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Methods of measurement of equipment used in terrestrial radio-relay systems - Part 3: Simulated systems - Section 4: Measurements for f.d.m. transmission

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KEY WORDS: Terrestrial radio-relay; radio terminal equipment; requirements; testing; certain conditions

METHODS OF MEASUREMENT FOR EQUIPMENT USED IN TERRESTRIAL RADIO-RELAY SYSTEMS
PART 3: SIMULATED SYSTEMS
SECTION FOUR - MEASUREMENTS FOR F.D.M. TRANSMISSION

Méthodes de mesure applicables au matériel utilisé dans les faisceaux hertziens terrestres
Troisième partie: Liaisons simulées
Section quatre - Mesures pour la transmission de la téléphonie multivoie à m.r.f.

Meßverfahren für Geräte in terrestrischen Richtfunksystemen
Teil 3: Simulierte Systeme
Hauptabschnitt vier: Messungen bei Frequenzmultiplex-Übertragung

BODY OF THE HD

The Harmonization Document consists of:

- IEC 487-3-4 (1982) ed 1; IEC/SC 12E, not appended

This Harmonization Document was approved by CENELEC on 13 September 1988.

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.

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 1989-04-01

to publish their new harmonized national standard by or before 1989-10-01

to withdraw all conflicting national standards by or before 1989-10-01.

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

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

Part 3: Simulated systems

Section Four — Measurements for f.d.m. transmission

Mots clés: faisceaux hertziens terrestres; équipement de raccordement de voie radioélectrique; mesure; exigences; conditions déterminées.

Key words: terrestrial radio-relay; radio terminal equipment; requirements; testing; certain conditions.

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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

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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.

PREFACE

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

A draft of Section Four was discussed at the meeting held in Berlin in 1973. As a result of this meeting, a draft, Document 12E(Central Office)27, was submitted to the National Committees for approval under the Six Months' Rule in September 1975.

As a result of the votes and comments received, an amended draft, Document 12E(Central Office)51, was submitted to the National Committees for approval under the Two Months' Procedure in October 1976.

The National Committees of the following countries voted explicitly in favour of publication:

Australia	Hungary
Austria	Japan
Belgium	Poland
Brazil	Romania
Canada	South Africa (Republic of)
Denmark	Sweden
Egypt	Turkey
France	United Kingdom
Germany	United States of America

Other IEC publications quoted in this standard:

Publications Nos. 487-3-1: Methods of Measurement for Equipment Used in Terrestrial Radio-relay Systems, Part 3: Simulated Systems.
Section One: General *(at present Publication 487-3).*

487-3-3: Section Three: Measurements for Monochrome and Colour Television Transmission.

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

Part 3: Simulated systems

SECTION FOUR – MEASUREMENTS FOR F.D.M. TRANSMISSION

1. Scope

This section deals with baseband-to-baseband measurements of the noise performance of simulated radio-relay systems used for frequency division multiplex (f.d.m.) telephony. These measurements are signal-related and are additional to those already given in Part 3, Section Two of this publication, Measurements in the Baseband, which are common to telephony, television and sound programme transmission.

2. Definitions and general considerations

The noise loading performance of a system is the noise power measured in a chosen narrow measuring channel, which simulates an unloaded telephone channel, when the baseband is loaded with random noise of uniform spectrum (white noise) at a conventional loading level (see Subclause 2.1). White noise applied to the baseband input of the system under test is limited to the frequency band occupied by the telephone channels by means of a high-pass and a low-pass filter. Noise measuring channels are provided by means of narrow band-stop filters which allow performance to be measured at several frequencies including channels located close to the bottom, middle and top of the baseband frequency range.

The total noise appearing within a noise measuring channel at the system output comprises basic noise and intermodulation noise (sometimes referred to as "idle noise" and "distortion noise" respectively). It is therefore common practice to measure the noise within each noise measuring channel with the baseband loaded with noise and then unloaded, in order to obtain the total noise and basic noise separately; from these results the intermodulation noise may be obtained.

The noise performance may be expressed as a noise power ratio (n.p.r.), a signal-to-noise ratio, in units of noise power or noise power level referred to the system zero relative level point. The units used may be picowatts, decibels above 1 pW or decibels below 1 mW, and they may be specified as a weighted or unweighted value.

Noise power ratio is defined as the ratio of the noise power in a measuring channel when the baseband is fully loaded with noise, to the power in that channel either with all the baseband loaded except the measuring channel (i.e. total noise) or with all the baseband unloaded (i.e. basic noise). n.p.r. is always expressed as a positive number of decibels.

Signal-to-noise ratio is defined as the ratio of the power of the standard test tone (0 dBm0) to the noise power, in a specified bandwidth within the noise measuring channel, both being referred to the same point in the circuit. Signal-to-noise ratio may be measured weighted or unweighted and is expressed as a positive number in decibels.

Conversion between commonly encountered noise loading measurement units may be made by reference to Appendix A.

2.1 *Conventional load*

The conventional loading level, which is defined by the C.C.I.T.T. (Reference 1), and recommended by the C.C.I.R. (Reference 2), is shown in Table I for some typical channel capacities. For other channel capacities the mean power level L_c of the conventional load may be calculated from the following expressions:

$$L_c = -15 + 10 \log_{10} N \text{ dBm0 for } N \geqslant 240 \quad (2\text{-}1)$$

$$L_c = -1 + 4 \log_{10} N \text{ dBm0 for } 12 \leqslant N < 240 \quad (2\text{-}2)$$

where N is the radio-relay system channel capacity

Notes 1. – These levels simulate the mean power of speech plus signalling currents, etc., transmitted over the system during the busy hour. Where a significant proportion of the baseband is used for v.f. telegraphy or data transmission, these expressions do not apply.

2. – Equations 2-1 and 2-2 give a good approximation to actual signals when $N \geqslant 60$. For smaller channel capacities, however, tests with white noise are less realistic owing to the differing nature of actual signals and test signals.

TABLE I

Level of the conventional load

(from References 2 and 6)

1	2	3	4
Number of telephone channels	Relative power level at point R' (dBr)	Level of the conventional load (dBm0)	Nominal power level of the test signal at point R' (dBm)
60	−45	6.1	−38.9
120	−45	7.3	−36.7
300	−42	9.8	−32.2
600	−45 −42	12.8	−32.2 −29.2
960	−45 −42	14.8	−30.2 −27.2
1 260	−37	16.0	−21.0
1 500	−37	17.5	−19.5
2 700	−37	19.3	−17.7

A conventionally loaded radio-relay system is one which is loaded at the conventional loading level with a uniform-spectrum random noise signal which is band-limited to correspond with the total bandwidth of the f.d.m. signal.

The test signal level in most cases is chosen to equal the conventional load.