>Outdoor telecommunication ports</i>					
Radio frequency conducted continuous	1	V	[IEC 61000-4-6]	A	0.15-80 MHz (Note 1)
Surges	0.5 (line-to-line) 1 (line-to-ground)	kV	[IEC 61000-4-5]	B	10/700 μ s (Note 2)
Fast transient	0.25	kV	[IEC 61000-4-4]	B	Capacitive clamp used
<i>Indoor telecommunication ports</i>					
Radio frequency conducted continuous	1	V	[IEC 61000-4-6]	A	0.15-80 MHz (Note 1)
Surges	0.5 (line-to-ground)	kV	[IEC 61000-4-5]	B	1.2/50 (8/20) μ s (Note 2)
Fast transient	0.25	kV	[IEC 61000-4-4]	B	Capacitive clamp used
<i>DC power port</i>					
Radio frequency conducted continuous	1	V	[IEC 61000-4-6]	A	0.15-80 MHz (Note 1)
Fast transient	0.25	kV	[IEC 61000-4-4]	B	

Table 1 – Equipment for telecom centre

Environmental phenomena	Test levels	Units	Basic standard	Performance criteria	Remarks
Voltage dips	0 0.004	V s	[IEC 61000-4-29]	A	High impedance (output impedance of test generator) (Note 5)
	0 0.01 and 0.1	V s	[IEC 61000-4-29]	C (Notes 3, 4)	(Note 5)
	0 0.004	V s	[IEC 61000-4-29]	A	Low impedance (output impedance of test generator) (Note 5)
	0 0.01 and 0.1	V s	[IEC 61000-4-29]	C (Notes 3, 4)	(Note 5)
Abnormal voltage	0 to 90 1	% of nominal voltage s		C (Notes 3, 4)	(Note 5)
	110 to 125 1	% of nominal voltage s		C (Notes 3, 4)	(Note 5)
Voltage variation	From 100 to 90 2	% of nominal voltage s		A	The test simulates a change in the DC voltage (is not an interruption but a change from the nominal value to a lower value)
	From 100 to 110 2	% of nominal voltage s		A	The test simulates a change in the DC voltage (is not an interruption but a change from the nominal value to a higher value)
<i>AC power ports</i>					
Radio frequency conducted continuous	1	V	[IEC 61000-4-6]	A	0.15-80 MHz (Note 1)
Surges	0.5 (line-to-line) 1 (line-to-ground)	kV	[IEC 61000-4-5]	B	1.2/50 (8/20) μ s (Note 2)

Table 1 – Equipment for telecom centre

Environmental phenomena	Test levels	Units	Basic standard	Performance criteria	Remarks
Fast transients	0.5	kV	[IEC 61000-4-4]	B	
Voltage dips	0	Residual voltage %	[IEC 61000-4-11]	B	
	0.5	Cycle			
	70	Residual voltage %	[IEC 61000-4-11]	C	
	25	Cycle			
Voltage interruption	0	Residual voltage %	[IEC 61000-4-11]	C	
	250	Cycle			

NOTE 1 – A lower test level above 10 MHz can be applied, see [ITU-T K.34] for the selection of a lower test level.

NOTE 2 – This test can be applied when appropriate CDN exists.

NOTE 3 – Following the restoration of the supply to the normal voltage range, the power conversion and management systems shall automatically restore service. The telecommunication equipment shall then resume operation according to its specifications. The abnormal service voltage shall not lead to the disconnection of the power supply, e.g., by causing circuit breakers, fuses or other such devices to operate.

NOTE 4 – For equipment with a low priority of service, it is acceptable to use the following performance criteria during the test: "Loss of function is allowed, the function can be restored by a manual operation of the user in accordance with the manufacturer's instructions. Functions and information protected by a battery backup shall not be lost."

NOTE 5 – This test is applicable only in equipment in which the battery backup is not permanently connected to the DC distribution system.

Table 2 – Equipment for customer premises

Environmental phenomena	Test levels	Units	Basic standard	Performance criteria	Remarks
<i>Enclosure port</i>					
Radio frequency electromagnetic field	3	V/m	[IEC 61000-4-3]	A	80-800 MHz
	10				800-1000 MHz
	10				1400-2700 MHz
Electrostatic discharge	4 (contact) 8 (air)	kV	[IEC 61000-4-2]	B	Contact and air discharge

Table 2 – Equipment for customer premises

Environmental phenomena	Test levels	Units	Basic standard	Performance criteria	Remarks
<i>Outdoor telecommunication ports</i>					
Radio frequency conducted continuous	3	V	[IEC 61000-4-6]	A	0.15-80 MHz (Note 1)
Surges	0.5 (line-to-line) 1 (line-to-ground)	kV	[IEC 61000-4-5]	B	10/700 μ s (Note 2)
Fast transients	0.5	kV	[IEC 61000-4-4]	B	Capacitive clamp used
<i>Indoor telecommunication ports</i>					
Radio frequency conducted continuous	3	V	[IEC 61000-4-6]	A	0.15-80 MHz (Note 1)
Surges	0.5 (line-to-ground)	kV	[IEC 61000-4-5]	B	1.2/50 (8/20) μ s (Note 2)
Fast transients	0.5	kV	[IEC 61000-4-4]	B	Capacitive clamp used
<i>DC power ports</i>					
Radio frequency conducted continuous	3	V	[IEC 61000-4-6]	A	0.15-80 MHz (Note 1)
Fast transients	0.5	kV	[IEC 61000-4-4]	B	
<i>AC power ports</i>					
Radio frequency conducted continuous	3	V	[IEC 61000-4-6]	A	0.15-80 MHz (Note 1)
Surges	0.5 (line-to-line) 1 (line-to-ground)	kV	[IEC 61000-4-5]	B	1.2/50 (8/20) μ s (Note 2)
Fast transients	0.5	kV	[IEC 61000-4-4]	B	
Voltage dips	0	Residual voltage %	[IEC 61000-4-11]	B	
	0.5	Cycle			
	70	Residual voltage %	[IEC 61000-4-11]	C	
	25	Cycle			
Voltage interruption	0	Residual voltage %	[IEC 61000-4-11]	C	
	250	Cycle			
NOTE 1 – A lower test level above 10 MHz can be applied; see [ITU-T K.34] for the selection of a lower test level.					
NOTE 2 – This test can be applied when appropriate CDN exists.					

Appendix I

Coupling and decoupling networks for continuous conducted signal test

(This appendix does not form an integral part of this Recommendation)

Table I.1 shows the typical common mode impedance Z_{ce} for appropriate CDN, as seen from the EUT port.

Table I.1 – Impedance of CDN as seen from EUT port

Parameter	Frequency band	Requirements
$ Z_{ce} $	0.15 MHz-26 MHz	$150 \Omega \pm 20 \Omega$
	26 MHz-80 MHz	$150 \Omega + 60 \Omega$ -45Ω

Table I.2 shows the typical specification for the CDN for balanced telecommunication line ports.

The insertion loss at a 600Ω termination is specified for voice-band analogue interface cable. The insertion loss at a 110Ω termination is specified for an ISDN digital interface testing. These values will not necessarily be appropriate for other interfaces and an appropriate specification will need to be prepared.

Example of CDNs for telecommunication lines are shown in Appendix III.

Table I.2 – Requirements for CDN

Parameters		Frequency band	Requirements
Common mode impedance Z_{ce}	Absolute value	0.15 MHz-26 MHz	$150 \Omega \pm 20 \Omega$
		26 MHz-80 MHz	$150 \Omega + 60 \Omega$ -45Ω
	Phase angle	0.15 MHz-26 MHz	$\pm 30^\circ$
		26 MHz-80 MHz	$\pm 45^\circ$
Coupling loss		0.15 MHz-80 MHz	$< 2 \text{ dB}$
Decoupling loss		0.15 MHz-26 MHz	$> 20 \text{ dB}$
		26 MHz-80 MHz	$> 40 \text{ dB}$
Insertion loss of transmission signal		300 Hz-10 kHz (600Ω termination)	$< 2 \text{ dB}$
		200 Hz-10 MHz (110Ω termination)	$< 6 \text{ dB}$
LCL		1 MHz	$> 60 \text{ dB}$
		10 MHz	$> 40 \text{ dB}$

Appendix II

Uniformity of test field

(This appendix does not form an integral part of this Recommendation)

When floor-standing equipment is set on a support 0.1 m above the ground reference plane, the appropriate field strength is shown in Figures II.1 and II.2. When equipment is set on a support 0.8 m above the ground reference plane, the field strength below 0.8 m is not specified.

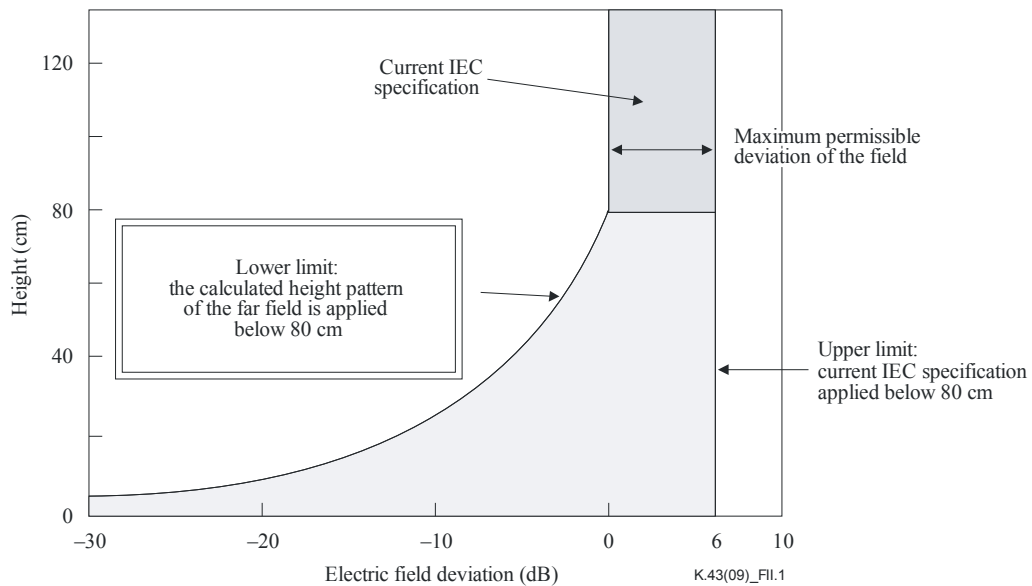


Figure II.1 – Appropriate electric field uniformity below 80 cm (horizontal polarization)

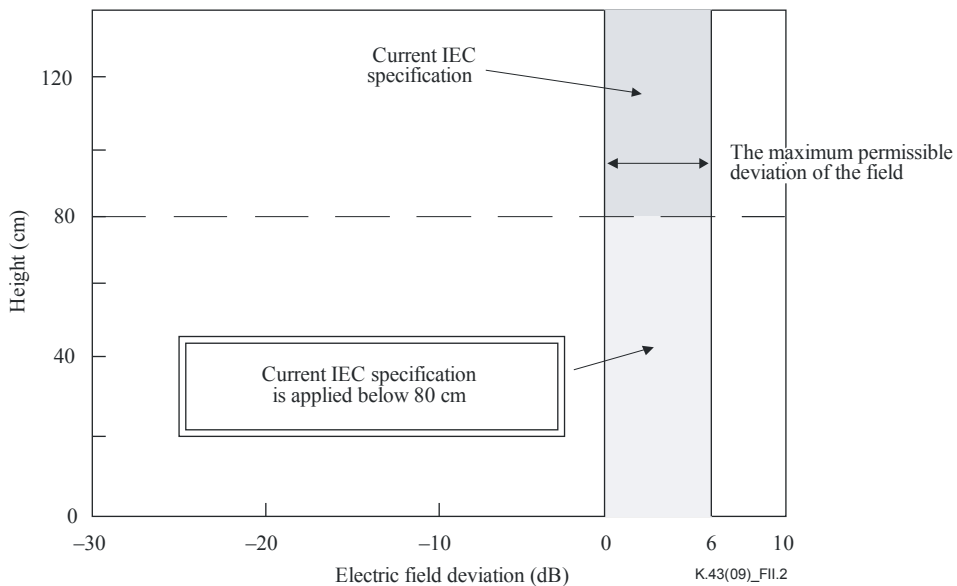
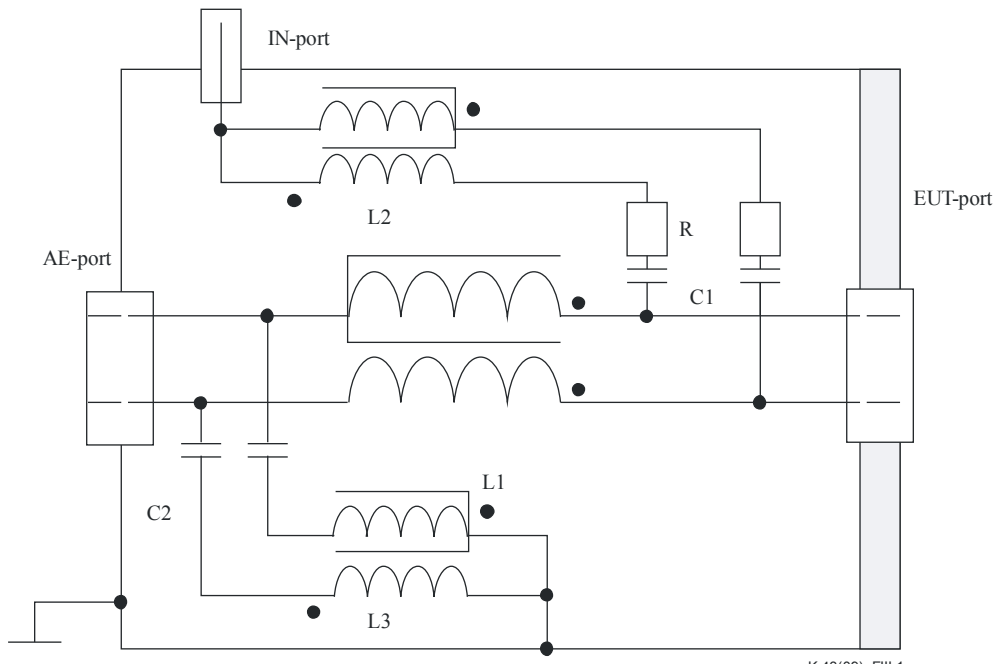


Figure II.2 – Appropriate electric field uniformity below 80 cm (vertical polarization)

Appendix III

Examples of coupling and decoupling network (CDN)

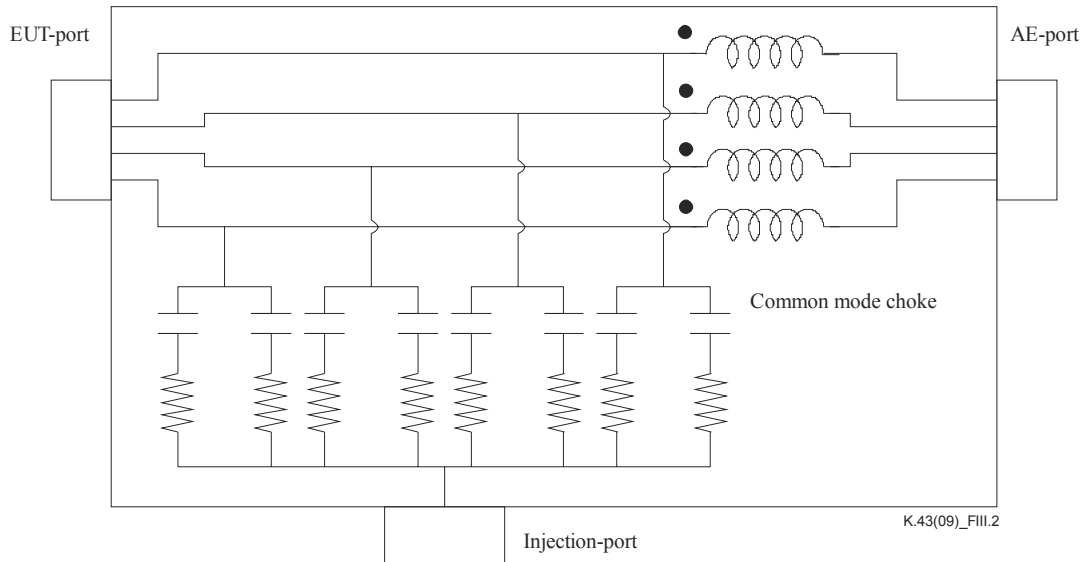
(This appendix does not form an integral part of this Recommendation)



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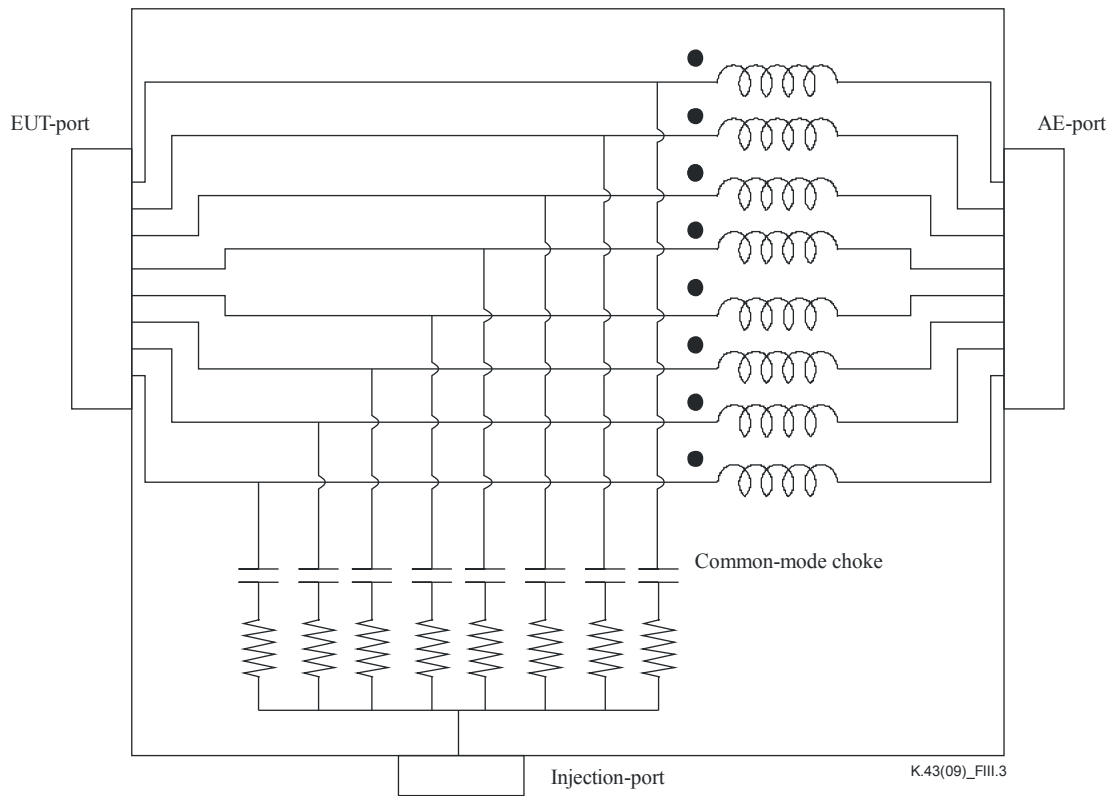
$C1$ (typ) = 10 nF
 $C2$ (typ) = 47 nF
 $R = 200 \Omega$
 $L1 \gg 280 \mu\text{H}$ at 150 kHz
 $L2 = L3 = 6 \text{ mH}$ (when $C2$ and $L3$ are not used, $L1 \geq 30 \text{ mH}$)

Figure III.1 – Example of a CDN for a two-wire balanced line



K.43(09)_FIII.2

Figure III.2 – Example of a CDN for a four-wire balanced line



NOTE – Impedance of common-mode choke coil > 250 Ω .

Figure III.3 – Example of a CDN for eight-wire balanced line

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