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SERIES K: PROTECTION AGAINST INTERFERENCE

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**Immunity requirements for telecommunication  
equipment**

ITU-T Recommendation K.43

(Previously CCITT Recommendation)

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ITU-T K-SERIES RECOMMENDATIONS  
**PROTECTION AGAINST INTERFERENCE**

*For further details, please refer to ITU-T List of Recommendations.*

## **ITU-T RECOMMENDATION K.43**

### **IMMUNITY REQUIREMENTS FOR TELECOMMUNICATION EQUIPMENT**

#### **Summary**

This Recommendation describes the generic immunity requirements for telecommunication equipment in a given environment. It does not cover the resistibility of equipment. Specific product family Recommendations supersede this Recommendation.

#### **Source**

ITU-T Recommendation K.43 was prepared by ITU-T Study Group 5 (1997-2000) and was approved under the WTSC Resolution No. 1 procedure on the 15th of May 1998.

## FOREWORD

ITU (International Telecommunication Union) is the United Nations Specialized Agency in the field of telecommunications. The ITU Telecommunication Standardization Sector (ITU-T) is a permanent organ of the ITU. The ITU-T is responsible for studying technical, operating and tariff questions and issuing Recommendations on them with a view to standardizing telecommunications on a worldwide basis.

The World Telecommunication Standardization Conference (WTSC), which meets every four years, establishes the topics for study by the ITU-T Study Groups which, in their turn, produce Recommendations on these topics.

The approval of Recommendations by the Members of the ITU-T is covered by the procedure laid down in WTSC Resolution No. 1.

In some areas of information technology which fall within ITU-T's purview, the necessary standards are prepared on a collaborative basis with ISO and IEC.

## NOTES

1. In this Recommendation, the expression "Administration" is used for conciseness to indicate both a telecommunication administration and a recognized operating agency.
2. The status of annexes and appendices attached to the Series K Recommendations should be interpreted as follows:
  - an *annex* to a Recommendation forms an integral part of the Recommendation;
  - an *appendix* to a Recommendation does not form part of the Recommendation and only provides some complementary explanation or information specific to that Recommendation.

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## **IMMUNITY REQUIREMENTS FOR TELECOMMUNICATION EQUIPMENT**

*(Geneva, 1998)*

### **1 Scope**

This Recommendation specifies the essential immunity requirements for equipment used within the public telecommunications networks and for terminal equipment connected to such networks. This Recommendation does not cover the resistibility of equipment.

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.

### **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; all users of this Recommendation are therefore encouraged to investigate 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.

- CCITT Recommendation G.703 (1991), *Physical/electrical characteristics of hierarchical digital interfaces*.
- ITU-T Recommendation K.27 (1996), *Bonding configurations and earthing inside a telecommunication building*.
- ITU-T Recommendation K.34 (1996), *Classification of electromagnetic environmental conditions for telecommunications equipment – Fast transient and radio-frequency phenomena*.
- IEC 61000-4-1 (1992), *Electromagnetic compatibility (EMC) – Part 4: Testing and measurement techniques – Section 1: Overview of immunity tests*.
- IEC 61000-4-2 (1995), *Electromagnetic compatibility (EMC) – Part 4: Testing and measurement techniques – Section 2: Electrostatic discharge immunity test*.
- IEC 61000-4-3 (1995), *Electromagnetic compatibility (EMC) – Part 4: Testing and measurement techniques – Section 3: Radiated, radio-frequency, electromagnetic field immunity test*.
- IEC 61000-4-4 (1995), *Electromagnetic compatibility (EMC) – Part 4: Testing and measurement techniques – Section 4: Electrical fast transient/burst immunity test*.
- IEC 61000-4-5 (1995), *Electromagnetic compatibility (EMC) – Part 4: Testing and measurement techniques – Section 5: Surge immunity test*.
- IEC 61000-4-6 (1996), *Electromagnetic compatibility (EMC) – Part 4: Testing and measurement techniques – Section 6: Immunity to conducted disturbances, induced by radio-frequency fields*.
- IEC 61000-4-8 (1993), *Electromagnetic compatibility (EMC) – Part 4: Testing and measurement techniques – Section 8: Power frequency magnetic field immunity test*.

- IEC 61000-4-9 (1993), *Electromagnetic compatibility (EMC) – Part 4: Testing and measurement techniques – Section 9: Pulse magnetic field immunity test.*
- IEC 61000-4-10 (1993), *Electromagnetic compatibility (EMC) – Part 4: Testing and measurement techniques – Section 10: Damped oscillatory magnetic field immunity test.*
- IEC 61000-4-11 (1994), *Electromagnetic compatibility (EMC) – Part 4: Testing and measurement techniques – Section 11: Voltage dips, short interruptions and voltage variations immunity tests.*

### 3 Definitions and abbreviations

#### 3.1 Definitions

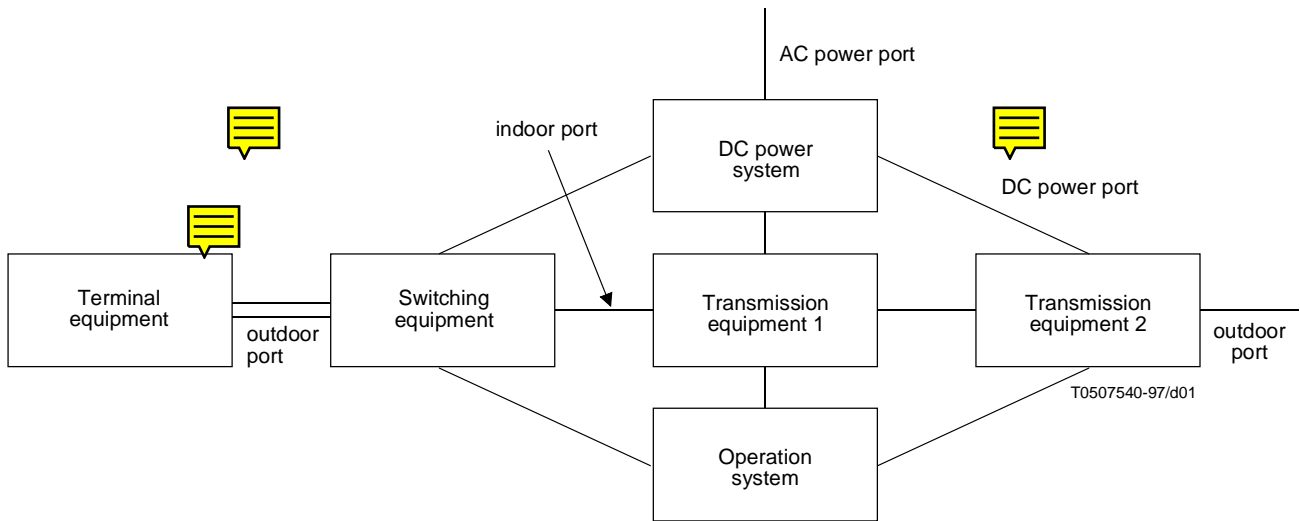
This Recommendation uses the definitions in the International Electrotechnical Vocabulary, Chapter 161: Electromagnetic Compatibility (IEC 60050-161). Additional definitions are:

- 3.1.1 burst (161-02-07):** A sequence of a limited number of distinct pulses or an oscillation of limited duration.
- 3.1.2 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.
- 3.1.3 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.
- 3.1.4 discontinuous interference (161-02-13):** Electromagnetic interference occurring during certain time intervals separated by interference-free intervals.
- 3.1.5 coupling and decoupling networks:** Coupling and Decoupling Networks (CDN) which terminates a cable with a common mode impedance to ground. The CDN shall not unduly affect the functional signals.
- 3.1.6 duration (of a pulse) (161-08-01):** The interval of time between the first and last instants when the instantaneous value of a pulse reaches 50% of its pulse magnitude.
- 3.1.7 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.
- 3.1.8 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.
- 3.1.9 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.
- 3.1.10 period:** A unit of duration equal to one cycle of AC supply frequency (used in IEC 61000-4-11).
- 3.1.11 port:** Particular interface of the specified equipment with the external electromagnetic environment (see Figure 1).
- 3.1.12 pulse (161-02-02):** An abrupt short-duration variation in a physical quantity followed by a rapid return to the initial value.
- 3.1.13 radio Frequencies (RF):** The frequency range above 9 kHz.
- 3.1.14 shielding effectiveness:** For a given external source, the ratio of electric and magnetic field strength at a point before and after the placement of the shield in question.
- 3.1.15 surge voltage (161-08-11):** A transient voltage wave propagating along a line or a circuit and characterized by a rapid rise followed by a slower decrease of the voltage.
- 3.1.16 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.



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

**3.1.18 ports in telecommunication (indoor port, outdoor port, enclosure port, DC power port, AC power port)**  
 – (See Figure 1):



**Figure 1/K.43**

## 3.2 Abbreviations

The following abbreviations are used in this Recommendation:

AC	Alternating Current
AE	Auxiliary Equipment
CDN	Coupling and Decoupling Network
CRT	Cathode Ray Tube
DC	Direct Current
EMC	Electromagnetic Compatibility
ESD	Electrostatic Discharge
EUT	Equipment Under Test
RF	Radio Frequency
VDU	Video Display Unit

## 4 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.

### 4.1 Equipment configuration

All tests should be applied in the normal installation conditions. Power and signal distribution, grounding, interconnecting cabling and physical placement of 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.

#### **4.2 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.

#### **4.3 Laboratory environment**

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

#### **4.4 Operation of equipment during tests**

The immunity tests described shall be performed with the Equipment Under Test (EUT) powered up, (i.e. connected to the mains or other supply), and operating in a manner which is as representative of normal operation as possible. 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 designed functions before and after the tests in order to demonstrate its immunity to malfunction and damage. Specific operating conditions for each product family will be specified in the relevant Recommendation.

### **5 Performance criteria**

This clause defines general compliance criteria and describes equipment immunity with criteria and test levels. Product specific compliance criteria will be specified in the relevant Recommendations. When specific compliance criteria exist, they will take precedence over the general compliance criteria.

The manufacturer has the obligation to express the performance criteria in terms which 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.

#### **5.1 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.

#### **5.2 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 allowed however. 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.

### 5.3 Performance criterion C

Loss of function is allowed, provided the function is set 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.

## 6 Immunity: Test method

### 6.1 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 test are to be applied should be identified by the manufacturer. The types of the 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 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 should be noted in the test report.

### 6.2 Particular conditions

#### 6.2.1 Electrostatic Discharge (ESD)

Electrostatic discharge tests shall be conducted in accordance with IEC 61000-4-2.

Application of the discharge shall be carried out in accordance with subclause 8.3 of IEC Publication 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 which 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 control panels and cabinets of tape and disk drive units, and wrist-straps are located behind a door or panels, they are to be tested with the door opened or the panels removed.

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

#### 6.2.2 Electrical Fast Transient/burst (EFT)

Electrical fast transient tests shall be conducted in accordance with IEC Publication 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 there is more than one of the same type port, 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 need not be tested.
- Because the EFT test signal or electromagnetic field from a generator may invade the Auxiliary Equipment (AE) and cause signal errors, the AE must be certified to withstand the invading EFT signals or AE must be decoupled from the EFT by filters and/or a shielded chamber.

### 6.2.3 Surges

Surge immunity test for AC supply line shall be conducted in accordance with IEC Publication 61000-4-5.

### 6.2.4 Radiated electromagnetic fields

Radiated electromagnetic field tests shall be conducted in accordance with IEC Publication 61000-4-3 with the following changes or clarifications:

- The test frequency can be either 27 MHz to 1000 MHz or 80 MHz to 1000 MHz. Guidance for frequency range selection is provided in Appendix II.
- For table-top equipment, the test field uniformity shall be satisfied for at least 12 of 16 points above 0.8 m.
- Appendix III provides some information on the appropriate uniformity of test field below 80 cm for floor standing equipment mounted on a non-conducting support above the earth plane.
- The test field shall be calibrated at least for the immunity test frequency.
- Although there is no precise technique for measuring the immunity of large-scale EUT that is not adequately illuminated by a radiating antenna (within the 3 dB beam width), 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.
- The EUT shall be positioned so that the four sides of the EUT are exposed to the electromagnetic field in sequence. In each position, the performance of the EUT is investigated. Each exposed surface of the EUT shall be at the same horizontal test distance from the physical center of the illuminating antenna during exposure.
- The RF sweep rate or frequency step shall be selected considering the EUT. Under all circumstances, the RF shall be swept with a maximum frequency step of 1% of the former frequency. A pre-scan method with a larger frequency step and higher test level may be used. Precise testing with a maximum frequency step of 1% shall be carried out in the sensitive frequency band found by the pre-scan.

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

- The dwell time at each frequency point shall be suitable for the response time of the EUT.
- The rate of change of frequency and time dwell shall be recorded in the test report.

### 6.2.5 Continuous conducted signals

The continuous conducted RF test shall be conducted in the frequency range 0.15 to 80 MHz in accordance with IEC Publication 61000-4-6 with the following changes or clarifications. When the radiated electromagnetic field tests is conducted from 27 MHz and cables are illuminated by the radio wave adequately, the continuous RF test in the frequency range 27 MHz to 80 MHz is not necessary.

- 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. In this case, the cable shall be illuminated adequately in the radiated electromagnetic field test.
- Typical specifications for the coupling and decoupling network 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 Publication 61000-4-6.
- The test signal sweep rate or frequency step shall be selected considering the EUT. Under all circumstances the test signal shall be swept with a maximum frequency step of 1% of the former frequency. A pre-scan method with a larger frequency step and higher test level can be used. A precise test with a maximum frequency step of 1% shall be carried out in the sensitive frequency band found by the pre-scan.

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

- The time dwell at each frequency point shall be suitable for the response time of the EUT.
- The rate of change of frequency and time dwell shall be recorded in the test report.

#### **6.2.6 Voltage dips, short interruptions and voltage variations**

Voltage dips, short interruptions and voltage variations tests shall be conducted with IEC Publication 61000-4-11. This test is applicable only to AC-powered equipment.

## **7 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.

## **8 Test levels**

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

The minimum test levels and performance criteria for general telecommunication equipment are shown in Tables 1 and 2. Specific 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 Recommendation 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 center. 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/K.43 – Equipment for telecom center**

	<b>Environmental phenomena</b>	<b>Test levels</b>	<b>Units</b>	<b>Basic standard</b>	<b>Performance criteria</b>	<b>Remarks</b>
<b>Enclosure port</b>						
	Radiofrequency electromagnetic field	1	V/m	IEC 61000-4-3	A	80-1000 MHz (Note 1)
	Electrostatic discharge	4 (Contact and air discharge)	kV	IEC 61000-4-2	B	Contact and air discharge
<b>Outdoor telecommunication ports</b>						
	Radio frequency conducted continuous	1	V	IEC 61000-4-6	A	0.15-80 MHz (Notes 2 and 3)
	Surges	0.5 (line to line) 1 (line to ground)	kV	IEC 61000-4-5	B	10/700 $\mu$ s (Note 4)
	Fast transients	0.25	kV	IEC 61000-4-4	B	Capacitive clamp used
<b>Indoor telecommunication ports</b>						
	Radio frequency conducted continuous	1	V	IEC 61000-4-6	A	0.15-80 MHz (Notes 2 and 3)
	Surges	0.5 (line to ground)	kV	IEC 61000-4-5	B	1.2/50 (8/20) $\mu$ s (Note 4)
	Fast transients	0.25	kV	IEC 61000-4-4	B	Capacitive clamp used
<b>DC power ports</b>						
	Radio frequency conducted continuous	1	V	IEC 61000-4-6	A	0.15-80 MHz (Notes 2 and 3)
	Fast transients	0.25	kV	IEC 61000-4-4	B	
<b>AC power ports</b>						
	Radio frequency conducted continuous	1	V	IEC 61000-4-6	A	0.15-80 MHz (Notes 2 and 3)
	Surges	0.5 (line to line) 1 (line to ground)	kV	IEC 61000-4-5	B	1.2/50 (8/20) $\mu$ s (Note 4)
	Fast transients	0.5	kV	IEC 61000-4-4	B	
	Voltage dips	> 95 0.5	% reduction period	IEC 61000-4-11	B	
		30 25	% reduction period	IEC 61000-4-11	C	
	Voltage interruption	95 250	% reduction period	IEC 61000-4-11	C	
NOTE 1 – The test may be performed with a start frequency lower than 80 MHz, but not less than 27 MHz.						
NOTE 2 – The lower test level above 10 MHz can be applied. The specific level is under study.						
NOTE 3 – The test level can be defined as equivalent current into 150 $\Omega$ .						
NOTE 4 – This test can be applied when appropriate CDN exists.						

**Table 2/K.43 – Equipment for customer premises**

	<b>Environmental phenomena</b>	<b>Test levels</b>	<b>Units</b>	<b>Basic standard</b>	<b>Performance criteria</b>	<b>Remarks</b>
<b>Enclosure port</b>						
	Radio frequency electro-magnetic field	3	V/m	IEC 61000-4-3	A	80-1000 MHz (Note 1)
	Electrostatic discharge	4 (conduct) 8 (air)	kV	IEC 61000-4-2	B	Contact and air discharge
<b>Outdoor telecommunication ports</b>						
	Radio frequency conducted continuous	3	V	IEC 61000-4-6	A	0.15-80 MHz (Notes 2 and 3)
	Surges	0.5 (line to line) 1 (line to ground)	kV	IEC 61000-4-5	B	10/700 $\mu$ s (Note 4)
	Fast transients	0.5	kV	IEC 61000-4-4	B	Capacitive clamp used
<b>Indoor telecommunication ports</b>						
	Radio frequency conducted continuous	3	V	IEC 61000-4-6	A	0.15-80 MHz (Notes 2 and 3)
	Surges	0.5 (line to ground)	kV	IEC 61000-4-5	B	1.2/50 (8/20) $\mu$ s (Note 4)
	Fast transients	0.5	kV	IEC 61000-4-4	B	Capacitive clamp used
<b>DC power ports</b>						
	Radio frequency conducted continuous	3	V	IEC 61000-4-6	A	0.15-80 MHz (Notes 2 and 3)
	Fast transients	0.5	kV	IEC 61000-4-4	B	
<b>AC power ports</b>						
	Radio frequency conducted continuous	3	V	IEC 61000-4-6	A	0.15-80 MHz (Notes 2 and 3)
	Surges	0.5 (line to line) 1 (line to ground)	kV	IEC 61000-4-5	B	1.2/50 (8/20) $\mu$ s (Note 4)
	Fast transients	0.5	kV	IEC 61000-4-4	B	
	Voltage dips	> 95 0.5	% reduction period	IEC 61000-4-11	B	
		30 25	% reduction period	IEC 61000-4-11	C	
	Voltage interruption	95 250	% reduction period	IEC 61000-4-11	C	
NOTE 1 – The test may be performed with a start frequency lower than 80 MHz, but not less than 27 MHz.						
NOTE 2 – The lower test level above 10 MHz can be applied. The specific level is under study.						
NOTE 3 – The test level can be defined as equivalent current into 150 $\Omega$ .						
NOTE 4 – This test can be applied when appropriate CDN exists.						

## Appendix I

### Coupling Decoupling Networks for continuous conducted signal test

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

**Table I.1/K.43 – 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	$150 \Omega + 60 \Omega$ $- 45 \Omega$

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

The insertion loss at a  $600 \Omega$  termination is specified for voice-band analog interface cable. The insertion loss at a  $110 \Omega$  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 IV.

**Table I.2/K.43 – 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	$150 \Omega + 60 \Omega$ $- 45 \Omega$
	Phase angle	0.15 MHz-26 MHz	$\pm 30^\circ$
		26 MHz-80 MHz	$\pm 45^\circ$
Coupling loss		0.15 MHz-80 MHz	$< 2$ dB
Decoupling loss		0.15 MHz-26 MHz	$> 20$ dB
		26 MHz-80 MHz	$> 40$ dB
Insertion loss of transmission signal		300 Hz-10 kHz ( $600 \Omega$ termination)	$< 2$ dB
		200 Hz-10 MHz ( $110 \Omega$ termination)	$< 6$ dB
LCL		1 MHz	$> 60$ dB
		10 MHz	$> 40$ dB



## Appendix II

### Guidance for determining when to use the radiated electromagnetic field test.

The continuous conducted signal test determines the immunity to induced voltage from a radiated electromagnetic field. The conducted signal test is applicable to the frequency range in which induction may affect the EUT. The radiated electromagnetic field test determines the immunity mainly to induced voltage on the wiring in the equipment under test.

Induction is small when the total dimensions of the equipment and cable are short enough, for example less than  $\lambda/10$ . However, when the total dimensions are larger than  $\lambda/4$ , most of the maximum voltage may induced on the cable in the equipment. Therefore, radiated immunity test should be applied when the total dimensions of the cable in the equipment exceed  $\lambda/4$  and same condition can be produced in test site for radiation immunity. Also, the radiated field test shall be applied for the cable for which adequate conducted immunity test does not exist.

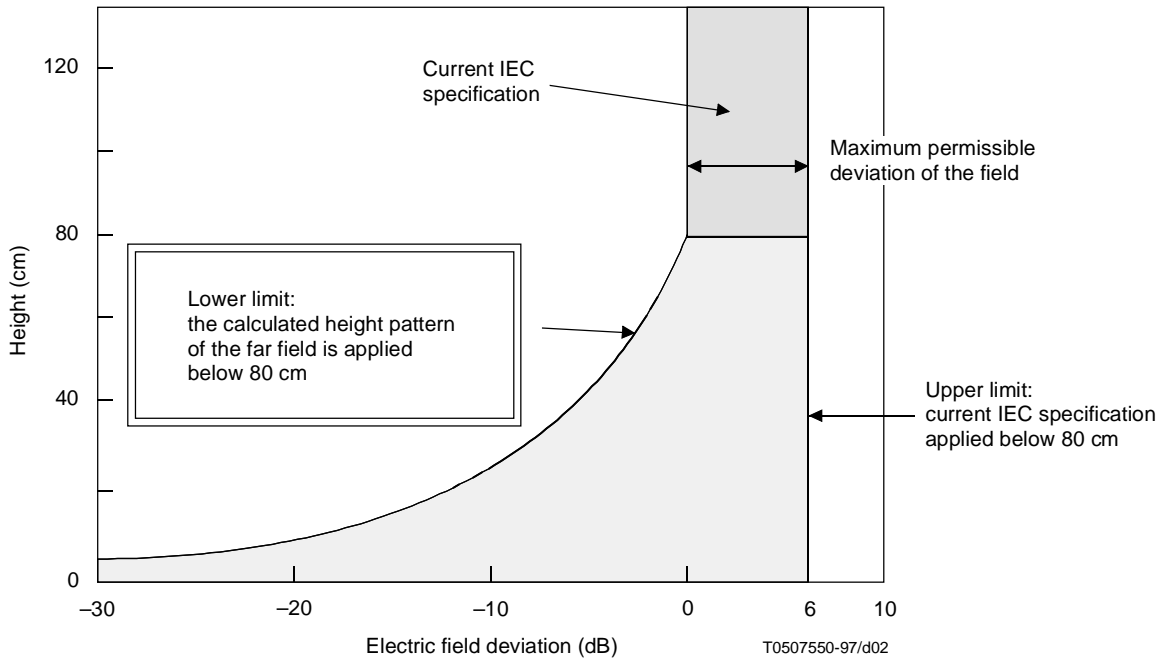
It is preferable to apply the radiated immunity test in frequency range 27 to 1000 MHz when the EUT is a rack mounted type. (It is possible to use the test method defined in IEC Publication 61000-4-3 down to 26 MHz).

The reason for the frequency range selection shall be described in the test report.

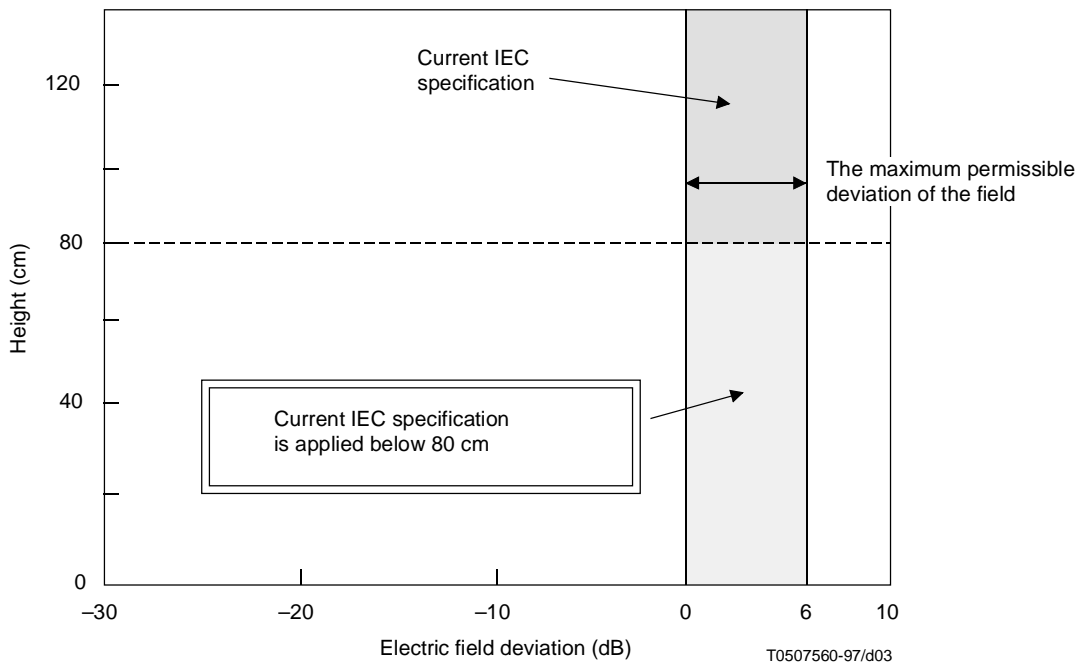
## Appendix III

### Uniformity of test field

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 III.1 and III.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.



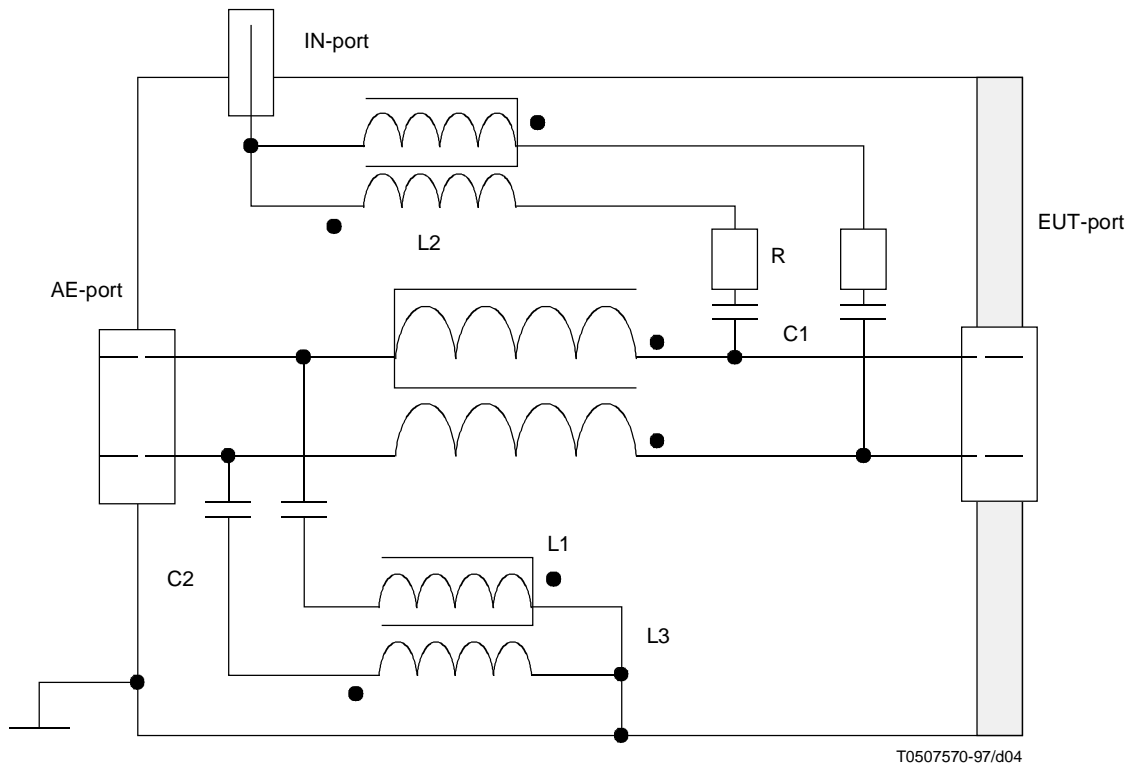
**Figure III.1/K.43 – Appropriate electric field uniformity below 80 cm (horizontal polarization)**



**Figure III.2/K.43 – Appropriate electric field uniformity below 80 cm (vertical polarization)**

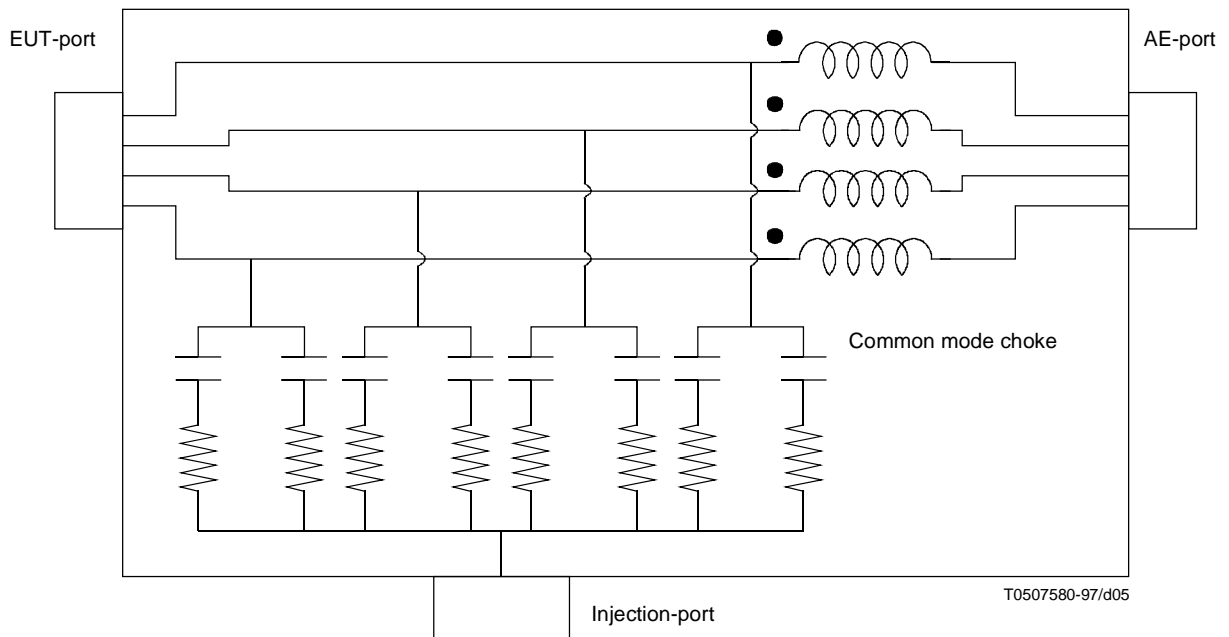
## Appendix IV

### Examples of Coupling/Decoupling Network (CDN)

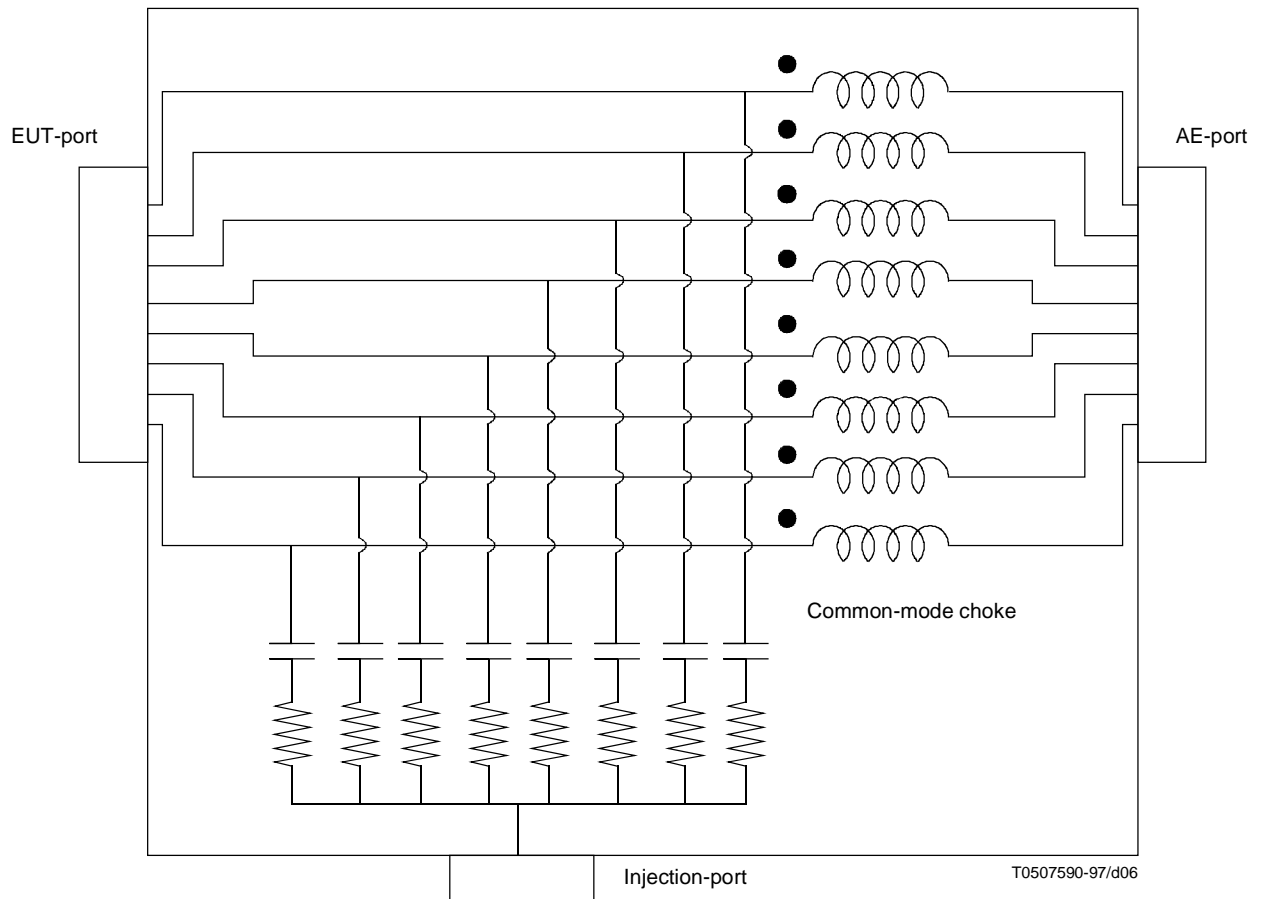


NOTE –  $C(\text{typ}) = 5.6 \text{ nF}$ ,  $R = 400 \ \Omega$ ,  $L1 \gg 280 \ \mu\text{H}$  at 150 kHz,  $L2 = 6 \text{ mH}$ .

**Figure IV.1/K.43 – Example of a CDN for two-wire balanced line**



**Figure IV.2/K.43 – Example of a CDN for four-wire balanced line**



NOTE – Impedance of common-mode choke coil > 250  $\Omega$ .

**Figure IV.3/K.43 – Example of a CDN for eight-wire balanced line**

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