INTERNATIONAL TELECOMMUNICATION UNION

ITU-T O.132

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STANDARDIZATION SECTOR
OF ITU

SPECIFICATIONS FOR MEASURING EQUIPMENT

QUANTIZING DISTORTION MEASURING EQUIPMENT USING A SINUSOIDAL TEST SIGNAL

ITU-T Recommendation O.132

(Extract from the *Blue Book*)

NOTES

1 ITU-T Recommendation O.132 was published in Fascicle IV.4 of the *Blue Book*. This file is an extract from the *Blue Book*. While the presentation and layout of the text might be slightly different from the *Blue Book* version, the contents of the file are identical to the *Blue Book* version and copyright conditions remain unchanged (see below).

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

Recommendation O.132

QUANTIZING DISTORTION MEASURING EQUIPMENT USING A SINUSOIDAL TEST SIGNAL

(Geneva, 1980; amended at Melbourne, 1988)

1 Introduction

This specification gives basic clauses describing the essential features to be provided in test equipment using a sinusoidal test signal for quantizing distortion measurements on PCM channels. It is important that the characteristics of quantizing distortion measuring apparatus of this type are sufficiently specified to ensure that they are capable of interworking and that they will give results of sufficient accuracy. This specification is based on a general statement of the method described as Method 2 in § 9 of Recommendation G.712 [1].

2 Testing method

The testing method consists of applying a sine-wave signal to the input port of a PCM channel and measuring the ratio of the received signal to distortion power, using the proper noise weighting (see § 3.3.4 below). The method also requires the use of a narrow-band rejection filter in the receiver equipment to block the sinusoidal test signal from the distortion measuring circuits so that the distortion power may be measured.

3 Specifications

3.1 *Test signal frequencies*

A test signal in either of two frequency bands may be required depending on the test-signal rejection filter being used to make the measurement. The preferred test frequencies are either 820 Hz or 1020 Hz. However, other frequencies in the rejection band of the test-signal rejection filter (such as 804 Hz or 850 Hz) may be used.

3.2 *Characteristics of the signal source*

3.2.1 *Signal level range*

At least −45 to +5 dBm0 for relative levels according to § 11 of Recommendation G.232 [2] with a setting accuracy of ± 0.2 dB.

3.2.2 *Output impedance* (frequency range 300 Hz to 4 kHz)

- Balanced, earth free (other impedances optional)..... 600 ohms
- Return loss ..... ≥ 30 dB
- Output signal balance..... ≥ 40 dB

3.2.3 Distortion and spurious modulation ratio ..... ≥ 50 dB

3.2.4 *Frequency accuracy and stability*

The accuracy and stability of the test signal frequency shall be appropriate to the frequency used and its position with respect to the rejection band of the filter concerned. The accuracy and stability must in any case be such that the frequency is never a submultiple of the PCM sampling rate.

3.3 *Characteristics of the measuring instrument*

3.3.1 *Measuring range and accuracy*

10 to 40 dB signal-to-distortion ratio with an accuracy of ± 1.0 dB.

3.3.2 *Input signal range*

At least −55 to +5 dBm0 for relative levels according to § 11 of Recommendation G.232 [2].

3.3.3 *Input impedance* (frequency range 300 Hz to 4 kHz)

– Balanced, earth free (other impedances optional)..... 600 ohms
– Return loss ..... ≥ 30 dB
– Input longitudinal interference loss (below 4 kHz) ..... ≥ 46 dB
– Input longitudinal interference loss (at 40 Hz) ..... ≥ 60 dB

3.3.4 *Measuring filter*

The value of the distortion signal shall be weighted by the standard CCITT noise weighting filter for telephony (see Recommendation O.41). Alternatively, C-message weighting may be used (see Annex A to Recommendation O.41). A calibration correction factor may be necessary when C-message weighting is used. The manufacturing tolerances on the characteristics of these filters may have to be less than is permitted in their respective specifications, in order to achieve the measuring accuracy in § 3.3.1.

3.3.5 *Test-signal reject filter*

Either of two test-signal rejection filters may be provided, with characteristics as given in Table 1/O.132.

TABLE 1/O.132

Test-signal reject filter characteristics

804 to 850 Hz test-signal reject filter	
Frequency	Loss
< 325 Hz	< 0.5 dB
< 570 Hz	< 1.0 dB
< 690 Hz	< 3.0 dB
800 to 855 Hz	> 50 dB (rejection band)
> 1000 Hz	< 3.0 dB
> 1105 Hz	< 1.0 dB
> 1360 Hz	< 0.5 dB
100 to 1020 Hz test-signal reject filter	
Frequency	Loss
< 400 Hz	< 0.5 dB
< 700 Hz	< 1.0 dB
< 860 Hz	< 3.0 dB
1000 to 1025 Hz	> 50 dB (rejection band)
> 1180 Hz	< 3.0 dB
> 1330 Hz	< 1.0 dB
> 1700 Hz	< 0.5 dB

3.3.6 *Detector characteristics*

An r.m.s. or quasi-r.m.s. detector having sufficient accuracy to meet the accuracy objective must be used for measuring the distortion signal.

3.3.7 *Bandwidth correction*

The calibration of the measuring instrument shall include a correction factor of appropriate value to account for the loss in effective noise bandwidth due to the test-signal reject filter. The correction factor assumes a uniform distribution of distortion power over the frequency range involved and is of the following form:

$$\text{Correction (dB)} = 10 \log_{10} \frac{\text{Effective bandwidth of standard noise weighting}}{\text{Effective bandwidth of the measuring instrument}}$$

4 Operating environment

The electrical performance requirements shall be met when operating at the climatic conditions as specified in Recommendation O.3, § 2.1.

References

[1] CCITT Recommendation *Performance characteristics of PCM channels between 4-wire interfaces at voice frequencies*, Vol. III, Rec. G.712.

[2] CCITT Recommendation *12-channel terminal equipment*, Vol. III, Rec. G.232.