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SERIES K: PROTECTION AGAINST INTERFERENCE

EMC requirements for each telecommunication network equipment – Product family Recommendation

ITU-T Recommendation K.48

(Formerly CCITT Recommendation)

ITU-T RECOMMENDATION K.48

EMC REQUIREMENTS FOR EACH TELECOMMUNICATION NETWORK EQUIPMENT – PRODUCT FAMILY RECOMMENDATION

Summary

This Recommendation specifies the emission and immunity requirements for switching, transmission, power and supervisory equipment. It also describes operational conditions for emission and immunity testing. Performance criteria for immunity tests are also specified.

Source

ITU-T Recommendation K.48 was prepared by ITU-T Study Group 5 (1997-2000) and was approved under the WTSC Resolution No. 1 procedure on 25 February 2000.

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.

NOTE

In this Recommendation, the expression "Administration" is used for conciseness to indicate both a telecommunication administration and a recognized operating agency.

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As of the date of approval of this Recommendation, the ITU had not received notice of intellectual property, protected by patents, which may be required to implement this Recommendation. However, implementors are cautioned that this may not represent the latest information and are therefore strongly urged to consult the TSB patent database.

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Recommendation K.48

EMC REQUIREMENTS FOR EACH TELECOMMUNICATION NETWORK EQUIPMENT – PRODUCT FAMILY RECOMMENDATION

(Geneva, 2000)

1 Scope

This Recommendation specifies the emission and immunity requirements for switching, transmission, power and supervisory equipment. It also describes operational conditions for emission and immunity testing. Performance criteria for immunity tests are also specified. The general operational condition and performance criteria are recommended in Recommendation K.43. This Recommendation describes the specific testing conditions to be applied to telecommunication network equipment.

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 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.

[1] ITU-T Recommendation K.43 (1998), *Immunity requirements for telecommunication equipment*.

[2] ITU-T Recommendation K.34 (2000), *Classification of electromagnetic environmental conditions for telecommunication equipment – Basic EMC Recommendation*.

[3] CISPR 22 (1997), *Information technology equipment – Radio disturbance characteristics – Limits and methods of measurement*.

[4] ITU-T Recommendation K.38 (1996), *Radiated emission test procedure for physically large systems*.

[5] ITU-T Recommendation O.150 (1996), *General requirements for instrumentation for performance measurements on digital transmission equipment*.

[6] CISPR 11 (1997), *Industrial, scientific and medical (ISM) radio-frequency equipment – Electromagnetic disturbance characteristics – Limits and methods of measurement*.

[7] ITU-T Recommendation K.27 (1996), *Bonding configurations and earthing inside a telecommunication building*.

[8] IEC 60050-161 (1990), *International Electrotechnical Vocabulary – Chapter 161: Electromagnetic compatibility*.

[9] IEC 60050-714 (1992), *International Electrotechnical Vocabulary – Chapter 714: Switching and signalling in telecommunications*.

[10] ITU-T Recommendation G.703 (1998), *Physical/electrical characteristics of hierarchical digital interfaces*.

3 Definitions and abbreviations

3.1 Definitions

The following definitions apply only in the context of this Recommendation, except where the reference to the International Electrotechnical Vocabulary is given adjacent to the subclause title.

3.1.1 aggregate signal: Digital signal related to the transmission of data derived by the aggregation of tributary signal, service channels, and other information necessary to the functionality of a transmission system.

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

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

3.1.4 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.

3.1.5 connection: A temporary association of transmission channels or telecommunication circuits, switching or other functional units set up to provide for the transfer of information between two or more points in telecommunication networks [8].

3.1.6 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.

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

3.1.8 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.

3.1.9 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.

3.1.10 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.

3.1.11 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.

3.1.12 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.

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

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

3.1.15 ports in telecommunication (indoor port, outdoor port, enclosure port, DC power port, AC power port) – See Figure 1.

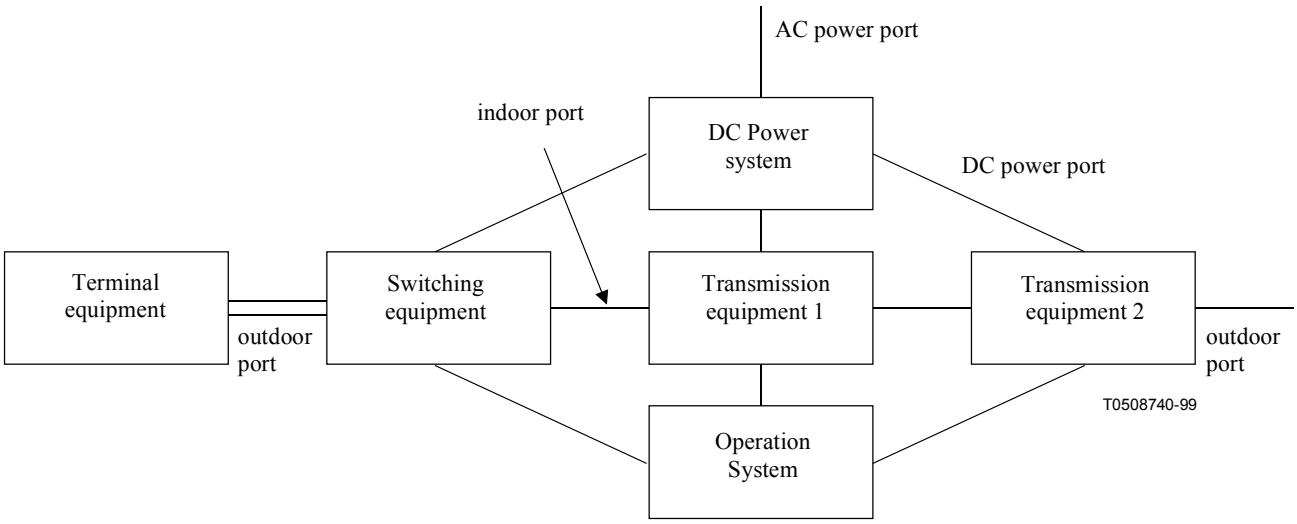

Figure 1/K.48 – Ports in telecommunication

3.1.16 power supply: A power source to which telecommunication equipment is intended to be connected.

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

3.1.18 Radio Frequencies (RF): The frequency range above 9 kHz.

3.1.19 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.

3.1.20 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.

3.1.21 telecommunication centre: Electromagnetic environment of telecommunication centre is described in Recommendation K.34.

3.1.22 telecommunication network: A network operated under a licence granted by a national telecommunications authority which provides telecommunications between network termination points (NTPs) (i.e. excluding terminal equipment beyond the NTPs).

3.1.23 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.

3.1.24 tributary signal: Digital signal related to the transmission of data at a bit rate defined by ITU-T Recommendation and coming from a multiplexer equipment; e.g. a signal at 2.048 Mbit/s in line with G.703 [10].

3.2 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

EMC Electromagnetic Compatibility

ESD Electrostatic Discharge

EUT Equipment Under Test

PRBS Pseudo Random Bit Sequence

RF Radio Frequency

UPS Uninterruptible power supply

VDU Video Display Unit

4 Test methods and limits

Both emission and immunity should be tested in accordance with Recommendation K.43 [1] or the appropriate basic standards.

4.1 Emission

The general requirements for test methods and limits apply according to [3]. Tables A.3 and A.4 are recommended for equipment in telecommunication centres and outdoor location. Recommendation K.38 [4] should be applied to large equipment tests.

Conduction emission measurement at power input and/or output should be made using the artificial mains network (AMN) at each port. Where the AMN cannot be used due to the current rating of the equipment under test (EUT), the voltage probe according to [6] should be used.

4.2 Immunity

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

For immunity testing, the general test methods and test levels in [1] apply. Test levels for telecommunication network equipment are shown in Tables A.1 and A.2. Test levels for specific installation should be selected based on the electromagnetic environment referred to [2].

Conducted immunity test shall be applied to one port at a time.

Conducted immunity testing shall be performed on power input and output ports and on signal ports.

If a Mesh Bonding Network (Mesh-BN) or Mesh Isolated Bonding Network (Mesh-IBN) according to Recommendation K.27 [7] is used throughout the installation, only ports connected to inter-system cables are to be tested. The manufacturer remains responsible for ensuring that no degradation in system immunity result from internal cabling (where the manufacturer controls both ends) not subjected to the immunity test.

It is possible to test equipment with primary protection if it is requested. The test condition should be added in the test report.

Line to line test for telecommunication line surges should not be applied for an equipment which has a protection system which does not generate line to line voltage.

If the specified maximum length of the connected line is less than 3 m no conducted immunity test is necessary. For surge tests on indoor signal lines, no test is necessary if the specified maximum length is less than 10 m.

One signal port of each type found on the equipment shall be tested. If in normal installation practice multi-pair cables (e.g. 64 × balanced pairs) and/or composite cables (e.g. a combination of fibre and copper) are used, they are to be tested as one single cable. Cables bundled for aesthetic or routing purposes are to be tested individually.

For multi-pair cables where multi-pair CDN does not exist, the test shall be applied to a single pair using an appropriate CDN, the remaining pairs should be considered to have been tested indirectly.

During the surge test, the EUT and all ports (other than the one connected to the generator) shall comply with the given compliance criteria. After the surge has been applied the generator shall be disconnected from the port and the port checked against the compliance criteria. The compliance criteria shall contain functional aspects.

Therefore, the test serves two purposes:

a) the immunity test of the EUT;

b) a test of resistibility of the port to which the generator is connected.

For screened cable, surges are applied directly to the screen.

During immunity testing using continuous phenomena, some or all of the following selected frequencies shall be investigated in addition to the sweep when applicable:

– the clock frequencies inside the specified frequency band of the test;

– 80, 120, 160, 230, 434, 460, 600, 863 and 900 MHz (± 1%) (RF field);

– 0.2, 1.0, 7.1, 13.56, 21.0, 27.12, 40.68 MHz (± 1%) (RF voltage).

5 General operational conditions and test configuration

The EUT shall be configured and operated in accordance with relevant basic EMC standards and clause 4/K.43.

The signal or control ports shall be correctly terminated either by auxiliary equipment necessary to exercise the ports or in their nominal impedance.

The equipment test conditions should be as close as possible to the installed conditions. Wiring should be consistent with the specifications. If the equipment is designed to be mounted in a rack or cabinet, it should be tested in this configuration.

A sufficient number of ports should be correctly terminated to ensure that the test is representative of normal operating conditions and the selection of ports should be recorded in the test report.

Only cables that are permanently connected should be included.

The types of cables connected to the EUT should be indicated in the test report.

The test configuration should be recorded in the test report.

6 Specific operational conditions and test configurations

Specific conditions for each product are as follows.

6.1 Operational conditions for switching equipment

As indicated in the general operating conditions, special additional equipment must often be used, e.g. a traffic simulator, and/or software, to reduce the test time and simulate traffic conditions.

The tariff and billing part should be included .

When it is impractical to test all ports, one of each type may be selected for the testing.

The tested ports should be configured for connection to another port at the other port's nominal impedance. Auxiliary equipment may be used to simulate the functional termination of the ports.

The switching system should be adequately loaded for performance measurement during immunity testing.

When the EUT is a distributed processing system consisting of both central and peripheral processing sub-systems, the test load should be applied only to the portion of the EUT affected by the particular test. Portions of the EUT that are judged to be unaffected by a particular test may be operated at lower load levels for that test. However, all units should be loaded to some extent.

For high-capacity processing systems, it may be impractical to increase the load on the EUT up to the prescribed level using only special additional equipment. In such cases, it is acceptable to generate additional traffic by using internal traffic simulation software or other artificial means to bring the call processing load up to the prescribed level. However, the minimum capability to detect and report call processing errors in the artificial traffic must be comparable to that for traffic generated by the use of special additional equipment.

Exercising equipment, e.g. a traffic simulator used for testing of other function, can also be used as exercising equipment for tariff and billing function.

Other switching system functions, such as data transfer and maintenance routines, should continue during immunity testing.

6.2 Operational conditions for transmission equipment

Typically the equipment will be configured as shown in Figure 2. As indicated in the general operating conditions, special additional equipment must often be used, e.g. line attenuator, line loop, path simulator.

The test configuration shall cover a representative set up of tributary signals within the aggregate interface signals.

In Figure 2, a test signal is derived from the test equipment A and looped through the EUT. If the EUT supports several identical channels, these may be connected in series and the test signal may be looped through all the channels.

The test equipment may be digital or analogue signal analyser as required. The test equipment may also loop back the test signal.

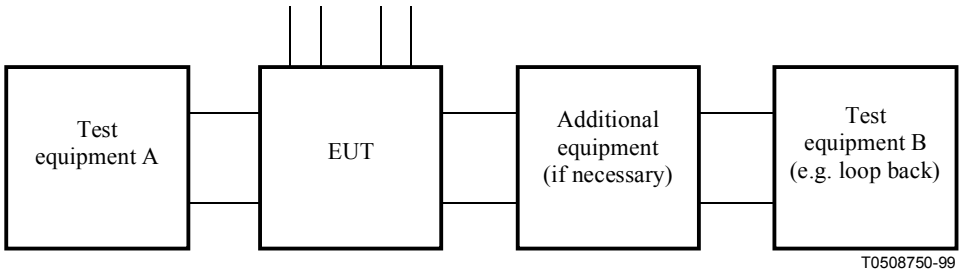

Figure 2/K.48 – Typical test configuration for transmission equipment

An appropriate test signal shall be used. The test signal shall be stated in the test report. The preferred digital transmission signal is the Pseudo Random Bit Sequence (PRBS) appropriate for the bit rate of the channel.

The modes of operation during testing shall be recorded in the test report.

Immunity test shall be performed at nominal values of all signal conditions and with typical value of line/path attenuation specified for each equipment.

When it is impractical to test all ports, one of each type may be selected for the testing.

6.3 Operational conditions for power equipment

The EUT load shall be resistive unless otherwise specified by the manufacturer.

Uninterruptible power supplies (UPS) should be tested both AC mains on and off.

The signal or control ports should be correctly terminated either by auxiliary equipment necessary to exercise the ports or by its nominal impedance.

The test shall be carried out at the input nominal voltage.

6.3.1 Emission

The measurements shall be made in the operating mode, producing the largest emission consistent with normal applications.

The EUT load should be adjusted within the normal operating range in order to maximize the emission.

Conducted emission is measured on the power input and output ports with artificial mains networks on both ports, and on one signal/control interface of each type found on the equipment.

6.3.2 Immunity

Testing may be performed with the EUT operating at reduced output power (50% is recommended). The actual output power level for each test must be stated in the test report.

Conducted immunity testing should be performed on the power input and output ports, and on one control port of each type found on the equipment.

Power and control cables no longer than 3 m (according to the manufacturer's specifications) need not be subjected to conducted immunity testing. However, cables that may be connected to an extensive network are subject to such testing.

Interconnecting cables between units of the same power supply system do not need to be tested.

6.4 Operational conditions for supervisory equipment

As indicated in the general operating conditions, special additional equipment must often be used, e.g. a traffic simulator, and/or software, to reduce the test time and simulate traffic conditions.

7 Performance criteria

The general performance criteria of clause 5/K.43 [1] apply.

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.

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.

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.

Performance criteria for each telecommunication network equipment are as follows.

7.1 Performance criteria for switching equipment

For the switching equipment, the following main signal ports are recognised.

– Analogue port (e.g. analogue subscriber's line, analogue interfaces to transmission equipment).

– Digital port [e.g. digital subscribers lines (ISDN), digital connection to transmission equipment].

The interfaces shall operate as described in the following subclauses.

7.1.1 Analogue ports

The performance of the equipment shall be verified for analogue voice frequency signal ports:

– by measuring the audio signal break-through (demodulated 1 kHz) on the signal port during continuous exposures in both signal path directions covering both analogue to digital conversion and digital to analogue conversion;

– by testing the functionality of the main signal port and the other signal ports after the transient exposures;

– by verifying that corruption of software and data held in memory has not occurred.

1) *Performance criteria A*

– The connection must be maintained throughout testing.

– During a sweep over the entire frequency range, the noise level measured at each two-wire analogue port at 600 Ω (ignoring the normal impedance of the port for practical reason) must be less than –40 dBm. The measurement shall be done selectively with a bandwidth ≤ 100 Hz at 1 kHz.

– Dialling tones shall be available.

At these selected frequencies:

– It should be possible to establish a connection between any two ports (e.g. between subscriber lines and between a subscriber line and a transmission port).

– It should be possible to terminate a connection in a controlled manner.

2) *Performance criteria B*

– Connections shall be maintained throughout the test.

– It should be possible to establish a connection between any two ports (e.g. between subscriber lines and between a subscriber line and a transmission port) after the application of the transients; short delays in making a connection are acceptable.

– It should be possible to clear a connection in a controlled manner after the application of the transients.

3) *Performance criteria C*

– A connection shall be maintained but communication may not be possible because of high noise levels.

– The EUT shall return automatically to normal performance after the cessation of the exposure.

7.1.2 Digital ports

The performance of the equipment shall be verified for digital signal ports:

– by measuring the number of induced bit errors on the main signal port during all exposures;

– by testing the functionality of the main signal port and the other signal ports during selected frequency tests and after the exposures;

– by verifying that corruption of software and data held in memory has not occurred.

1) *Performance criteria A*

During the sweep:

– The established connections shall be maintained throughout the testing.

– The number of bit errors at the end of each individual disturbance exposure shall not exceed the maximum number of errors expected for normal operation.

– The number of errors is calculated as: (the maximum bit error ratio specified by the manufacturer) × (bit rate) × (test time).

– The test time is taken to be the dwell time at each frequency of the exposure.

– For reduction of the test time, criterion in Table 1 may be adopted.

Table 1/K.48

Bit rate	Criterion
64 kbit/s	0
2 Mbit/s	0
NOTE – The bit error rate "0" means that no additional bit errors are measured during each individual disturbance exposure.	

At selected frequencies:

– it should be possible to establish a connection between any two ports (e.g. between subscriber lines and between a subscriber line and a transmission port);

– it should be possible to clear a connection in a controlled manner.

2) *Performance criteria B*

– The established connection shall be maintained throughout the testing.

– It shall be possible to establish a connection between two ports after the end of transient disturbances.

– It shall be possible to clear a connection in a controlled manner after the end of test signal.

3) *Performance criteria C*

– The general performance criteria C apply.

7.2 Performance criteria for transmission equipment

The performance criteria for transmission equipment are as follows.

7.2.1 Analogue ports

The performance of the equipment shall be verified for analogue voice frequency signal ports:

– by measuring the audio signal break-through (demodulated 1 kHz) on the signal port during continuous exposures in both signal path directions covering both analogue to digital conversion and digital to analogue conversion;

– by testing the functionality of the main signal port and the other signal ports after the transient exposures;

– by verifying that corruption of software and data held in memory has not occurred.

1) *Performance criteria A*

– The connection must be maintained throughout testing.

– During a sweep over the entire frequency range, the noise level measured at each two-wire analogue port at 600 Ω (ignoring the normal impedance of the port for practical reason) must be less than –40 dBm. The measurement shall be done selectively with a bandwidth ≤ 100 Hz at 1 kHz.

2) *Performance criteria B*

– Connections shall be maintained throughout the test. The EUT shall return automatically to normal performance after the cessation of the exposure.

3) *Performance criteria C*

– A connection is maintained but communication may not be possible because of high noise levels.

– The EUT shall return automatically to normal performance after the cessation of the exposure.

7.2.2 Digital ports

The performance of the equipment shall be verified for digital signal ports:

– by measuring the number of induced bit errors on the main signal port during all exposures;

– by testing the functionality of the main signal port and the other signal ports after the exposure;

– by verifying that corruption of software and data held in memory has not occurred.

1) *Performance criteria A*

During the sweep:

– When applicable, the established connections shall be maintained throughout the testing.

– The number of bit errors at the end of each individual disturbance exposure shall not exceed the maximum number of errors expected for normal operation.

– The number of errors is calculated as: (the maximum bit error ratio specified by the manufacturer) × (bit rate) × (test time).

– The test time is taken to be the dwell time at each frequency of the exposure.

– For reduction of the test time, criterion in Table 1 may be adopted.

At selected frequencies:

– When applicable, it should be possible to establish a connection between any two ports to be connected.

– It should be possible to clear a connection in a controlled manner (when this function exists).

2) *Performance criteria B*

– Loss of frame alignment or loss of synchronization is not allowed during each individual exposure. The above does not apply to surge testing where some loss of frame alignment may be expected. For this test, the EUT shall operate as intended following the cessation of the exposure.

– Connections shall be maintained throughout the test. The EUT shall return automatically to normal performance after the cessation of the exposure.

3) *Performance criteria C*

– Temporary loss of function is allowed. The EUT shall return automatically to normal performance after the cessation of the exposure.

7.2.3 Specific performance criteria

7.2.3.1 SDH and PDH interfaces

7.2.3.1.1 Tributary interfaces and aggregate interfaces

The criteria specified in 7.2.2 apply to the interfaces specified in ITU-T Recommendations G.703 and G.958 (optical interfaces).

7.2.3.2 ISDN interfaces

7.2.3.2.1 Primary rate access ISDN interfaces

The criteria specified in 7.2.2 apply to the interfaces specified in ITU-T Recommendation I.431.

7.2.3.2.2 Network termination NT1 for ISDN "U" interfaces

The criteria specified in 7.2.2 apply to the interfaces specified in ITU-T Recommendation G.961.

7.2.3.2.3 Network termination NT1 for ISDN "S/T" interfaces

The criteria specified in 7.2.2 apply to the interfaces specified in ITU-T Recommendation I.430.

7.2.3.3 Analogue interface

7.2.3.3.1 Trunk interfaces and leased line interfaces

The criteria specified in 7.2.1 apply to the interfaces specified in ITU-T Recommendation G.712 .

7.2.3.3.2 Subscriber interfaces

The criteria specified in 7.2.1 apply to the interfaces specified in ITU-T Recommendation Q.552.

7.2.3.4 V.10, V.11, V.24, V.28, V.35, V.36, X.24 and similar V- and X- series interfaces

The criteria specified in 7.2.2 apply to the interfaces specified in ITU-T Recommendations V.10, V.11, V.24, V.28, V.35, V.36 and X.24.

7.2.3.5 Ethernet and packet-data interfaces

To the interfaces specified in ISO/IEC 8802-3 and ITU-T Recommendation X.25 , the criteria below apply:

1) *Performance criteria A*

For interfaces which are intended for the transmission of third party data traffic, a selected port shall be connected to test equipment (e.g. a data communications analyser) as a single point-to-point data link. This will avoid excessive failed transmission attempts caused by data collisions and bus contention problems.

The interface shall be suitably exercised and monitored throughout the test period for erroneous frames.

No more than 5% additional erroneous frames above the quiescent level shall be permitted during the exposure.

2) *Performance criterion B*

The data link connection shall be maintained.

7.2.3.6 Service and maintenance interfaces

The functional performance of ports of this type, not intended to be permanently connected and therefore not subjected to immunity testing, shall be verified according to the manufacturer's specification following cessation of the electromagnetic exposure on other ports.

7.2.3.7 Synchronization interfaces

The performance of slave clocks specified in ITU-T Recommendations G.812 and G.813 shall be checked with the equipment synchronized with an external source.

1) *Performance criterion A*

During the exposure, synchronization shall not be lost.

2) *Performance criteria B*

No alarm indications shall persist after the exposure.

The functional performance according to the manufacturer's specification shall be verified following cessation of the exposure.

7.2.3.8 Remote alarm interfaces

These interfaces are defined by the manufacturer.

1) *Performance criterion A*

No false alarms shall occur during continuous exposures.

2) *Performance criterion B*

No false alarm indications shall persist after the exposure.

7.3 Performance criteria for power supply equipment

The performance criteria for power supply equipment is as follows.

The power supply equipment ports to be monitored during testing can be categorized as:

– DC secondary interface ports;
– AC secondary interface ports;
– control/signal ports.

7.3.1 General performance criteria for power supply equipment

1) *Performance criteria A*

– During the application of immunity tests, the EUT output voltage range shall be in accordance with the normal service condition.
– During and after the exposure, the EUT shall operate without alarms, false alarm indications (power supply failure, protection failure, etc.) or false display indications.

2) *Performance criteria B*

– After the application of the test signal, the power supply shall operate as intended.

– During the test, the output voltage shall never reach a level high enough to damage telecommunication equipment usually connected to power supply equipment and it shall be in accordance with the normal service condition, just after the disturbance application.

– Just after the exposure, the EUT shall operate without alarms, false alarm indications (power supply failure, protection failure, etc.) or false display indications.

3) *Performance criteria C*

Loss of supervised or alarm function is allowed. Nevertheless after the application of the test, all functions shall operate as intended. The output voltage range shall be in accordance with the normal service condition.

7.3.2 Particular performance criteria for power supply equipment

The particular performance criteria for power supply equipment is defined for DC secondary output ports and AC secondary output ports as follows.

7.3.2.1 DC secondary output port

1) *Performance criteria A*

The maximum level of wide band noise on the DC secondary interface shall not exceed 10 mV. The noise should be measured by psophometer conforming to Recommendation O.41.

7.3.2.2 AC secondary output port

1) *Performance criterion A*

During the application of immunity tests, the voltage fluctuation must be less than ± 10% of nominal voltage.

7.4 Performance criteria for supervisory equipment

Following performance criteria specific for supervisory equipment apply.

1) *Performance criteria A*

– The connections between the supervising and supervised equipment must be maintained.

– No supervisory functions shall be affected by immunity testing.

– No false alarms, such as signal lamps and printer misprints, shall occur.

2) *Performance criteria B*

– The supervisory equipment shall not affect the normal operation of the equipment being supervised.

– The operating speed of the supervising equipment may be reduced.

– Any minor priority supervisory function may be affected during immunity testing. These functions shall resume normal performance at cessation of the exposure. For example, false alarms shall reset.

ANNEX A

Immunity Test Levels

Table A.1/K.48 – Equipment for telecommunication centre

	Environmental phenomena	Test levels	Units	Basic standard	Performance criteria	Remarks
Enclosure port						
	Radio frequency electromagnetic field	3	V/m	IEC 61000-4-3	A	80-1000 MHz (Notes 1 and 5)
	Electrostatic discharge	4	kV	IEC 61000-4-2	B	Contact and air discharge
Outdoor telecommunication ports						
	Radio frequency conducted continuous	3	V	IEC 61000-4-6	A	0.15-80 MHz (Notes 2, 3 and 5)
	Surges	0.5 (line to line) 1 (line to ground)	kV	IEC 61000-4-5	B	10/700 µs (Note 4)
	Fast transients	0.5	kV	IEC 61000-4-4	B	
Indoor telecommunication ports						
	Radio frequency conducted continuous	3	V	IEC 61000-4-6	A	0.15-80 MHz (Notes 2, 3 and 5)
	Surges	0.5 (line to ground)	kV	IEC 61000-4-5	B	1.2/50 (8/20) µs (Note 4)
	Fast transients	0.5	kV	IEC 61000-4-4	B	
DC power ports						
	Radio frequency conducted continuous	3	V	IEC 61000-4-6	A	0.15-80 MHz (Notes 2, 3 and 5
	Fast transients	0.5	kV	IEC 61000-4-4	B	

Table A.1/K.48 – Equipment for telecommunication centre *(concluded)*

	Environmental phenomena	Test levels	Units	Basic standard	Performance criteria	Remarks
AC power ports						
	Radio frequency conducted continuous	3	V	IEC 61000-4-6	A	0.15-80 MHz (Note 5)
	Surges	0.5 (line to line) 1 (line to ground)	kV	IEC 61000-4-5	B	1.2/50 (8/20) μs
	Fast transients	1.0	kV	IEC 61000-4-4	B	
	Voltage dips	> 95 0.5	% reduction period	IEC 61000-4-11	B	(Note 6)
		30 25	% reduction period	IEC 61000-4-11	C	(Note 6)
	Voltage interruption	95 250	% reduction period	IEC 61000-4-11	C	(Note 6)

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 Ω.

NOTE 4 – This test may not be applied for unscreened cable when appropriate CDN does not exist.

NOTE 5 – It is recognized that radio frequency electromagnetic field and conducted continuous voltage are 1 V/m and 1 V respectively in major telecommunication centre.

NOTE 6 – This test applies to equipment having a rated input current not exceeding 16 A per phase.

Table A.2/K.48 – Equipment for outdoor locations

	Environmental phenomena	Test levels	Units	Basic standard	Performance criteria	Remarks
Enclosure port						
	Radio frequency electromagnetic field	3	V/m	IEC 61000-4-3	A	80-1000 MHz (Notes 1 and 5)
	Electrostatic discharge	4	kV	IEC 61000-4-2	B	Contact and air discharge
Telecommunication ports						
	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 μs (Note 4)
	Fast transients	0.5	kV	IEC 61000-4-4	B	
DC power ports						
	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	
AC power ports						
	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) μs
	Fast transients	1.0	kV	IEC 61000-4-4	B	
	Voltage dips	> 95 0.5	% reduction period	IEC 61000-4-11	B	(Note 6)
		30 25	% reduction period	IEC 61000-4-11	C	(Note 6)
	Voltage interruption	95 250	% reduction period	IEC 61000-4-11	C	(Note 6)

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 Ω.

NOTE 4 – This test may not be applied for unscreened cable when appropriate CDN does not exist.

NOTE 5 – In cases where mobile communications are permitted, radio field immunity higher than 10 V/m may be requested at communication frequencies.

NOTE 6 – This test applies to equipment having a rated input current not exceeding 16 A per phase.

Table A.3/K.48 – Equipment for telecommunication centre (Emission)

		Frequency	Quasi-peak Limit	Average limit	Basic standard	Remarks
Enclosure port						
	Radiated electromagnetic field	30 to 230 MHz	40 dB(μV/m)	N/A	CISPR Pub. 22	Physically large systems should be tested according to K.38
		230 to 1000 MHz	47 dB(μV/m)			
Telecommunication ports (outdoor and indoor)						
	Conducted disturbance voltage	0.15 to 0.5 MHz	97 to 87 dB(μV)	84 to 74 dB(μV)	CISPR Pub. 22	(Notes 1, 2 and 3)
		0.5 to 30 MHz	87 dB(μV)	74 dB(μV)		
AC power ports						
	Conducted disturbance voltage	0.15 to 0.5 MHz	79 dB(μV)	66 dB(μV)	CISPR Pub. 22	(Note 2)
		0.5 to 30 MHz	73 dB(μV)	60 dB(μV)		
DC power ports						
	Conducted disturbance voltage	0.15 to 0.5 MHz	79 dB(μV)	66 dB(μV)	CISPR Pub. 22	(Note 2)
		0.5 to 30 MHz	73 dB(μV)	60 dB(μV)		

NOTE 1 – The limits decrease linearly with the logarithm of the frequency.

NOTE 2 – Equivalent current limit can be applied.

NOTE 3 – Provisionally, a relaxation of 10 dB over the frequency range of 6 MHz to 30 MHz is allowed for high speed service having significant spectral density in this band. However, this is restricted to the common mode disturbance converted by the cable for the wanted signal.

Table A.4/K.48 – Equipment for outdoor location (Emission)

		Frequency	Quasi-peak Limit	Average limit	Basic standard	Remarks
Enclosure port						
	Radiated electromagnetic field	30 to 230 MHz	30 dB(μV/m)	N/A	CISPR Pub. 22	Physically large systems should be tested according to K.38
		230 to 1000 MHz	37 dB(μV/m)			
Telecommunication ports (outdoor and indoor)						
	Conducted disturbance voltage	0.15 to 0.5 MHz	84 to 74 dB(μV)	74 to 64 dB(μV)	CISPR Pub. 22	(Notes 1, 2 and 3)
		0.5 to 30 MHz	74 dB(μV)	64 dB(μV)		
AC power ports						
	Conducted disturbance voltage	0.15 to 0.5 MHz	66 to 56 dB(mV)	56 to 46 dB(μV)	CISPR Pub. 22	(Notes 1 and 2)
		0.5 to 5 MHz	56 dB(μV)	46 dB(μV)		
		5 to 30 MHz	60 dB(mV)	50 dB(μV)		
DC power ports						
	Conducted disturbance voltage	0.15 to 0.5 MHz	66 to 56 dB(μV)	56 to 46 dB(μV)	CISPR Pub. 22	(Notes 1 and 2)
		0.5 to 5 MHz	56 dB(μV)	46 dB(μV)		
		5 to 30 MHz	60 dB(μV)	50 dB(μV)		

NOTE 1 – The limits decrease linearly with the logarithm of the frequency.

NOTE 2 – Equivalent current limit can be applied.

NOTE 3 – Provisionally, a relaxation of 10 dB over the frequency range of 6 MHz to 30 MHz is allowed for high speed service having significant spectral density in this band. However, this is restricted to the common mode disturbance converted by the cable for the wanted signal.

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