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**Integrated Services Digital Network (ISDN);  
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Part 1 : General**

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## Foreword

This European Telecommunication Standard (ETS) has been produced by the Terminal Equipment (TE) Technical Committee of the European Telecommunications Standards Institute (ETSI) in collaboration with members of the Business Telecommunications (BT) and Transmission and Multiplexing (TM) Technical Committees.

This ETS aims to meet the urgent requirements of network operators and equipment manufacturers who are designing equipment to operate with the Integrated Services Digital Network (ISDN) primary rate access interface.

This is the first part of a multi-part ETS which comprises the following:

ETS 300 046: "Integrated Services Digital Network (ISDN); Primary rate access - safety and protection".

ETS 300 046-1 (Part 1): General.

ETS 300 046-2 (Part 2): Interface  $I_a$  - safety.

ETS 300 046-3 (Part 3): Interface  $I_a$  - protection.

ETS 300 046-4 (Part 4): Interface  $I_b$  - safety.

ETS 300 046-5 (Part 5): Interface  $I_b$  - protection.

Parts 2 to 5 of this ETS each cover one aspect of a specific equipment interface and are to be used in conjunction with Part 1, which contains references and test circuits that are common to all parts of this ETS.

The corresponding ETS for ISDN basic access is ETS 300 047, ("Integrated Services Digital Network (ISDN); Basic access - safety and protection, Parts 1 to 5").

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## 1 Scope

This ETS applies to equipment that has interface  $I_a$  or  $I_b$  at the S or T reference point for ISDN primary rate access, including Terminal Equipment (TE) and all types of Network Termination (NT) other than NT1, and that is intended to be installed on customers' premises. It specifies safety requirements by reference to EN 41003 [1] and EN 60950 [2], but also includes some tests that are not in those standards. It specifies tests to be performed at interface  $I_a$  or  $I_b$ , auxiliary interfaces where applicable, the mains electric supply interface and user-accessible parts of the equipment.

This ETS covers aspects of safety related to communication interfaces  $I_a$  and  $I_b$ . Safety aspects of other parts of the equipment, including other interfaces, are not covered by this ETS. Attention is called to the provisions of EN 60950 [2] and EN 41003 [1].

Parts 4 and 5 of this ETS cover the safety and protection requirements for interface  $I_b$  of NT2. They do not cover interface  $I_b$  of NT1 but this should be regarded as:

- having Safety Extra Low Voltage (SELV) circuits;
- satisfying the compliance criteria in subclause 5.7 (Impulse transfer) and the relevant impulse levels of Part 5 of this ETS; and
- being tolerant to the dc or ac current in the transmit and receive pairs as specified in subclause 5.10 of Part 3 of this ETS.

This ETS identifies the following conditions:

- a "controlled situation" concerning mains (see subclause 3.1);
- an "unexposed environment" concerning interfaces  $I_a$  and  $I_b$  (see subclause 3.1).

The tests in this ETS are designed to represent normal conditions, i.e. when both a controlled situation and an unexposed environment exist. However, for primary rate access interfaces the environment is always assumed to be unexposed.

Consequences of operating in conditions that are not normal are discussed in Annex A (informative) to this part of the ETS. For use where conditions cannot be made normal by means external to the equipment, "extra-strength" equipment is described in an annex to the relevant part of the ETS.

## 2 Normative references

This ETS incorporates, by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications do not apply to this ETS unless specifically invoked herein. For undated references the latest edition of the publication referred to applies.

CENELEC EN 41003 [1] and EN 60950 [2] contain Special National Conditions and National A-deviations for some countries. Where these deviations apply to provisions that are referred to in this ETS, they shall apply to equipment, complying with this ETS, intended for use in those countries.

- [1] EN 41003 (1991): "Particular electrical safety requirements for equipment to be connected to telecommunication networks".
- [2] EN 60950 (IEC 950 (1986) modified) (1988 - including amendments 1 and 2): "Safety of information technology equipment including electrically operated business machines".
- [3] IEC 60: "High-voltage test techniques".
- [4] HD 384 (IEC 364): "Electrical installations of buildings".

- [5] HD 384-4-41 (IEC 364-4-41 (1982)): "Electrical installations of buildings - Protection for safety - Protection against electric shock".
- [6] HD 384-5-54 (IEC 364-5-54): "Electrical installations of buildings - Earthing arrangements and protective conductors".
- [7] prHD 384.7.707 S1 (IEC 364-7-707): "Electrical installations of buildings - Earthing requirements for the installation of data processing equipment".
- [8] IEC 664 (1980): "Insulation co-ordination within low-voltage systems including clearances and creepage distances for equipment".
- [9] IEC 801-2 (1991): "Electromagnetic compatibility for industrial process measurement and control equipment - Part 2: Electrostatic discharge requirements".
- [10] IEC 801-5: "Electromagnetic compatibility for industrial process measurement and control equipment - Part 5: Surge voltage immunity requirements".

NOTE: CD 801-5: "Draft revision of IEC 801-5, IEC document 65 (Secretariat)106".

- [11] IEC 990 (1989): "Methods of measurement of touch current and protective conductor current".
- [12] CCITT Recommendation K.22 (1988): "Overvoltage resistibility of equipment connected to an ISDN T/S bus".
- [13] CCITT Recommendation I.411 (1988): "ISDN user-network interfaces - Reference configurations".
- [14] CCITT Recommendation I.412 (1988): "ISDN user-network interfaces - Interface structure and access capabilities".
- [15] ETS 300 011 (1992): "Integrated Services Digital Network (ISDN); Primary rate user-network interface, Layer 1 specification and test principles".
- [16] ETR 012 (1992): "Terminal Equipment (TE); Safety categories and protection levels at various interfaces for telecommunication equipment on customers' premises".

NOTE: For the purposes of this ETS, the latest European equivalent of the IEC version (in particular where modifications are, or have been, taking place) means that the relevant EN/HD applies.

### 3 Definitions and abbreviations

#### 3.1 Definitions

For the purpose of this ETS the following definitions, together with those given in EN 60950 [2], EN 41003 [1] and CCITT Recommendation I.411 [13], apply.

**Primary rate access:** a user-network arrangement that corresponds to the primary rate of 2 048 kbit/s. The bit rate of the D-channel for this type of access is 64 kbit/s. The typical primary rate interface structures are as given in CCITT Recommendation I.412 [14].

**Terminal Equipment (TE):** equipment having terminal-terminating aspects of TE1, TA or NT2 functional groups, where these have an  $I_a$  interface. For definitions of these terms see CCITT Recommendation I.411 [13].

**Network Termination (NT):** equipment having  $I_b$  network-terminating aspects of NT1 or NT2 functional groups where these have an  $I_b$  interface. For definitions of these terms see CCITT Recommendation I.411 [13].



**Interface I<sub>a</sub> (I<sub>a</sub>):** user side of the ISDN user-network interface (see ETS 300 011 [15]).

**Interface I<sub>b</sub> (I<sub>b</sub>):** network side of the ISDN user-network interface (see ETS 300 011 [15]).

**Controlled situation:** a situation in which the mains electric supply to the equipment conforms with IEC 664 [8], installation category II (maximum impulse voltage 2,5 kV peak).

NOTE 1: The use of the word "controlled" does not necessarily imply that protective measures are necessary to obtain a controlled situation. The necessary control is normally achieved by the capacitances and inductances of the mains electric supply wiring. This is known as an inherently controlled situation.

**Unexposed environment:** an environment in which interface I<sub>a</sub> or I<sub>b</sub> does not normally experience conditions in excess of those represented in the tests defined in CCITT Recommendation K.22 [12], paragraph 7.

**Normal conditions:** conditions where both a controlled situation concerning mains and an unexposed environment concerning interfaces I<sub>a</sub> and I<sub>b</sub> exist.

**Extra-strength equipment:** equipment which meets enhanced requirements and is declared as such by its manufacturer.

**Safety Extra Low Voltage circuit (SELV circuit):** for definition see EN 60950 [2].

**Telecommunication Network Voltage circuit (TNV circuit):** for definition see EN 41003 [1].

**Compliance criterion:** permitted level of malfunction or damage caused by a test. Where compliance criterion A or B is specified, it is defined as follows:

**criterion A:** equipment shall operate properly within the specified limits after the test without:

- the need for resetting the fault protection facilities;
- the need to change any hardware component;
- reloading of data other than data of a type declared in the operating instructions to be unprotected data.

**criterion B:** no fire hazard shall arise in the equipment as a result of the tests.

NOTE 2: These definitions for criteria A and B are based on those used in CCITT K-series of Recommendations.

**User-accessible part:** a part in an operator access area as defined in EN 60950 [2].

### 3.2 Abbreviations

For the purposes of this ETS, the following abbreviations apply.

BT	Business Telecommunications
EN	Norme Européenne (European Standard)
ESD	Electrostatic Discharge
ETR	ETSI Technical Report
ETS	European Telecommunication Standard
ETSI	European Telecommunications Standards Institute
EUT	Equipment Under Test
I <sub>a</sub>	Interface a

$I_b$	Interface b
IEC	International Electrotechnical Committee
ISDN	Integrated Services Digital Network
NT	Network Termination
PE	Protective Earth
PS	Power Source
SELV circuit	Safety Extra Low Voltage circuit
TA	Terminal Adaptor
TE	Terminal Equipment
TM	Transmission and Multiplexing
TNV circuit	Telecommunication Network Voltage circuit

#### 4 Reference configurations

The reference configurations for all aspects of the ISDN user-network interface are given in CCITT Recommendation I.411 [13]. Extracts are given in figure 1 below which indicate the appearance of interface points  $I_a$  and  $I_b$  in relation to the S and T reference points.

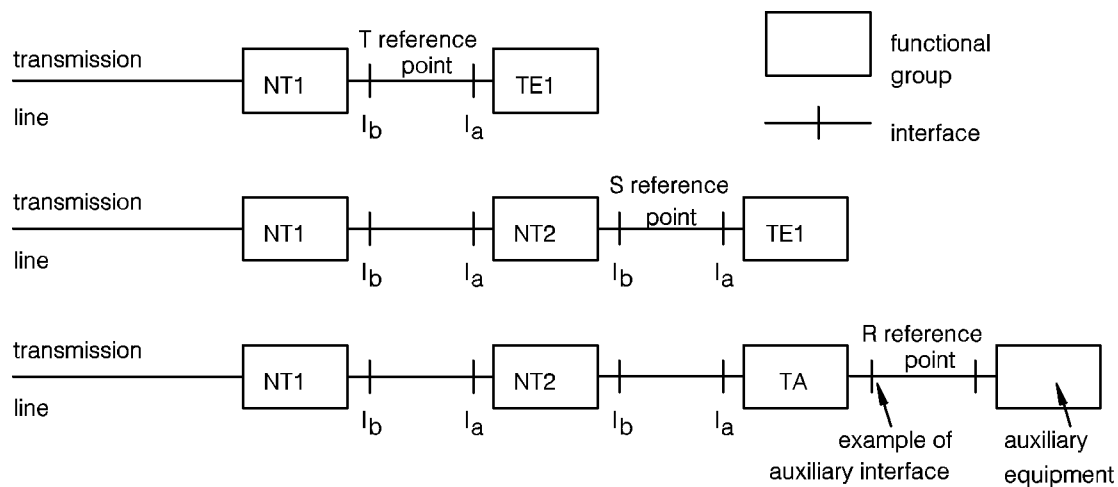


Figure 1: Examples of ISDN configurations

TE in general, and Terminal Adaptor (TA) and Network Termination (NT) in particular, may have interfaces, known as auxiliary interfaces, in addition to interfaces  $I_a$  or  $I_b$  or both. An example is shown in figure 1. The possible impact of such configurations is discussed in Annex F (informative).

In the tests of this ETS, the possibility of such connections is taken into account in the test arrangements; it shall not be necessary to connect actual equipment to these interfaces for testing purposes.

## 5 Test conditions

The tests described in other parts of this ETS shall be carried out under the conditions defined in this Clause.

NOTE 1: Many of the test configurations could lead to hazardous test conditions.

Where indicated in the relevant test in another part of this ETS, the Equipment Under Test (EUT) shall be placed on a reference plane. This shall consist of a conductive plate, connected to protective earth for safety purposes during the test.

Unless otherwise stated, the tests described shall be performed with the EUT connected to the mains or other supply and with the supply switch in the "ON" position. When tested in powered condition, the EUT may be in any defined layer 1 state as described in ETS 300 011 [15], except F0 or G0.

NOTE 2: The test conditions described do not necessarily correspond to the normal operating condition of the EUT.

The mains supply for test configurations shall be a TN-S power system. Where the local supply does not meet this requirement, an isolating transformer or other means shall be used to create a TN-S power system. Where the test configuration requires a connection between the supply neutral and protective earth there should be only one such connection.

The power supply voltage shall be maintained at nominal value.

During the tests, unless otherwise stated:

- equipment shall be enclosed in metal foil over non-conductive parts likely to be touched during use, the foil being connected to the reference plane of the test circuit; and
- unearthed conductive user-accessible parts of the enclosure shall be connected to the reference plane;
- if a connection point is provided for the shield of the interface cable, the tests shall be carried out with this connected to the reference plane, and repeated with it disconnected, unless the manufacturer's installation instructions make it clear that only one mode of connection is applicable.

At least one of each type of auxiliary interface shall be terminated according to its individual requirements, and a suitable path provided to the reference plane of the test circuit. All interfaces not specified to be used or terminated for a test shall be left open.

Where a maximum test voltage is specified, tests shall also be made at lower voltages if it is necessary to confirm that the equipment shall resist any voltage up to the specified maximum (e.g. below the threshold voltage of built-in overvoltage protectors).

Each test shall be applied for the number of times indicated. The time interval between applications shall be one minute and, in the case of pulse tests, the polarity shall be reversed between consecutive pulses.

EUT, as tested, shall include the cord and plug connection to the interface, unless it is designed for permanent connection to the interface wiring, and, if mains powered, the power supply cord if this is supplied as part of the EUT. If no power supply cord is supplied as part of the EUT, the tests shall be carried out with a cord having a length of 3 metres.

Unless otherwise specified in this ETS, the tests shall be carried out on a single sample which shall withstand all the relevant tests. The sample shall be representative of the equipment the user would receive, or shall be the actual equipment ready for shipment to the user.

As an alternative to carrying out tests on the complete equipment, tests may be carried out separately on simulated circuits, components or sub-assemblies outside the equipment, provided that inspection of the equipment and circuit arrangements ensures that such testing indicates that the assembled equipment would conform to the requirements of this ETS.

Where the EUT has more than one interface  $I_a$  or  $I_b$ , the tests shall be carried out on one sample interface, or, where different types of construction are used, on one sample of each type of construction.

## **6 Compliance**

Where this ETS refers specifically to certain provisions of other standards (see Clause 2), these become provisions of this ETS. Compliance with other provisions of the reference standards shall not be required by this ETS.

Equipment is in compliance with the requirements of this ETS if it passes all the tests of the relevant parts of this ETS.

Equipment is in compliance with the requirements for extra-strength equipment if it passes all the tests of the relevant part with the enhanced test levels given in annexes to the relevant part of this ETS.

## **7 Test generators and networks**

The test circuits required by the other parts of this ETS are given in annexes to this part, as follows:

- Annex B (normative): Test generators.
- Annex C (normative): Coupling networks.
- Annex D (normative): Terminating network.
- Annex E (normative): Measuring device for touch current.

Parameters not specified in these annexes, such as the charging voltage for a surge generator, are given in the relevant part of this ETS.

## **Annex A (informative): Additional requirements for "extra-strength" equipment**

This annex discusses conditions that are not in line with a "controlled situation" as defined in Clause 3 of this ETS. It is recognized that particular environmental conditions, the physical properties of some electrical distribution systems and, in some cases, national regulations may lead to a particular installation, site or area to be classified as an "uncontrolled situation". Earth potential differences, caused by particular mains installation practices, may require additional attention. Such conditions can occur in a site, an installation or a geographical area.

In an "uncontrolled situation" it can be expected that overvoltages at the mains interface of the equipment may exceed the limits of IEC 664 [8], installation category II. The preferred solution is to bring all mains installations in an area or site to the IEC 664 [8] installation category II standard, i.e. to bring about a "controlled situation". This can be done for a site by installing protection elements to the mains or by providing an isolating transformer where the mains enters the building.

If this is not achieved, it is necessary to adopt a solution for each individual equipment using either protection devices to earth or isolation. Protection devices to earth require that a protective earth reference is available at the mains supply or socket-outlet. Isolation (e.g. by means of an isolating transformer) may either be implemented externally, between the mains supply and the equipment, or integrated in the equipment.

If all the necessary separation or protection devices are integrated in the equipment, it is extra-strength equipment.

For extra-strength equipment, enhanced protection requirements and test levels for certain tests are given in an annex to the relevant part of this ETS. The other test conditions and the test circuits are unchanged.

### Annex B (normative): Test generators

This annex defines the types of test generator used in this ETS.

The component values in figures B.1 and B.2 are nominal. The actual values shall be such that the measured open-circuited output waveforms comply with the relevant parts of IEC 60 [3].

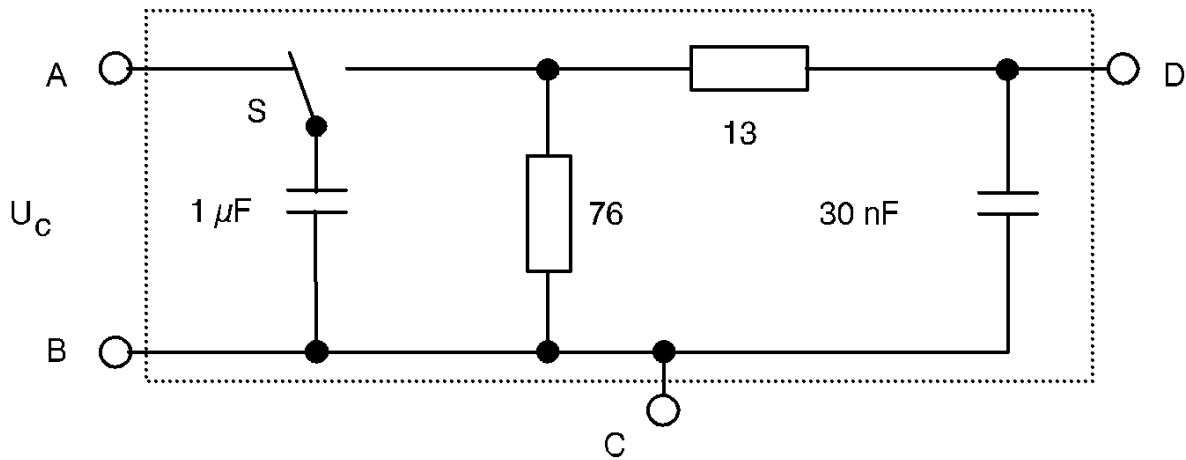


Figure B.1: Generator for 1,2/50µs pulse form

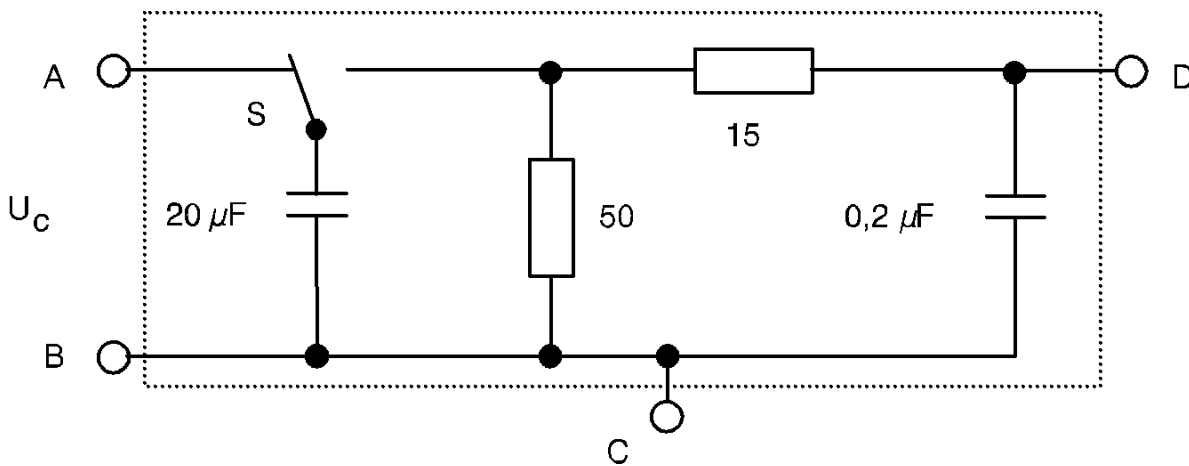


Figure B.2: Generator for 10/700µs pulse form

**Annex C (normative): Coupling networks**

This annex defines the coupling networks used in this ETS.

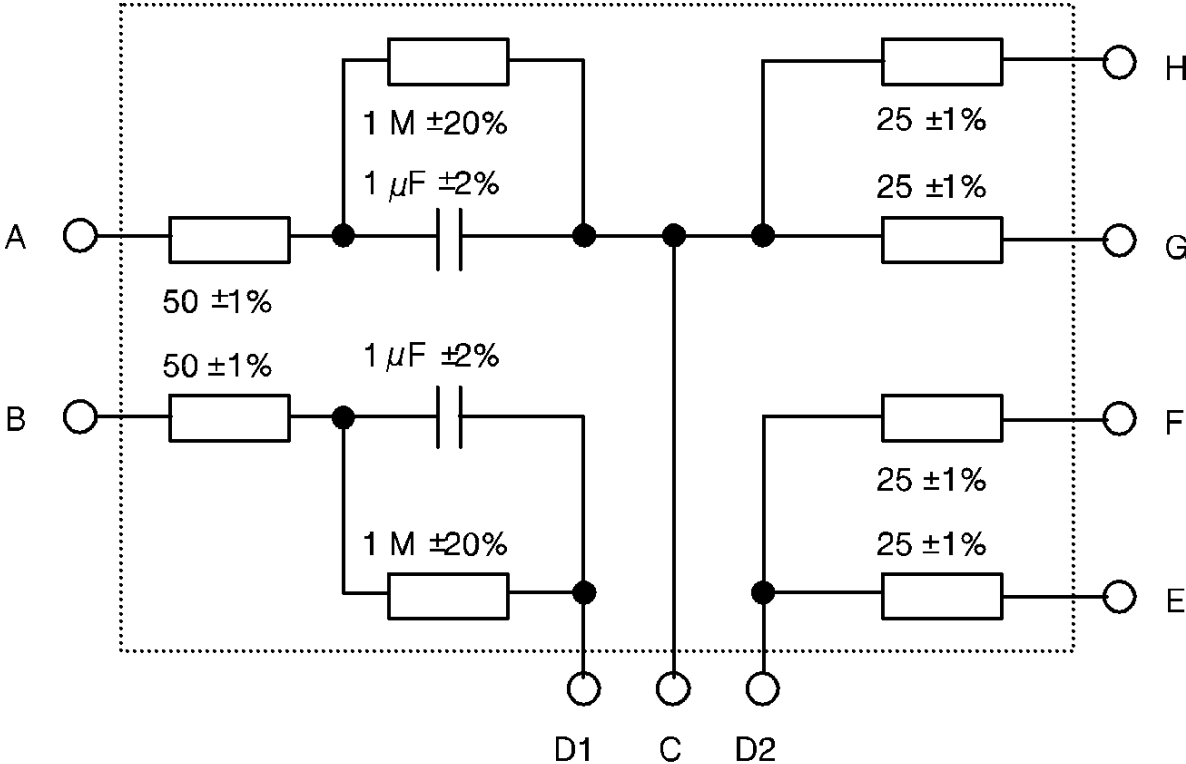
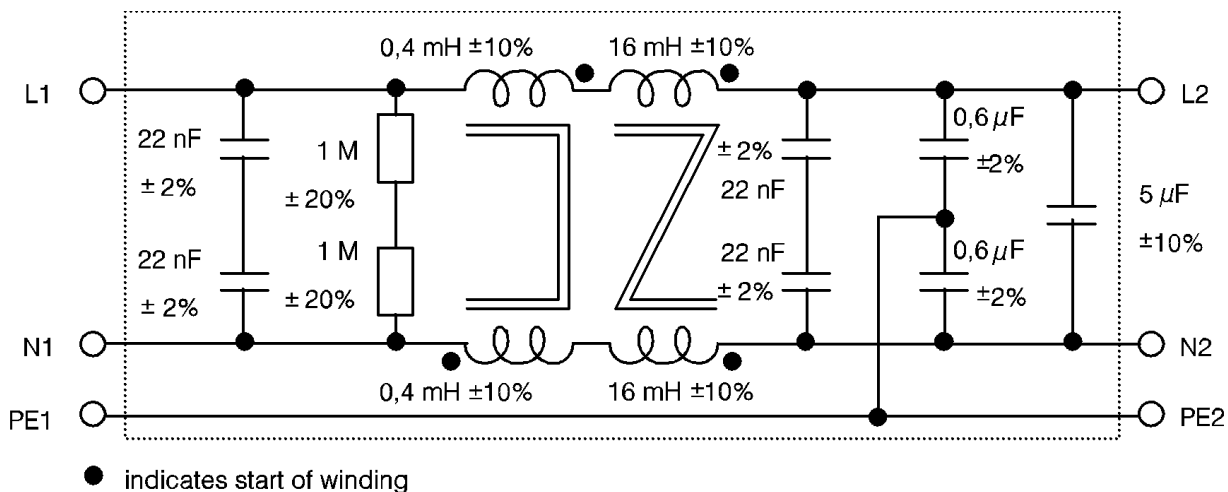


Figure C.1: Coupling network



NOTE: The impedance matching network is required to protect the mains supply and the power source for remote power feeding from test overvoltages and to establish standard termination conditions for the test. It is used:

- to couple the EUT either to the ac mains or to the dc feeding source PS;
- to terminate the mains input with the low impedance port L2/N2, to standardise the presentation of the mains source;
- to feed the EUT from a high impedance port L1/N1 to allow for effective surge application at the feeding interface of the TE.

In conjunction with a coupling capacitance of 1 μF as incorporated in the coupling network figure C.1, a nominal pulse form of 1,2/50 μs shall be influenced by the high impedance port L1/N1 of the impedance matching networks; figure C.2, to a reduced time to half value of about 40 μs. For the nominal pulse form 10/700 μs the time to half value may be reduced to approximately 100 μs. This reduction is envisaged and in line with the statistics of overvoltages at mains socket-outlets.

**Figure C.2: Impedance matching network**



### Annex D (normative): Terminating network

This annex defines the terminating network to be used for impulse transfer tests.

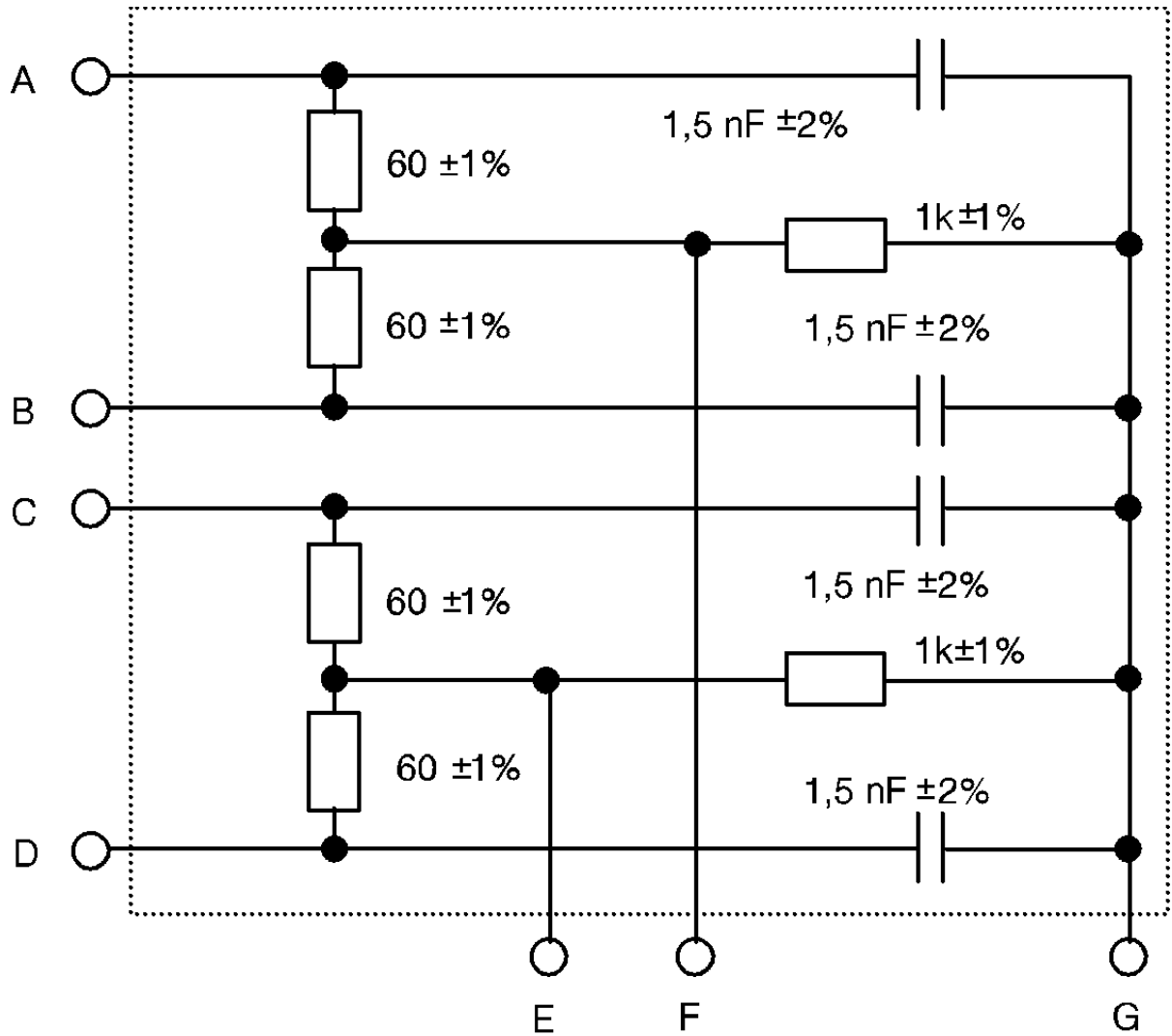
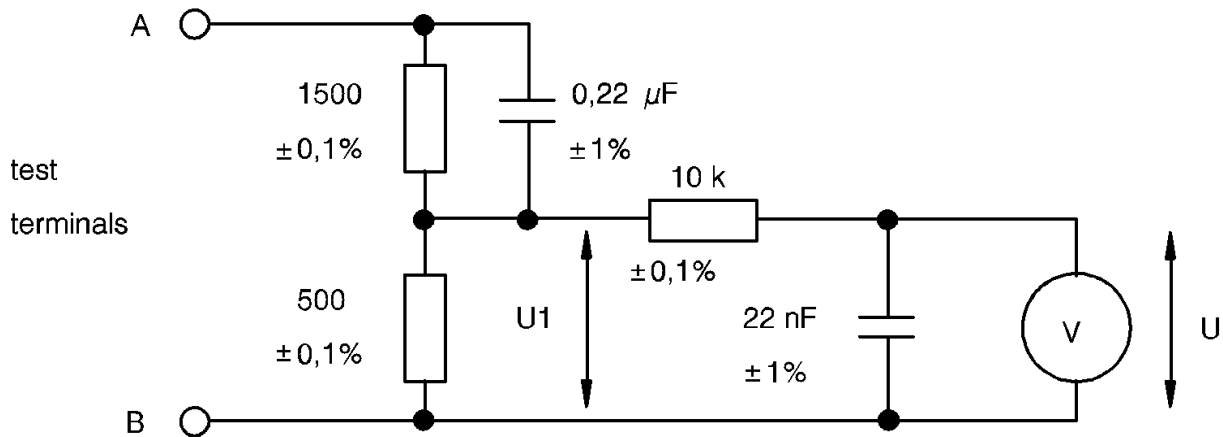


Figure D.1: Terminating Network

**Annex E (normative): Measuring device for touch current**

This annex defines the measuring device for the touch current test.



- V: voltmeter:
- true r.m.s. reading
  - uncertainty  $\mu$  2%
  - input resistance  $\cdot$  1 Mohm
  - input capacitance  $\mu$  200 pF
  - frequency range 15 Hz to 1 MHz.

$$\text{Weighted touch current} = \frac{U}{500} \text{ A}$$

**Figure E.1: Measuring device for touch current**

## Annex F (informative): Equipment interconnection

TE in general, and TA and NT in particular, may have other interfaces, known as auxiliary interfaces, in addition to interfaces  $I_a$  and  $I_b$ , or both, see figure F.1.

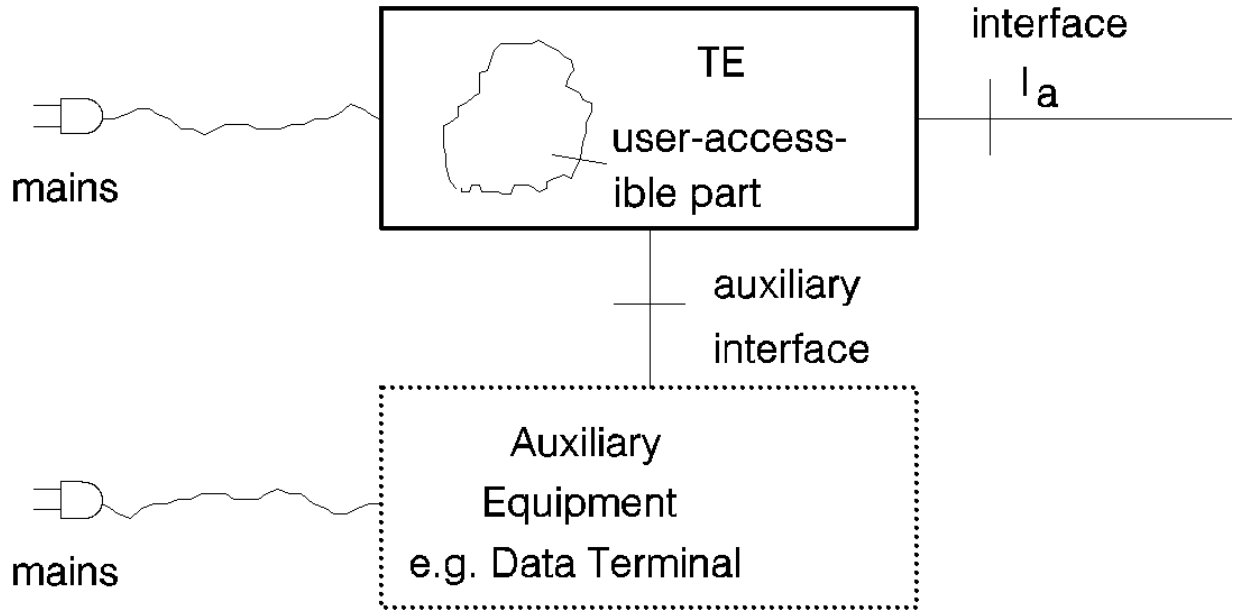
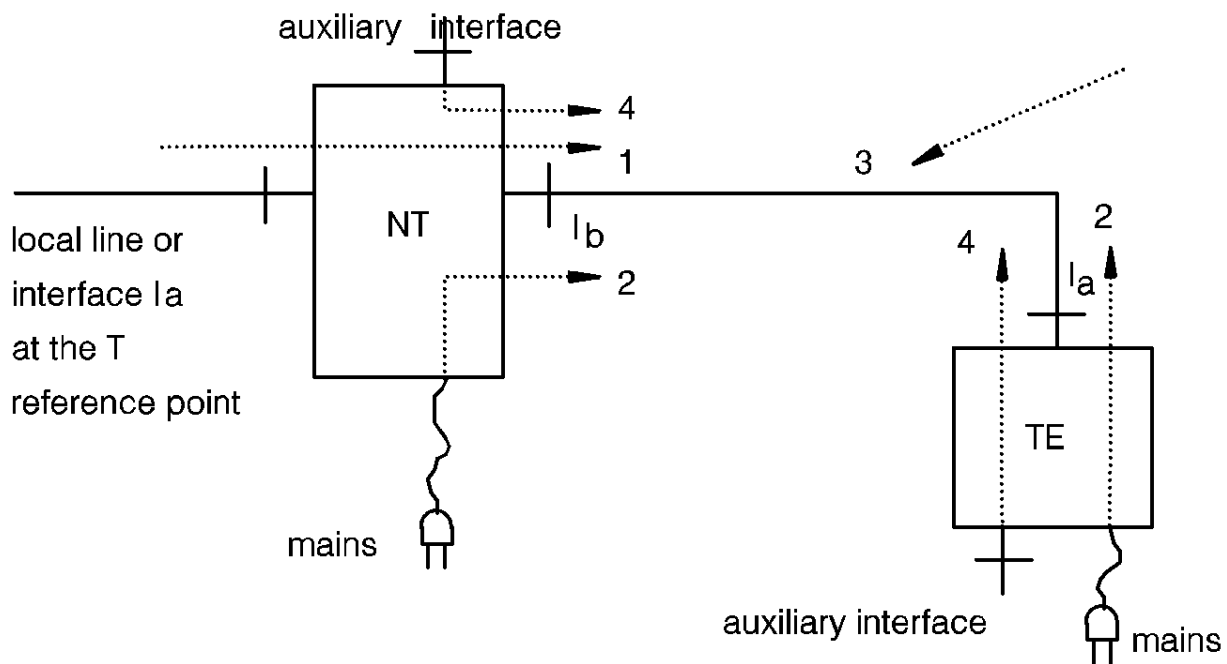


Figure F.1: Connection of auxiliary equipment to TE

Connection of equipment to an auxiliary interface may increase the touch current measured at interface  $I_a$  or  $I_b$ . Examples of paths for this additional current are the same as reference 4 in figure F.2. The tests in the relevant part of this ETS take this fact into account.

Connection of equipment to an auxiliary interface may also provide additional sources for overvoltages in the TE. Examples of paths for overvoltages are given in figure F.2. The tests in the relevant part of this ETS take this fact into account.



- 1) Transfer of a.c. or impulsive voltage from the line.
- 2) Transfer of a.c. or impulsive voltages from the mains.
- 3) Direct influence (capacitive, inductive or by physical contact) on the interface wiring by:
  - atmospheric discharge, or
  - current or voltage in neighbouring installations.
- 4) Transfer of impulsive voltages from auxiliary equipment via an auxiliary interface.

**Figure F.2: Examples of paths for overvoltage**

**History**

<b>Document history</b>	
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