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SPECIFICATIONS FOR MEASURING EQUIPMENT

AUTOMATIC EQUIPMENT FOR RAPIDLY MEASURING STEREOPHONIC PAIRS AND MONOPHONIC SOUND-PROGRAMME CIRCUITS, LINKS AND CONNECTIONS

ITU-T Recommendation O.33

(Previously "CCITT Recommendation")

FOREWORD

The ITU-T (Telecommunication Standardization Sector) is a permanent organ of the International Telecommunication Union (ITU). The ITU-T is responsible for studying technical, operating and tariff questions and issuing Recommendations on them with a view to standardizing telecommunications on a worldwide basis.

The World Telecommunication Standardization Conference (WTSC), which meets every four years, establishes the topics for study by the ITU-T Study Groups which, in their turn, produce Recommendations on these topics.

The approval of Recommendations by the Members of the ITU-T is covered by the procedure laid down in WTSC Resolution No. 1 (Helsinki, March 1-12, 1993).

ITU-T Recommendation O.33 was revised by ITU-T Study Group 4 (1993-1996) and was approved under the WTSC Resolution No. 1 procedure on the 27th of July 1995.

NOTE

In this Recommendation, the expression "Administration" is used for conciseness to indicate both a telecommunication administration and a recognized operating agency.

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Recommendation O.33

AUTOMATIC EQUIPMENT FOR RAPIDLY MEASURING STEREOPHONIC PAIRS AND MONOPHONIC SOUND-PROGRAMME CIRCUITS, LINKS AND CONNECTIONS

(Malaga-Torremolinos, 1984; amended at Melbourne, 1988; revised in 1995)

1 General

An automatic measuring equipment for sound-programme circuits must be capable of rapidly measuring all relevant parameters necessary for checking the quality of such circuits. The parameters to be measured and the facilities that must be offered by the equipment are outlined in this Recommendation but neither the measurement method nor the processing of the results are specified in detail. Manufacturers are thus free to adopt any appropriate design that will fulfil the requirements of this Recommendation. However, it is evident that it would be advantageous to control the measurement sequence by stored programs. The use of different measuring sequences, each suited to the requirements of individual users and individual applications should be possible.

It should be noted that the equipment will meet the requirements of Recommendations N.12 [1] and N.13 [2]. However, measurement of every parameter specified in Recommendations N.10 [3], N.21 [4] and N.23 [5] is not possible, e.g. group delay/frequency response.

2 Basic design

The equipment shall consist of either two units, send and receive, or a combined sending and receiving unit of modular construction permitting a send-only or receive-only facility.

The measurement results should be made available by a direct display via a storage mechanism to permit a long-term display of any measured parameter.

The results of the measurements are not only to permit an immediate decision by the staff in the field, but also to provide the basis for later exact evaluation by the responsible transmission engineer. It is preferred that the results be available also as a 110- and 300-baud ISO-7 bit serial data output [6] at a standard RS 232-C [7] interface, selectable between 110 and 300 bauds, or optionally, at a Standard IEEE 488/IEC 625 [8] interface.

In each case, the parameters measured must be clearly identified and the source code given (see 2.1).

The equipment must be capable of measuring at least the following parameters:

- a) received level (insertion gain);
- b) frequency/attenuation distortion (frequency response);
- c) harmonic distortion (non-linear distortion);
- d) signal-to-noise ratio unweighted, and weighted in accordance with CCIR Recommendation 468 [9];
- e) compandor linearity;
- f) programme modulated noise and expanded noise.

These parameters are further defined in clause 4.

In addition, the equipment must be capable of measuring in channels A and B at least the following parameters:

- g) interchannel difference in gain and phase;
- h) interchannel crosstalk and circuit transposition.

The stereo parameters are further defined in clause 5.

The physical design should preferably be such that this capability is provided by user conversion of the monophonic equipment by the addition of appropriate plug-in units and, possibly, minor internal wiring changes.



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The equipment will be required to send audio test signals at amplitudes consistent with that required at the user's test point. Since the nominal working levels vary from broadcasting organization to broadcasting organization, and from PTT Administration to Administration, it is not desirable to specify absolute levels. "TEST" level has therefore been defined as the level 9 dB below the maximum permitted level at the point at which the measurement is made. TEST level corresponds to an absolute value of 0 dBm0 when measured at a point of zero relative level (0 dBr) [10]. Manufacturers of automatic measurement equipment should therefore choose to make TEST level equal to a convenient level (e.g. 0 dBm0).

At this fixed level, the send frequency amplitudes in the programme measurement sequences will conform to the definitions for permitted maximum level (+9 dBm0s), alignment level (0 dBm0s) and measuring level (−12 dBm0s) given in Recommendation N.15 [11].

Switching should be provided so that TEST level may be set to +6 dB, 0 dB, or −3 dB with respect to 0.775 V r.m.s. This switch must be protected, particularly for absolute values greater than 0 dBm0, against unintentional operation, e.g. by mounting it inside the instrument. Consideration should also be given to providing −20 dB with respect to 0.775 V r.m.s.

2.1 Start/source/program identification

The measurement sequence will be chosen to suit the requirements of individual applications. Defined measurement programs are annexed to this Recommendation. The sequence of operations of the measurement program together with the associated time units are shown.

The sequence of audio test signals is to be preceded by a start/source/program identification signal which will:

- instruct the receiving unit to start the measurement sequence;
- identify the source of the test signals;
- indicate which of the stored measurement programs is to be used.

The start/source/program identification signal using the ISO-7 [6] code with one even parity bit and two stop bits, is to be sent by frequency-shift keying with a mark frequency of 1650 Hz and a space frequency of 1850 Hz, at a transmission rate of 110 bauds.

The message structure of the identification signal is formed by the following order of characters:

- Start of heading (character "SOH");
- Source identification (four alphanumeric characters);
- Special signalling (one character);
- Start of text (character "STX");
- Measurement program identification (two numeric characters 00-99);
- End of text (character "ETX").

The mark frequency shall be transmitted for at least 18 ms (two bits) before the start bit of the SOH character.

The end of the second stop bit of the ETX character defines the start of the measurement sequence.

The start/source/program identification signal shall be set at 12 dB below TEST level.

2.2 Modes of operation

It shall be possible to operate the equipment in automatic or manual modes.

2.2.1 Automatic mode

In the automatic mode, the sending unit shall cycle once through a complete programmed test sequence on receipt of a start signal given either by a push-button on the sending unit or by the momentary closing of a remote pair of contacts. The receiver shall, on receipt of the identification signal from the sending unit, cycle once through the complete programmed measurement sequence, storing and/or printing the results for subsequent examination.