SLOVENSKI STANDARD
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Methods of measurement for equipment used in digital microwave radio transmission systems - Part 2: Measurements on terrestrial radio-relay systems - Section 11: Cross-polarization interference canceller (IEC 60835-2-11:1996)

Methods of measurement for equipment used in digital microwave radio transmission systems -- Part 2: Measurements on terrestrial radio-relay systems -- Section 11: Cross-polarization interference canceller

Meßverfahren für Geräte in digitalen Mikrowellen-Funkübertragungssystemen - Teil 2: Messungen an terrestrischen Richtfunksystemen -- Hauptabschnitt 11: Kreuzpolarisations-Interferenz-Unterdrücker

Méthodes de mesure applicables au matériel utilisé pour les systèmes de transmission numérique en hyperfréquence -- Partie 2: Mesures applicables aux faisceaux hertziens terrestres -- Section 11: Dispositifs d'annulation du brouillage de polarisation croisée

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English version

Methods of measurement for equipment used in digital microwave radio transmission systems
Part 2: Measurements on terrestrial radio-relay systems
Section 11: Cross-polarization interference canceller
(IEC 835-2-11:1996)

Méthodes de mesure applicables au matériel utilisé pour les systèmes de transmission numérique en hyperfréquence
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Meßverfahren für Geräte in digitalen Mikrowellen-Funkübertragungssystemen
Teil 2: Messungen an terrestrischen Richtfunksystemen
Hauptabschnitt 11: Kreuzpolarisations-Interferenz-Unterdrücker
(IEC 835-2-11:1996)

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CENELEC
European Committee for Electrotechnical Standardization
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Europäisches Komitee für Elektrotechnische Normung

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Foreword

The text of document 12E/263/FDIS, future edition 1 of IEC 835-2-11, prepared by SC 12E, Radio-relay and fixed satellite communication systems, of IEC TC 12, Radiocommunications, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 60835-2-11 on 1996-10-01.

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) 1997-07-01
- latest date by which the national standards conflicting with the EN have to be withdrawn (dow) 1997-07-01

Annexes designated "normative" are part of the body of the standard.
In this standard, annex ZA is normative.
Annex ZA has been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 835-2-11:1996 was approved by CENELEC as a European Standard without any modification.

Annex ZA (normative)

Normative references to international publications with their corresponding European publications

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).

NOTE: When an international publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

Publication	Year	Title	EN/HD	Year
IEC 835-2-8	1993	Methods of measurement for equipment used in digital microwave radio transmission systems Part 2: Measurements on terrestrial radio-relay systems Section 8: Adaptive equalizer	EN 60835-2-8	1993

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

Part 2:
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Section 11: Cross-polarization interference canceller

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

METHODS OF MEASUREMENT FOR EQUIPMENT USED IN DIGITAL MICROWAVE RADIO TRANSMISSION SYSTEMS –

Part 2: Measurements on terrestrial radio-relay systems –

Section 11: Cross-polarization interference canceller

FOREWORD

1) The IEC (International Electrotechnical Commission) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of the IEC is to promote international cooperation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, the IEC publishes International Standards. Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. The IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.

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International Standard IEC 835-2-11 has been prepared by subcommittee 12E: Radio-relay and satellite communication systems, of IEC technical committee 12: Radiocommunications.

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

FDIS	Report on voting
12E/263/FDIS	12E/271/RVD

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

INTRODUCTION

To make a more efficient use of the radio spectrum, multi-state modulation techniques are employed. These techniques have improved the spectral efficiency of the radio channel by increasing the number of modulation states for example 16 QAM, 64 QAM or 256 QAM.

Another attractive method for achieving the high spectral efficiency is to transmit two different signals simultaneously on orthogonal polarizations at the same nominal carrier frequency over the same hop. This method may double the transmission capacity of digital radio systems but there is a limited isolation between the signals because the orthogonal polarization cannot be perfectly achieved due to imperfect waveguide and antenna alignments. Moreover, that limited isolation is still further reduced by various conditions such as multipath propagation or rainfall, and is of a time-variant nature. Consequently, dual-polarized channels sharing the same nominal carrier frequency face mutual interference. Therefore, in the case of high multi-state modulation, it is necessary to use adaptive countermeasures against the cross-polarization interference. In practice, such cross-polarization interference cancellers (XPICs) are usually included in demodulators.

Adaptive XPICs consist of i.f. or baseband transversal filters in order to handle dispersive signals and interference due to multipath propagation. Moreover, there are two kinds of transversal filters. One is the baud-space transversal filter and the other is the fractional-space one, whose delay period per one tap is generally half of that of the baud-space transversal filter.

An example of the XPIC operation is illustrated in figure 1. For convenience, the orthogonal polarizations are referred as horizontal (H) polarization and vertical (V) polarization, respectively. In the figure, the i.f. transversal filter is shown for simplicity. The operation of the baseband transversal filter is essentially equivalent to that of the i.f. filter. The figure illustrates how the XPICs operate by using the received V-polarization signal and adjusting its amplitude and phase by means of the transversal filter.

As a result, the cross-polarization interference present in the received H-polarization signal is reduced by subtracting the adjusted V-polarization signal (cancelling signal). Modification of the amplitude and phase is accomplished over the entire bandwidth of the signal, since the frequency characteristics of the cross-polarization interference are different from those of the received cross-polarization main signal.

Figure 1 shows only the effect of V to H depolarization. There is also the effect of the H to V depolarization. Therefore, practical XPICs have structures as shown in figure 2. The transversal filters that cancel the cross-polarization interference depolarized from the V-polarization signal are adaptively controlled to minimize the V component of the H error signal.

The results of the measurements depend not only on the XPIC but also on the demodulator. These measurements are only applicable if suitable i.f. interface points are available.

METHODS OF MEASUREMENT FOR EQUIPMENT USED IN DIGITAL MICROWAVE RADIO TRANSMISSION SYSTEMS –

Part 2: Measurements on terrestrial radio-relay systems –

Section 11: Cross-polarization interference canceller

1 Scope

This section of IEC 835-2 deals with measurement for cross-polarization interference cancellers (XPIC) used in digital microwave radio-relay systems.

2 Normative reference

The following normative document contains provisions which, through reference in this text, constitute provisions of this section of IEC 835-2. At the time of publication, the edition indicated was valid. All normative documents are subject to revision, and parties to agreements based on this section of IEC 835-2 are encouraged to investigate the possibility of applying the most recent edition of the normative document indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

IEC 835-2-8: 1993, *Methods of measurement for equipment used in digital microwave radio transmission systems – Part 2: Measurements on terrestrial radio-relay systems – Section 8: Adaptive equalizer*

3 Static characteristics

3.1 *C/N versus cross-polarization isolation (XPI) (flat fading condition)*

3.1.1 *General considerations*

Cross-polarization isolation (XPI) as defined for two radio waves transmitted with the same power and orthogonal polarizations, is the ratio at the reception point of the power received from one of the waves to the power from the other wave, in the expected polarization of the first wave.

At relatively high C/N values (low noise), the BER is essentially determined by the XPI. A constant BER, for example 10^{-4}, resulting from the cross-polarization interference, will depend on the XPIC performance. Furthermore, it is important to measure the lock-in performance by decreasing the value of the cross-polarization interference from a lock-out state as well as the XPIC performance (hereinafter referred to as ordinary performance measurement) measured by increasing the value of the cross-polarization interference from a lock-in state.