IEC 61606-2

Edition 2.0 2009-07

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Audio and audiovisual equipment – Digital audio parts – Basic measurement methods of audio characteristics –
Part 2: Consumer use

Équipements audio et audiovisuels – Parties audionumériques – Méthodes fondamentales pour la mesure des caractéristiques audio –
Partie 2: Utilisation grand public

IEC 61606-2:2009-07(en-fr)

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

Part 2: Consumer use

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International Standard IEC 61606-2 has been prepared by IEC technical committee 100: Audio, video and multimedia systems and equipment.

This second edition cancels and replaces the first edition published in 2003. It constitutes a technical revision.

The significant technical changes with respect to the first edition are the following:

- changed the period of preconditioning;
- add A weighting filter in measuring instruments;
- correct the wrong reference number;
- some inappropriate descriptions have been improved.

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

FDIS	Report on voting
100/1548/FDIS	100/1582/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

This part is to be used in conjunction with IEC 61606-1, General.

A list of all parts of the IEC 61606 series, under the general title *Audio and audiovisual equipment – Digital audio parts – Basic measurement methods of audio characteristics*, can be found on the IEC website.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

The committee has decided that the contents of this publication will remain unchanged until the maintenance result date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

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

Part 2: Consumer use

1 Scope

This part of IEC 61606 is applicable to 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. This International Standard specify 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 60268-2, *Sound system equipment – Part 2: Explanation of general terms and calculation methods*

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

IEC 61606-1:2009, *Audio and audiovisual equipment – Digital audio parts – Basic measurement methods of audio characteristics – Part 1: General*

IEC 61672-1, *Electroacoustics – Sound level meters – Part 1: Specifications*

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 Terms and definitions

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

3.1.1
analogue full-scale amplitude
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 load impedance
value defined in IEC 61938, or in the case of general purpose audio for consumer equipment, 22 kΩ

3.1.3
normal measuring level
analogue signal level equal to –20 dB of analogue full-scale amplitude

3.1.4
normal source impedance
value defined in IEC 61938, or in the case of general purpose audio for consumer equipment, 2,2 kΩ

3.2 Explanation of terms “jitter”

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

4.1 General

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

4.2 Environmental conditions

As specified in 4.1 of IEC 61606-1.

4.3 Power supply

As specified in 4.2 of IEC 61606-1.

4.4 Test signal frequencies

As specified in 4.3 of IEC 61606-1.

4.5 Standard setting

As specified in 4.4 of IEC 61606-1.

4.6 Preconditioning

As specified in 4.5 of IEC 61606-1.

4.7 Measuring instruments

4.7.1 General

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

4.7.2 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:

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

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

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

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 f_s. 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,

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

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

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

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

and $t \leq L/2$.

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

4.7.3 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:

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

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:

$$V_N = ((V_{f1}^2 + V_{f2}^2 + V_{f3}^2 + \ldots V_{fL}^2) + (V_{fH}^2 + V_{fH+1}^2 + V_{fMAX}^2))^{1/2}$$

The total distortion D is obtained from the equation:

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

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

4.7.4 Analogue weighting filter

The weighing filter used shall have A-weighing characteristics with tolerances ±1 dB as specified for sound level measurements in IEC 61672-1.

4.7.5 Digital weighting filter

The characteristics of weighing filter shall comply with A-weighing characteristics with tolerances ±1 dB as specified for sound level measurements in IEC 61672-1.

4.7.6 Digital spectrum analyzer

A digital spectrum analyzer computes the Fast Fourier transform (FFT) of the input digital signal.

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

5.1 General

The methods of measurement described in the following sub-clauses 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.

5.2 Input/output characteristics

5.2.1 Maximum output amplitude

5.2.1.1 Input signal

Frequency: 997 Hz

Signal level: full-scale level.

5.2.1.2 Procedures

Set the EUT to the standard setting specified in 4.5.

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 %.

5.2.2 Gain difference between channels

5.2.2.1 Block diagram of measuring devices

Connect the EUT and measuring instrument as in Figure 1.

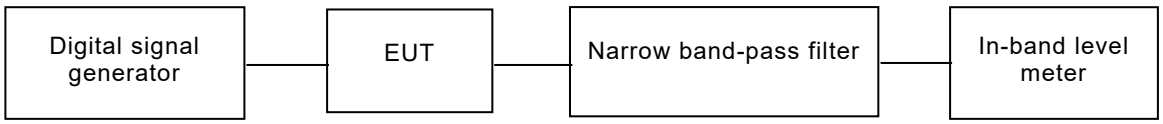

Figure 1 – Connection diagram of equipment

5.2.2.2 Input signal

Frequency: 997 Hz.

Signal level: normal measuring level (–20 dB_{FS}).

5.2.2.3 Procedure

The following procedure applies.

a) Set the EUT to the standard settings specified in 4.5.

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.

5.3 Frequency characteristics

5.3.1 Frequency response

5.3.1.1 Block diagram of measuring devices

Connect the EUT and measuring instruments as shown in Figure 2.

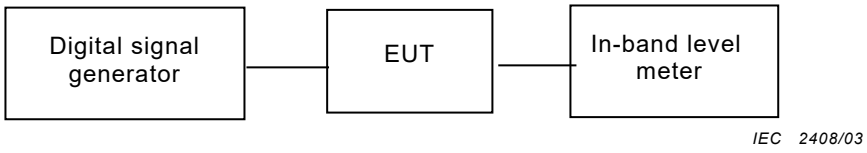

Figure 2 – Connection diagram of equipment

5.3.1.2 Input signal

The following characteristics apply.

a) Reference signal

Frequency: 997 Hz.

Signal level: normal measuring level (–20 dB_{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, the frequency range is from 16 Hz to 1/2 × f_s which is the same as the comment under the Table 1 of IEC 61606-1.

Signal level: normal measuring level (–20 dB_{FS}).

5.3.1.3 Procedure

The following procedure applies.

a) Set the EUT to the standard settings specified in 4.5.

b) Apply a reference signal to the EUT and measure the output signal with the analogue in-band 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.

5.3.2 Group delay (phase linearity)

5.3.2.1 Block diagram of measuring devices

Connect the EUT and measuring instruments as in Figure 3.

Figure 3 – Connection diagram of equipment

5.3.2.2 Input signal

The signal generator for group delay measurement (described in IEC 61606-1, 4.6.2.3.2) shall be used.

5.3.2.3 Procedure

The following procedure applies.

a) Set the EUT to the standard settings specified in 4.5.

b) Apply the input signal to the EUT.

c) 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 group delay τ_R from the following equation:

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

d) 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.

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

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

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

5.4 Noise characteristics

5.4.1 Signal-to-noise ratio

5.4.1.1 Block diagram of measuring devices

Connect the EUT and measuring instrument as in Figure 4.

Figure 4 – Connection diagram of equipment

5.4.1.2 Input signal

The following characteristics apply.

Signal (A): Signal level = Full-scale level.

Frequency = 997 Hz.

Signal (B): Digital zero.

5.4.1.3 Procedure

The following procedure applies.

a) Set the EUT to the standard settings specified in 4.5.
b) Apply the signal (A) to the EUT and note the reading of the meter as A dB_{FS}.
c) Apply the signal (B) to the EUT and note the meter reading B dB_{FS}.
d) The signal-to-noise ratio SN in dB is obtained from the equation: $SN = (A - B)$.

5.4.2 Dynamic range

5.4.2.1 Block diagram of measuring devices

Connect the EUT and measuring instrument as in Figure 5.