

Audio and audiovisual equipment — Digital audio parts — Basic measurement methods of audio characteristics —

Part 2: Consumer use

The European Standard EN 61606-2:2004 has the status of a British Standard

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National foreword

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**Audio and audiovisual equipment –
Digital audio parts –
Basic measurement methods of audio characteristics
Part 2: Consumer use
(IEC 61606-2:2003)**

Equipements audio et audiovisuels -
Parties audionumériques –
Méthodes fondamentales pour la mesure
des caractéristiques audio
Partie 2 : Utilisation par le consommateur
(CEI 61606-2:2003)

Digitale Audio- und audiovisuelle Geräte -
Grundlegende Messverfahren
der Audio-Eigenschaften
Teil 2: Allgemeingebrauch
(IEC 61606-2:2003)

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European Committee for Electrotechnical Standardization
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Europäisches Komitee für Elektrotechnische Normung

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Foreword

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EN 61606-1 and this European Standard supersede EN 61606:1997.

The following dates were fixed:

- latest date by which the EN has to be implemented
at national level by publication of an identical
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- latest date by which the national standards conflicting
with the EN have to be withdrawn (dow) 2006-12-01

Annex ZA has been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 61606-2:2003 was approved by CENELEC as a European Standard without any modification.

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AUDIO AND AUDIOVISUAL EQUIPMENT – DIGITAL AUDIO PARTS – BASIC MEASUREMENT METHODS OF AUDIO CHARACTERISTICS –

Part 2: Consumer use

1 Scope

This part of IEC 61606 deals with the basic measurement methods of the audio characteristics of the digital audio part of audio and audiovisual equipment for consumer use. The common measuring conditions and methods are described in IEC 61606-1. Specific conditions and methods of measurement for consumer equipment are given in this standard.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 61606-1, *Audio and audiovisual equipment – Digital audio parts – Basic measurement methods of audio characteristics – Part 1: General*

IEC 60268-2, *Sound system equipment – Part 2: Explanation of general terms and calculation methods*

IEC 60958 (all parts), *Digital audio interface*

IEC 61883-6, *Consumer audio/video equipment – Digital interface – Part 6: Audio and music data transmission protocol*

IEC 61938, *Audio, video and audiovisual systems – Interconnections and matching values – Preferred matching values of analogue signals*

3 Terms, definitions, explanations and rated values

3.1 Definitions

For the purposes of this part of IEC 61606, the terms and definitions given in IEC 61606-1 as well as the following apply.

3.1.1**analogue full-scale amplitude**

the nominal signal level of an EUT corresponding to the digital full-scale level

NOTE In order to accommodate the EUT in an audio system, it is recommended that the analogue full scale amplitude has the value defined in IEC 61938. In the case of general purpose audio for consumer equipment, the amplitude is 2 V r.m.s.

3.1.2**normal measuring level**

analogue signal level equal to -20 dB of analogue full-scale amplitude

3.1.3**normal source impedance**

the value defined in IEC 61938, or in the case of general purpose audio for consumer equipment, 2,2 k Ω

3.1.4**normal load impedance**

the value defined in IEC 61938, or in the case of general purpose audio for consumer equipment, 22 k Ω

3.2 Explanation of terms

See 3.2 of IEC 61606-1

3.3 Digital interface for measurement

This standard can be applied to IEC 60958 or IEC 61883-6.

Other interfaces having the same specification as in 3.1 of IEC 61606-1 may also be used.

3.4 Rated values

For a full explanation of these terms, see IEC 60268-2. The following are rated conditions for digital audio equipment which should be specified by the manufacturer:

- rated supply voltage;
- rated supply frequency;
- rated pre-emphasis and de-emphasis characteristics;
- rated digital input word length;
- rated sampling frequencies.

4 Measuring conditions

The measuring conditions applied in this part are the same as those given in IEC 61606-1, together with those given below.

4.1 Environmental conditions

As in IEC 61606-1.

4.2 Power supply

As in IEC 61606-1.

4.3 Test signal frequencies

As in IEC 61606-1.

4.4 Standard setting

As in IEC 61606-1.

4.5 Preconditioning

As in IEC 61606-1.

4.6 Measuring instruments

All specifications given in IEC 61606-1 are applicable, together with those given below.

4.6.1 Digital level meter

The r.m.s. signal level, V_{total} is calculated from the digital data within the in-band frequency range.

One method of calculation is as follows:

When the frequency components are calculated by the FFT method, the signal level is calculated as follows. All of the frequency components which are within the in-band frequency range are calculated using the following equation:

$$V_{\text{total}} = (V_{f1}^2 + V_{f2}^2 + V_{f3}^2 + \dots + V_{fn}^2)^{1/2}$$

The signal level S in dB_{FS} is calculated from the following equation:

$$S \text{ dB}_{\text{FS}} = 20 \log_{10} (V_{\text{total}} / V_{\text{full}})$$

where V_{full} is the r.m.s. value of the full-scale amplitude of a 1 kHz signal.

The number of data points for the FFT calculation is greater than the value of fs . The window used for the measurement shall be the minimum window having the following parameters:

$$W(t) = 1/L [a_0 + a_1 \cos(2\pi t/L) + a_2 \cos(4\pi t/L) + a_3 \cos(6\pi t/L)]$$

where

L is the number of data points.

$$a_0 = 0,363\,491\,2$$

$$a_1 = 0,489\,268\,2$$

$$a_2 = 0,136\,508\,8$$

$$a_3 = 0,010\,731\,8$$

$$t \leq L/2$$

NOTE If the signal level is calculated directly using digital data, it should be filtered to the in-band frequency range before the calculation.

4.6.2 Distortion meter

Calculate the ratio of the total signal output to the noise and distortion component.

NOTE One measurement method is as follows.

The r.m.s. signal level, V_{total} is calculated from the resultant in-band frequency components of the fast Fourier Transformation (FFT) of the processed input signal:

$$V_{\text{total}} = (V_{f1}^2 + V_{f2}^2 + V_{f3}^2 + \dots V_{fn}^2)^{1/2}$$

V_N , is obtained by the FFT for frequency ranges from 4 Hz to f_L , which is 1/1,5 of the measuring frequency and f_H which is 1,5 times the measuring frequency to the upper limit frequency f_{MAX} , V_N is derived from the following equation:

$$V_N = ((V_{f1}^2 + V_{f2}^2 + V_{f3}^2 + \dots V_{fL}^2) + (V_{fH}^2 + V_{fH+1}^2 + V_{f\text{MAX}}^2))^{1/2}$$

The total distortion D is obtained from the equation:

$$D\% = V_N / V_{\text{total}} \times 100$$

The conditions for the measurement are the same as those for the digital level meter.

5 Methods of measurement (digital-in/analogue-out)

The methods of measurement described in the following subclauses apply to the equipment where the input signal is a digital audio signal and the output signal is an analogue signal. All the specifications described in IEC 61606-1 which correspond to this standard are applied to these subclauses.

These subclauses specify the details of measurement methods for consumer use equipment.

If the EUT provides two or more channels, all channels should be measured in the same way. The word length and sampling frequency shall be stated in the expression of the results of the measurement.

5.1 Input/output characteristics

5.1.1 Maximum output amplitude

5.1.1.1 Input signal

Frequency: 997 Hz

Signal level: full-scale level.

5.1.1.2 Procedures

Set the EUT to the standard setting specified in 4.4.

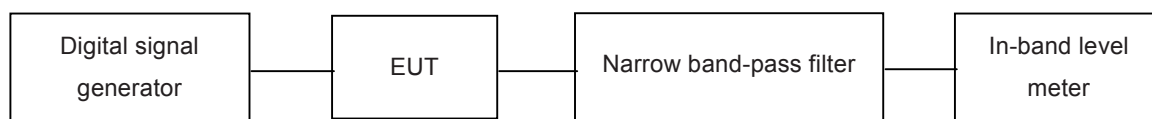
Apply the input signal to the EUT.

Adjust the level control and measure the maximum output voltage which does not show clipping and has total distortion of less than 1 %.

5.1.2 Gain difference between channels

5.1.2.1 Method of measurement

Connect the EUT and measured equipment as in Figure 1.



IEC 2407/03

Figure 1 – Connection diagram of equipments

5.1.2.1.1 Input signal

Frequency: 997 Hz.

Signal level: normal measuring level ($-20 \text{ dB}_{\text{FS}}$).

5.1.2.1.2 Procedure

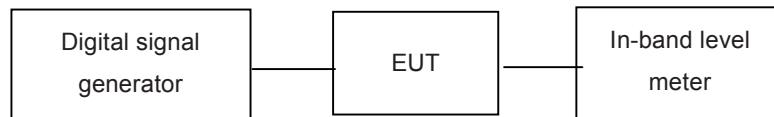
- a) Set the EUT to the standard settings specified in 4.4.
- b) Adjust the gain control (if any) to the maximum position. Apply the same input signal to all channels to be measured, either simultaneously or in turn.
- c) Measure the output level of each channel.
- d) The gain difference between the channels is expressed in dB.

5.2 Frequency characteristics

5.2.1 Frequency response

5.2.1.1 Method of measurement

Connect the EUT and measured equipment as in Figure 2.



IEC 2408/03

Figure 2 – Connection diagram of equipments

5.2.1.1.1 Input signal

a) Reference signal

Frequency: 997 Hz.

Signal level: normal measuring level ($-20 \text{ dB}_{\text{FS}}$).

b) Test signal

Frequency: in the case of the discrete frequency method see IEC 61606-1, Table 1. In the case of the sweep frequency method see IEC 61606-1, Table 2.

Signal level: normal measuring level ($-20 \text{ dB}_{\text{FS}}$).

5.2.1.1.2 Procedure

- a) Set the EUT to the standard settings specified in 4.4.
- b) Apply a reference signal to the EUT and measure the output signal with the r.m.s. level meter.
- c) Repeat the same measurement as in b) for the test signals. Calculate the voltage ratio between measurement b) and c) in dB.
- d) The results are presented in a table or graphically.

5.2.2 Group delay (phase linearity)

5.2.2.1 Method of measurement

Connect the EUT and measured equipment as in Figure 3.



IEC 2409/03

Figure 3 – Connection diagram of equipments

5.2.2.1.1 Input signal

The signal generator for group delay measurement (described in IEC 61606-1, 4.6.1.3.1) shall be used.

5.2.2.1.2 Procedure

- Set the EUT to the standard settings specified in 4.4.
- Apply the input signal to the EUT.
- Analyze the output waveform from the EUT using FFT equipment to obtain the phase ϕ_R (degree) of the 1 kHz signal and calculate the delay time τ_R from the following equation:

$$\tau_R = (-\phi_R / 360) \times (1/997)$$

- Repeat analyzing the testing frequency to obtain the phase ϕ_C and the delay time τ_C from the following equation.

$$\tau_C = (-\phi_C / 360) \times (1/f)$$

If the phase wraps in excess of 360° , the reading shall be adjusted before computing the above equation.

- The group delay difference (τ_{RC}) and phase linearity (ϕ_{RC}) at the measured frequency can be obtained from following equations.

$$\tau_{RC} = \tau_R - \tau_C$$

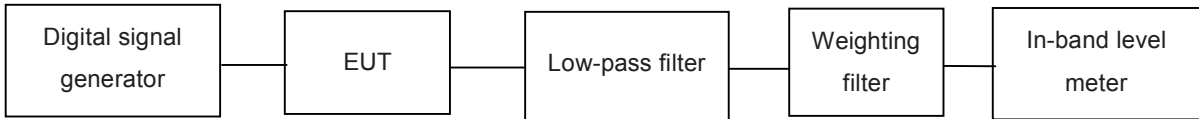
$$\phi_{RC} = \tau_{RC} \times 360 \times f$$

5.3 Noise characteristics

5.3.1 Signal-to-noise ratio

5.3.1.1 Method of measurement

Connect the EUT and measured equipment as in Figure 4.



IEC 2410/03

Figure 4 – Connection diagram of equipment

5.3.1.1.1 Input signal

Signal (A): Signal level = Full-scale level.
 Frequency = 997 Hz.

Signal (B): Digital zero.

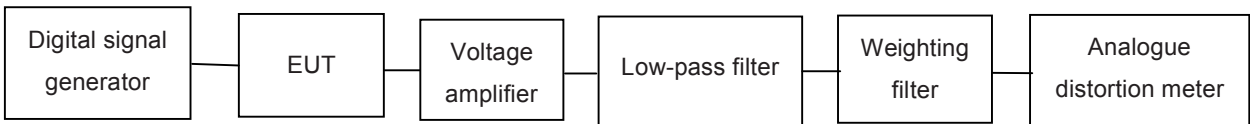
5.3.1.1.2 Procedure

- a) Set the EUT to the standard settings specified in 4.4.
- b) Apply the signal (A) to the EUT and note the reading of the meter as $A \text{ dB}_{\text{FS}}$.
- c) Apply the signal (B) to the EUT and note the meter reading $B \text{ dB}_{\text{FS}}$.
- d) The signal-to-noise ratio SN in dB is obtained from the equation: $SN = (A - B)$.

5.3.2 Dynamic range

5.3.2.1 Method of measurement

Connect the EUT and measured equipment as in Figure 5.



IEC 2411/03

Figure 5 – Connection diagram of equipment

NOTE If the analogue distortion meter has sufficient amplification for the measurement, the voltage amplifier may not be needed.

5.3.2.1.1 Input signal

Frequency: 997 Hz.
 Signal level: $-60 \text{ dB}_{\text{FS}}$.