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ETSI Guide

Public Switched Telephone Network (PSTN); Method of rating terminal equipment so that it can be connected in series and/or in parallel to a Network Termination Point (NTP)

European Telecommunications Standards Institute

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Contents

Foreword

This ETSI Guide (EG) has been produced by ETSI Project Analogue Terminals and Access (ATA) and is now submitted for the ETSI standards Membership Approval Procedure (MAP).

Introduction

The nature of analogue presentation to a Public Switched Telephone Network (PSTN) is such that a vast number of different configurations of user Terminal Equipment (TE) are possible. Previously, on a national level, it has been assumed that a certain maximum configuration is likely, i.e. a certain maximum number of TEs might be connected in parallel, and another maximum number of TEs might be connected in series. This has been reflected in some national approval requirements given in ETS 300 001.

However, when harmonizing the terminal equipment attachment requirements on a pan-European level, it has been recognized that the best way forward is to define the network capabilities at the access to the user, at the Network Termination Point (NTP), rather than to assume a certain configuration of terminals at the user's location. This means that a single terminal may consume all of the available network capability, or it can be shared by a number of terminals, all being connected to the NTP in an arbitrary combination of series and/or parallel connections.

As a consequence of the above, users can now determine how to best use the network resources to their advantage, and can make a conscious decision based on their particular needs about how to configure the TEs at their location, so that their needs are met whilst still being within the capabilities of the network.

To this end, this EG discusses a method of allocating network resources to TEs connected in series and/or in parallel to a NTP of the analogue presented PSTN. This method could be used by TE suppliers to indicate, on a voluntary basis, how much of the network resources a TE consumes.

The method also be used by network operators and PBX suppliers, to indicate the capacity of their network or extension interfaces in terms easily understood by users. A common way of expressing the network capabilities might be useful at the time the voice telephony service is fully liberalized, particularly since users will be able to choose between several Public Telecommunications Operators (PTOs).

For such a method to be of practical use, a common unit is to be taken as a basis. The parameters which are influenced by a parallel connection of terminals are indicated, and a Loading Factor (LF) is defined and assigned for each of these parameters. The loading factor is given in Loading Units (LU).

Recommendations are given to the suppliers regarding some aspects of series connected equipment.

1 Scope

The present document discusses a method of rating terminal equipment so that it can be connected in series and/or in parallel to a Network Termination Point (NTP) of the analogue presented Public Switched Telephone Network (PSTN) in a manner compatible with network resources.

It describes a method based on arbitrary units that could be used by:

1) terminal equipment suppliers, to indicate how much of the network resources a terminal equipment consumes;
2) network operators, to indicate the capacity of their network;
3) users, to decide how many TEs they can connect.

2 References

References may be made to:

a) specific versions of publications (identified by date of publication, edition number, version number, etc.), in which case, subsequent revisions to the referenced document do not apply; or
b) all versions up to and including the identified version (identified by "up to and including" before the version identity); or
c) all versions subsequent to and including the identified version (identified by "onwards" following the version identity); or
d) publications without mention of a specific version, in which case the latest version applies.

A non-specific reference to an ETS shall also be taken to refer to later versions published as an EN with the same number.

[1] ETS 300 001: "Attachments to the Public Switched Telephone Network (PSTN); General technical requirements for equipment connected to an analogue subscriber interface in the PSTN

[2] TBR 21 (1997): "Terminal Equipment (TE); Attachment Requirements for pan-European approval for connection to the analogue Public Switched Telephone Networks (PSTNs) of terminal equipment (excluding terminal equipment supporting the voice telephony service) in which network addressing, if provided, is by means of DTMF signalling".

[3] DIN 44015-1 (1995): "Requirements for terminal equipment and configurations connected to analogue subscribe interfaces of the PSTN/ISDN of the Telekom, Part 1: Transmission and switching requirements for terminal and concentrating equipment".

[4] BAPT 223 ZV 5 (1996): "Type approval specification for terminal equipment intended for connection to analogue accesses (with the exception of emergency telephone and direct dialling-in accesses) in the telephone network/ISDN of Deutsche Telekom AG".

[5] BS 6305: "Specifications of general requirements for apparatus for connection to the British Telecom public switched telephone network".

[6] Federal Communications Commission (FCC) 47, CFR 68.500: "Code of Federal Regulations (USA); Title 47 Telecommunication; Chapter 1 Federal Communications Commission, Part 68 Connection of Terminal Equipment to the Telephone Network".

NOTE: This document can be obtained from:
Superintendent of Documents
Washington DC 20402
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[7] ITU-T Recommendation G.117 (1996): "Transmission aspects of unbalance about earth (definitions and methods)".

[8] ETR 344 (1997): "Terminal Equipment (TE); The technical feasibility of a harmonized plug and socket standard for European Public Switched Telephone Network (PSTN) access".

3 Definitions and abbreviations

3.1 Definitions

The following definitions apply:

3.1.1 General terms

Installation Connection Point (ICP): A point on a user installation, intended to accept the connection of a TE. See figure 2.

NOTE 1: The ICP may also be part of a series connected TE.

NOTE 2: The ICP may present to the TE physical characteristics identical to those of the NTP.

Loading Factor (LF): The portion of PSTN resources used by a TE or a set of TEs (installation) when connected to a Network Termination Point (NTP).

Loading Unit (LU): An arbitrary unit to measure (or evaluate) the Loading Factor.

Longitudinal Conversion Loss (LCL): As described in ITU-T Recommendation G.117 [7] subclause 4.1.3.

Network Termination Point (NTP): The physical point at the boundary of the PSTN intended to accept the connection of a TE. See figure 1.

NOTE 3: Directive 90/387/EEC defines NTP as "All physical connections and their technical access specifications which form part of the public telecommunications network and are necessary for access to and efficient communications through that public network".

Public Telecommunications Operator (PTO): An operator of a Public Telecommunications Network or part thereof.

Reference impedance Z_R: A complex impedance made up of 270 ohms in series with a parallel combination of 750 ohms and 150 nF. This is shown in annex A, figure A.1.

Series connected TE: TE which provides an Installation Connection Point intended to accept the connection of a second TE to be excited solely by loop current derived from the PSTN via the NTP.

Terminal Equipment (TE): Equipment intended to be connected to a PSTN; i.e.:

a) to be connected directly to the termination of a PSTN, or;

b) to interwork with a PSTN being connected directly or indirectly to the termination of a PSTN,

in order to send, process or receive information.

NOTE 4: This definition is based on that given in Directive 91/263/EEC.

Terminal Connection Point (TCP): The point of the TE intended to be connected to the PSTN either directly or indirectly via a suitable adapter, installation facilities or another serially connected TE. See figure 1.

User installation: The means (cables and mechanical adaptors) used to connect between the NTP and one or more Installation Connection Points so as to permit one or more TE to access one NTP.

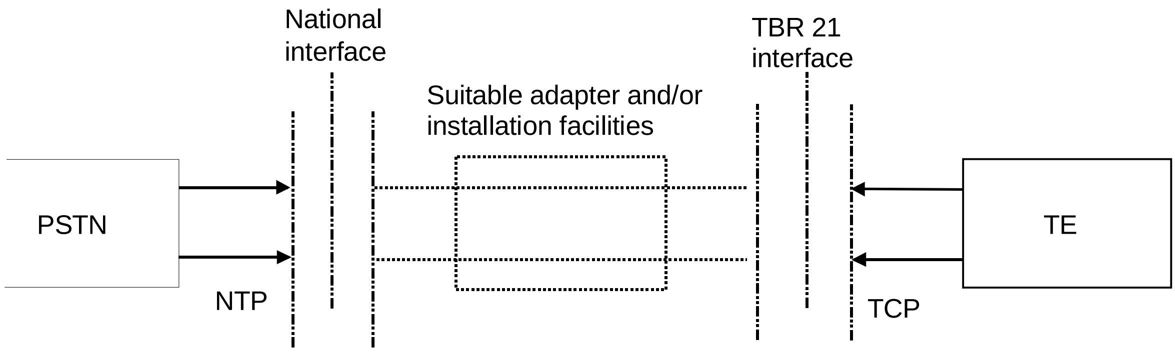

Figure 1: Network Termination Point and Terminal Connection Point

3.1.2 States

Loop state: The state where the TE draws sufficient DC current to activate the exchange.

Loop transferred state: A state of series connected TE where the installation connection point is internally through-connected to the TCP.

Quiescent state: The state where the TE draws insufficient DC current to activate the local exchange.

3.2 Abbreviations

The following abbreviations apply:

AC	Alternating Current
DC	Direct Current
DTMF	Dual Tone Multi-Frequency (MFPB or MF)
FCC	Federal Communications Commission
ICP	Installation Connection Point
LCL	Longitudinal Conversion Loss
LF	Loading Factor
LU	Loading Unit
MF	Multi Frequency
MFPB	Multi Frequency Push Button
NTP	Network Termination Point
PBX	Private Branch Exchange
PSTN	Public Switched Telephone Network
PTO	Public Telecommunications Operator
rms	root mean square
TBR	Technical Basis for Regulation
TCP	Terminal Connection Point
TE	Terminal Equipment

4 Reference configuration

The PTO provides the user with a NTP, to which approved TEs can be attached.

When a user installation exists, it can be prepared either

- for the connection of one TE; or
- for the connection of an arbitrary combination of several TEs connected in series and/or in parallel.

Figure 2 shows an example of the second case.

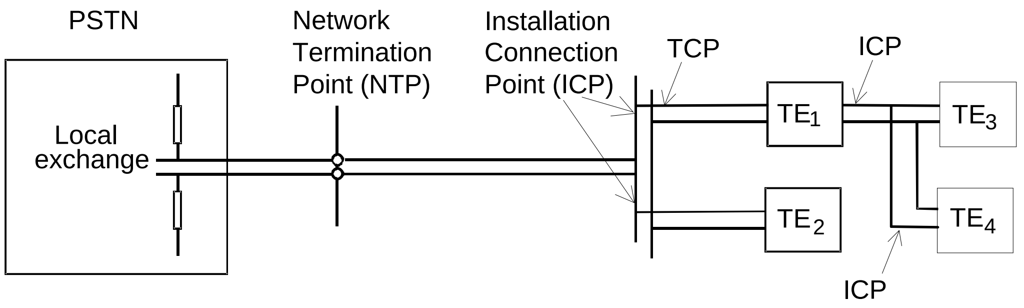

Figure 2: Example of user's installation

In general, one can assume that only one TE is active (as considered by the user) at a time. In practice this means that this particular TE is in loop state, either initiating a call or engaged in a communication with a far end TE. If someone uses, or attempts to use, two or more TEs simultaneously in loop state, the service may be severely degraded, and will be outside the scope of this EG.

So, for instance, if a loop state has been transferred (this normally means that a call has been transferred) from:

- TE_1 in figure 2, to TE_3 or TE_4, TE_1 will be placed in loop transferred or through-connecting state;
- TE_1 in figure 2, to TE_2, TE_1 will be placed in quiescent state after TE_2 has been placed in loop state.

NOTE: Some national mechanical connection arrangements for multiple TEs automatically ensure that only one TE in loop state is connected to the NTP at any time. See also clause 5.

5 Connection arrangements

The connection arrangements for attachment of TEs to the NTP vary between countries. The present methods of connections are given in chapter 8 of ETS 300 001 [1].

An adapter (mechanical and/or electrical) may be needed between the TCP and the NTP, see figure 1.

NOTE 1: Studies have been carried out on "the technical feasibility of a harmonized plug and socket standard for European Public Switched Telephone Network (PSTN) access", see ETR 344 [8].

NOTE 2: Examples of some national connection arrangements are given in annex B.

6 Method of rating terminal equipment

6.1 General

The method described in the present document is based on the following assumptions:

Once a common set of requirements is established as mandatory for the TE to gain a pan-European approval for installation of a single TE, it may be considered that:

- all European PTOs provide enough resources to enable a proper operation of such TE from the point of view of the loading effects;
- every TE not consuming all the network resources may share them with other TEs.

To evaluate how much of the resources are consumed by each TE it is necessary to establish a method of rating the terminal. An accurate method is nevertheless extremely complex and difficult to understand for the average consumer. This EG therefore establishes a consumer friendly, approximate evaluation method.

6.2 Determination of Loading Factor for a TE

For each TE, every parameter which might affect the access conditions or the transmission performance in respect of parallel connection of TEs will correspond to a parameter specific Loading Factor (LF), see table 1.

NOTE 1: Loading Factors are not given for series aspects of parallel/series connection. Recommendations for these aspects are given in subclause 6.3.2.

The Loading Factor is given in Loading Units (LU). For each parameter an arbitrary value is defined as 100 LU. The LF for a certain parameter can then be calculated by a parameter dependent formula given in table 1. The table also indicates where test methods can be found.

NOTE 2: A terminal may have different settings corresponding to different LFs for one or more parameters.

NOTE 3: Annex A gives further information in case of some tests based on methods in ETS 300 001 [1].

NOTE 4: The LFs defined in the tables are based on the present technologies and market situation but their defining formulae should be used in the future without the need of changes. With the evolution of technologies it is expected an increase of the LF supported by PTOs.

Table 1: Parallel aspects of parallel/series connection.

Operating state of TE	Parameter	Test method	Value for 100 LU	Formula for calculation of LF and unit for input data
Quiescent, Transferred	Resistance to earth	prTBR 21 [2], A.4.4.4	R = 10 MΩ	1 000/R [MΩ]
Quiescent, Transferred	Impedance to earth at 50 Hz See note 1	ETS 300 001 [1], A.9.2.2.1	Z = 200 kΩ	20 000/Z [kΩ]
Quiescent, Transferred	DC resistance	prTBR 21 [2], A.4.4.1	R = 1 MΩ	100/R [MΩ]
Quiescent	Lowest impedance at 25 Hz and 50 Hz	prTBR 21 [2], A.4.4.2.1	Z = 4 kΩ	400/Z [kΩ]
Quiescent, Transferred	Lowest impedance in the range 0,3 - 3,4 kHz	ETS 300 001 [1], A.4.1.1	Z = 10 kΩ	1 000/Z [kΩ]
Quiescent, Transferred	Lowest impedance at 12 kHz and 16 kHz ± 1 % See note 2.	ETS 300 001 [1], A.4.1.1	Z = 10 kΩ	1 000/Z [kΩ]
Quiescent	DC current during ringing	TBR 21 [2], A.4.4.2.3	I = 0,6 mA	$100 \times I / 0{,}6$ [mA]
Quiescent, Loop	Highest unbalance about earth in the range 50 - 3 400 Hz	TBR 21 [2], A.4.4.3 and A.4.7.4	LCL = 46 dB	$100 \times 10^{(46 - LCL)/20}$ [dB]
Transferred	Highest unbalance about earth in the range 50 - 3 400 Hz	ETS 300 001 [1], A.4.2.2.2 See note 3.	LCL = 46 dB	$100 \times 10^{(46 - LCL)/20}$ [dB]
Quiescent, Transferred	Noise	ETS 300 001 [1], A.4.5.1	N = -64 dBmp	$100 \times 10^{(64 + N)/10}$ [dBmp]

NOTE 1: Only applicable for TEs providing a common reference terminal which is connected to the PSTN earth.
NOTE 2: This applies for a TE not intended to detect metering pulses. A TE intended for detection of metering pulses has typically an impedance of nominally 200 Ω within the detection frequency band, see ETS 300 001 [1], subclause 9.2.1.4.
NOTE 3: Measured with 600 Ω load simulating the AC load of a terminating TE in loop state.

6.3 Guidance for the supplier

In some countries ringing signals lower than 30 Vrms (e.g. 24 Vrms) may appear at the NTP depending upon certain circumstances. Particularly for electro-acoustic ringers without local power supply it is recognized that this voltage may be insufficient to produce an acoustic output expected from some users or suitable for applications in noisy surroundings. For series and parallel installations any attenuation inserted in the ringing frequency range may effect the interworking function. On the other hand detecting a too low ringing level will easily result in false interworking (for example, in some countries inductions up to 17 Vrms may occur on the line).

6.3.1 Guidance related to parallel connection of TEs

A TE will need to be designed so that its use of network resources is appropriate for its intended application. A TE intended for parallel connection will need to consume only part of the available resources, for example less than 30 LU.

6.3.2 Guidance related to series connection of TEs

A TE intended to be connected also behind a series connected TE will need to yield some of the network resources to allow for the connection of one or two series connected TEs.

NOTE 1: It is not common that there are more than two series connected TEs plus the TE terminating the connection in one particular branch of an installation.

A TE intended for series connection with other TEs will need to consume very little of the available resources when in loop transferred state because most of the resources are needed for the TE which is terminating the connection and is in loop state. Table 2 makes some recommendations for applicable parameters, and indicates where test methods can be found.

NOTE 2: Annex A gives further information in case of some tests based on methods in ETS 300 001 [1].

Table 2: Recommended maximum values for series connected TEs.

Parameter	Recommended maximum value	Test method
DC series resistance	50 Ω See notes 1, 2	ETS 300 001 [1], A.2.5
Insertion loss at 25 Hz and 50 Hz	0,4 dB	ETS 300 001 [1], A.4.3 Z = 4 kΩ
Insertion loss in the range 0,3 - 3,4 kHz	0,4 dB	ETS 300 001 [1], A.4.3 $Z = Z_R$
Insertion loss at 12 kHz and 16 kHz ± 1 %	0,4 dB	ETS 300 001 [1], A.4.3 Z = 200 Ω
NOTE 1 The voltage drop should not be greater than that which would be dropped across a 50 Ω resistor replacing the TE. NOTE 2: Some series connected TEs may present a non-linear voltage-current characteristic, e.g. a diode bridge. The voltage drop of such devices should not exceed 2 V for loop currents not exceeding 40 mA. It is recognized that this may cause incorrect operation in terminating equipment when connected to long lines.		

If these recommendations or assumptions are not true the supplier should inform the user how to proceed.

6.4 Information to the user

6.4.1 Information from the PTO

The PTO should inform the users about the LF that the PSTN can support at the NTP. The LF specified by the PTO should be the lowest of the LFs for the individual parameters (given in table 1) of the network interface, rounded down to the nearest whole number.

NOTE 1: In addition to the LF-value discussed above, the PTO is invited to also give the applicable values of each individual parameter. This more detailed information would enable a skilled user to take full advantage of the available resources at the NTP.

6.4.2 Information from the supplier

The supplier should make the LF of the TE in question (in terms of LU) readily available to the user. This value should be at least the highest of the different LFs given in table 1, rounded up to the nearest whole number. Where a TE has different settings resulting in different LFs, either these different LFs should be given (indicating the relevant LF for each setting of the TE) or the highest LF should be assigned to all settings of the TE.

Users should be informed that the total loading of their installation can be obtained by adding the LU values of connected TEs.

The user can then compare the resulting LF of the installation with the value given by the PTO. It can be assumed that:

- when the total LF of the TEs forming the installation is equal to or lower than the maximum value (in terms of LU) for the resources defined by the PTO the installation will operate properly; but
- when the total LF of the TEs forming the installation is higher than the maximum value for the resources defined by the PTO, there may be degradation in the TE performance (such as a failure of proper interworking with the PSTN).

NOTE 1: An example of how to derive the LF of an installation is given in subclause 6.5.

NOTE 2: In addition to the LF-value discussed above, the supplier may also give the applicable values of each individual parameter. This more detailed information would enable a skilled user to take full advantage of the available resources at the NTP. In this case the LFs for each individual parameter need to be added to obtain the loading.

6.5 Example of the LF of an installation

As an example the configuration in figure 2 is examined. Table 3 gives examples of LFs for the TEs involved and the resulting LF of the installation.

Table 3: Example of LFs for TEs.

TEs involved in installation	LF for TEs [LU]
TE_1	12
TE_2	23
TE_3	15
TE_4	28
Resulting LF of the installation	78

If, as an example, the NTP can support 100 LU, the installation in figure 2 could support a further loading of 22 LU (100 - 78). If the user wishes to include a further TE in the installation it should have a LF of no more than 22 LU, otherwise there may be degradation in the performance of the installation.

Annex A:
Test principles

Test principles are given in the standards referred to in tables 1 and 2.

In the case of some tests in ETS 300 001 [1], the following test conditions are used:

Table A.1: Test conditions in ETS 300 001.

Operating state of TE	Parameter	Test method	Test values
Quiescent, Transferred	Impedance in the range 0,3 - 3,4 kHz	ETS 300 001 [1], A.4.1.1	Input level (V_{t2}): 1,0 Vrms
Quiescent, Transferred	Impedance at 12 kHz and 16 kHz	ETS 300 001 [1], A.4.1.1	Input level (V_{t2}): 1,0 Vrms
Transferred	Insertion loss in the range 0,3 - 3,4 kHz	ETS 300 001 [1], A.4.3 Z = Z_R	Input level (e): 1,0 Vrms
Transferred	Insertion loss at 12 and 12 kHz	ETS 300 001 [1], A.4.3, Z = 200 Ω	Input level (e): 1,0 Vrms
Loop	Impedance at 12 kHz and 16 kHz	ETS 300 001 [1], A.4.1.1	Input level (V_{t2}): 1,0 Vrms DC condition: 50 V, 2 050 Ω
Transferred	DC series resistance	ETS 300 001 [1], A.2.5	DC feeding voltage: 50 V R_L = 360 Ω

The reference impedance Z_R is a complex impedance made up of 270 Ω in series with a parallel combination of 750 Ω and 150 nF as shown in figure A.1.

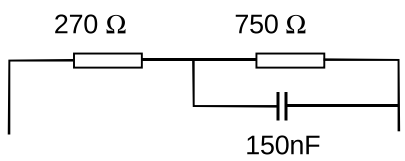

Figure A.1: Reference impedance Z_R

Annex B: Some present national connection arrangements

In a number of countries, there are methods for handling the configurations of multiple terminals. In some cases, these methods are imposed by regulation. For information, some cases are described here.

B.1 DIN 44015-1 used for Deutsche Telekom's network

The industry standard DIN 44015-1 [3] specifies additional attachment requirements to those included in the regulatory requirements BAPT 223 ZV 5 [4]. It describes the transmission and switching requirements placed on TE and TE configurations for connection to analogue PSTN interfaces of the telephone network/ISDN of Deutsche Telekom which are needed to meet the network access conditions according to regulation BAPT 223 ZV 5. TE configurations complying with the specification of DIN 44015-1 satisfy the approval conditions applying for the analogue network termination. The application of this standard is not a prerequisite for type approval.

The standard is based on the assumption that

- only one TE of the configuration constitutes the busy, dial or operating state;
- the total loop resistance of the installation does not exceed 10 Ω;
- certain access variants, given in the standard, are met;
- there is a maximum of 4 ringing detectors;
- there is a maximum of 2 preceding TEs before the last TE.

The standard also describes mechanical connection arrangements for different scenarios.

B.2 Ringer Equivalence Number as used in the UK

The previously used approval standard BS 6305 [5] specifies requirements on the ringer circuit (ringing threshold and impedance) of a TE through a procedure that results in a "ringer equivalence number", a REN, being assigned for the TE.

The definition of REN is based on the characteristics of a British Telecom type 59D ringer. A TE is connected in parallel with a simulated 59D ringer, and a ringing voltage is applied through a test circuit. If the voltage across the simulated 59D ringer is higher than 20 V rms, and the TE ringer responds to the ringing voltage, additional TEs (maximum 10) are connected in parallel. The REN is calculated as 3 divided by the maximum number of TEs in parallel, where both the above mentioned criteria are still met. This results in a REN between 3 and 0,33. However, a REN of 4 can be assigned for a TE which detects a ringing voltage when no other ringers are connected in parallel. BS 6305 [6] uses the REN to control the DC quiescent current drawn by the TE (according to the formula 30 x REN in microamps).

B.3 Swiss PSTN

B.3.1 General information

The present (1997) valid approval standards (dated from 1995) specify requirements for the PSTN interface assuming the following configurations are typical ones:

- one TE may be in series with another or two other TE;
- up to three TE may be in parallel in quiescent state;
- only one TE will be activated (loop state) by the user at a time.

In the future the Swiss regulator will adopt the European harmonized standards and recommend the studies undertaken by ETSI in order to maintain a high level of service performances.

At present (1997) the Swiss PSTN provides every NTP with AoC (12 kHz charge meter pulses up to 10 V). Up to now, immunity to such AoC-signalling has been required in the national requirements. In the future, such requirements seem not to be "essential". Therefore to prevent a major degradation of service during the transmission phase of the loop state, the introduction of a filter between TCP and NTP with the characteristics referred below is strongly recommended.

B.3.2 AOC (12 kHz) Filter

The inclusion of the above recommended filter in a mechanical adapter seems to be the most cost effective solution. This adapter should be considered a galvanic Through Connecting Equipment (TCE) including components barring the 12 kHz through connection and without active circuit components ("no noise", "no higher frequency disturbances" generation).

The interface conditions on the TCP should be passed on to the ICP (branch side of the TCE).

Following performances should be observed if the adapter is loaded with a load of 20 MΩ:

- insulation between the two PSTN leads ≥ 10 MΩ;
- insulation between the two PSTN leads and a possible Earth lead ≥ 10 MΩ.

Following performances should be observed if the adapter is loaded with loads between 0 and 1 kΩ (typical value 300 Ω):

- lightning protection according to ITU-T Recommendation K.21;
- protection against voltages up to 60 V DC + 90 Vrms through a 600 Ω source (ring trip);
- longitudinal conversion transfer loss in the ringing signal range ≤ -57 dB;
- longitudinal conversion transfer loss in the voice range ≤ -57 dB;
- series resistance of Rs ≤ 25 Ω;
- insertion loss in the ringing signal range (ref. 2 kΩ) ≤ 0.5 dB;
- insertion loss in the voice band (ref. 600 Ω) ≤ 0.5 dB;
- insertion loss in the AoC range (12 kHz ± 1 %, ref. 600 Ω) ≥ 30 dB.

B.4 Ringer Equivalence Number as used in the US

In FCC Part 68 [6], which describes the attachment requirements for "Connection of Terminal Equipment to the Telephone Network" in the US, there is at present a definition of a Ringer Equivalence in FCC part 68 [6] subclause 68.312 "On-hook impedance limitations". Ringing signals with different frequencies and voltages are used, and the requirements depend upon the type of equipment in question. For an individual equipment with loop start facilities there are limits imposed for the following parameters see FCC part 68 [6] (subclause 68.312(b)(1)):

- DC resistance between tip and ring (i.e., "a" and "b" wires in Europe), and between each of the tip and ring conductors and earth ground when tested at lower voltages;
- DC resistance between tip and ring, and between each of the tip and ring conductors and earth ground when tested at higher voltages;
- DC current flowing between tip and ring during ringing;
- AC impedance during ringing with different frequencies (classified as Ringing Type A and B).

The Ringer Equivalence is only being defined for "AC impedance during ringing". The ringer equivalence is five times the stated impedance limit, divided by the minimum measured AC impedance see FCC part 68 [6], (subclause 68.312(d)(1)). A TE can have Ringer Equivalence stated for more than one Ringing Type.

It is required that the TE ("registered terminal equipment") has at least one Ringer Equivalence Number shown on the registration label see FCC part 68 [6], (subclause 68.312(e)).

It is stated that "the sum of all such ringer equivalencies on a given telephone line or loop shall not exceed 5" see FCC part 68 [6] (subclause 68.312(f)).

B.5 The Ringer Equivalence Number - CZ and the Insertion Equivalence Number used in the Czech Republic

Present requirements include rules governing the number of TEs which can by connected to one NTP and their configuration. These requirements are published in the fourth edition of ETS 300 001 [1].

The ETS 300 001 [1] section 8.3 (CZ) specifies the methods for determination of the number and configuration of different TEs connected simultaneously to one NTP in Czech Republic PSTN. A Ringer Equivalence Number - CZ (REN-CZ) and Insertion Equivalence Number (IEN) with requirements for concatenation of various TE types (series connected, terminal connected, 2-poles, 3-poles, 4-poles and 5-poles) are specified.

The parallel connection of more TEs to NTP is not permitted.

The total number of series connected TEs depends on the properties of each of the connected TE. If the TE meet all requirements of ETS 300 001 [1] (CZ), it is possible to serial connect two TEs to NTP without verification of admissibility.

If more then two TEs are to be connected in series to one NTP, the admissibility of the configuration of these TEs is to be verified according following formulas.

$$\Sigma \text{ REN-CZi} \leq 2 \qquad \text{(x)}$$

and

$$\Sigma \text{ IENi} \leq 80 \qquad \text{(y)}$$

where:

REN-CZ Ringer Equivalent Number - CZ

is the ringing detector impedance Z of the TE, expressed by its equivalent number (the measurement methods and calculation - see ETS 300 001 [1] section 3.1.1 (CZ) 3, section 3.1.1 (CZ) 4 and section A.3.1.1 (CZ) 3).

$$\text{REN-CZi} = 2000 / \text{Zi} \qquad (\text{Z in } \Omega)$$

IEN Insertion Equivalent Number

is the series resistance Rs of the series-connected TE, expressed by its equivalent number (the measurement method and the calculation - see ETS 300 001 [1] section 2.5 (CZ)).

$$\text{IENi} = \text{Rsi} / 1 \qquad (\text{Rs in } \Omega)$$

i is the order number of the TE series connected to the NTP.

NOTE 1: The ringing detector impedance shall be in the range 2 kΩ to 10 kΩ for TEs of the types 1, 3 (I) and 3 (II), capable of an independent operation according to ETS 300 001 [1] section 1.4.4.1 (CZ) 3.

NOTE 2: The ringing detector impedance shall be higher than 2 kΩ for TE of the type 1, 3 (I) and 3 (II) which cannot be connected to a NTP and operated independently (see ETS 300 001 [1] section 1.4.4.1 (CZ) 4), but only in connection with the other TE having the capability of an independent operation.

NOTE 3: The series resistance Rs of series connected TE (TE Type 3 (I), Type 3 (II)) shall not exceed 80 Ω.

NOTE 4: Types of TE (for example TE Type 1, TE Type 2, TE Type 3 (I) etc.) are described in ETS 300 001 [1] section 1.4.4.2).

When the sums for (x) and for (y) are higher then the maximum value, the considered TEs configuration cannot be attached to the NTP.

Every TE shall be labelled with its REN-CZ and IEN by the manufacturer.

Where the TE is not marked with the REN-CZ value (REN-CZ not indicated), the subscriber can used following implicit value for calculation:

$$\text{REN-CZ} = 1$$

Where the TE is not marked with the IEN value (IEN not indicated), the subscriber can used following implicit value for calculation:

$$\text{IEN} = 20$$

Annex C: Bibliography

- 91/263/EEC: "Council Directive of 29 April 1991 on the approximation of the laws of the Member States concerning telecommunications terminal equipment, including the mutual recognition of their conformity". The TTE Directive.

History

Document history		
V1.1.1	October 1997	Membership Approval Procedure MV 9750: 1997-10-14 to 1997-12-12