SLOVENSKI STANDARD
SIST EN 60835-2-4:2002/A1:2002

01-oktober-2002

Methods of measurement for equipment used in digital microwave radio transmission systems - Part 2: Measurements on terrestrial radio-relay systems - Section 4: Transmitter/receiver including modulator/demodulator - Amendment A1 (IEC 60835-2-4:1993/A1:1997)

Methods of measurement for equipment used in digital microwave radio transmission systems -- Part 2: Measurements on terrestrial radio-relay systems -- Section 4: Transmitter/receiver including modulator/demodulator

Meßverfahren für Geräte in digitalen Mikrowellen-Funkübertragungssystemen -- Teil 2: Messungen an terrestrischen Richtfunksystemen -- Hauptabschnitt 4: Sender/Empfänger einschließlich Modulator/Demodulator

Méthodes de mesure applicables au matériel utilisé pour les systèmes de transmission numérique en hyperfréquence -- Partie 2: Mesures applicables aux faisceaux hertziens terrestres -- Section 4: Emetteur/récepteur, modulateur/démodulateur inclus

Ta slovenski standard je istoveten z: EN 60835-2-4:1995/A1:1997

ICS:

33.060.30	Radiorelejni in fiksni satelitski komunikacijski sistemi	Radio relay and fixed satellite communications systems

SIST EN 60835-2-4:2002/A1:2002 en

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 60835-2-4/A1

December 1997

ICS 33.060.30

Descriptors: Radiocommunications, telecommunications, communication equipment, radio relay systems, microwave frequencies, digital technics, transmitters, receivers, modems, measurements, characteristics

English version

Methods of measurement for equipment used in digital microwave radio transmission systems
Part 2: Measurements on terrestrial radio-relay systems
Section 4: Transmitter/receiver including modulator/demodulator
(IEC 60835-2-4:1993/A1:1997)

Méthodes de mesure applicables au matériel utilisé pour les systèmes de transmission numérique en hyperfréquence
Partie 2: Mesures applicables aux faisceaux hertziens terrestres
Section 4: Emetteur/récepteur modulateur/démodulateur inclus
(CEI 60835-2-4:1993/A1:1997)

Meßverfahren für Geräte in digitalen Mikrowellen-Funkübertragungssystemen
Teil 2: Messungen an terrestrischen Richtfunksystemen
Hauptabschnitt 4: Sender/Empfänger einschließlich Modulator/Demodulator
(IEC 60835-2-4:1993/A1:1997)

This amendment A1 modifies the European Standard EN 60835-2-4:1995; it was approved by CENELEC on 1997-10-01. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this amendment the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CENELEC member.

This amendment exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the Central Secretariat has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

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

Central Secretariat: rue de Stassart 35, B - 1050 Brussels

Ref. No. EN 60835-2-4:1995/A1:1997 E

Foreword

The text of document 102/8/FDIS, future amendment 1 to IEC 60835-2-4:1993, prepared by IEC TC 102, Equipment used in mobile services and satellite communication systems, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as amendment A1 to EN 60835-2-4:1997 on 1997-10-01.

The following dates were fixed:

– latest date by which the amendment has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	1998-08-01
– latest date by which the national standards conflicting with the amendment have to be withdrawn	(dow)	1998-08-01

Endorsement notice

The text of amendment 1:1997 to the International Standard IEC 60835-2-4:1993 was approved by CENELEC as an amendment to the European Standard without any modification.

NORME INTERNATIONALE

INTERNATIONAL STANDARD

CEI
IEC
60835-2-4

1993

AMENDEMENT 1
AMENDMENT 1

1997-11

Amendement 1

Méthodes de mesure applicables au matériel utilisé pour les systèmes de transmission numérique en hyperfréquence –

Partie 2:
Mesures applicables aux faisceaux hertziens terrestres –
Section 4: Emetteur/récepteur, modulateur/démodulateur inclus

Amendment 1

Methods of measurement for equipment used in digital microwave radio transmission systems –

Part 2:
Measurements on terrestrial radio-relay systems –
Section 4: Transmitter/receiver including modulator/demodulator

International Electrotechnical Commission 3, rue de Varembé Geneva, Switzerland
Telefax: +41 22 919 0300 e-mail: inmail@iec.ch IEC web site http: //www.iec.ch

Commission Electrotechnique Internationale
International Electrotechnical Commission
Международная Электротехническая Комиссия

CODE PRIX
PRICE CODE F

Pour prix, voir catalogue en vigueur
For price, see current catalogue

FOREWORD

This amendment has been prepared by IEC technical committee 102: Equipment used in mobile sevices and satellite communication systems.

The text of this amendment is based on the following documents:

FDIS	Report on voting
102/8/FDIS	102/18/RVD

Full information on the voting for the approval of this amendment can be found in the report on voting indicated in the above table.

Page 3

CONTENTS

Add, on page 5, the following items:

Figures

Page 29

5.3 Selective fading signature

Add the following new text:

5.3.1 General considerations

Digital radio-relay systems designed for the transmission of high bit rates are susceptible to selective fading due to multipath propagation. This results in a BER which is higher than that which would be caused by flat fading of the same mean value.

In order to assess the sensitivity of the radio-relay system to the effects of multipath propagation during acceptance or type test, a "two-ray fading simulator" can be used in the i.f. or r.f. path of the receiver. Signatures measured with this simulator, as explained in the next subclause, are suitable for the comparison of different digital radio-relay systems and adaptive equalizers in their sensitivity to multipath fading, and also for predicting outage time due to selective fading in the field.

In the simplified block diagram of the two-ray fading simulator shown in figure 5, the i.f. or r.f. input signal is split into a direct path and a delayed path, simulating the direct and reflected signal components. The i.f. or r.f. output signal is derived by the combination of these two components. The voltage transfer function of the simulator, normalized to the gain of the direct path, can be expressed as:

$$| H(f) | = [\, 1 + b^2 - 2b \cos 2\pi (f - f_0)\, \tau \,]^{1/2}$$

where

b is the ratio of amplitudes of the delayed and direct path output signals;

τ is the delay which can be either positive, when the direct path signal is of higher amplitude than the delayed path signal, or negative when it is lower (minimum or non-minimum phase, respectively).

This periodic function has minima at frequencies for which $2\pi(f - f_0)\,\tau = 0, 2\pi, 4\pi,\ldots$ so the separation between these points is $1/\tau$, and the displacement of the nearest minimum from the channel band centre is f_0 (see figure 6).

To generate a single minimum value or notch within the channel band (which is the usual case during selective fading conditions), a delay time resulting in a notch separation much higher than the channel bandwidth is chosen. A commonly used value is τ = 6,3 ns, giving a separation of $1/\tau$ = 158,4 MHz.

Figure 5 shows the functional arrangement of the simulator. The notch depth and the notch frequency displacement f_0 from the band centre are adjustable to simulate the uneven amplitude response corresponding to selective fading conditions. The notch depth is controlled by adjusting the amplitude of the delayed and/or direct signal, while f_0 is controlled by phase adjustment. The notch tuning range should cover the channel bandwidth which depends upon the bit-rate transmitted and upon the type of modulation.

5.3.2 Method of measurement

The test arrangement for measuring signatures is the same as that shown in figure 3 for BER measurements except that the two-ray simulator is placed either at the r.f. or i.f. input of the receiver (see IEC 60835-2-8).

With a direct path only, i.e. high attenuation in the delayed path resulting in a flat response, nominal receiver input level corresponding to no fading is set (minimum phase). Following this adjustment, two measurement methods are possible.

Method 1

The notch offset frequency is set to several fixed values in the transmission band, and at each frequency, the notch depth is gradually increased until the specified threshold BER is reached, and this notch depth is noted.

Method 2

The notch depth is set to several fixed values, and for each notch depth, the notch offset frequency is gradually decreased, starting from outside the transmission band, for both positive and negative offset frequencies, until the specified threshold BER is reached, and these two notch offset frequencies are noted.

Method 2 gives more accurate results for large offset frequencies where the variation of notch depth with frequency is large, whereas Method 1 is more accurate for small offset frequencies where this variation is small.

The same measurements should be carried out also when the delayed path signal level is higher than the direct path signal level, i.e. for the non-minimum phase case.

Signature measurements are normally carried out at a nominal receiver input level to minimize the effect of thermal noise, and should be performed both by increasing and decreasing the notch depth at fixed frequencies (Method 1), and by increasing and decreasing the frequency of fixed depth notches (Method 2), in order to identify any hysteresis effects.

5.3.3 Presentation of results

The results of the signature measurement should be presented graphically by plotting the notch depths in decibels which produce the specified BER as a function of notch frequency displacement from the band centre, for both minimum phase and non-minimum phase conditions (see figure 7).

5.3.4 Details to be specified

The following items should be included, as required, in the detailed equipment specification:

a) receiver input level, dBm;

b) bit rate;

c) pseudo random sequence length;

d) measurement time of BER;

e) threshold BER, e.g. 10^{-3};

f) delay time to be used in the simulator e.g. 6,3 ns;

g) notch frequency displacement range (e.g. ±15 MHz) (Method 1);

h) required minimum notch depth in decibels, in the above notch frequency displacement range, resulting in the threshold BER stated in e) above;

I) notch depth (e.g. 12 dB) (Method 2);

j) required minimum notch frequency range, with the above notch depth, resulting in the threshold BER stated in e) above;

k) statement of minimum or non-minimum phase condition.

Page 39

Insert the following new figures:

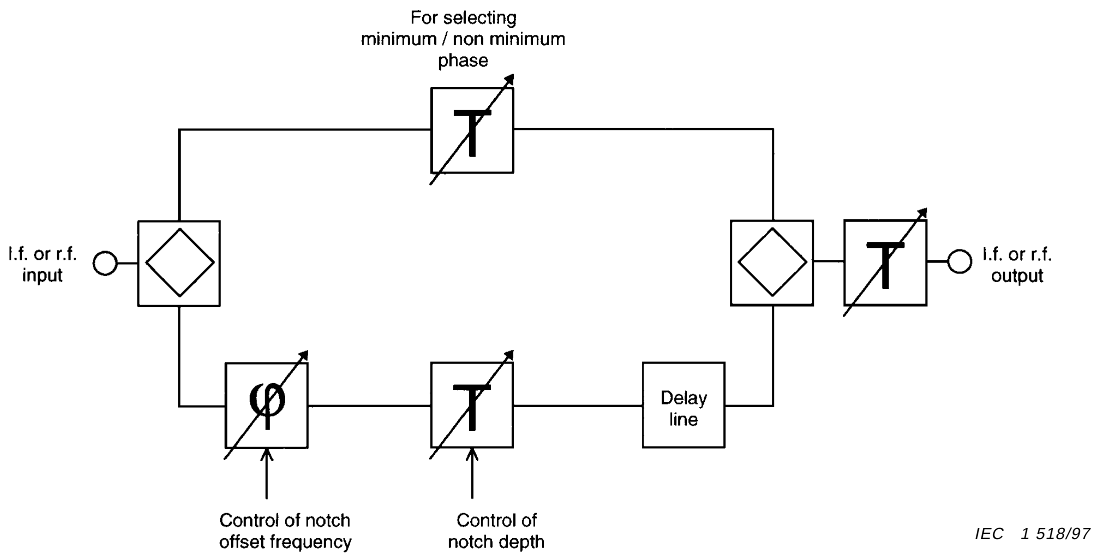

Figure 5 – Functional arrangement of the two-ray fading simulator

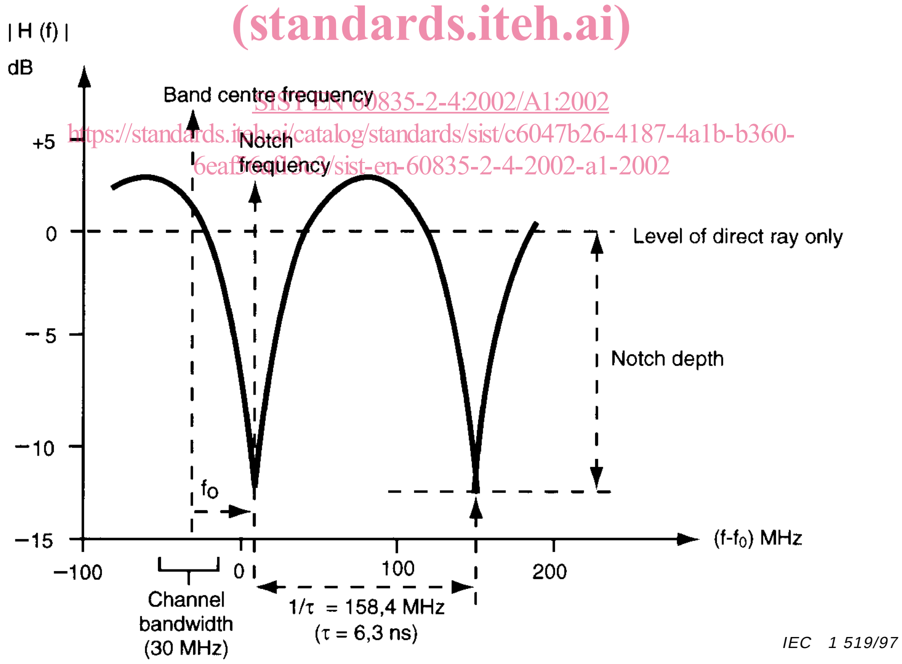

Figure 6 – Wideband frequency characteristic of the two-ray i.f. fading simulator