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Methods of measurement of equipment used in terrestrial radio-relay systems - Part 3: Simulated systems - Section 6: Measurements for sound-programme transmission

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METHODS OF MEASUREMENT FOR EQUIPMENT USED IN TERRESTRIAL RADIO-RELAY SYSTEMS
PART 3: SIMULATED SYSTEMS
SECTION SIX - MEASUREMENTS FOR SOUND-PROGRAMME TRANSMISSION

Méthodes de mesure applicables au matériel utilisé dans les faisceaux hertziens terrestres
Troisième partie: Liaisons simulées
Section six - Mesures concernant la transmission de la modulation sonore

Meßverfahren für Geräte in terrestrischen Richtfunksystemen
Teil 3: Simulierte Systeme
Hauptabschnitt sechs - Messungen für Tonkanalübertragung

BODY OF THE HD

The Harmonization Document consists of:

- IEC 487-3-6 (1984) ed 1; IEC/SC 12E, not appended

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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.

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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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.

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

Six Months' Rule	Report on Voting
12E(CO)83	12E(CO)103

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 3: Simulated systems

SECTION SIX — MEASUREMENTS FOR SOUND-PROGRAMME TRANSMISSION

1. Introduction

This section deals with methods of measurement for sound-programme analogue channels carried by radio-relay systems. The measurements are concerned only with the audio frequency band and are additional to those required on the radio-relay system baseband for television in Part 3, Section Three, for f.d.m. telephony in Part 3, Section Four and for mutual interference in Part 3, Section Five of this publication. In practice, the sound channels may be derived using analogue techniques, such as frequency-modulated sub-carriers (Reference 1), or by time division multiplex using digital techniques.

In the following clauses, methods of measurement are described for the transmission of the sound programmes by means of sub-carriers located above the television channel within the baseband. However, these methods are also applicable to other means of sound-programme transmission using radio-relay systems. Relevant CCIR or CCITT Recommendations and Reports are given in Clause 6 and, in general, the methods of measurement described in this section accord with those Recommendations or Reports.

1.1 *Level of test signals*

Unless otherwise stated, the level used for the measurement of any given characteristic should accord with the appropriate CCIR or CCITT Recommendations. In cases where pre-emphasis of the sound-programme channel is employed (Reference 2), it is necessary to ensure that the channel under test is not over-loaded at the higher modulation frequencies.

2. Noise and cross-talk

2.1 *Definition and general considerations*

Noise in a sound-programme channel comprises random noise and single-tone interference; the latter is also called periodic noise. In sound-programme channels of radio relay systems, noise and cross-talk are governed by the number of sound channels transmitted in the same baseband, as well as by the presence or absence of a television channel.

Random noise including cross-talk is measured in one sound programme channel while the television channel and the other sound channels are simultaneously loaded by conventional loading signals simulating typical programme material. Conventional loading for the television channel is the colour-bar signal, in accordance with Part 3, Section Five of this publication: Measurement of Mutual Interference, and Reference 3. Conventional loading for the sound channels is a suitably-shaped white-noise signal with cyclically changing levels in accordance to Reference 4. These loading signals in the disturbing channels introduce essentially unintelligible cross-talk into the disturbed sound channel.

Single-tone interference is measured in a sound channel without loading the other sound channels. Intelligible cross-talk is measured in a sound channel whilst another sound channel is loaded, and is defined as the difference in decibels between the output signal in the loaded channel and the output level of the corresponding signal in the disturbed channel.

Preceding all measurements, a sinusoidal test signal of specified level and frequency is applied to the input of the sound channel being measured, and the output level is noted as a reference. Random noise and single-tone interference are defined as the differences in decibels between this output test-signal level and the measured noise and interference level.

The measurements to be made are summarized in Table I:

TABLE I

Wideband measurements				
Measured parameter	Random noise including cross-talk		Random noise without cross-talk	
Loading and weighting conditions / Receiver input level	Television channel loaded by colour-bar signal, other sound channels loaded by shaped white-noise		Television channel and other sound channels unloaded	
	Weighted	Unweighted	Weighted	Unweighted
Nominal	X	X	X	X
Corresponding to several fading values	X			

Selective measurements			
Measured parameter	Single-tone interference (periodic noise)		Intelligible cross-talk
Loading conditions / Receiver input level	Television channel loaded by colour-bar signal, sound channel unloaded	Television channel unloaded, sound channel unloaded	One other sound channel loaded by sinusoidal signals of different frequencies
Nominal	X	X	X
Corresponding to several fading values			

2.2 *Methods of measurement*

2.2.1 *Single-tone interference*

The measurement of single-tone interference is carried out at nominal receiver input levels to the simulated radio-relay system. Single-tone interference is measured by a selective level-meter (or wave-analyzer) having a suitably narrow bandwidth so that the thermal noise contribution does not mask the tones to be measured. The television channel is loaded by the colour-bar signal, in accordance with Sub-clause 2.1 and all other sound channels are unloaded. The selective level-meter is tuned through the audio frequency range, and the measured levels of single tones are noted.

The measurement should be repeated without the television loading in order to assess the relative increase in the levels of the tones due to the television loading.

2.2.2 *Random noise*

Random noise is measured by means of a wideband level-meter covering the audio-frequency range, preferably using a quasi-peak reading instrument in accordance with Reference 5. Alternatively, an r.m.s. reading instrument may be used; in this case, the measured value would be about 5 dB less than that obtained with a peak-reading instrument. In order to assess the subjective disturbing effect of the random noise, the weighting network shown in Figure 1, page 34, is used (see also Reference 5). In order to include the cross-talk effect of the other channels, these channels are loaded by suitable signals: the television channel is loaded by the colour-bar signal, and the other sound channels by a suitably shaped white-noise signal, as explained in Sub-clause 2.1. Measurements are carried out initially at nominal receiver input levels to the simulated radio-relay system, and then repeated at several other levels.

First, an unweighted measurement is made in order to assess the effect of any low-frequency noise components which, although may not have a significant subjective disturbing effect on the listener, still may have a loading effect on the sound channel. Next, all loading signals are removed, and both weighted and unweighted measurements are repeated in order to assess the relative noise level increase due to the loading of the television and sound channels.

Note. — The measured wideband levels may be regarded as representing the true random noise if the measured single-tone interference levels, as described in Sub-clause 2.2.1, are sufficiently low.

2.2.3 *Intelligible cross-talk*

This measurement is carried out at the nominal receiver input level of the simulated radio-relay system. For the measurement of intelligible cross-talk, the other sound channels, one at a time, are loaded by sinusoidal test signals of different frequencies. A selective level-meter, tuned to each frequency, is then used to measure the level of the corresponding signals at the output of the disturbed channels.

2.3 *Presentation of results*

The results of single-tone interference, random noise and intelligible cross-talk measurements, expressed in decibels, should be tabulated. For random noise, the type of instrument, i.e. quasi-peak or r.m.s. and the weighting network used, should be stated. For single-tone interference and intelligible cross-talk, the bandwidth of the selective level-meter should be given. Also, the types and levels of applied loading signals, and the receiver r.f. input levels used should be stated.

2.4 *Details to be specified*

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

a) test-tone level and frequency range of measured sound channel;

b) type and level of loading signals applied to the television channel and to the sound channels;

c) type of meter, i.e. quasi-peak or r.m.s., and the weighting characteristic used for wideband random noise measurements;

d) bandwidth of selective level-meter to be used for single-tone interference and intelligible cross-talk measurements;

e) receiver r.f. input levels;

f) permitted maximum single-tone interference level, in decibels, for the given frequencies and loading conditions;

g) permitted maximum random noise level, in decibels, for given loading, weighting and receiver input level conditions;

h) permitted intelligible cross-talk ratio, in decibels, for the given frequencies;

3. Linear distortion

To determine the effect of distortion which does not depend upon the signal level in a sound-programme channel, it is necessary to measure or to check the following:

a) The input and output characteristics:

— input and output impedances and matching conditions;
— terminal balance ratio;
— common mode-rejection ratio.

b) The input and output levels.

c) The transfer characteristics:

— the amplitude/frequency characteristic;
— the group-delay/frequency characteristic.

The distortion contributed by the baseband, i.f. and r.f. parts of a simulated radio-relay system is usually negligible when compared with the distortion measured within the sound-programme channel.

3.1 *Input and output impedances and matching conditions*

3.1.1 *Definitions and general considerations*

The audio frequency input impedance of sound-programme channelling equipment usually has a nominal value of 600 Ω, balanced with respect to earth. The output impedance also is usually balanced with respect to earth but is often lower in value than the nominal load impedance to the extent that the open circuit transmission level does not decrease by more than a small specified amount when the load is connected (References 6 and 7).