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Methods of measurement of equipment used in terrestrial radio-relay systems - Part  
2: Measurements for sub-systems - Section 4: Frequency modulators

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METHODS OF MEASUREMENT FOR EQUIPMENT USED IN  
TERRESTRIAL RADIO-RELAY SYSTEMS  
PART 2: MEASUREMENTS FOR SUB-SYSTEMS  
SECTION FOUR - FREQUENCY MODULATORS

Méthodes de mesure applicables  
au matériel utilisé dans les  
faisceaux hertziens terrestres  
Deuxième partie: Mesures sur les  
sous-ensembles  
Section quatre - Modulateurs de  
fréquence

Meßverfahren für  
Geräte in terrestrischen  
Richtfunksystemen  
Teil 2: Messungen an Untersystemen  
Hauptabschnitt vier: Frequenzmodulatoren

BODY OF THE HD

The Harmonization Document consists of:

- IEC 487-2-4 (1984) ed 1; IEC/SC 12E, not appended

This Harmonization Document was approved by CENELEC on 1986-09-10.

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The English and French versions of this Harmonization Document are provided by the text of the IEC publication and the German version is the official translation of the IEC text. The German translation is available.

According to the CENELEC Internal Regulations the CENELEC member National Committees are bound:

to announce the existence of this Harmonization Document at national level  
by or before 1987-03-15

to publish their new harmonized national standard  
by or before 1987-09-15

to withdraw all conflicting national standards  
by or before 1987-09-15.

Harmonized national standards are listed on the HD information sheet,  
which is available from the CENELEC National Committees or from the CENELEC Central Secretariat.

The CENELEC National Committees are the national electrotechnical committees of Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxemburg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

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**Méthodes de mesure applicables au matériel  
utilisé dans les faisceaux hertziens terrestres**

Deuxième partie: Mesures sur les sous-ensembles

Section quatre — Modulateurs de fréquence

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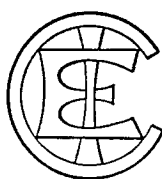
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**Methods of measurement for equipment  
used in terrestrial radio-relay systems**

Part 2: Measurements for sub-systems

Section Four — Frequency modulators

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## INTERNATIONAL ELECTROTECHNICAL COMMISSION

**METHODS OF MEASUREMENT FOR EQUIPMENT  
USED IN TERRESTRIAL RADIO-RELAY SYSTEMS**
**Part 2: Measurements for sub-systems  
Section Four — Frequency modulators**

## 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.
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PREFACE

This standard has been prepared by Sub-Committee 12E: Microwave Systems, of IEC Technical Committee No. 12: Radiocommunications.

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

Six Months' Rule	Report on Voting
12E(CO)87	12E(CO)104

Further information can be found in the Report on Voting indicated in the table above.

# METHODS OF MEASUREMENT FOR EQUIPMENT USED IN TERRESTRIAL RADIO-RELAY SYSTEMS

## Part 2: Measurements for sub-systems

### SECTION FOUR — FREQUENCY MODULATORS

#### 1. Scope

Methods are given in this section for the measurement of the electrical characteristics of frequency modulators. Furthermore, where possible, only measurements involving the basic modulator are considered, that is excluding the baseband section comprising the pre-emphasis network and the networks associated with sound sub-carrier signals, pilot signals and auxiliary signals. Methods of measurement for frequency demodulators are given in Section Five. Measurements between baseband terminals of modulator/demodulator assemblies are covered by various sections of Part 3 of this publication.

#### 2. Definition

For the purpose of this standard, a frequency modulator is a sub-system which, by analogue means, modulates an intermediate frequency (i.f.) carrier by a baseband signal. This may be a multi-channel frequency division multiplex (f.d.m.) telephony signal or television signal with associated sound sub-carrier signals, pilot signals and auxiliary signals.

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Such baseband signals are normally analogue but digital signals are not excluded. However, the methods of measurement described in this section are intended for assessing the performance of the modulator when analogue signals are transmitted.

A modulator sub-system usually comprises the following three main sections:

- a baseband section;
- a baseband to i.f. section (modulator);
- an i.f. section.

#### 3. General

A block diagram for a typical modulator sub-system is shown in Figure 1, page 24. The characteristics to be measured can be divided into three principal categories:

- Non-transfer characteristics.
- Baseband to i.f. characteristics.
- Certain baseband-to-baseband transmission characteristics in conjunction with a measurement demodulator.



The first category concerns measurements at the baseband port only and at the i.f. port only including frequency and spurious/harmonic signal measurements at the i.f. output. These measurements are described elsewhere in this publication.

The second category of measurements forms an essential part of this section because of the nature of the device under test: transfer from baseband to i.f.

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

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

#### 4. I.F. output characteristics

##### 4.1 *Return loss*

See Part 1, Section Three of this publication: Measurements in the Intermediate-frequency Range.

##### 4.2 *Level*

See Part 1, Section Three of this publication.

##### 4.3 *Carrier frequency*

See Part 1, Section Three of this publication.

##### 4.4 *Spurious and/or harmonic signals*

See Part 1, Section Three of this publication.

#### 5. Baseband input 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  $S_m$  of a modulator, for a sinusoidal signal of a given frequency, is expressed as the ratio of the frequency deviation  $\Delta f$  to the peak value of the baseband input voltage  $V_b$ :

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

$V_b$  and  $\Delta f$  are both expressed in peak values or both in r.m.s. values.