

**REGULATION FOR TELECOMMUNICATIONS EQUIPMENTS
CERTIFICATION REGARDING THE ELECTROMAGNETIC
COMPATIBILITY ASPECTS**

HEADING I
GENERAL PROVISIONS

Chapter I
Business Purpose

Art. 1° The purpose of this regulation is to determine the requirements of the electromagnetic compatibility to be met by the telecommunications products, aiming to complement the specific regulations of these products, for Certification purposes with the Telecommunication National Agency Anatel.

Chapter II
References

Art. 2° For Regulation purposes, the following references will be used:

I - Anatel – Regulation for the Certification and Homologation of Telecommunications Products.

II - IEC 61000-4-2(2001) - Electromagnetic Compatibility (EMC) - Part 4: Testing and Measurement Techniques. Section 2 Electrostatic discharge immunity test.

III - IEC 61000-4-3 (2002) - Electromagnetic Compatibility (EMC) - Part 4: Testing and Measurement Techniques. Section 3 Radiated electromagnetic field requirements.

IV - IEC 61000-4-4 (2004) - Electromagnetic Compatibility (EMC) - Part 4: Testing and Measurement Techniques. Section 4 Electrical fast transient.

V - IEC 61000-4-5 (2001) - Electromagnetic Compatibility (EMC) - Part 4: Test and Measurement Techniques - Section 5: Surge Immunity Test.

VI - IEC 61000-4-6 (2004) - Electromagnetic Compatibility (EMC) - Part 4: Testing and Measurement Techniques. Section 6 Immunity to conducted disturbances induced by radio-frequency fields.

VII - IEC 61000-4-11 (2004) - Electromagnetic Compatibility (EMC): Part 4: Testing and Measurement Techniques; Section 11: Voltage dips, short interruptions and voltage variations; Immunity tests.

VIII - CISPR 11 (2003) - Industrial, scientific and medical (ISM) radio-frequency equipment - Electromagnetic disturbance characteristic - Limits and methods of measurement.

IX - CISPR 22 (2005) - Limits and methods of measurement of radio disturbance characteristics of information technology equipment

X - CISPR 24 (1997), Amend 1 (2001) e Amend 2 (2002) - Information technology equipment - Immunity characteristics - Limits and methods of measurement

XI - ITU-T Rec. K.21 (2003) - Resistibility of telecommunication equipment installed in customer premises to overvoltages and overcurrents.

XII - ITU-T Rec. K.44 (2003) - Resistibility tests for telecommunication equipment exposed to overvoltages and overcurrents - Basic recommendation.

XIII - ITU-T Rec. K.38 (1996) - Radiated emission testing of physically large telecommunication systems.

XIV - ITU-T Rec. K.48 (2003) - EMC Requirements for each telecommunication equipment - product family recommendation

Chapter I Scope

Art.3° The following provisions are applied to the telecommunications equipments. Further equipments which may occupy telecommunications terminal functions or provide access to the added value services, including Internet, will be subject of specific regulation.

I – The Requirements for the Emission of Electromagnetic Disturbances apply to the equipments susceptible of compulsory certification, according to the terms in the specific regulation mentioned in the item I, of the art. 2°. Regarding equipments which use the radioelectric spectrum, the emission requirements of irradiated electromagnetic disturbances described in this regulation (herein) are only applicable in the absence of requirements of intentional emission of radiofrequency or the spurious emissions disposed in the product specific regulation.

II - The Requirements of Immunity to Electromagnetic Disturbances apply to classified equipments such as Telecommunications Products of Categories I and II, according to the terms of the specific regulation mentioned in the item I of the art. 2°, once they are destined for the public use in general (see Annex II).

III - The Requirements of Resistibility to Electromagnetic Disturbances apply to Telecommunications Products of Categories I and II, according to the terms of the specific regulation mentioned in the item I of the art. 2°, once they are destined for the public use in general (see Annex II).

Chapter IV Definitions

Art. 4° For Regulation purposes, the following definitions will be used:

I – Integrated Antenna: antenna used by radio-communication equipments which may not be turned off or removed for measurement or test implementations.

II - Removable Antenna: antenna used by radio-communication equipments which may be disconnected or removed for measurement or test implementations.

III - Electromagnetic Compatibility: the capacity of a device, equipment or system, to

operate according to the operational characteristics, within its electromagnetic environment, without imposing unbearable disturbance to other equipments, devices or systems which share the same electromagnetic environment.

IV – Equipment to be certified - EBC: telecommunications equipment that is subject to the tests described within this Regulation, intended for the certification of this equipment.

V – Class A equipment: equipment with specific characteristics for the installation at telecommunication stations. These equipments may cause radio-interference problems if installed at residential environment or areas.

VI – Class B equipment: equipment intended for use on domestic or residential setting/environment with specific characteristics for the user installations, for installation of access networks or for situations in which the place of use is not fixed (e.g.: portable equipment fed by batteries). These equipments may be used at telecommunication stations.

VII - Radio-communication Equipment: telecommunications equipment which uses the radioelectric spectrum and which includes one or more transmitters and receptors of radioelectric signals for fixed, mobile or portable usage.

VIII – Exclusion Band (of radiofrequency): frequency bands related to characteristics of reception and/or transmission of a radio-communication equipment which shall be excluded from the evaluation, during the electromagnetic compatibility tests, of a radio-communication equipment covering irradiated and conducted electromagnetic disturbances.

IX – Transmission exclusion band: band of radioelectric spectrum out of which the emission of a transmitter data corresponds mainly to spurious emissions.

X – Reception exclusion band: Band of frequencies related to the operation of the receptor in which electromagnetic disturbances may not be applied on immunity tests to irradiated and conducted RF disturbances.

XI – Necessary Bandwidth (of emission): for a specific emission class, it is the minimum value of bandwidth adequately occupied by the emission to insure the transmission of the information with the speed and required qualities for the employed system, at the specified conditions.

XII – Common mode: test mode concerning the electromagnetic disturbances applied among conductor(s) of the port under test and the grounding.

XIII – Differential mode: test mode concerning the electromagnetic disturbances applied among conductor(s) of the port under test.

XIV - Electromagnetic disturbances: electromagnetic phenomenon capable of undermining the performance of a device, equipment or system, or of affecting, unfavorably, alive or inert matter.

XV – External port: it is a specific interface of certain equipment which connects to conductors that stretch beyond the edification or sheltering limits.

XVI – Internal port: it is a specific interface of certain equipment which connects to conductors which are restricted to the edification or sheltering limits.

XVII – Polarity: characteristic of a unidirectional electromagnetic disturbance which determines the direction of the electrical current circulation through the equipment under test. For a positive polarity disturbance, the electrical current circulates from the generator terminal to the grounding terminal, while for a negative polarity disturbance, the electrical current circulates from the grounding terminal to the generator terminal.

XVIII – Power Supply Port: telecommunications equipments port with local feeder by means of which the electrical energy is supplied towards its operation and, in case of PLC (Power line Communication) technology equipments, it also traffics the information.

XIX – Telecommunications port: telecommunications equipments port by means of which the information is transited and, in cases of tele-fed equipments, it also transits the electrical energy meant for its operation, such as, for example: port for connection to the SFTS, local network port (Ethernet), port for network xDSL, etc. Ports meant for the connection to peripheral equipments do not fit this definition, such as for example: port RS232, port USB, parallel port (printer), etc.

XX – Fictitious Network on V (Artificial Mains Network - AMN): device used for mediation of radiofrequency disturbances emitted by the equipment at the power supply ports.

XXI - Electromagnetic disturbances emission requirements: limits established for the electromagnetic disturbances emitted by telecommunications equipments, in a conducted or irradiated form, aiming to protect the telecommunications services, including services of radiobroadcasting, against electromagnetic interference.

XXII - Requirements of immunity to electromagnetic disturbances: limits established as to insure the normal operation of telecommunications equipments, when/while these are submitted to electromagnetic disturbances, in conducted or irradiated forms, with intensity compatible with their operation environments.

XXIII – Requirements of resistibility to electromagnetic disturbances: limits established as to insure the normal operation of telecommunication equipments, after they have been submitted to conducted electromagnetic disturbances, which intensity are compatible with their operation environments.

XXIV – Switched Fixed Telephone Service - SFTS: it is the telecommunications service, which by means of voice transmission and other signals, it is meant for communication among determined fixed ends, utilizing telephony processes.

Chapter V Regulation Enforcement

Art. 5° The enforcement of this Regulation, shall observe the following conditions:

I – The number of equipments which makes up the sample to be tested, the number of power supply and telecommunications ports to be tested per equipment, the acceptance criteria, as well as the configurations of the equipment to be tested shall be defined according to the applicable Anatel Regulation.

II – Some of the tests of this Regulation require the performance of operation evaluations of the equipment to be certified. The description of this operation evaluation shall agree with the applicable Anatel Regulation.

III – The equipment to be certified shall be tested during all operation stages and with a duration that is compatible with the specificity of each product, according to regulation in force. The description of these stages shall be defined according to the applicable Anatel Regulation.

IV - In cases in which important detailing for the electromagnetic immunity tests or for the electromagnetic emission are not specified within this regulation or in specific regulation of the product, prescriptions contained in the mentioned references in the items X or XIV of the art. 2º may be used.

HEADING II ELECTROMAGNETIC DISTURBANCE EMISSION REQUIREMENTS

Chapter I Specifications of Electromagnetic Disturbances Emission Requirements

Art. 6º The prescriptions for the emission of electromagnetic disturbances presented as follows, apply to the equipments indicated in the item I, of the art. 3º, taking into account the determined classification in the items V and VI, of the art. 4º.

§1º The emissions, from the power supply ports of the equipment to be certified shall meet the limits presented in the table 1, for class A equipments, or table 2, for class B equipments, based on the document referred in the item IX, of the art. 2º.

Table 1 - Limits of conducted disturbance at the power supply ports for the class A equipments.

Frequency Band MHz	Limits dB(∞ V)	
	Almost-peak	Average
0,15 to 0,50	79	66
0,50 to 30	73	60

Table 2 - Limits of conducted disturbance at the power supply ports for class B equipments.

Frequency Band MHz	Limits dB (∞ V)	
	Almost-peak	Average
0,15 to 0,50	66 to 56 (the limit decreases linearly with the frequency logarithm)	56 to 46 (the limit decreases linearly with the frequency logarithm)
0,50 to 5	56	46

5 to 30	60	50
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§2° Irradiated emissions from the equipment to be certified shall meet the limits presented in the tables 3 and 4, based on the document referred in the item IX, of the art. 2°. The approach about the measurement uncertainty is also described in this document.

Table 3 - Limits for the emission of irradiated disturbances of class A equipments.

Frequency Band MHz	Almost-peak Limits dB(∞ V/m)
30 to 230	40
230 to 1000	47

Table 4 - Limits for the emission of irradiated disturbances of class B equipments.

Frequency Band MHz	Almost-peak Limits dB(∞ V/m)
30 to 230	30
230 to 1000	37

§3o In the tables 1, 2, 3 and 4, for the mentioned bands transition frequencies, the lesser value limit must be applied.

§4° Radio-communication equipments, by means of this requirement, are classified as:

- a) Equipments with integrated antenna.
- b) Equipments with not integrated or removable antenna.

§5o The equipments seen in the paragraphs a and b, apply to the requirements specified in the 1st paragraph and, in case there are no irradiated spurious emission requirements specified in the specific regulation about the product, the requirements defined in the 2° paragraph also apply.

§6° In the emission measurements of electromagnetic disturbances, the exclusion transmission band related to the emission of radioelectric signals shall be disregarded so as to meet the limits prescribed in the paragraph 2°.

Chapter II The Conditions to Verify the Requirements

Art. 7° The general conditions to verify the compliance with the requirements must agree with the test procedures specified in the document referred in the item IX of the art. 2°, including the approach related to the measurement uncertainty.

Sole Paragraph. When the specific regulation of the concerned product specifies operation configurations and conditions applicable to the electromagnetic compatibility tests, they must be obeyed.

Art. 8° Additionally, the following provisions must be obeyed, when applicable:

§1° The measurement of the disturbances conducted in the power supply ports must be executed by using the V fictitious network, according to the described in the document referred in the subsection IX, of the art. 2°; however, when it is not possible to use this device, due to, for example, the elevated current levels, the tension test port specified in the document indicated in the subsection VIII of the art. 2° must be used.

§2° In case of equipment with several telecommunications ports, the quantity of ports and their configuration during the tests must comply with the provisions of the document referred in the subsection IX of the art. 2°, and the following conditions must be observed:

- a) Only equipment ports which are permanently used must be included in the test; therefore, ports used for equipment configuration are excluded, according to the description of the equipment to be certified.
- b) In the absence of the prescriptions in the specific regulation of the equipment to be certified and whenever there are several subscribers' lines, all of them must be used during the tests. In cases in which the number of subscribers is higher than 32, a minimum number of 32 (thirty two) subscribers will be accepted, chosen among the existent ones, so they can be used.

§3° The type of cabling utilized in the tests must agree with the product specifications and it must be mentioned in the test report.

§4° If the equipment is designed to operate inside a cabinet, tests must be performed within this configuration.

§5° Tests configuration must be registered in the test report.

§6° For power supply equipments, converters, inverters and rectifiers used to supply energy to telecommunication equipments, the emission test conducted at the power supply ports must be performed at the input and at the output energy ports.

§7° When the equipment has several ports of different types of analogical or digital interfaces, except for prescriptions in the specific regulation of the equipment to be certified, at least one port of each interface type must be tested.

§8° For radio-communication equipments, the following conditions must be observed , when applicable:

- a) During the measurement of the irradiated and conducted emissions, due to the transmitter of an equipment of radio-communication, the exclusion transmission band must be taken into account. This band depends on the frequency of the fundamental frequency and the necessary bandwidth of the emission of the transmitter in question.
- b) The exclusion band is not applied when the transmitter is configured in its stand by mode or when the emission measurement from the receptors, amplifiers and other parts which do not have as a function the emission of radioelectric signals is executed.
- c) In the absence of any other specification, the exclusion transmission band to be considered during the emission test of electromagnetic disturbances, is defined as being the band delimited

by the frequencies which are separated from the emission fundamental frequency in $\pm 250\%$ of the diffusion between channels, or from the concerned transmitter emission maximum bandwidth, disposed in specific regulation of the product.

- d) Equipments which use the radioelectric spectrum may have the characteristics which demand from the manufacturer, the incorporation of software and/or special features that allow the test performance. For example, radio-communication equipment of restrict radiation, classified as device of periodical operation, needs some source of software or hardware which allows to obtain a transmitter operation time that is sufficient to execute the emitted electromagnetic field intensity level measurement.
- e) The equipment under test must be practiced in a way to represent its normal usage.
- f) The signal source that will be eventually needed to supply the modulation signal to the transmitter under test must be placed outside the test environment.
- g) For receptors or transmitters with removable antenna, the RF (radiofrequency) connection for the establishment of the communication link, must be performed at the antenna connector of the equipment through a shielded transmission line as, for example, a coaxial cable, being cautious to avoid the effects of the common mode currents of the shielding over the test.
- h) Measurement must be performed in the operation mode which produces the emission level in the frequency band consistent with its normal application:
- i) When the equipment has an integrated antenna, the test must be performed with the antenna placed in its usual condition of use.
- j) The output of the radiofrequency signal of the transmitter must be connected to a charge with impedance characteristics that are compatible with the antenna usually connected to the terminal.
- l) During the test, the transmitted power must be adjusted at the maximum admissible value in the normal condition of operation of the equipment under certification.

HEADING III REQUIREMENTS OF IMMUNITY TO ELECTROMAGNETIC DISTURBANCES

Chapter I Specification of the Requirements of the Immunity to Electromagnetic Disturbances

Art.9° The prescription on electromagnetic immunity which is hereunder presented refers to the equipments shown in the item II, of art. 3° of this Regulation, in which for equipments that use the radioelectric spectrum and that include transmitters and/or receptors, the tests that involve irradiated or conducted disturbances of radiofrequency must take into account the exclusion band of the transmitter or receptor and the relevance of the concerned test.

§1° The equipment must be immune to the sequences of fast electric transients with repetition frequency of 5 kHz, according to the prescriptions contained in the document referred in the item IV, of the art. 2°, and it must meet the disturbances levels of table 5.

Table 5 – Disturbances levels in the test of immunity to fast electric transients

Level (kV)	Tested Ports
0,5	Telecommunication
1	Power supply (ac and dc.)*

* ac - alternating current and dc – direct current

§2° The equipment must be immune to the radiofrequency disturbance applied in common mode at the power supply and telecommunication ports, established by a modulated sine signal in 80% by a 1 kHz tone according to the prescriptions contained in the reference of the item VI, of the art. 2°, at the frequency band between 150 kHz and 80 MHz and with the adjusted levels based on values specified in the table 6.

Table 6 – Signal in the test of immunity to conducted radiofrequency disturbances.

Frequency Band (MHz)	Disturbance Adjustment level (V) Without modulation
0,15 to 80	3

§3° The equipment must be immune to radiofrequency disturbances irradiated in the bands of 80 MHz to 1 GHz and 1,4 GHz to 2,0 GHz. Characteristics of the disturbing signal, made by a sine modulated signal with a 1 kHz tone must comply with the prescriptions contained in the document referred in the item III, art. 2°, adopting the specified values in the following table 7, for adjustment of the disturbing signal.

Table 7 – Signal adjustment levels of the test of immunity to irradiated radiofrequency disturbances

Frequency Band	Disturbance Adjustment level (V/m) Without modulation
80 MHz to 1 000 MHz	3
1,4 GHz to 2,0 GHz	3

§4° The equipment must be immune to electrostatic discharge with characteristics described in the document referred in the item II, of the art. 2°, adopting the levels specified in the table 8:

Table 8 - Levels of disturbances in the test of immunity to electrostatic discharge

Level (kV)	Discharge application Mode
6	Discharge by contact
8	Discharge by air

§5° The equipment must be immune to surges which characteristics meet the prescription contained in the document referred in the item II, of the art. 2°, in which levels of testing must be applied to the surges specified in the table 9.

Table 9 - Levels of test of immunity to surges.

Level (kV)		Application Mode	Tested Ports
Internal Ports	External Ports		
0,5	1,0	Line for grounding	Telecommunication
1,0		Line for line	Power supply in ac.
2,0		Line for grounding	Power supply in ac.

Note: The immunity requirement for surge is not applicable for ports of power supply in dc.

- a) For shielded cables, surges are applied directly to the shielding.
- b) The immunity test to surges must not be applied at the internal ports to which the specified cable length is smaller than 10 meters.
- c) You may disregard the test of data internal ports for which there is no pulse coupling and uncoupling device, which the simple presence does not affect the proper functioning of the port.

§6° Equipments fed by the electrical network must be immune to reductions and interruptions of network tension, according to what has been described in the document referred in the item VII, of the art. 2°, with levels specified in the table 10.

Table 10 – Test levels of immunity to the interruption of the electrical network tension.

Level	Tension Reduction Percentage (%)	Duration in periods (cycles)
1	>95	0,5
2	30	30
3	>95	300

Chapters II Conditions for the Verification of the Requirements

Art. 10 The equipment to be certified must be placed in representative condition of its normal operation and, during the test, and it must present characteristics of performance according to the specified in the art. 12, observing the following conditions when applicable:

I – Test of immunity to conducted disturbances must not be applied to ports which cables connected to them have a length equal or lower than three meters.

II – In the test of immunity to conducted and irradiated RF disturbances of equipments which use the radioelectric spectrum, the applicable exclusion band must be used.

III – Mobile and portable equipments which, in normal working condition may be used connected to the battery charger, must have the feeder lines of alternating current tested regarding the immunity to conducted disturbances.

IV – In cases in which radio-communication equipments have characteristics which demand software and/or special resources for the execution of the immunity test here prescribed, the supply of such equipment will be the manufacturer’s responsibility.

V – The equipment to be certified must be performed in a way that represents its normal use.

VI – Precautions, such as the use of shielded chamber and filters, must be taken in order to avoid electromagnetic disturbance effects over the measurement and auxiliary equipments installed out of the test environment.

VII – The signal source occasionally needed to supply to the transmitter under test the modulation signal, must be placed out of the test environment. The figures 1, 2 and 3 present examples of test configuration for radio digital receptor and transmitter.

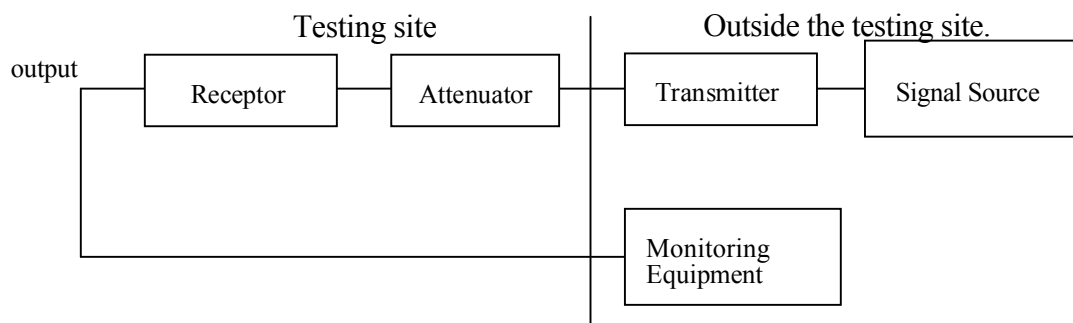


Figure 1 – Sample of the assembly of a receptor testing

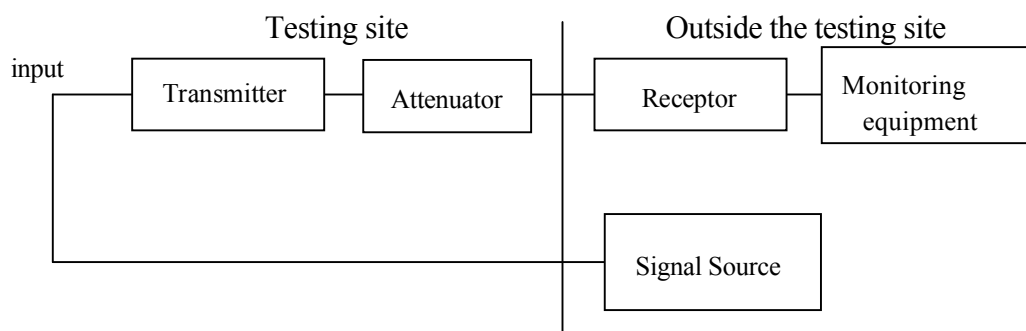


Figure 2 - Example of transmitter test mounting

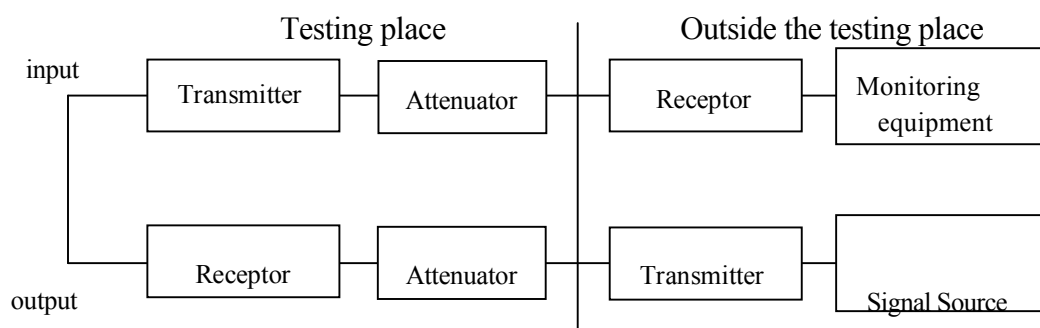


Figure 3 - Example of transceiver test mounting

VIII - For receptors and transmitters with removable antenna, the RF connection to establish the communication link must be done at the equipment antenna connector through the shielded transmission line such as, for example, a coaxial cable.

IX – The signal level used to establish the communication link during the tests must be informed by the manufacturer, and it must be sufficiently higher than the receptor maximum sensibility level, so we can have a very stable link before applying the electromagnetic disturbances. In the absence of other provision and if applicable, a level that is 30 dB higher than the receptor maximum sensibility level may be adopted.

X – A transmission exclusion band must be adopted, according to the defined in the item c, paragraph 8 of the art. 8.

XI – In the absence of other provisions in the product specific regulation, the reception exclusion band must be considered as being the frequency band necessary for the equipment operation, extended in each one of the frequency extremes, in 5% of the band central frequency value, or extended by a band that is enough, so the applied disturbance does not befall in image frequencies.

XII – If in the specific standards or regulations of the equipment under certification, criteria that are different from those adopted in the subsections X and XI are defined, these criteria must be adopted and declared together with the results.

XIII - In the conducted and irradiated radiofrequencies disturbances immunity test, disturbances in the exclusion bands frequencies must not be applied.

XIV – Abnormalities in the performance of the receptor incorporated to a transceiver, which occur during the test of immunity to RF disturbance in discrete frequencies, might be of a narrow band kind and, in this case, they must not be considered as nonconformities. In order to discern this kind of response, the following procedures must be followed:

- a) The disturbing signal frequency where the abnormality occurred must be increased and decreased by a value that is equivalent to the double of the FI filter passage bandwidth (intermediate frequency) that precedes the receptor demodulator, or the product operation passage bandwidth, according to the specified by the manufacturer.
- b) If, at both new frequencies, or at least at one of them, the product complies with the specified performance criterion, the response will be considered a narrow band one. In case this does not occur, the test must be redone, by varying the referred disturbing signal frequency of a value corresponding to twice and a half of the passage bands mentioned above.
- c) If even so the product does not comply with the specified performance criterion for at least one of the resulting frequencies, the response will be considered as a broadband one and, therefore, it will indicate a situation of nonconformity of the product.

§1° In case there is no provisions in the specific regulation about the equipment to be certified, every time that is applicable, the following parameters must be verified in the evaluation of the equipment performance characteristics:

- a) indication of alarms;
- b) possibility of establishment or interruption of calls;
- c) error rate at the digital interfaces;
- d) “frame error rate” (FER)
- e) At the analogical or voice interfaces - differential signal level that results from the radiofrequency disturbance demodulation. In this case, when there is no other provision, the level of -40 dBm over an impedance of 600 Ω (independent of the actually used impedance) is adopted as limit, selectively measured in 1 kHz, with a passage band that is equal or lesser than 100 Hz, with the line active and connected to the adequate auxiliary equipment.

§2° For radio-communication equipments, additionally consider, when applicable, the following characteristics:

- a) the noise signal relation SINAD, for audio and analogical interfaces;
- b) FER – frame error rate, for digital interfaces;
- c) involuntary transmission or emission of radioelectric signals;
- d) nonoccurrence of loss of functionalities;
- e) nonoccurrence of loss of link;

f) in case of radiofrequency amplifiers, gain alterations must not be higher than 1 dB,

§3° It is required that the testing report describes the performance characteristics verified during the tests.

Art. 11 By means of verification of the compliance with the equipments electromagnetic immunity requirements, in the absence of provisions in specific regulations for the product, the following criteria are defined, to be observed in the performance evaluation:

I - Criteria A - during the testing, the equipment must work normally, complying with its technical specifications or without alteration of performance or of its evaluated characteristics.

II - Criteria B – abnormalities in the equipments performance will only be admitted at the disturbance application moment. However, loss of call, alarms or loss of memorized data must not occur. Once the disturbance application is finished, the equipment must present the operation original conditions, according to its technical specifications.

III - Criteria C – The equipment abnormal working with loss of functionalities is admitted, during the tests execution period; however, once the tests are done, the equipment must present the operation original conditions, either automatically or by external intervention.

Art. 12 The verification of the electromagnetic immunity requirements, described in the art. 9°, must obey the following provisions:

§1° The immunity to fast electrical transients must be verified, according to the procedures presented in the document referred in the subsection IV, of the art. 2°, adopting the criteria B of performance defined in the subsection II, of the art. 11.

§2° The immunity to radiofrequency disturbances, at the power supply and telecommunication ports must be verified according to the procedures presented in the document referred in the subsection VI, of the art. 2°, adopting the criteria A of performance defined in the subsection I, of the art. 11.

§3° The immunity to irradiated radiofrequency disturbances must be verified, according to the procedures presented in the document referred in the subsection III, of the art. 2°, adopting the criteria A of performance defined in the subsection I, of the art. 11.

§4° The equipment immunity to electrostatic charges must be verified, according to the procedures presented in the document referred in the subsection II, of the art. 2°, adopting the criteria B of performance defined in the subsection II, of the art. 11.

§5° The equipment immunity to surges must be verified, according to the procedures presented in the document referred in the subsection V, of the art. 2°, adopting the criteria B of performance defined in the subsection II, of the art. 11.

§6° The equipment immunity to reductions and interruptions of the alternating current power supply tension must be verified, according to the procedures presented in the document referred in the subsection VII, art. 2°, adopting the criteria B of performance for the level 1 indicated in the table 12 and criteria C, for the levels 2 and 3 indicated in the same table. Both criteria are defined in the art. 11.

HEADING
IV
RESISTIBILITY REQUIREMENTS TO ELECTROMAGNETIC DISTURBANCES

Chapter I
Specifications of the Resistibility Requirements

Art.13 The equipment to be certified must support the application of electromagnetic disturbances at its telecommunications and power supply ports, which maximum intensities must be specified next. After the disturbances application, the equipment to be certified must work normally, according to its specifications.

§1° The equipment to be certified must support the application of electromagnetic disturbances of 1500 V, peak (opened circuit tension) at the telecommunications external ports. These disturbances must be produced by the generator described in the art. 16, paragraph 1°, and they must be applied according to the conditions described in the articles 14 and 15. Example of telecommunications external port: port for connection with the SFTS metallic pair.

§2° The equipment to be certified must support the application of electromagnetic disturbances of 1000 V, peak (opened circuit tension) at the telecommunications internal ports (examples: Ethernet port and CPCT extension). These disturbances must be produced by the generator described in the art. 16, paragraph 2°, and they must be applied according to the conditions described in the articles 14 and 15.

§3° The equipment to be certified must support the application of electromagnetic disturbances of 600 V, effective (opened circuit tension) at the telecommunications external ports. These disturbances must be produced by the generator described in the art. 16, paragraph 3°, and they must be applied according to the conditions described in the articles 14 and 15. Example of telecommunications external port: port for connection with the SFTS metallic pair.

§4° The equipment to be certified must support the application of electromagnetic disturbances at the power supply external ports. The generator opened circuit tension must be 4000 V, peak, for the disturbances applied in common mode and 2000 V, peak, for the disturbances applied in differential mode. These disturbances must be produced by the generator described in the art. 16, paragraph 4°, and they must be applied according to the conditions described in the articles 14 and 15.

§5° The tolerances for the electromagnetic disturbances intensities are specified below.

- a) Plus or minus 10% (ten percent) around the peak values specified in the paragraphs 1°, 2° and 4° of this article.
- b) Plus or minus 5% (five percent) around the effective values specified in the paragraph 3° of this article.

Chapter II
Conditions for the Requirements Verification

Art.14 By means of the resistibility requirements verification, the equipment to be certified must be treated as a set in which limits must be established by the manufacturer. All the protection devices situated within this set limit must be considered as a permanent part of the equipment. From the set that

corresponds to the equipment to be certified, it can be identified:

- I - telecommunications external ports (for example, interface for connection with the SFTS);
- II - telecommunications internal ports (for example, interface for connection with the local network);
- III - power supply ports (for example, tension cord to connect to the power supply outlet);
- IV - one grounding terminal.

§1° When the equipment to be certified does not present a grounding terminal, it must be placed on a metallic plate and this plate must be used as grounding terminal.

§2° The resistibility requirements must be verified when the equipment under test is located at a room with an environmental temperature of $(25 \pm 3)^{\circ}\text{C}$ and air relative humidity of $(50 \pm 20)\%$.

§3° In order to verify the resistibility requirements, the equipment to be certified must be fed by its nominal tension and it must be tested in each and every operation mode during a significant period of time (for example, a telecommunications port of a SFTS equipment must be tested at the closed link and opened link conditions).

§4° When the electromagnetic disturbances are applied in the EBC, some telecommunications ports that are not being submitted to the test must be connected to the reference grounding, by using dischargers on gas or equivalent devices (see Figures I.1 to I.4), according to the described below:

- a) In order to verify the requirements specified in the art. 13, paragraphs 1° and 3°, the telecommunications internal ports that are normally connected to long conductors (with a length bigger than ten meters) must be connected to the reference grounding through the dischargers on gas or equivalent devices.
- b) In order to verify the requirements specified in the art. 13, paragraphs 2° e 4°, the telecommunications external ports must be connected to the reference grounding through the dischargers on gas or equivalent devices.
- c) For EBC with several telecommunications ports, at least 4 (four) ports must be connected to the reference grounding through dischargers on gas or equivalent devices.
- d) The dischargers on gas or equivalent devices mentioned in this paragraph must present a trigger tension in slow climbing between 200 V and 300 V.
- e) After the test, the verification of the EBC working must also comprise the ports that were connected to the reference grounding through the dischargers on gas or equivalent devices.

§5° The disturbances application must be done, observing the following conditions:

- a) For the disturbance specified in the art. 13, paragraph 1°, 10 (ten) applications in common mode (see Figure I.1) and 10 (ten) in differential mode (see Figure I.2) must be done, in which 5 (five)

applications must be done in the positive polarity and 5 (five) must be done in the negative polarity. When applicable, for each polarity, 3 (three) applications with the link opened and 2 (two) applications with the link closed must be executed.

b) For the disturbance specified in the art. 13, paragraph 2°, 10 (ten) applications in common mode (see Figure I.1) must be executed, in which 5 (five) application must be done in the positive polarity and 5 (five) must be done in the negative polarity. When applicable, for each polarity, 3 (three) applications with the link opened and 2 (two) applications with the link closed must be executed.

c) For the disturbance specified in the art. 13, paragraph 3°, 5 (five) applications in common mode (see Figure I.1) and 5 (five) in differential mode (see Figure I.2) must be done. When applicable, for each mode, 3 (three) applications with the link opened and 2 (two) applications with the link closed must be executed.

d) For the disturbance specified in the art. 13, paragraph 4°, 10 (ten) applications in common mode for each conductor (see Figure I.3) and 10 (ten) in differential mode (see Figure I.4) must be executed, in which 5 (five) applications must be done in the positive polarity and 5 (five) must be done in the negative polarity.

e) The interval between successive applications must be at least 1 (one) minute.

Art.15 When applicable, the EBC must be connected to the electromagnetic disturbances generator and with power supply equipment through the coupling and uncoupling network, respectively. The Figures I.1 to I.4 (in the Annex I) exemplify connections diagrams to perform the tests. The coupling and uncoupling networks shown in the Figures I.1 to I.4 must not significantly change the energy transferred from the generator to the EBC.

§1° In order to verify the requirements specified in the art. 13, paragraph 1°, the test mounting must comply with the following requirements (see Figures I.1 and I.2):

a) The power supply equipment to be connected to the port under test, as well as the uncoupling network, must not be connected to the grounding.

b) The electric resistance measured from the uncoupling network input terminals (power supply equipment side), with the output terminals short-circuited, must be higher than 600 Ω and lower than 800 Ω .

c) With only the coupling network connected to the generator, the opened circuit tension measured at the terminals that will be connected to the EBC must comply with the requirements specified for the test (peak value, climbing time and decay time).

d) With only the coupling network connected to the generator, the relation between the opened circuit tension peak values and the short-circuit current measured at the terminals that will be connected to the EBC must correspond to the generator impedance (27,5 $\Omega \pm 10\%$ between the lines and the grounding), according to the indicated in the Figure I.5.

§2° In order to verify the requirement specified in the art. 13, paragraph 2°, the test mounting must comply with the following requirements:

a) The port under test does not need to be fed.

b) With only the coupling network connected to the generator, the opened circuit tension measured at the terminals that will be connected to the EBC must comply with the requirements specified for the test (peak value, climbing time and decay time).

c) With only the coupling network connected to the generator, the relation between the opened circuit tension peak values and the short-circuit current measured at the terminals that will be connected to the EBC must correspond to the generator impedances ($53 \Omega \pm 10\%$ between the lines and the grounding), according to the indicated in the Figure I.6.

§3° In order to verify the requirement specified in the art. 13, paragraph 3°, the test mounting must comply with the following requirements:

a) The power supply equipment to be connected to the port under test, as well as the uncoupling network, must not be connected to the grounding.

b) The electric resistance measured from the uncoupling network input terminals (power supply equipment side), with the output terminals short-circuited, must be higher than 600Ω and lower than 800Ω .

c) The coupling network must not be used.

d) The opened circuit tension measured at the terminals that will be connected to the EBC must comply with the requirements specified for the testing (effective value and duration).

e) The relation between the opened circuit tension effective values and the short-circuit current, measured at the terminals that will be connected to the EBC, must correspond to the generator impedance, according to the specified in the art. 16, paragraph 3°, item b.

§4° In order to verify the requirement specified in the art. 13, paragraph 4°, the test mounting must comply with the following requirements:

a) The uncoupling circuit current conduction capacity must be compatible with the power of the equipment to be submitted to the test.

b) With only the coupling and uncoupling networks connected to the generator and with the uncoupling network input terminals connected to the grounding (power supply equipment side), the opened circuit tension measured at the terminals that will be connected to the EBC must comply with the requirements specified for the test (peak value, climbing time and decay time).

c) With only the coupling and uncoupling networks connected to the generator, the short-circuit current measured at the terminals that will be connected to the EBC must comply with the requirements specified for the test (peak value, climbing time and decay time).

Chapter III Electromagnetic Disturbances Generator

Art.16 The electromagnetic disturbances generators are specified below, based on the documents referred in the subsections XI and XII of the art. 2°.

§1° In order to verify the resistibility of the equipment to be certified, when submitted to the electromagnetic disturbances specified in the art. 13, paragraph 1°, a generator must be used according to the defined in the Figure I.5. This generator, when in opened circuit, must generate an electromagnetic disturbance in the form of an impulsive tension wave, with (10 ± 3) μs of climbing time and (700 ± 140) μs of decay time.

§2° In order to verify the resistibility of the equipment to be certified, when submitted to the electromagnetic disturbances specified in the art. 13, paragraph 2°, a generator must be used according to the defined in the Figure I.6. This generator, when in opened circuit, must produce an electromagnetic disturbance in the form of an impulsive tension wave, with $(1,20 \pm 0,36)$ μs of climbing time and (50 ± 10) μs of decay time.

§3° In order to verify the resistibility of the equipment to be certified, when submitted to the electromagnetic disturbances specified in the art. 13, paragraph 3°, a generator must be used according to the defined in the Figure I.7. This generator must produce an electromagnetic disturbance in the form of tension waves (in opened circuit) or current waves (in opened circuit) described by sine waves with a frequency of 60 Hz. The following conditions must also be observed:

- a) The electromagnetic disturbance duration must be (200 ± 30) ms;
- b) The rate between the opened circuit tension effective values and the short-circuit current must be equal to (600 ± 60) Ω ;

§4° In order to verify the resistibility of the equipment to be certified, when submitted to the electromagnetic disturbances specified in the art. 13, paragraph 4°, a generator must be used, and this generator, when in opened circuit, must produce an electromagnetic disturbance in the form of an impulsive tension wave, with $(1,20 \pm 0,36)$ μs of climbing time and (50 ± 10) μs of decay time. When short-circuited, this generator must generate an electromagnetic disturbance in the form of a impulsive current wave, with $(8,0 \pm 1,6)$ μs of climbing time and (20 ± 4) μs of decay time. The rate between the opened circuit tension peak values and the short-circuit current must be equal to $(2,0 \pm 0,2)$ Ω .

§5° The electromagnetic disturbances climbing and decay times are defined in the document referred in the subsection V of the art. 2°.

ANNEX I

EXAMPLES OF DIAGRAMS AND GENERATORS FOR RESISTIBILITY TESTS

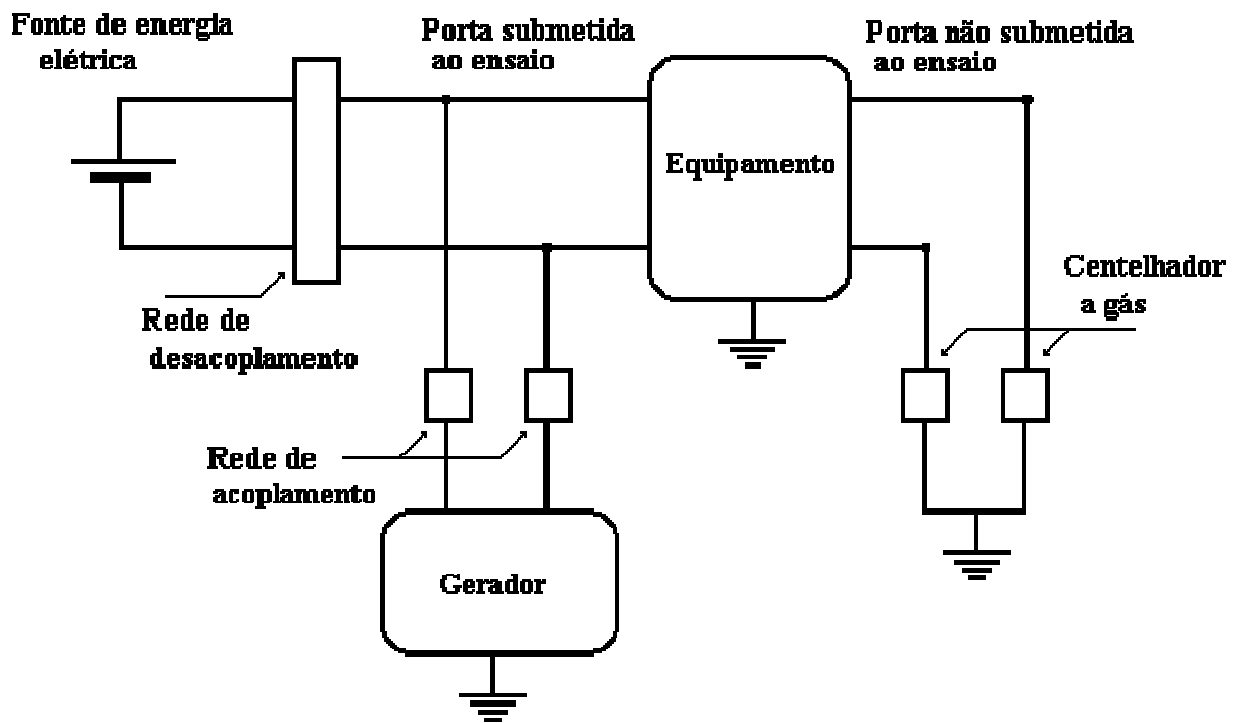


Figure I.1 - Diagram of the test mounting at telecommunications port - common mode.

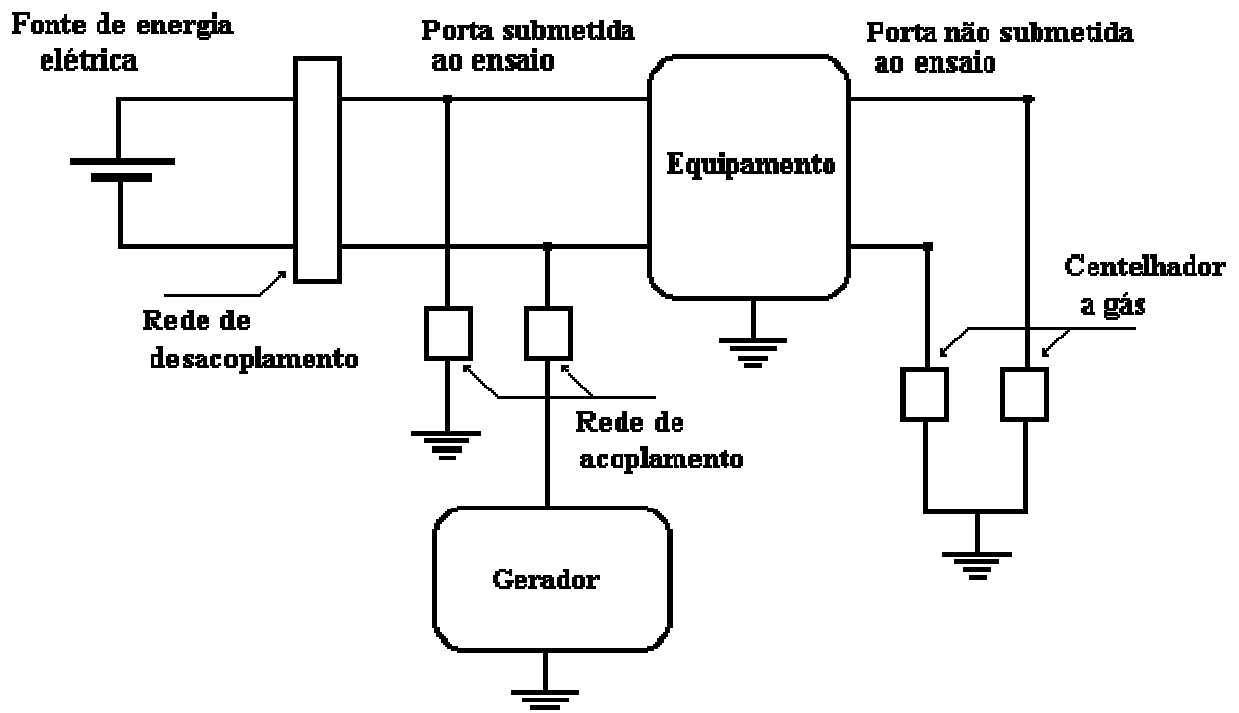


Figure I.2 – Diagram of the test mounting at telecommunications port - differential mode.

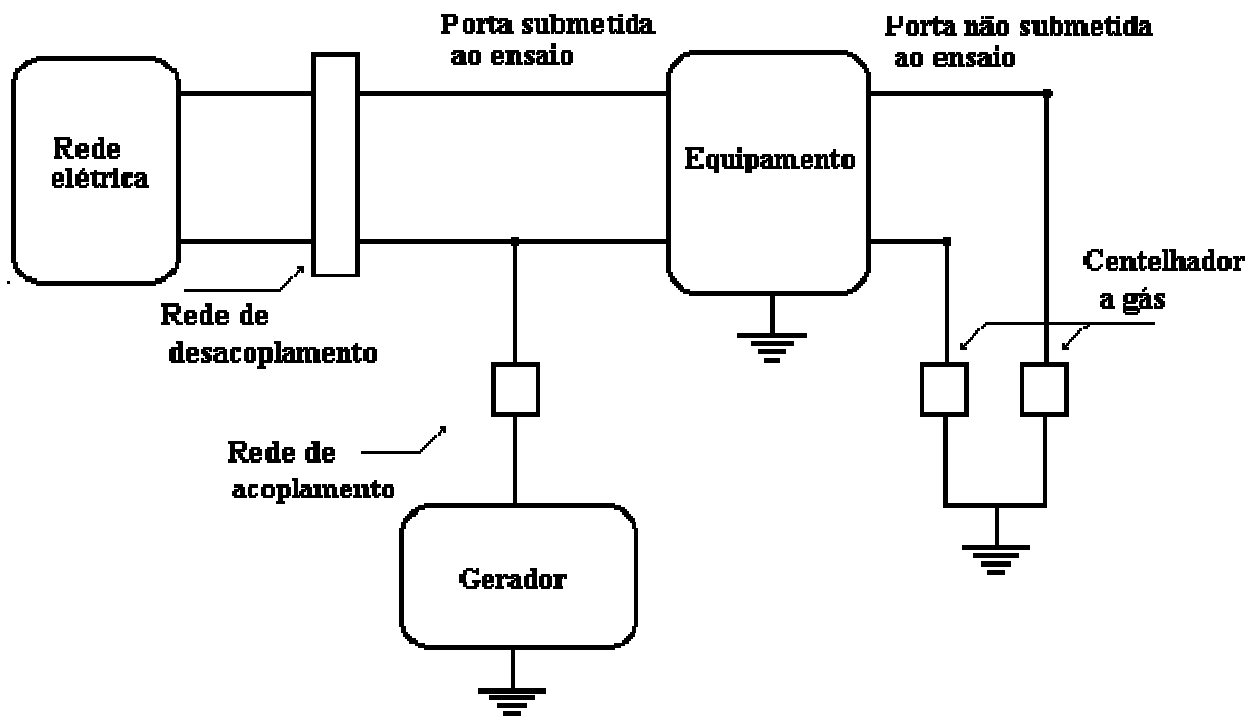


Figure I.3 – Diagram of the test mounting at power supply port - common mode.

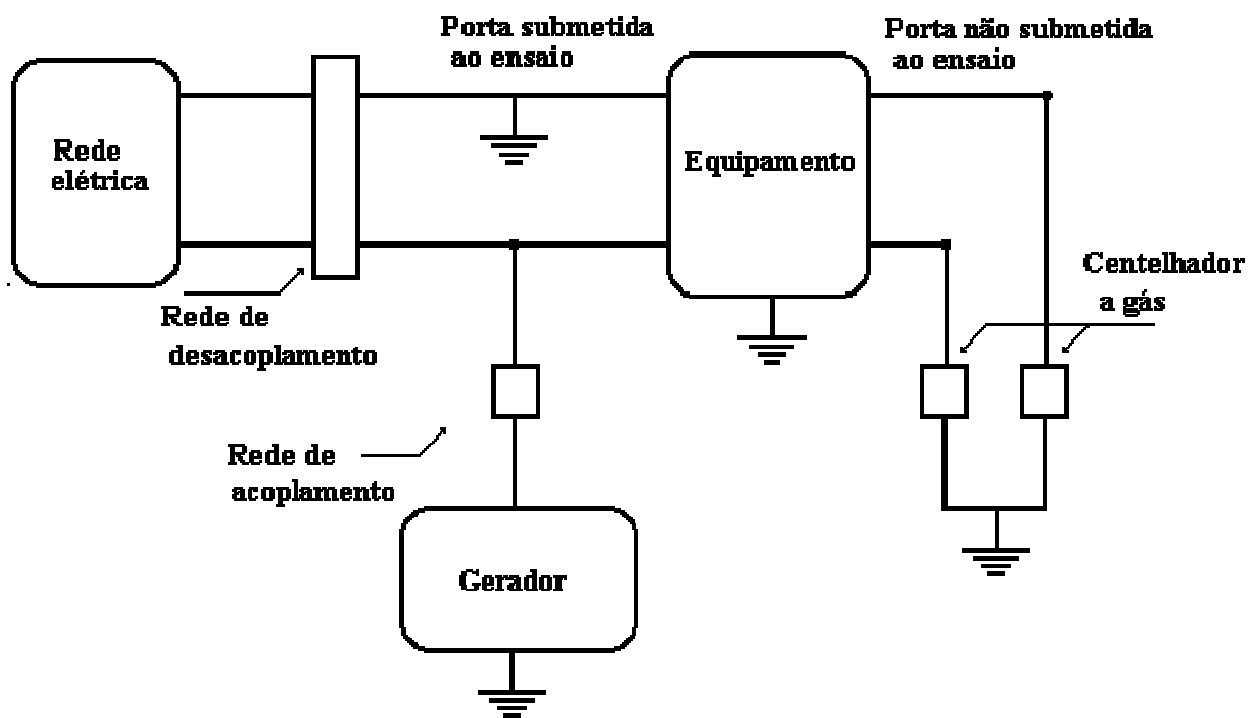


Figure I.4 – Diagram of the test mounting at power supply port - differential mode.

Figures translation:

Figure I.1 - Power supply equipment - Port submitted to test - Port not submitted to test - Equipment - Uncoupling network - Discharger on gas - Coupling network - Generator.

Figure I.2 - Power supply equipment - Port submitted to test - Port not submitted to test - Equipment - Uncoupling network - Discharger on gas - Coupling network - Generator.

Figure I.3 - Electric network - Port submitted to test - Port not submitted to test - Equipment - Uncoupling network - Discharger on gas - Coupling network - Generator.

Figure I.4 - Electric network - Port submitted to test - Port not submitted to test - Equipment - Uncoupling network - Discharger on gas - Coupling network - Generator.

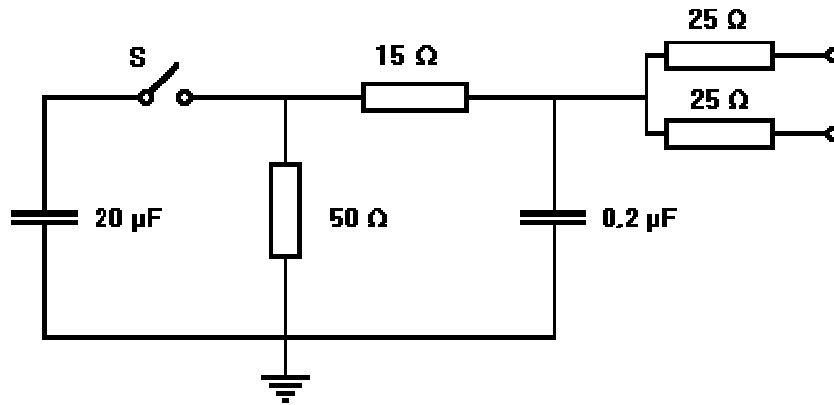


Figure I.5 - Generator of electromagnetic disturbances of 10/700 μ s.

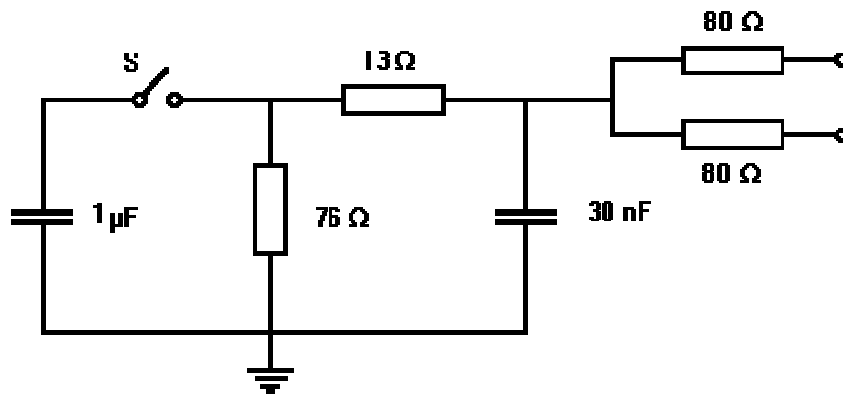


Figure I.6 - Generator of electromagnetic disturbances of 1,2/50 μ s (in case of four wires port, use four resistors of 160 Ω instead of two resistors of 80 Ω).

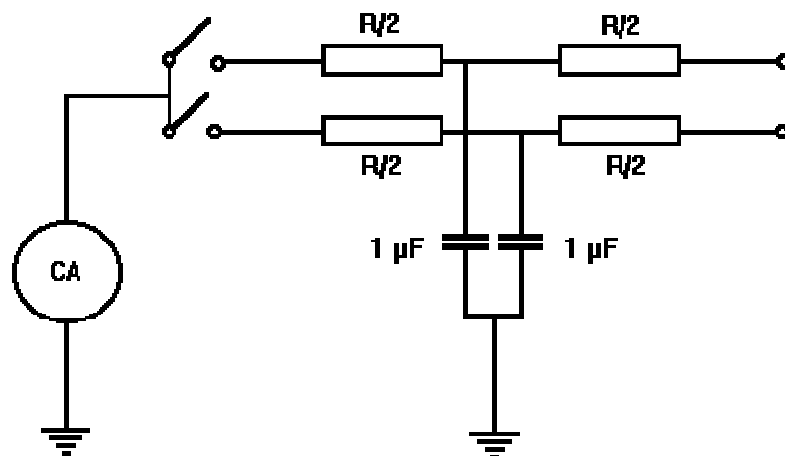


Figure I.7 - Generator of electromagnetic disturbances in industrial frequency.

ANNEX II

EXAMPLES OF PRODUCTS DESTINED FOR THE USE OF THE PUBLIC IN GENERAL

II.1 The following equipments are examples of products destined for telecommunications users:

- a) All the equipments classified as Telecommunications Products of Category I.
- b) The equipments classified as Telecommunications Products of Category II are listed below:
 - Restricted radiation equipment
 - Modem for land station
 - Transceiver with spectrum diffusion
 - Digital trunking - base transceiver
 - SMM transceiver by satellite
 - Rural base fixed transceiver
 - MMDS transceiver – return
 - Sonorous broadcasting auxiliary service transceiver
 - Digital transceivers
 - Fixed, mobile and portable transceivers - AM
 - Fixed, mobile and portable transceivers - FM
 - Auto-cine transmitter
 - Remote control transmitter
 - Digital transmitters
 - Fixed, mobile and portable transmitters - AM
 - Fixed, mobile and portable transmitters - FM

Observation: this list is illustrative only and it might be extended according to the identification of other products that can be classified in the Category II conceptualization.