SIST

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Methods of measurement for radio equipment used in satellite earth stations - Part 2: Measurements for sub-systems - Section 6: Frequency demodulators (IEC 60510 -2-6:1992)

Methods of measurement for radio equipment used in satellite earth stations -- Part 2: Measurements for sub-systems -- Section 6: Frequency demodulators

Meßverfahren für Funkgerät in Satelliten-Erdfunkstellen -- Teil 2: Messungen an Untersystemen -- Hauptabschnitt 6: Frequenzdemodulatoren

Méthodes de mesure pour les équipements radioélectriques utilisés dans les stations terriennes de télécommunication par satellites -- Partie 2: Mesures sur les sous-ensembles -- Section 6: Démodulateurs de fréquence

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ICS:

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ENGLISH VERSION

Methods of measurement for radio equipment used in satellite earth stations
Part 2: Measurements for sub-systems
Section six: Frequency demodulators
(IEC 510-2-6:1992)

Méthodes de mesure pour les équipements radioélectriques utilisés dans les stations terriennes de télécommunication par satellites
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Section six: Démodulateurs de fréquence
(CEI 510-2-6:1992)

Meßverfahren für Funkgerät in Satelliten-Erdfunkstellen
Teil 2: Messungen an Untersystemen
Hauptabschnitt Sechs: Frequenzdemodulatoren
(IEC 510-2-6:1992)

This European Standard was approved by CENELEC on 1994-03-08. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard 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 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.

CENELEC members are the national electrotechnical committees of Austria, Belgium, 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

FOREWORD

The CENELEC questionnaire procedure, performed for finding out whether or not the International Standard IEC 510-2-6:1992 could be accepted without textual changes, has shown that no common modifications were necessary for the acceptance as European Standard.

The reference document was submitted to the CENELEC members for formal vote and was approved by CENELEC as EN 60510-2-6 on 8 March 1994.

The following dates were fixed:

- latest date of publication of an identical national standard	(dop)	1995-03-15
- latest date of withdrawal of conflicting national standards	(dow)	1995-03-15

Annexes designated "normative" are part of the body of the standard.
In this standard, annex ZA is normative.

ENDORSEMENT NOTICE

The text of the International Standard IEC 510-2-6:1992 was approved by CENELEC as a European Standard without any modification.

ANNEX ZA (normative)

OTHER INTERNATIONAL PUBLICATIONS QUOTED IN THIS STANDARD WITH THE REFERENCES OF THE RELEVANT 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.

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

IEC Publication	Date	Title	EN/HD	Date
510-1-3	1980	Methods of measurement for radio equipment used in satellite earth stations - Part 1: Measurements common to sub-systems and combinations of sub-systems - Section Three: Measurements in the i.f. range	-	-
510-1-4	1986	Section Four: Measurement in the baseband	-	-
510-2-5	1992	Part 2: Measurements for sub-systems Section five: Frequency modulators	EN 60510-2-5	1994
510-3	series	Part 3: Methods of measurement on combinations of sub-systems	EN 60510-3	series

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Methods of measurements for radio equipment used in satellite earth stations

Part 2:
Measurements for sub-systems
Section Six – Frequency demodulators

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

METHODS OF MEASUREMENT FOR RADIO EQUIPMENT USED IN SATELLITE EARTH STATIONS

Part 2: Measurements for sub-systems
Section six: Frequency demodulators

FOREWORD

1) 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.

2) They have the form of recommendations for international use and they are accepted by the National Committees in that sense.

3) In order to promote international unification, the IEC expresses the wish that all National Committees should adopt the text of the IEC recommendation for their national rules in so far as national conditions will permit. Any divergence between the IEC recommendation and the corresponding national rules should, as far as possible, be clearly indicated in the latter.

This standard has been prepared by Sub-Committee 12E: Radio relay and fixed satellite communications systems, of IEC Technical Committee No. 12: Radiocommunications.

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

Six Months' Rule	Report on Voting
12E(CO)119	12E(CO)130

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

The following IEC publications are quoted in this standard:

Publications Nos. 510-1-3 (1980):	Methods of measurement for radio equipment used in satellite earth stations - Part 1: Measurements common to sub-systems and combinations of sub-systems - Section three: Measurements in the i.f. range.
510-1-4 (1986):	Section four: Measurements in the baseband.
510-2-5 (1992):	Part 2: Measurements for sub-systems - Section five: Frequency modulators.
510-3:	Part 3: Methods of measurement for combinations of sub-systems.

METHODS OF MEASUREMENT FOR RADIO EQUIPMENT USED IN SATELLITE EARTH STATIONS

Part 2: Measurements for sub-systems
Section six: Frequency demodulators

1 Scope

Methods are given in this section for the measurement of the electrical characteristics of frequency demodulators. Threshold and carrier-to-noise ratio measurements are included because these are essential for satellite systems. Where possible, only measurements involving the basic demodulator are considered, excluding the equipment comprising the de-emphasis network and the networks associated with sound sub-carrier signals, pilot signals and auxiliary signals.

Methods of measurement for frequency modulators are given in section five. Measurements between the baseband terminals of modulator/demodulator assemblies are covered by the various sections of part 3 of this publication.

2 Definition

For the purpose of this standard a frequency demodulator is a sub-system which, by analogue means, demodulates an intermediate frequency (i.f.) carrier which has been frequency modulated by a baseband signal. This may be a multi-channel telephony or television signal with associated sound sub-carrier signals, pilot signals and auxiliary signals.

Such baseband signals are normally analogue but digital signals are not excluded. However, the methods or measurement described in this section are intended for assessing the performance of the demodulator when analogue signals are transmitted. A demodulator sub-system usually comprises the following three main sections:

- an intermediate frequency (i.f.) section;
- an i.f. to baseband section (e.g. discriminator);
- a baseband section.

3 General

A block diagram for a typical demodulator as used in satellite earth stations is shown in figure 1.

Currently, two different types of demodulator are used, namely conventional demodulators and threshold-extension demodulators.

The characteristics to be measured can be divided into three principal categories:

- non-transfer characteristics;
- i.f. to baseband characteristics;
- certain baseband-to-baseband transmission characteristics in conjunction with a measurement modulator.

The first category of measurements applies to i.f. input measurements (see 4) and baseband output measurements (see 5).

The second category of measurements forms the essential part of this section because of the nature of the device under test - transfer from i.f. to baseband. In order to assess the influence of the i.f. input level, some specified tests shall be made at nominal, minimum and maximum specified i.f. input levels.

NOTE - Measurement of the influence of spurious amplitude modulation is not included in this Standard since the input level is assumed to be entirely within the operating range of the limiter, the amplitude/phase conversion of the latter being assumed to be negligible.

The third category of measurements includes those to be carried out on the complete modulator/demodulator (modem) assembly except that the actual or system modulator is replaced by a measurement modulator.

It is very important to know the separate contribution of a demodulator to the total permitted tolerance of performance characteristics because, in an operational situation, demodulators of one design or manufacturer may have to work with modulators of another design or manufacturer. Compensation effects between modulator and demodulator are therefore undesirable and each demodulator should fulfil the prescribed specification in association with a measurement modulator. This procedure requires that the measurement modulator has a better performance than that specified for the demodulator under test.

4 I.F. input return loss

See part 1, section three of this publication: Measurements in the i.f. range.

Measurements at harmonics of the intermediate frequency may also be required.

5 Baseband output impedance and return loss

See part 1, section four of this publication: Measurements in the baseband.

6 Deviation sensitivity

6.1 *Definition and general considerations*

The deviation sensitivity (S_d) of a demodulator for a sinusoidal signal of a given frequency is expressed as the ratio of the peak value of the baseband output voltage (V_b) to the frequency deviation (Δf):

$$S_d = \frac{V_b}{\Delta f} \quad \text{(V/MHz)} \qquad (6\text{-}1)$$

V_b and Δf are both expressed in peak or r.m.s. values.

The deviation sensitivity of the demodulator is usually a function of the baseband frequency because of the effect of the de-emphasis network. In some cases, however, it is possible to gain access to the baseband output point (figure 1) before the de-emphasis network: in such cases, the measured deviation sensitivity of the discriminator is independent of the baseband frequency used.

6.2 *Methods of measurement*

Two methods for obtaining the deviation sensitivity by means of a test signal of accurately known deviation may be used, namely, the Bessel zero and the two-signal methods as discussed below.

In the first method, the measurement is made with a well-defined modulation index of 2,404 83 at relatively low modulation frequencies, e.g. less than about 2 MHz, whilst in the second method a low modulation index (e.g. not exceeding about 0,2) at relatively high modulation frequencies (e.g. above 2 MHz) is used. This latter method is therefore especially applicable to measurements at the pilot and sound sub-carrier frequencies.

6.2.1 *The Bessel zero method*

A suitable arrangement for measuring the deviation sensitivity of the demodulator and for calibrating the deviation of the measurement modulator is shown in figure 2.

The method of measurement is known as the Bessel zero method and calibration of the deviation sensitivity of the measurement modulator is based upon the fact that, in the case of sinusoidal modulation, the carrier frequency spectral line first disappears for a modulation index (m_f) given by:

$$m_f = \frac{\Delta f}{f} = 2{,}404\ 83 \qquad (6\text{-}2)$$

where Δf is the peak frequency deviation and f is the modulating frequency.

The "zero" or point of first disappearance of the i.f. carrier is observed on the spectrum analyzer, but a perfect zero may not be obtained due to residual harmonic distortion of the baseband signal generator. However, a decrease in carrier level of 30 dB or more is regarded as adequate.