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OF ITU

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SERIES L: CONSTRUCTION, INSTALLATION AND
PROTECTION OF CABLES AND OTHER ELEMENTS
OF OUTSIDE PLANT

**Outside plant copper networks for ISDN
services**

ITU-T Recommendation L.19

(Previously CCITT Recommendation)

ITU-T L-SERIES RECOMMENDATIONS
**CONSTRUCTION, INSTALLATION AND PROTECTION OF CABLES AND OTHER ELEMENTS OF
OUTSIDE PLANT**

For further details, please refer to ITU-T List of Recommendations.

FOREWORD

The ITU-T (Telecommunication Standardization Sector) is a permanent organ of the International Telecommunication Union (ITU). The ITU-T is responsible for studying technical, operating and tariff questions and issuing Recommendations on them with a view to standardizing telecommunications on a worldwide basis.

The World Telecommunication Standardization Conference (WTSC), which meets every four years, establishes the topics for study by the ITU-T Study Groups which, in their turn, produce Recommendations on these topics.

The approval of Recommendations by the Members of the ITU-T is covered by the procedure laid down in WTSC Resolution No. 1 (Helsinki, March 1-12, 1993).

ITU-T Recommendation L.19 was prepared by ITU-T Study Group 6 (1993-1996) and was approved by the WTSC (Geneva, 9-18 October 1996).

NOTES

1. In this Recommendation, the expression "Administration" is used for conciseness to indicate both a telecommunication administration and a recognized operating agency.
2. The status of annexes and appendices attached to the Series L Recommendations should be interpreted as follows:
 - an *annex* to a Recommendation forms an integral part of the Recommendation;
 - an *appendix* to a Recommendation does not form part of the Recommendation and only provides some complementary explanation or information specific to that Recommendation.

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OUTSIDE PLANT COPPER NETWORKS FOR ISDN SERVICES

(Geneva, 1996)

Introduction

The local subscriber network has been providing the means for subscriber connection to the basic telephone service, without encountering any major transmission problems at voice frequencies (300 to 3400 Hz). Therefore, it is not necessary to systematically carry out test measurements of the quality of the subscriber loops for ISDN services.

1 Considering

1.1 Objectives

Considering that the digital access section between the local exchange and the customer is a key element of the successful introduction of ISDN, the following requirements for the network should be taken into account:

- the ability to operate on the existing two-wire unloaded lines, with open wires being excluded;
- the objective of achieving 100% cable fill for ISDN basic access without pair selection, cable rearrangements or the removal of Bridged Taps (BTs);
- the objective of being able to extend the ISDN basic access services provided to the majority of customers without the use of regenerators. In the remaining few cases special arrangements may be required;
- the coexistence, in the same cable unit, with most of the existing services like telephony and voiceband data transmission;
- various national regulations concerning Electro-Magnetic Compatibility (EMC);
- the provision of power feeding via the network under normal or restricted modes via the basic access;
- the provision of the capability to support maintenance functions.

1.2 Transmission medium

The transmission medium over which the digital transmission system is expected to operate is the access copper network.

This network employs cables of pairs to provide services to customers.

In this network, customers are connected to the local exchange via local lines.

A copper local line is expected to be able to simultaneously carry bidirectional digital transmission providing ISDN basic rate access between Line Termination (LT) and Network Termination (NT1). However, there are systems which do not require this feature.

To simplify the provision of ISDN basic access, a digital transmission system should be capable of satisfactory operation over the majority of the copper local lines without special conditioning. The maximum number of copper local lines that can be used for ISDN is obtained by keeping ISDN requirements to a minimum.

In the following, the term Digital Local Line (DLL) is used to describe a copper local line that meets minimum ISDN requirements.

2 It is recommended that

2.1 Minimum ISDN requirements

- a) no loading coils;
- b) no open wires;
- c) when Bridged Taps (BTs) are present, the following rules should be applied:
 - maximum number of BTs: 2;
 - maximum BT length: 500 m.

NOTE – A bridged tap is an unterminated twisted pair section bridged across the line and connected at flexibility points or joints.

In the case of more than 2 BTs, the number of BTs will depend on the BT length.

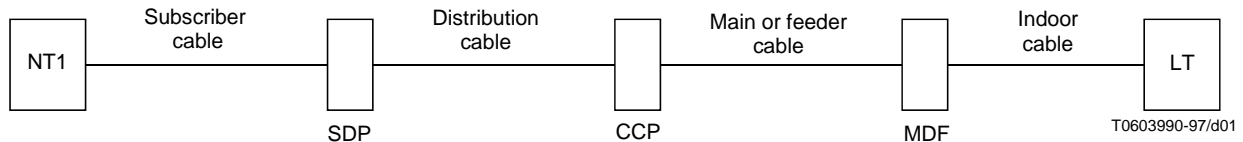
2.2 Digital local line physical characteristics

A digital local line should be constructed of one or more cable sections that are spliced or interconnected together.

The distribution or main cable is structured as follows:

- cascade of cable sections of different diameters and lengths;
- one or more bridged taps may exist at various points in feeder and distribution cables;

NOTE – A general description is shown in Figure 1 and typical examples of cable characteristics are given in Table 1.



Points of interconnection are:

MDF Main Distribution Frame
 CCP Cross Connection Point (or splice)
 SDP Subscriber Distribution point

Figure 1/L.19 – Digital local line physical model

Table 1/L.19 – Typical cable characteristics

	Indoor cable	Main cable	Distribution cable	Subscriber cable
Wired diameter (mm)	0.3 to 0.6	0.3 to 1.4	0.3 to 1.4	0.3 to 0.9
Structure	SQ or TP L or B	SQ or TP L or B	SQ or TP L or B	SQ, TP or UP
Maximum number of pairs	1200	2400/0.4 mm 4800/0.3 mm	600/0.4 mm	2 (aerial cable) 600 (indoor cable)
Mutual capacitance (nF/km at 800 Hz)	55 to 120	25 to 60	25 to 60	35 to 120
TP Twisted Pairs SQ Star Quads UP Untwisted Pairs L Layer B Bundles (units)				

2.3 Digital local line electrical characteristics

Taking into account that the transmitted signal will suffer impairment due to crosstalk, impulsive noise and the non-linear variation with frequency of digital local line characteristics.

2.3.1 Principal characteristics

The principal electrical characteristics should be:

- insertion loss limited to 36 dB or 32 dB at 40 kHz depending on the system (50 dB at 160 kHz);
- group delay limited to 80 μ s at 40 kHz.

2.3.2 Crosstalk

NOTE – Crosstalk noise, in general, is due to finite coupling loss between pairs sharing the same cable, especially those pairs that are physically adjacent. Finite coupling between pairs causes an interference of the signal flowing on one DLL (disturbing DLL) to be coupled into an adjacent DLL (disturbed DLL). This interference is known as crosstalk noise.

Near-End Crosstalk (NEXT) is assumed to be the dominant type of crosstalk.

NEXT noise coupled into a disturbed digital local line from a number of digital local lines disturbers is represented as being due to an equivalent single disturber digital local line with a coupling loss versus frequency characteristic known as Power Sum Loss (PSL).

The power sum loss should not be less than 50 dB at 40 kHz (44 dB at 160 kHz) and decreases 15 dB/decade with frequency.

2.3.3 Unbalance to earth

The digital local line will have finite balance to earth. Unbalance to earth is described in terms of Longitudinal Conversion Loss (LCL). Its limit should be 45.5 dB at 40 kHz decreasing by 5 dB/decade with frequency.

2.3.4 Impulse noise

The digital local line will have impulse noise resulting from other systems sharing the same cables as well as from other sources. The impulse noise should be contained within the envelope given in Figure 2.

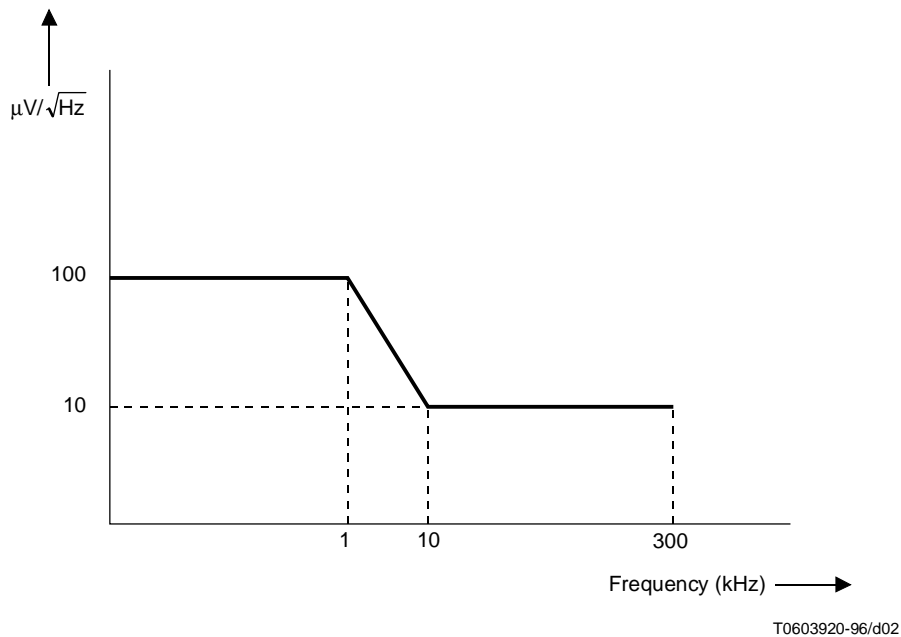


Figure 2/L.19 – Impulse noise

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