

International Telecommunication Union

**ITU-R**  
Radiocommunication Sector of ITU

**Recommendation ITU-R BT.2022**  
(08/2012)

**General viewing conditions for subjective  
assessment of quality of SDTV and HDTV  
television pictures on flat panel displays**

**BT Series**  
**Broadcasting service**  
**(television)**



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<b>RA</b>	Radio astronomy
<b>RS</b>	Remote sensing systems
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<b>SA</b>	Space applications and meteorology
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<b>SM</b>	Spectrum management
<b>SNG</b>	Satellite news gathering
<b>TF</b>	Time signals and frequency standards emissions
<b>V</b>	Vocabulary and related subjects

*Note: This ITU-R Recommendation was approved in English under the procedure detailed in Resolution ITU-R 1.*

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## RECOMMENDATION ITU-R BT.2022\*

**General viewing conditions for subjective assessment of quality of SDTV and HDTV television pictures on flat panel displays**

(Question ITU-R 81-1/6)

(2012)

**Scope**

This Recommendation specifies general viewing conditions for subjective assessment of quality of SDTV and HDTV television pictures on flat panel displays.

**Keywords**

Subjective Assessment, Quality, SDTV, HDTV, UHDTV, Flat panel, Display

The ITU Radiocommunication Assembly,

*considering*

- a) that Recommendation ITU-R BT.500 has been developed assuming the use of CRT displays in subjective assessment;
- b) that the transition from CRT to non-CRT display imposes the use of non-CRT displays for subjective assessment;
- c) that the picture rendering characteristics may differ between CRT and non-CRT displays;
- d) that increasingly SDTV and HDTV flat panel displays (FPDs) are being used for subjective quality assessment of television pictures,

*recognizing*

- a) that Recommendations ITU-R BT.814 and BT.815 provide specifications and alignment procedures for setting of brightness and contrast of displays;
- b) that Recommendation ITU-R BT.1848 provides guidelines on safe areas of 625-line, 720-line and 1 080-line formats of wide-screen 16:9 aspect ratio digital productions;
- c) that Recommendation ITU-R BT.1886 specifies the reference electro-optical transfer function (EOTF) that the displays used in HDTV programme production should follow in order to facilitate consistent picture presentation;
- d) that Report ITU-R BT.2129 investigates user requirements for a flat panel display as a master monitor in an HDTV programme production environment,

*noting*

- 1 that specific viewing conditions for subjective assessments of specific systems are given in the related Recommendations (e.g. Recommendation ITU-R BT.710 for the HDTV and Recommendation ITU-R BT.1129 for SDTV);
- 2 that Recommendations ITU-R BT.710 and BT.1129 came into force before the development of wide screen flat panel displays,

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\* Radiocommunication Study Group 6 made editorial amendments to this Recommendation in October 2017 in accordance with Resolution ITU-R 1.

*recommends*

that the general viewing conditions described in Annex 1 should be used for subjective assessment of picture quality.

## **Annex 1**

### **1 General viewing conditions**

Different environments with different viewing conditions are described.

The laboratory viewing environment is intended to provide critical conditions to check systems. General viewing conditions for subjective assessments in the laboratory environment are given in § 1.1.

The home viewing environment is intended to provide a means to evaluate quality at the consumer side of the TV chain. General viewing conditions in § 1.2 reproduce a home environment. These parameters have been selected to define an environment slightly more critical than the typical home viewing situations.

Some aspects relating to the monitor characteristics are also discussed.

#### **1.1 General viewing conditions for subjective assessments in a laboratory environment**

The assessors' viewing conditions should be arranged as follows:

- |    |   |  |
|----|---|--|
| a) | Room illumination:  | low                                    |
| b) | Chromaticity of background:   | $D_{65}$                               |
| c) | Peak luminance <sup>1</sup> :   | 70-250 cd/m <sup>2</sup> (See § 1.7.2) |
| d) | Monitor contrast ratio:   | $\leq 0.02$ (See § 1.7.1)              |
| e) | Ratio of luminance of background behind picture monitor to peak luminance of picture: | $\approx 0.15$                         |

#### **1.2 General viewing conditions for subjective assessments in a home environment**

- |    |  |  |
|----|--|--|
| a) | Environmental illuminance on the screen (incident light from the environment falling on the screen, should be measured perpendicularly to the screen): | 200 lux                                |
| b) | Peak luminance <sup>1</sup> :  | 70-500 cd/m <sup>2</sup> (See § 1.7.2) |
| c) | Ratio of luminance of inactive screen to peak luminance monitor contrast ratio:  | $\leq 0.02$ (See § 1.7.1)              |

#### **1.3 Viewing distance**

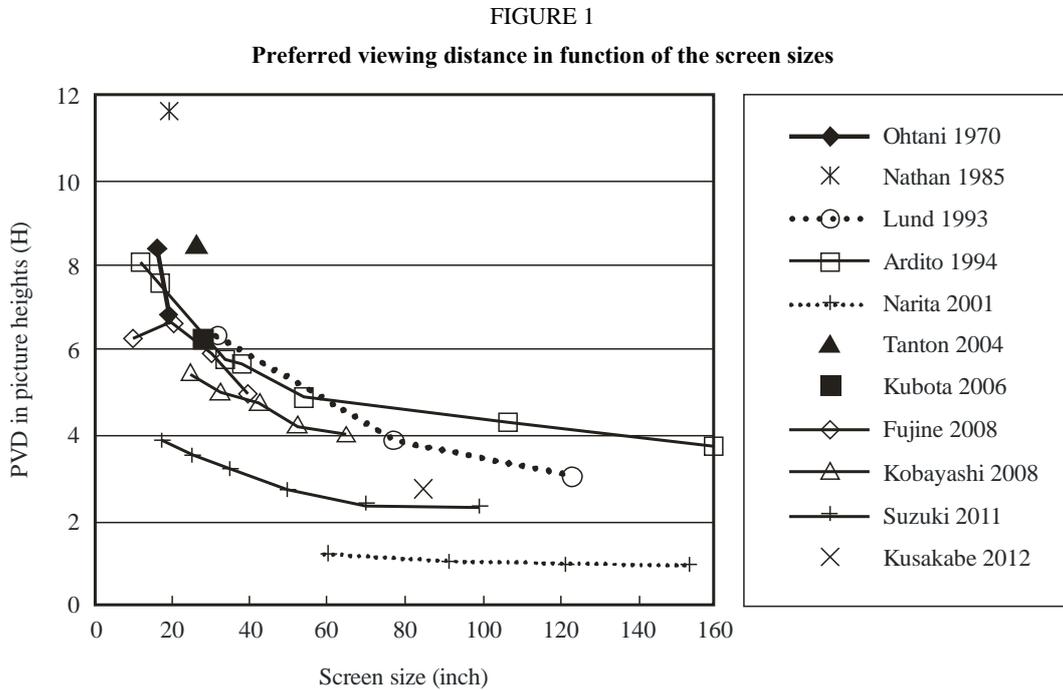
The viewing distance is based on the screen size and it can be selected according to two distinct criteria: the preferred viewing distance (PVD) and the design viewing distance (DVD). The selection of one or the other of the two criteria will depend upon the purpose of the study.

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<sup>1</sup> Peak luminance should be adjusted according to the room illumination.

### 1.3.1 Preferred viewing distance

The preferred viewing distance (PVD) is based upon viewers' preferences which have been determined empirically. The PVD (in function of the screen sizes) is shown in Fig. 1, which contains a number of data sets collected from available sources. This information may be referred to for designing a subjective assessment test.



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### 1.3.2 Design viewing distance

The design viewing distance (DVD), or optimal viewing distance, for a digital system is the distance at which two adjacent pixels subtend an angle of 1 arc-min at the viewer's eye; and the optimal horizontal viewing angle as the angle under which an image is seen at its optimal viewing distance.

Table 1 reports the optimal viewing distances (and optimal horizontal viewing angles) for several image resolution systems expressed in multiples of the picture's height.

TABLE 1

Optimal horizontal viewing angle, optimal viewing distance in picture heights (H)

Image system	Reference	Aspect ratio	Pixel aspect ratio	Optimal horizontal viewing angle	Optimal viewing distance
720 × 483	Rec. ITU-R BT.601	4:3	0.89	11°	7 H
640 × 480	VGA	4:3	1	11°	7 H
720 × 576	Rec. ITU-R BT.601	4:3	1.07	13°	6 H
1 024 × 768	XGA	4:3	1	17°	4.5 H
1 280 × 720	Rec. ITU-R BT.1543 Rec. ITU-R BT.1847	16:9	1	21°	4.8 H

TABLE 1 (*end*)

Image system	Reference	Aspect ratio	Pixel aspect ratio	Optimal horizontal viewing angle	Optimal viewing distance
1 400 × 1 050	SXGA+	4:3	1	23°	3.3 <i>H</i>
1 920 × 1 080	Rec. ITU-R BT.709	16:9	1	31°	3.2 <i>H</i>
3 840 × 2 160	Rec. ITU-R BT.2020	16:9	1	58°	1.6 <i>H</i>
7 680 × 4 320	Rec. ITU-R BT.2020	16:9	1	96°	0.8 <i>H</i>

#### 1.4 Observation angle

The maximum observation angle relative to the normal should be constrained so that deviations in reproduced colour on the screen should not be visible to an observer. The optimal horizontal viewing angle of an image system under test should also be considered to determine the observation angle.

#### 1.5 Monitor processing

Monitor processing such as image scaling, frame rate conversion, image enhancer, if implemented, should be done in such a way as to avoid introducing artefacts. A test report should indicate whether de-interlacer is used or not for interlaced signals. It is preferable not to use de-interlacer if interlaced signals can be displayed without it.

#### 1.6 Monitor resolution

The resolution of professional monitors usually complies with the required standards for subjective assessments in their luminance operating range.

To check and report the maximum and minimum resolutions (centre and corners of the screen) at the used luminance value might be suggested.

If consumer FPD TV sets are used for subjective assessments, it is strongly recommended to check and report the maximum and minimum resolutions (centre and corners of the screen) at the used luminance value.

At present the most practical system available to subjective assessments performers, in order to check monitors or consumer TV sets resolutions, is the use of a swept test pattern electronically generated.

#### 1.7 Monitor adjustment

Brightness and contrast of a monitor should be adjusted under the environment illuminance by using the PLUGE waveforms in accordance with Recommendation ITU-R BT.814.

The monitor contrast ratio should be measured in accordance with Recommendation ITU-R BT.815.

##### 1.7.1 Monitor contrast

Contrast could be strongly influenced by the environment illuminance.

Professional monitors seldom use technologies to improve their contrast in a high illuminance environment, so it is possible they do not comply with the requested contrast standard if used in a high illuminance environment.

Consumer monitors typically use technologies to get a better contrast in a high illuminance environment.

### **1.7.2 Monitor brightness**

When adjusting the LCD monitor brightness, it is preferable to use backlight intensity control rather than using signal level scaling to retain the bit precision. In the case of other display technologies that do not use a backlight, the white level should be adjusted by means other than signal level scaling. Note that PDP controls the brightness by the number of light radiations, and if lower brightness is set, tone reproduction will be degraded.

### **1.8 Monitor motion artefacts**

The display should not introduce motion artefacts that are introduced by specific display technologies. On the other hand, the motion effects included in the input signal should be represented on the display.

### **1.9 Monitor characteristics in general**

Note that using different characteristics of monitors would yield different picture quality. Thus, it is strongly recommended that characteristics of the monitors used should be checked beforehand. Recommendation ITU-R BT.1886 – Reference electro-optical transfer function for flat panel displays used in HDTV studio production and Report ITU-R BT.2129 – User requirements for a Flat Panel Display (FPD) as a Master monitor in an HDTV programme production environment may be referred to when professional FPD monitors are used for subjective assessment.

### **1.10 Safe areas of wide-screen 16:9 aspect ratio SDTV and HDTV picture displays**

Safe areas for 625, 720 and 1080 line picture displays are provided in Recommendation ITU-R BT.1848.

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