
Methods of measurement for equipment used in digital microwave radio transmission systems - Part 2: Measurements on terrestrial radio-relay systems - Section 6: Protection switching (IEC 60835-2-6:1995)

Methods of measurement for equipment used in digital microwave radio transmission systems -- Part 2: Measurements on terrestrial radio-relay systems -- Section 6: Protection switching

Meßverfahren für Geräte in digitalen Mikrowellen-Funkübertragungssystemen -- Teil 2: Messungen an terrestrischen Richtfunkssystemen -- Hauptabschnitt 6: Schutzschaltungen

Méthodes de mesure applicables au matériel utilisé pour les systèmes de transmission numérique en hyperfréquence -- Partie 2: Mesures applicables aux faisceaux hertziens terrestres -- Section 6: Commutation de protection

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EN 60835-2-6

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Descriptors: Radiocommunications, telecommunications, communication equipment, digital technics, radio-relay systems, microwave frequencies, measurements, switching, protection

English version

**Methods of measurement for equipment used in digital
microwave radio transmission systems
Part 2: Measurements on terrestrial radio-relay systems
Section 6: Protection switching
(IEC 835-2-6:1995)**

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

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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.

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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

Foreword

The text of document 12E(CO)168, future edition 1 of IEC 835-2-6, 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 60835-2-6 on 1995-03-06.

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) 1996-03-01
- latest date by which the national standards conflicting with the EN have to be withdrawn (dow) 1996-03-01

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 835-2-6:1995 was approved by CENELEC as a European Standard without any modification.

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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.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 835-1-3	1992	Methods of measurement for equipment used in digital microwave radio transmission systems Part 1: Measurements common to terrestrial radio-relay systems and satellite earth stations - Section 3: Transmission characteristics	EN 60835-1-3	1995
IEC 835-2-5	1993	Part 2: Measurements on terrestrial radio-relay systems - Section 5: Digital signal processing sub-system	EN 60835-2-5	1995

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INTERNATIONALE
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60835-2-6

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1995-03

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

Partie 2:

**Mesures applicables aux faisceaux hertziens
terrestres**

Section 6: Commutation de protection

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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 6: Protection switching

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Commission Electrotechnique Internationale
International Electrotechnical Commission
Международная Электротехническая Комиссия

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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 6: Protection switching**

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.
- 2) The formal decisions or agreements of the IEC on technical matters, prepared by technical committees on which all the National Committees having a special interest therein are represented, express, as nearly as possible, an international consensus of opinion on the subjects dealt with.
- 3) They have the form of recommendations for international use published in the form of standards, technical reports or guides and they are accepted by the National Committees in that sense.
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International Standard IEC 835-2-6 has been prepared by sub-committee 12E: Radio-relay and fixed satellite communication systems, of IEC technical committee 12: Radio-communications.

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

DIS	Report on voting
12E(CO)168	12E/251/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.

IEC 835 consists of the following parts, under the general title: Methods of measurement for equipment used in digital microwave radio transmission systems and satellite earth stations.

- Part 1: 1990, Measurements common to terrestrial radio-relay systems and satellite earth stations.
- Part 2: 1990, Measurements on terrestrial radio-relay systems.
- Part 3: 1990, Measurements on satellite earth stations.

INTRODUCTION

The CCIR Recommendation 753* provides a general background to protection methods and characteristics. In particular, section 3 of the annex 1 of this recommendation outlines the methods of protection and gives an overview of the types of protection arrangements. The principal factors influencing the choice of switching criteria are also stated.

Classes of protection switching equipment

The main classes of automatic protection switching equipment are associated with digital radio-relay systems. In the first type, a no-break, slipless change-over is effected in conditions where the main channel performance degrades sufficiently slowly to allow a standby channel of equal transmission delay to be made ready and duly substituted. In the second type, switching to the standby path takes no account of transmission delay difference and consequently, the change-over generally results in a short break of transmission, accompanied by a delay difference in the transmission path. When this delay difference exceeds a certain threshold, this may result in a slip (i.e. the addition or loss of one or more bits) in the downstream equipment. A switching operation may be termed hitless if the change-over is slipless, and is such that no errors are introduced when both the operating and standby channel have no errors, and the switching is effected without overriding the switching logic.

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A typical automatic slipless protection system in which a number of channels are protected for example by a single protection channel (N+1 system) is described in the following sub-clause. Protection systems using two protection channels (N+2 systems) operate in a similar manner.

For a given direction of transmission between two adjacent terminal equipments in a digital radio-relay system, one of a group of channels is dedicated to serve as a standby channel. Each channel to be protected may be assigned a priority rating in respect of its ability to command the use of the standby channel. Channels with equal priority status are protected on a "first come, first served" basis. When not used for protection, the standby channel may carry occasional traffic; in this case, the occasional traffic has no priority, and will be removed as soon as any operating channel needs the standby channel. The principal criteria for initiating a switchover between any one of the main channels and the standby channel are as follows:

- a) loss of signal, i.e. data missing or loss of synchronization;
- b) degradation of the operating channel, resulting in a BER in excess of a predetermined value (within a range of 10^{-3} to 10^{-6} , for example);
- c) restoration of a previously failed main channel, i.e. an improvement of the BER to better than a predetermined value (typically one-to-two orders of magnitude better than in item b).

* CCIR Recommendation 753: *Preferred methods and characteristics for the supervision and protection of digital radio-relay systems*. (Geneva, 1992)

When protection is required at the receive terminal and when the protection channel is in normal condition and not occupied, the transmit terminal is instructed, via an associated control signal, to apply the traffic of the appropriate channel to the standby channel input. Traffic continues to be applied in parallel to the original channel so that both channels are carrying nominally identical traffic.

At the receive terminal, the signal of the standby channel (and in some implementations, the operating channel also) passes via a variable delay element. As the digital signal is present both at the output of the main channel and the standby channel, they are compared bit by bit, and the delay difference is systematically removed until an acceptable correlation is measured between the two inputs to the comparator. When this is achieved, the standby channel is switch-selected at the receive terminal in place of the main channel. The change-over is thus arranged to give only an acceptable number of errors.

The change-over is also called slipless if bit coincidence is achieved immediately prior to switching.

If loss of signal in a main channel occurs, no comparison can take place. In such cases, the receive terminal will automatically force a change-over after a given delay has occurred. Confirmation of successful change-over is exchanged via the supervisory control signal.

Once the performance of the main channel is deemed to be satisfactory, receive-end slipless switch-back from the standby channel to the appropriate main channel follows. In the case of N+1 or N+2 protection systems, confirmation of successful change-over is then passed, via the supervisory control signal, to the transmit terminal where switching is also restored to free the standby channel, and thus make it available for the protection of other channels.

In some protection switching systems, two BER switching criteria are applied in the range of 10^{-6} to 10^{-3} . In this case, if the standby channel is occupied by the channel in which only the lower BER is exceeded, and another main channel with a BER exceeding the higher criterion or in the "loss-of-signal" condition needs protection, the former channel is switched back to its original position and the standby channel will be occupied by the latter channel.

In comparison with the above slipless protection switching system, non-slipless protection switching systems are simpler in concept. Upon request from the receive terminal to implement a change-over, the transmit terminal switches the traffic to the standby channel (i.e. parallel transmission over main and standby channels takes place). The receive terminal then switches to the standby channel once satisfactory transmission is confirmed. No attempt is made to remove the transmission delay difference between the main and standby channel. This may result in a brief interruption or even a slip in the operating path.

In addition to automatic protection switching facilities, most equipment offers the facility for switching under manual control. This control may be carried out directly at the terminals, and in some cases also by means of an associated supervisory and control channel.