SLOVENSKI STANDARD
SIST EN 50289-1-7:2002

01-september-2002

Communication cables - Specifications for test methods - Part 1-7: Electrical test methods - Velocity of propagation (Note: Applies in conjunction with EN 50289-1-1)

Communication cables - Specifications for test methods -- Part 1-7: Electrical test methods - Velocity of propagation

Kommunikationskabel - Spezifikationen für Prüfverfahren -- Teil 1-7: Elektrische Prüfverfahren - Ausbreitungsgeschwindigkeit

Câbles de communication - Spécifications des méthodes d'essai -- Partie 1-7: Méthodes d'essais électriques - Vitesse de propagation

Ta slovenski standard je istoveten z: **EN 50289-1-7:2001**

ICS:

33.120.20	Žice in simetrični kabli	Wires and symmetrical cables

SIST EN 50289-1-7:2002 **en**

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 50289-1-7

June 2001

ICS 33.120.20

English version

Communication cables - Specifications for test methods Part 1-7: Electrical test methods - Velocity of propagation

Câbles de communication -
Spécifications des méthodes d'essai
Partie 1-7: Méthodes d'essais électriques -
Vitesse de propagation

Kommunikationskabel -
Spezifikationen für Prüfverfahren
Teil 1-7: Elektrische Prüfverfahren -
Ausbreitungsgeschwindigkeit

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CENELEC

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

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Ref. No. EN 50289-1-7:2001 E

Foreword

This European Standard was prepared by SC 46XC, Multicore, Multipair and Quad Data communication cables, of Technical Committee CENELEC TC 46X, Communication cables.

The text of the draft was submitted to the formal vote and was approved by CENELEC as EN 50289-1-7 on 2001-03-01.

The following dates were fixed:

- latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	2002-04-01
- latest date by which the national standards conflicting with the EN have to be withdrawn	(dow)	2004-04-01

This European Standard has been prepared under the European Mandate M/212 given to CENELEC by the European Commission and the European Free Trade Association.

Contents

1 Scope

Part 1-7 of EN 50289 details the test methods to determine the velocity of propagation of the finished cables used in analogue and digital communication systems.

It is to be read in conjunction with Part 1-1 of EN 50289, which contains essential provisions for its application.

2 Normative references

This European Standard 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 apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

EN 50289-1-1	2001	Communication cables – Specifications for tests methods -- Part 1-1: Electrical test methods – General requirements
EN 50289-1-11	2001	Communication cables - Specifications for test methods -- Part 1-11: Electrical test methods - Characteristic impedance, input impedance, return loss
EN 50290-1-2[1)]	-	Communication cables -- Part 1-2: Definitions

3 Definitions

For the purpose of this European Standard, the definitions of EN 50290-1-2 apply in addition to the following ones.

3.1
velocity of propagation

Phase velocity

The phase velocity of propagation, v_p, as defined in EN 50290-1-2, is derived from the measurement of the phase constant ß at known frequencies:

$$v_p = 2 \times \pi \times \frac{f}{\beta} \qquad (1)$$

[1)] At draft stage

Group velocity

The group velocity of propagation, ν_g, as defined in EN 50290-1-2, is derived from the measurement of the phase constant ß at known frequencies:

$$\nu_g = 2\times\pi\times\frac{df}{d\beta} \approx 2\times\pi\times\frac{\Delta f}{\Delta\beta} = 2\times\pi\times\frac{f_2 - f_1}{\beta_2 - \beta_1} \qquad (2)$$

where

ν = velocity of propagation in m/s;

ν_g = group velocity of propagation in m/s;

ν_p = phase velocity of propagation in m/s;

f = frequency, where $f_2 > f_1$;

β = phase constant in radians/m at frequency f_2 and f_1.

β may be either derived from a transmission measurement as indicated below or from an open/short circuit measurement as explained in EN 50289-1-11.

$$\beta \bullet L = \tfrac{1}{2}\times\arctan\left[\frac{2A}{(1-A^2)\times\sin(B)}\right] \qquad (3)$$

$$A = \sqrt{\frac{|Z_s|}{|Z_o|}} \qquad (4)$$

$$B = \tfrac{1}{2}(\varphi_s - \varphi_o) \qquad (5)$$

where

L = cable length in meter;

$|Z_o|$ = magnitude of the input impedance of the cable with an open circuit at the cable end;

$|Z_s|$ = magnitude of the input impedance of the cable with a short circuit at the cable end;

φ_o = phase angle of the input impedance of the cable with an open circuit at the cable end;

φ_s = phase angle of the input impedance of the cable with a short circuit at the cable end.

NOTE The velocity of propagation, group velocity and phase velocity are almost equal for frequencies greater than 1 MHz when measured on symmetric or coaxial cables (when the cables operate only in TEM mode).

4 Test method

4.1 Equipment

As an alternative to a network analyser a generator and phase meter or vector voltmeter may be used. Accuracy of test set up shall be better than 1 %.

4.2 Test sample

When symmetrical cables are to be measured, the ends of the cable under test (CUT) shall be prepared, such that when connected to the terminals of the test equipment the twisting of the pairs/quads is maintained.

4.3 Procedure

4.3.1 Calibration procedure

The phase shift of the test set-up shall be measured over the whole specified frequency range. The whole frequency range shall be measured with a linear sweep. The calibration data shall be recorded to enable the test results to be corrected.

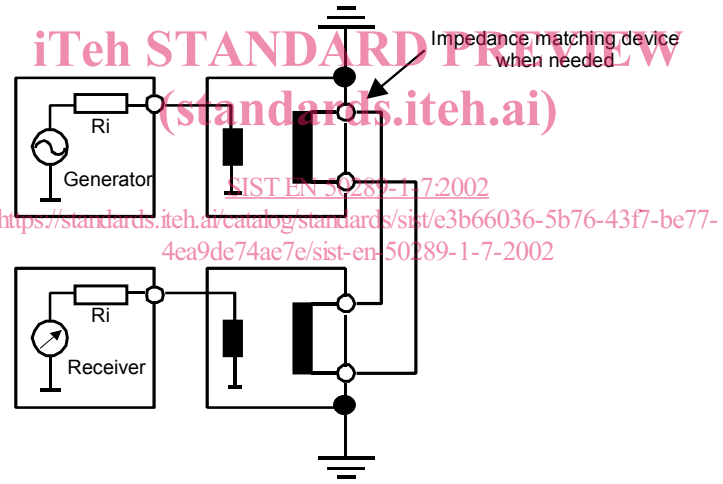

Figure 1 - Calibration set up

4.3.2 Measuring procedure

The CUT shall be connected to the terminators of the measuring devices/baluns. The set-up shall be optimised, such that the mismatching between the measuring ports and the CUT is minimised by the baluns and the impedance matching device. The phase shift shall be measured over the whole specified frequency range and at the same frequency points as for the calibration procedure. The whole frequency range shall be measured with a linear sweep. All pairs/quads of the CUT shall be measured.

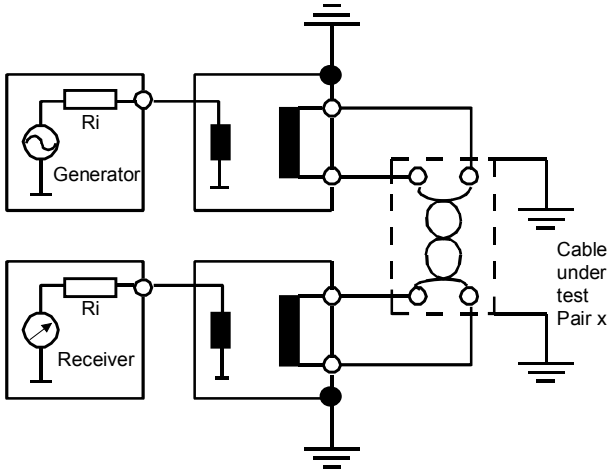

Figure 2 - Measuring set-up

5 Expression of test results

5.1 Phase measurement

For the evaluation of the velocity of propagation it is necessary to have full phase shift information. Normally phase meters and vector voltmeters measure the phase in the range of $-\pi$ and $+\pi$. In this case the phase shift has to be transformed into a monotonic decreasing function of frequency in the range of 0 and $-\infty$ (Figure 3).

Some network analysers provide this function.

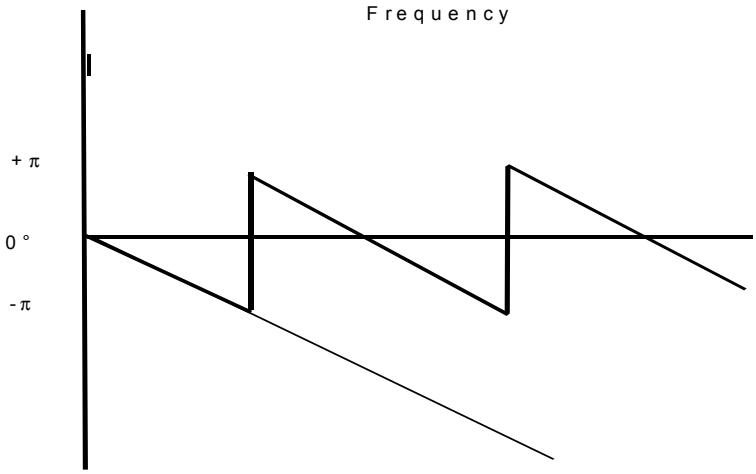

Figure 3 – Phase shift expanded