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Contents

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Foreword

This European Telecommunication Standard (ETS) has been produced by the Business TeleCommunications (BTC) Technical Committee of the European Telecommunications Standards Institute (ETSI).

This ETS is a framework document which is intended for use by administrations, public and private network operators. It deals with the transmission planning of Private Branch Networks (PBNs) with digital access to the Integrated Services Digital Network (ISDN)/Public Switched Telephone Network (PSTN) which send or receive speech telephone calls. It recognizes the overall responsibility of administrations for ensuring that the quality of national communications is consistent with international quality objectives.

Public networks within Europe contain a mixture of analogue and digital equipment and there are significant differences in the design of the analogue networks in different countries (e.g. different loudness levels). In addition, although the public networks will eventually be very similar when they are fully digital, the conversion from analogue to digital will be carried out in different ways and at different times in different countries. During this conversion process, it may be possible to increase the impairment allowances given to private networks and the greatest possible flexibility in this respect is desirable.

This ETS relates only to calls which pass through a public switched network to an International Switching Centre (ISC). In the case of other calls (e.g. national calls) it may be possible for the impairment allowances for private networks to be increased.

The approach followed is to specify the performance of a private network at the point or points where it is connected to a public network. This approach may also be used for private networks that include international leased circuits, provided that the performance at the connection point is maintained. However, the approach to more complex topologies using international leased circuits is for further study.

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1 Scope

This ETS is related to Private Branch Networks (PBNs) with a digital access to the Integrated Services Digital Network (ISDN)/Public Switched Telephone Network (PSTN) with a fully 4-wire call path between the Network Connection Point (NCP) and an International Switching Centre (ISC). It applies to call paths carrying 3,1 kHz voice telephony between the NCP and the terminal in the PBN that sets up or answers the call. If a call, before or after it is first answered, is diverted or extended within the PBN, by means of a user-controlled feature, the extended call path is outside the scope of this ETS.

This ETS does not contain a compliance test specification. A compliance test at each NCP for each possible call path within the network would require a prohibitive amount of testing for all networks except the smallest. Furthermore, private networks are subject to frequent changes. Where a compliance statement is provided, it shall be supported by computations and transmission performance data for the apparatus involved (e.g. showing compliance with relevant ETSs).

The limits quoted in this ETS should ensure satisfactory echo and loudness performance.

This ETS does not apply to configurations where a part of the transmission path between the terminal and the public network contains a segment that incorporates mobile systems or cordless telephones.

2 Normative references

This ETS incorporates by dated and 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 apply to this ETS only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

[1] ETS 300 085 (1990): "Integrated Services Digital Network (ISDN); 3,1 kHz telephony teleservice; Attachment requirements for handset terminals (Candidate NET 33)".

[2] CCITT Recommendation G.122 (1988): "Influence of national systems on stability, talker echo, and listener echo in international connections".

[3] CCITT Recommendation G.131 (1988): "Stability and echo".

3 Definitions, abbreviations and reference configurations

3.1 Definitions

For the purposes of this ETS, the following definitions apply:

Channel, transmission channel: a means of unidirectional transmission of signals between two points.

Circuit, telecommunication circuit: a combination of two transmission channels permitting bidirectional transmission of signals between two points, to support a single communication.

NOTE 1: In a telecommunication network, the use of the term "circuit" is generally limited to a telecommunication circuit directly connecting two switching devices or exchanges, together with associated terminating equipment.

Connection (in telecommunications): a chain of circuits interconnected by switching points, between two different points in the network.

NOTE 2: A connection is the result of a switching operation.

NOTE 3: A connection which allows an end-to-end communication, e.g. conversation, may be called a "complete connection".

NOTE 4: A connection makes a communication possible but is not a communication.

Echo balance return loss: the echo balance return loss is the balance return loss averaged with 1/f power weighting over the telephone band, in accordance with CCITT Recommendation G.122 [2], § 4.

Echo loss: the echo loss is the semi-loop loss averaged with 1/f power weighting over the telephone band, in accordance with CCITT Recommendation G.122 [2], § 4.

In the case where a 2-wire point exists, the echo loss is approximately equal to the sum of the transmission losses from 4-wire to 2-wire and 2-wire to 4-wire and the echo balance return loss.

Integrated Services Digital Network (ISDN): a public telecommunication network which supports ISDN services between any two T reference points.

Long-term: in this ETS the expression "long-term" is used. This term shall be interpreted as follows, with regard to the time interval involved: "long-term" applies to a period when major changes to a Private Automatic Branch Exchange (PABX)/PBN are possible and necessary in order to ensure better performance and/or compatibility in a wider range.

Loudness ratings: within the context of ITU-T (CCITT), a loudness rating is an objective measure of the loudness loss, i.e. a weighted, electro-acoustic loss between certain interfaces in the telephone network.

NOTE 5: An important attribute of the loudness rating is the additivity. This means that if the circuit between the interfaces is subdivided into sections, the sum of the individual section loudness ratings is equal to the Overall Loudness Rating (OLR).

Loudness ratings provide a logical basis for judging both the wanted transmission from the talking to the listening subscriber as well as some unwanted phenomena such as excessive sidetone, echoes and crosstalk.

Useful loudness ratings are:

Overall Loudness Rating (OLR): the loudness loss between the speaking subscriber's mouth and the listening subscriber's ear via a connection.

Receive Loudness Rating (RLR): the loudness loss between an electric interface in the network and the listening user's ear.

Send Loudness Rating (SLR): the loudness loss between the speaking user's mouth and an electric interface in the network.

Talker's Echo Loudness Rating (TELR): the loudness loss between a user's mouth and his earphone via the delayed echo path.

NOTE 6: For more information on loudness rating properties, see the ITU-T P-series of Recommendations.

Network Connection Point (NCP): a NCP is a point at which two separately run networks are inter-connected. In the context of this ETS, NCP refers to the connection point between a PBN and an ISDN.

Private Branch Network (PBN): a PBN comprises a Private Telecommunication Network (PTN) and the connected terminal equipment for the speech service.

Public Switched Telephone Network (PSTN): the term is used to describe the ordinary telephone system including subscriber lines, local exchange and the complete system of trunks and the exchange hierarchy which makes up the network.

Semi-loop loss: in an arrangement comprising of a 4-wire circuit (or a cascade connection of several 4-wire circuits) with unwanted coupling between the go and return direction at the ends of the circuit (usually via a 4-wire terminating set, or via acoustical coupling), the semi-loop loss is the loss measured between input and output, these points having equal relative levels, e.g. digital points.

Short-term: in this ETS the expression "short-term" is used. This term shall be interpreted as follows, with regard to the time interval involved: "short-term" applies during the current period when no major changes at the PABX/PBN can be implemented for technical and/or economic reasons.

Stability loss: the lowest value of the semi-loop loss in the frequency band to be considered under worst case conditions (e.g. open-circuit and short-circuit terminations).

Transmission time: the time between the emission of a signal and the time it is received. Transmission time for connections with digital segments includes delay due to equipment processing as well as propagation delay itself.

NOTE 7: The term "Transmission time" replaces the terms "Propagation time/delay" formerly used in ITU-T (CCITT) Recommendations.

3.2 Abbreviations

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

A/D	Analogue/Digital
D/A	Digital/Analogue
ISC	International Switching Centre
ISDN	Integrated Services Digital Network
LE	Local Exchange
NCP	Network Connection Point
OLR	Overall Loudness Rating
PABX	Private Automatic Branch eXchange
PBN	Private Branch Network
PSTN	Public Switched Telephone Network
PTN	Private Telecommunication Network
RLR	Receive Loudness Rating
SLR	Send Loudness Rating
TELR	Talker's Echo Loudness Rating

3.3 Reference configurations

Figure 1 shows examples of reference configurations.

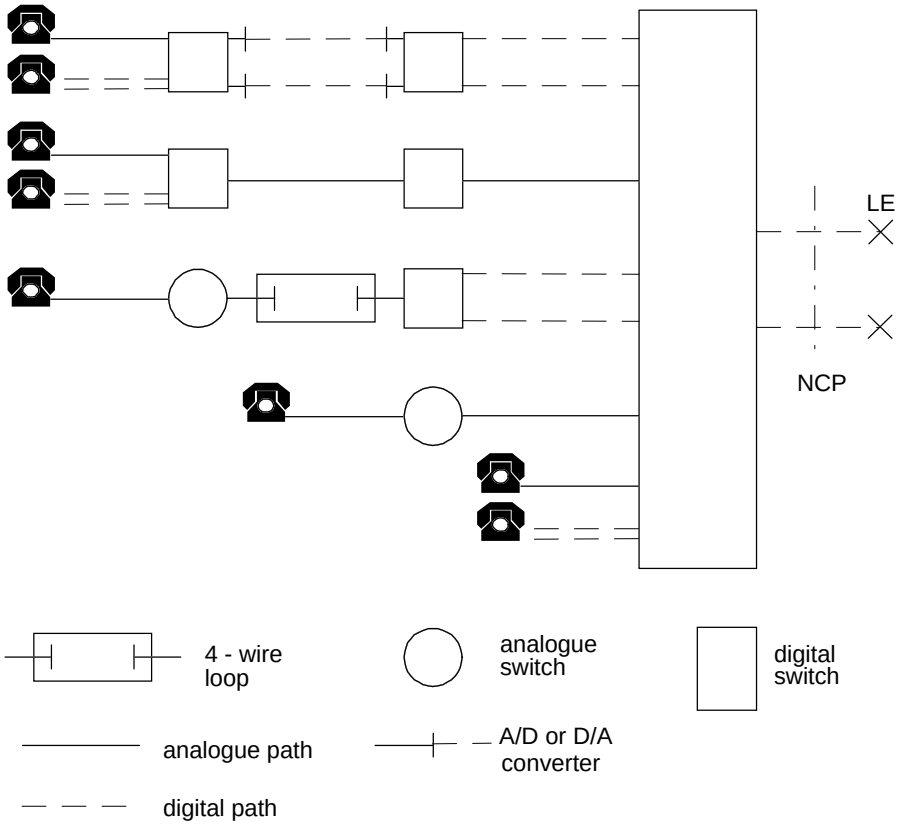

Figure 1: Examples of connections between terminals within the PBN and the NCP

4 Echo control

NOTE: For the bearer service category "Circuit-mode 64 kbit/s unrestricted" (see ETS 300 102-1) it is recognized that it is the responsibility of the customer to ensure a sufficient control of echo and loss because no provisions can be made in the public network to this respect.

4.1 Transmission time

The private network shall be designed so that for each possible call path without additional echo control within the PBN the mean one-way transmission time between the acoustic interfaces of the user apparatus and the NCP does not exceed 5 ms, except where national administrations specify higher values which may vary from area to area of their country, according to the formula:

$$t = (25 - t_p)/2 \text{ ms}$$

where t_p represents the transmission time in milliseconds for the public network on national calls.

NOTE 1: Any means of achieving additional echo control is acceptable, including e.g. the use of echo cancellation devices, or the provision of a wholly 4-wire transmission path to the acoustic interfaces of the terminal.

NOTE 2: In the largest European countries, t_p may be higher than 15 ms. Nevertheless, according to the new "ETSI model for the overall voice transmission quality mouth to ear", the levels of quality when t_p is in the range 15 ms to 20 ms, without using echo control devices, are very similar.

In calculating the transmission time, the mean delay values for the items shall be used.

4.2 Echo loss of the private network at the NCP

Echo loss is defined in subclause 3.1. The second paragraph of the definition gives a simple rule for its calculation.

The echo loss averaged across all possible call paths within the private network, shall exceed 24 dB for long-term objective and 20 dB for short-term objective. This is based on a TELR of 34 dB (see CCITT Recommendation G.131 [3], figure 2/G.131) and talker SLR/RLR values of 7 dB and 3 dB (see ETS 300 085 [1]), respectively.

Private network providers and operators are advised to discuss with the public network operator providing a service at the NCP, the values and time periods applicable to short-term and long-term objectives.

NOTE 1: These rules for talker echo should also ensure that the listener echo is satisfactory.

NOTE 2: In addition to the electrical echo paths of the PBN seen from the NCP, there will also be an acoustic echo path via the terminal apparatus. However the treatment of acoustic echo especially in conjunction with handsfree telephones is outside the scope of this ETS.

NOTE 3: In any call path where either the transmission time specified in subclause 4.1 is exceeded, or where the echo loss does not exceed a value 7 dB less than the values specified above and cannot be increased, an echo control device should be used. In the case of using echo control devices inside the PBN the value of allowed transmission time is outside the scope of this ETS.

5 Stability

In order to ensure stability, the stability loss seen from the NCP of each echo path in the PBN shall exceed 6 dB at all frequencies in the range from 200 Hz to 3 600 Hz (see I-ETS 300 004, subclause 5.2.1.8.2).

6 Loudness ratings

In the long term, the PBN should be designed to evolve towards nominal values at the NCP of SLR = + 7 dB and RLR = + 3 dB.

NOTE: This is intended to meet the ITU-T's (CCITT's) long term objectives for OLR.

In the short term, the nominal SLR and RLR values for each call path within the PBN and for each type of telephone set, shall lie in the following ranges at the NCP:

SLR: + 7 dB to + 16,5 dB;

RLR: + 3 dB to + 12,5 dB.

Considering the loudness ratings of existing telephones (as specified in present national standards for telephones intended for analogue connection to the PSTN) lower values of loudness ratings at the NCP shall be permitted. However, in order to minimize echo, those lower values should be avoided as far as possible.

Annex A (informative): Bibliography

1) I-ETS 300 004 (1991): "Business Telecommunications (BT); Transmission characteristics at 2-wire analogue interfaces of a digital Private Automatic Branch Exchange (PABX)".

2) ETS 300 102-1: "Integrated Services Digital Network (ISDN); User-network interface layer 3; Specifications for basic call control".

3) ITU-T Recommendation P.76: "Determination of loudness ratings; fundamental principles".

4) ITU-T Recommendation P.79: "Calculation of loudness ratings".

History

Document history	
April 1994	First Edition
January 1996	Converted into Adobe Acrobat Portable Document Format (PDF)