

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

Part 3: Measurements on satellite earth stations —

Section 3.9 Terminal equipment SCPC-PSK

The European Standard EN 60835-3-9:1995 has the status of a
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ICS 33.060.30

Committees responsible for this British Standard

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- British Broadcasting Corporation
- British Radio and Electronic Equipment Manufacturers' Association
- British Telecommunications plc
- ERA Technology Ltd.
- Institution of Electrical Engineers
- Radio, Electrical and Television Retailers' Association
- Radiocommunications Agency

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National foreword

This British Standard has been prepared by Technical Committee EPL/12 and is the English language version of EN 60835-3-9:1995 *Methods of measurement for equipment used in digital microwave radio transmission systems — Part 3: Measurements on satellite earth stations — Section 3.9 Terminal equipment — SCPC-PSK*, published by the European Committee for Electrotechnical Standardization (CENELEC). It is identical with IEC 835-3-9:1993, published by the International Electrotechnical Commission (IEC).

BS EN 60835 is published in three Parts. The other Parts are:

- *Part 1: Measurements common to terrestrial radio-relay systems and satellite earth stations;*
- *Part 2: Measurements on terrestrial radio-relay systems.*

Some of the many Sections of the three Parts have appeared under the number BS 7573, of the same generic title.

When using this British Standard, reference is required to BS EN 60835-1-1.2, BS EN 60835-1-1.3¹⁾ and BS EN 60835-1-1.4¹⁾.

This Section of BS EN 60835 covers methods of measurement on Single-Channel-Per-Carrier, Phase-Shift-Keying, (SCPC-PSK) terminal equipment using pulse code modulation (PCM) encoding. The terminal can be used in a pre-assigned mode or be integrated in a Demand Assignment Multiple Access (DAMA) network.

The methods described are applicable to SCPC-PSK equipment used in international satellite systems and most of the methods are also applicable to systems used in domestic or regional satellite systems.

Cross-references

Publication referred to	Corresponding British Standard
	BS EN 60835 <i>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</i>
EN 60835-1-2:1993 (IEC 835-1-2:1992)	Section 1.2:1995 <i>Basic characteristics</i>
EN 60835-1-3:1995 (IEC 835-1-3:1992)	Section 1.3:1995 <i>Transmission characteristics</i> ¹⁾
EN 60835-1-4:1992 (IEC 835-1-4:1992)	Section 1.4:1995 <i>Transmission performance</i> ¹⁾

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Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, the EN title page, pages 2 to 18, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

¹⁾ In preparation.

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English version

Methods of measurement for equipment used in digital
microwave radio transmission systems
Part 3: Measurements on satellite earth stations
Section 9: Terminal equipment SCPC-PSK

(IEC 835-3-9:1993)

Méthodes de mesure applicables au matériel
utilisé pour les systèmes de transmission
numérique en hyperfréquence
Partie 3: Mesures applicables aux stations
terriennes de télécommunications par satellite
Section 9: Equipement terminal SCPC-MDP
(CEI 835-3-9:1993)

Meßverfahren für Geräte in digitalen
Mikrowellen-Funkübertragungssystemen
Teil 3: Messungen an Satelliten-Erdfunkstellen
Hauptabschnitt 9: SCPC-PSK-Endgeräte
(IEC 835-3-9:1993)

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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.

This European Standard 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.

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CENELEC

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

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Foreword

The text of the International Standard IEC 835-3-9:1993, prepared by SC 12E, Radio-relay and fixed satellite communications systems, of IEC TC 12, Radiocommunications, was submitted to the formal vote and was approved by CENELEC as EN 60835-3-9 on 1994-12-06 without any modification.

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) 1995-12-01
- latest date by which the national standards conflicting with the EN have to be withdrawn (dow) 1995-12-01

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.

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Introduction

A block diagram of a typical SCPC-PSK terminal is shown in Figure 1. The terminal may be divided into two portions; the channel units and the intermediate frequency (i.f.) sub-system. The channel units accept voice or data signals and modulate i.f. carriers, and vice versa. Only one voice or data channel is processed by a channel unit. Therefore, numbers of channel units, the number depending on the traffic requirements, are usually installed in an earth station. The channel units for voice and data are different.

For example, on the transmit-side, a channel unit for voice accepts a voice signal and converts it to a PCM signal at 56 kbit/s. A voice detector is provided to detect the existence of the voice signal and to radiate a carrier only while the voice signal is active. The output carrier therefore becomes a stream of short bursts. A channel synchronizer (transmit-side) attaches a preamble word at the beginning of each burst and inserts frame synchronizing words at specified intervals. The output signal of the channel synchronizer, e.g. 64 kbit/s, is applied to a PSK modulator where biphase or quadriphase phase shift keying modulation is performed on the carrier. The output carrier frequency is controlled by a transmit frequency synthesizer.

On the receive-side, the received, PSK-modulated i.f. carrier is selected by a receive frequency synthesizer and demodulated by a PSK demodulator. The demodulated PCM signal, e.g. 64 kbit/s, is applied to a channel synchronizer (receive-side), and word synchronization is achieved. The voice signal is then recovered by a PCM decoder.

In the case of a channel unit used for data signals, an incoming data signal, e.g. at a bit-rate of 48 kbit/s or 56 kbit/s, is scrambled and combined with additional bits for error correction in a data encoder. The encoded signal, e.g. 64 kbit/s, is then applied to a PSK modulator which is the same as that used for voice signals. On the receive-side, the recovered signal from the PSK demodulator is applied to a data decoder, where correct code synchronization is recovered and error correction is performed.

The output signal of each PSK modulator is applied to an i.f. combiner in the i.f. sub-system and combined with each other. A reference pilot signal is also combined in the case of the reference earth station. The combined i.f. signal is amplified and sent to the up-converter in the earth station i.f./r.f. equipment. The received i.f. signal from the down-converter is first applied to automatic frequency control (a.f.c.) and automatic gain control (a.g.c.) circuits, where any frequency inaccuracy arising from the local oscillators of the satellite transponder and/or earth station i.f./r.f. equipment is corrected using the reference pilot signal. The a.g.c. function also uses the pilot signal. The output frequency of the a.f.c. and a.g.c. circuits may differ from the input frequency because of frequency conversion during the a.f.c. function. It may also differ between manufacturers' equipment. The output signal is then divided by an i.f. divider and applied to the PSK demodulator of the channel units.

1 Scope

This section of IEC 835-3 deals with methods of measurement on Single-Channel-Per-Carrier, Phase-Shift-Keying, (SCPC-PSK) terminal equipment utilizing PCM encoding. The SCPC-PSK terminal may be used in a pre-assigned mode or integrated in a Demand Assignment Multiple Access (DAMA) network.

The measurement methods described in this section are applicable to SCPC-PSK equipment used in international satellite systems. However, most of the methods of measurement will also be applicable to systems used in domestic or regional satellite systems.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this section of IEC 835-3. At the time of publication, the editions indicated were valid. All normative documents are subject to revision, and parties to agreements based on this section of IEC 835-3 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

IEC 835-1-2:1992, *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 2: Basic characteristics.*

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.*

IEC 835-1-4:1992, *Methods of measurement for equipment used in digital microwave radio transmission systems — Part 1: Measurements common to terrestrial radio-relay and satellite earth stations — Section 4: Transmission performance.*

CCITT Recommendation G.712, *Performance characteristics of PCM channels between 4-wire interfaces at voice frequencies.*

CCITT Recommendation O.41, *Specification for a psophometer for use on telephone — type circuits.*

CCITT Recommendation O.131, *Specification for a quantizing distortion measuring apparatus using a pseudo-random noise stimulus.*

CCITT Recommendation O.132, *Specification for a quantizing distortion measuring equipment using a sinusoidal test signal.*

3 PCM channel codec

The following methods of measurement are in accordance with CCITT Recommendations (see CCITT Recommendation G.712). The measurement can be performed by a loopback connection either at i.f., or at the digital side, of the PCM codec, whichever is the most convenient. A typical arrangement for measuring the performance of a PCM channel codec is shown in Figure 2. When the i.f. loopback connection method is used, the voice detector circuit shall be disabled so that the i.f. signal is transmitted regardless of the presence or absence of a voice input signal.

3.1 Idle channel noise level

3.1.1 Definition

The idle channel noise level is the noise level at the output terminal of the PCM decoder in the absence of the input voice signal.

3.1.2 Method of measurement

The idle channel noise level is measured by noise measuring equipment connected to the output terminal of the PCM decoder with the input port of the PCM coder terminated by a matched load (see Figure 2). A noise weighting network as specified in CCITT Recommendation O.41 should be used.

3.1.3 Presentation of results

The results should be expressed in dBm0p, that is, psophometrically weighted noise level with reference to the test tone level.

3.1.4 Details to be specified

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

- a) the maximum permitted idle channel noise level;
- b) loopback connection method applied.

3.2 Total distortion including quantizing distortion

3.2.1 Definition

The signal-to-total distortion (including quantizing distortion) ratio is the ratio of the voice signal level to the total distortion level at the output terminal of the PCM decoder.

3.2.2 Method of measurement

The measurement can be performed by either of two methods. According to the first method given in CCITT Recommendation O.131, and shown in Figure 3, a band-limited pseudo-random noise signal (via filter F1, 350 Hz to 550 Hz), is applied to the input terminal of the PCM coder at specified levels (e.g. in the range of – 60 to 0 dBm0). At each level, the noise at the PCM decoder output terminal is measured by a noise receiver in two bands; first in the band 350 Hz to 550 Hz via filter F1, then in the band 800 Hz to 3 400 Hz via filter F2. The signal-to-total distortion ratio, given by the difference in decibels between the levels thus measured, has to be scaled from the measuring band of filter F2 (800 Hz to 3 400 Hz), to the total voice channel band (300 Hz to 3 400 Hz) by a factor equal to the ratio of these bands, that is by adding 0,76 dB to the result of the measurement.

According to the second method given in CCITT Recommendation O.132, a sinusoidal test signal is applied to the input terminal of the PCM coder at specified levels (e.g. in the level range given above). At each input level, the signal level at the PCM decoder output is measured. The test signal is then blocked by a narrow band rejection filter, and the total distortion product is measured by an r.m.s., or quasi-r.m.s., detector via a standard telephony noise weighting filter (see CCITT Recommendation O.41). The signal-to-total distortion ratio is given by the difference in decibels between the two measured levels.

This has to be scaled by a correction factor which is the difference in decibels between the measuring bandwidth, excluding the stop-band at the rejection frequency, and the total measuring bandwidth including the stop-band.