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Minimum allowable values of energy efficiency and energy efficiency grades for flat panel televisions and set-top boxes

平板电视与机顶盒 能效限定值及能效等级

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Table of Contents

Minimum allowable values of energy efficiency and energy efficiency grades for flat panel televisions and set-top boxes

1 Scope

This Standard specifies energy efficiency grades, minimum allowable values of energy efficiency, energy efficiency calculation and test methods for flat panel televisions and general-purpose set-top boxes (also known as "digital TV receiver").

This Standard is applicable to LCD TV and OLED TV that work normally under AC220V, 50Hz power supply conditions; of which the main functions include ground, cable, satellite or other analog and digital signal reception, demodulation and display (hereafter collectively referred to as "flat panel TV"). It is also applicable to liquid crystal and OLED display device of which the main function is a TV, without a tuner, but it is circulated as a TV product. This Standard applies to set-top boxes that work normally under AC220V, 50Hz power supply conditions, including cable set-top boxes, ground set-top boxes, satellite set-top boxes and network set-top boxes.

This Standard is not applicable to live broadcast satellite set-top boxes.

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.

GB 3174, *Characteristics of PAL-D television broadcasting system*

GB/T 8170, *Rules of rounding off for numerical values & expression and judgement of limiting values*

GB/T 14857, *Specifications of encoding parameters of digital television for studio*

GB/T 17309.1, *Methods of measurement on receivers for television broadcast transmissions - Part 1: General considerations - Electrical*

3.2 passive standby mode

the flat panel TV is connected to power supply and produces neither sound nor image, but it can be switched to on mode by remote control or other external signals

low power state that the set-top box is connected to power supply and does not provide the main function

NOTE: The set-top box can enter this mode only after receiving external excitation signals such as remote control and buttons. Through excitation by remote control device, internal signal, the set-top box can return to on mode from this mode.

3.3 passive standby power

under the test methods specified in this Standard, the active power of flat panel TVs and set-top boxes measured in passive standby mode

3.4 on mode static power for flat panel televisions

under the test methods specified in this Standard, the active power measured when a flat panel TV is playing a static test image under on mode

3.5 on mode dynamic power for flat panel televisions

under the test method specified in this Standard, the active power measured when a flat panel TV is playing dynamic test signals under on mode

3.6 on mode power for flat panel televisions

active power used to calculate and evaluate the energy efficiency of flat panel TVs

NOTE: The on mode power for flat panel televisions is determined from the on mode static power and the on mode dynamic power, see 6.2.

3.7 fluctuation values of power for flat panel televisions

the ratio of the absolute value of the difference between the on mode static power and the on mode dynamic power TO the on mode static power

3.8 minimum allowable values of energy efficiency for flat panel televisions

under the test methods specified in this Standard, the minimum energy efficiency value and the maximum passive standby power value allowed for flat panel TVs

The minimum energy efficiency required by minimum allowable values of energy efficiency for the flat panel television, of which the resolution is not greater than 1920×1080, is grade 3 of energy efficiency grades in Table 1. The minimum energy efficiency required by minimum allowable values of energy efficiency for the flat panel television, of which the resolution is greater than 1920×1080 but not greater than 3840×2160, is grade 4 of energy efficiency grades in Table 1. The minimum energy efficiency required by minimum allowable values of energy efficiency for the flat panel television, of which the resolution is greater than 3840×2160, is grade 5 of energy efficiency grades in Table 1.

The passive standby power of all flat panel televisions shall be less than or equal to 0.50W (be round off according to the relevant provisions of GB/T 8170; keep two significant digits).

For flat panel televisions that use external power, the external power supply used shall also comply with the minimum allowable values of energy efficiency in GB 20943.

5.2 Minimum allowable values of energy efficiency for set-top boxes

The minimum allowable values of energy efficiency for set-top boxes is grade 3 of energy efficiency grades in Table 2.

For set-top boxes that use external power, the external power supply used shall also comply with the minimum allowable values of energy efficiency in GB 20943.

6 Calculation method for energy efficiency

6.1 Calculation of power fluctuation value for flat panel televisions

The power fluctuation value of LCD TV is calculated according to formula (1):

$$\Delta P = \frac{|P_j - P_d|}{P_j} \times 100\% \qquad \cdots\cdots(1)$$

Where,

ΔP - Power fluctuation value, expressed in %;

P_j - On mode static power, in watts (W);

P_d - On mode dynamic power, in watts (W).

Annex A

(normative)

Test methods for energy efficiency for flat panel televisions

A.1 Test environment

A.1.1 Working conditions

Unless otherwise specified, the audio part and video part shall be under on mode. Various settings shall be adjusted in accordance with A.3.2. If the adjustment position is different, it shall be explained in the test result.

A.1.2 Ambient conditions

Test under temperature, humidity and air pressure within the following range:

- Ambient temperature: 23°C±5°C;

- Relative humidity: 25%~75%;

- Atmospheric pressure: 86kPa~106kPa.

A.1.3 Power supply

The voltage is AC220×(1±1%)V. The frequency is 50×(1±1%) Hz. The total harmonic distortion shall not exceed 2%.

A.1.4 Test site

In order to avoid stray light from interfering with the test results, the test shall be carried out in a dark room and the stray illumination of the dark room shall be less than or equal to 1lx.

A.2 Test signals

A.2.1 Video test signal

The test signal shall be differentiated according to the characteristics of resolution, amplitude-to-type ratio.

The analog signal shall meet the requirements of GB 3174. The standard definition digital signal shall comply with relevant regulations of GB/T 14857. The video signal format shall be 720×576i/50Hz. The high-definition digital signal shall comply with relevant regulations of GY/T 155. The video signal

Figure A.1 -- Schematic diagram of limit eight grayscale nine window signal

A.2.1.3 Dynamic video signal

The dynamic video signal is a 50Hz active test sequence defined by IEC 62087-2:2015. The signal length is 10min.

A.2.2 Audio test signal

The audio test signal is a sine wave signal that the frequency is 1kHz and the signal level is -18dBFS.

A.3 Test conditions

A.3.1 Test interface and input signal

The test signal input terminal of energy efficiency for flat panel televisions prefers to use RF input interface (if there is more than one RF interface, it shall test separately; select the worst result for assessment of energy efficiency grades). The modulation mode of analog radio frequency signal is set according to the provisions of GB/T 17309.1. The modulation mode of ground digital radio frequency signal is set according to GB 20600. The modulation mode of wired digital radio frequency signal is set according to GY/T 170. The modulation mode of satellite digital radio frequency signal is set according to GB/T 17700.

If there is no RF input interface, use digital audio-video interface or use baseband interface for testing. Prefer digital interface for testing.

When using digital audio-video interface, the video signal format of HDTV is 1920×1080i/50Hz; the video signal format of standard definition TV is 720×576i/50Hz. The input video signal format of products with a resolution greater than 1920×1080 is 1920×1080i/50Hz. The audio test signal frequency is 1kHz. The signal level is -18dBFS.

When using baseband interface, the video signal format of HDTV is 1920×1080i/50Hz. The video signal format of standard definition TV is 720×576i/50Hz. The audio test signal frequency is 1kHz. The rated input voltage is 500mV (effective value).

Information such as test interface, channel modulation mode, channel parameters, radio frequency signal level, digital single-channel video signal bit rate shall be stated in the inspection report.

A.3.2 Adjustment of standard on mode for flat panel televisions

A.3.2.1 General requirements

- The volume control is adjusted to the position where the main sound speaker outputs 50mW. For televisions with surround sound equipment, speakers other than the front speakers shall be turned off.

A.3.2.8 Other controls

If controlled by other users, put it in the exit-factory position. If there is no preset location setting, adjust them to the position where it can get the best picture and sound.

A.3.2.9 Additional functions of flat panel televisions

Additional functions refer to functions other than the basic functions of TV demodulation, decoding, display screen, and sound production, such as DVD, networking, video, computer, game console.

Additional functions that can be closed by the user shall be adjusted to the off mode.

A.3.2.10 Factory menu

The menu other than those used by the default user, if the calling method and use method are not introduced in the user manual, shall not be used in testing.

A.4 Testing procedures for energy efficiency for flat panel televisions

The testing procedures for energy efficiency for flat panel televisions are as follows:

a) Connect the test system as shown in Figure A.2. The brightness test distance is 3 times the display screen height. Power on all test equipment. Adjust voltage and frequency appropriately. If the flat panel television needs to work at the same time by two or more independent power supply parts to complete the function of general-purpose flat panel television, that is, to receive input signal, to generate image and sound, then it shall need to connect these independent parts to the power meter. Calculate the total power consumption.

Annex B

(normative)

Test methods for passive standby power for flat panel televisions

B.1 Test conditions

B.1.1 Ambient conditions

Same with A.1.2.

B.1.2 Power supply

Same with A.1.3.

B.2 Test instruments

Power meter is active power meter of which the crest factor is greater than or equal to 3, the minimum current range is less than or equal to 10mA.

B.3 Test procedures for passive standby power for flat panel televisions

The test procedures for passive standby power for flat panel televisions are as follows:

a) Power on all test equipment. Adjust the working range correctly. If the flat panel television needs to work at the same time by two or more independent power supply parts to complete the function of general-purpose flat panel television, that is, to receive input signal, to generate image and sound, then the passive standby power of each part shall be tested independently, which shall respectively comply with the allowable value of passive standby power in 5.1.

b) Connect the flat screen television to the test equipment. Stop additional functions.

c) Adjust the flat screen television from on mode to passive standby mode.

d) After 10min in passive standby mode, use a power meter with power averaging function to monitor 5min. The measured average power shall be the passive standby power. Or use an electricity meter (or power meter with digital integration function) to monitor 5min (ensure to sample more than 200 times during integration time). Calculate the passive standby power according to formula (B.1):

Annex C

(normative)

Test methods for power for set-top boxes

C.1 Test environment

C.1.1 Ambient conditions

Test under temperature, humidity and air pressure within the following range:

- Ambient temperature: 23°C±5°C;
- Relative humidity: 25%~75%;
- Atmospheric pressure: 86kPa~106kPa.

C.1.2 Power supply

The voltage is AC220×(1±1%) V. The frequency is 50×(1±1%) Hz. The total harmonic distortion shall not exceed 2%.

C.2 Test instruments

Power meter is active power meter, of which the resolution is at least 0.01W, the minimum current range is ≤10mA; ensures that the test accuracy is better than 5% under continuous working conditions.

C.3 Test method

C.3.1 Setting of set-top boxes

The set-top boxes are set as follows:

a) When the set-top box has the additional function not included in Table 4, if this function can be stopped by user, it shall be stopped.

b) When the set-top box is powered by an external power adapter, it shall use a standard adapter for testing.

C.3.2 Input signal

The test signal of high-definition digital video shall meet the requirements of GB/T 17975.1, GB/T 17975.2, GB/T 17975.3, GY/T 155. The signal format is 1920×1080i/50Hz.

The standard test conditions II for satellite set-top boxes are as follows:

a) Channel coding complies with GB/T 17700;

b) Single channel video bit rate: 2Mbps~25Mbps;

c) Symbol rate: 2MS/s~45MS/s;

d) Package length: 188byte;

e) Inner code code-rate: 3/4;

f) Convolutional interleaving depth: I=12;

g) Roll-off factor: α=0.35;

h) RF frequency: 950MHz~2150MHz;

i) Input level of the tested set-top box: -40dBm;

j) Noise bandwidth: signal occupied bandwidth/(1+α);

k) The audio output volume of the tested set-top box is adjusted to the maximum.

C.3.7 Standard test conditions for network set-top boxes

C.3.7.1 General requirements

The power test of network set-top boxes uses wireless receiving or USB interface receiving method. When the test signal cannot be received by wireless reception, store the test signal on the USB flash drive. The network set-top box directly plays the content on the USB flash drive.

C.3.7.2 Standard test condition states for network set-top boxes

The standard test condition states for network set-top boxes are as follows:

a) The test signal adopts the 50Hz activity sequence specified in IEC 62087-2:2015;

b) The test signal shall meet the requirements of GB/T 17975.1, GB/T 17975.2, GB/T 17975.3, GY/T 155. The signal format is 1920×1080i/50Hz. The file format is .TS;

c) Encoding method: MPEG-2;

d) Encoding rate: 18Mbps.

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