

Automated measurements of picture and sound quality of state-of-the-art TV sets

The R&S®DVSG digital video signal generator supports the development and quality assurance of latest-generation TV sets and projectors. It is a cost-effective one-box solution that offers outstanding technical parameters and can be completely remote-controlled when used in automated test systems.

Signals for the development and quality assurance of the latest TV sets

State-of-the-art TV sets with deep-color support provide enhanced color depth and offer viewers unprecedented picture quality. The devices must also be tested for quality features such as luminance, contrast, color, viewing angle and motion artifacts (see box on page 3). The R&S®DVSG digital video signal generator fulfills all the requirements for a high-precision reference signal source. It outputs uncompressed static and moving video sequences of up to 1080p and PC resolutions of up to 1920 × 1200 (WUXGA) at a color depth of up to 12 bit.

A typical setup to measure the described parameters consists of the R&S®DVSG, which provides the test patterns in line with standards such as those created by the European Broadcasting Union (EBU), and an instrument for measuring luminance and color (FIG 1).



FIG 1 Typical test setup: The R&S®DVSG digital video signal generator generates the test patterns specified in the standards. A spectroradiometer is used for measuring luminance and color.



FIG 2 Audio analysis at the analog and digital outputs of a TV set using the R&S®UPV audio analyzer.

The test patterns are, for example, output to the display under test via the HDMI interface in the R&S®DVSG. A spectroradiometer is normally used for measuring luminance and color. These devices enable precise contrast measurements with adjustable measurement angles and are positioned at a distance that is three to four times the display height of the device under test. The R&S®DVSG as well as most commercial spectroradiometers can be remote-controlled via an external PC.

The R&S®DVSG with its Windows® XP embedded operating system works like a system controller and can also be used for remote-control or evaluation applications. Together with the spectroradiometer, the R&S®DVSG provides reproducible measurement results that exceed the requirements of the measurement guidelines. The digital adjustment of the amplitude of the entire video signal or of individual video signal components allows the exact measurement of the gamut in 0.1 percent steps.

Versatile audio generator

New challenges have to be met in the development and testing of modern display equipment, including the requirement for high-precision signal sources that contain all state-of-the-art digital interfaces as well as the appropriate test signals, e.g. HD signals and moving-picture sequences. The R&S®DVSG digital video signal generator from Rohde & Schwarz has been specially designed to meet these requirements. It can also be used as a pure transport stream player and recorder, an application for which it is particularly suited due to its extensive signal libraries and excellent price/performance ratio. The R&S®DVSG is an ideal choice in the development and production of TV displays as well as for servicing and for use in test houses.

The generator was presented in detail in NEWS 197/08 (pp. 46–49).

Multichannel audio functions, for example in surround sound systems with up to eight audio channels, are increasingly becoming standard in the consumer electronics sector. Besides comprehensive video signal test capabilities, the R&S®DVSG offers many audio generator functions via the HDMI interface. When combined with an audio analyzer such as the R&S®UPV, the R&S®DVSG can thoroughly test the audio components of TV sets via the analog and digital outputs on as many as eight channels (FIG 2). The R&S®DVSG features a sine tone generator that can generate test signals for the measurement of amplitude, total harmonic distortion, crosstalk, etc. It also includes ready-made test signals for measuring frequency response and lip synchronicity. The R&S®UPV and the R&S®DVSG have a uniform remote-control interface in line with the VXI11 standard, which makes an efficient implementation of automated test sequences possible.

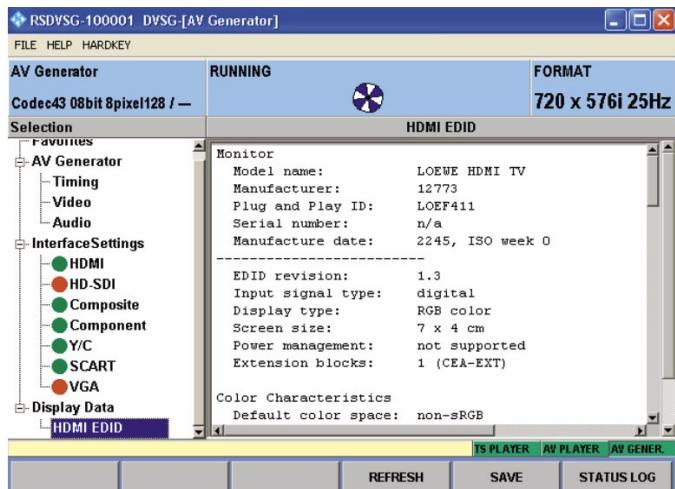


FIG 3 The R&S®DVSG offers an analysis function for the extended display identification data (EDID).

In order to fully enjoy picture and sound especially in consumer electronics, smooth interaction between DVD or Blu-ray disk players and recorders, amplifiers and TV sets is crucial. However, if the interconnected consumer electronics devices support different modes, this can be difficult. Take

screen resolution, for example. Problems can occur if a device is operated in a mode that is not available on another device. To avoid this, state-of-the-art TV sets are provided with a type of electronic data sheet – the extended display identification data (EDID) table, which is transmitted via the HDMI interface. It contains information about manufacturer, supported resolutions and timings, audio and video formats, color and gamma settings, etc. If a Blu-ray player is connected to a TV set, for example, the player evaluates the EDID data and configures the optimum output formats. An analysis function in the R&S®DVSG allows the development and verification of the EDID contents in the HDMI signal (FIG 3). The EDID can be stored as a text or binary file to enable further processing or analysis also via the remote-control interface

Summary

The rapid technological progress of TV sets and projectors places diverse demands on T&M systems. These tasks can be accomplished only with high-end and automatable measuring instruments. The R&S®DVSG digital video signal generator from Rohde & Schwarz offers a broad scope of features and is ideal for handling current and future requirements in development labs and quality assurance.

Harald Gsödl

Basic quality parameters of displays

To assess the overall quality of a display, measurement standards worldwide define a wide variety of measurements.

The most important classic quality parameters are explained below:

- **Dynamic range** This parameter defines the luminance ratio of maximum white level to black level, i.e. the luminance scale that is maximally supported by a display.
- **Contrast** Unlike the dynamic range of a display, which involves the separate measurement of the maximum white level and a black level, the contrast is measured simultaneously in a test pattern.
- **Gamma** This parameter defines the electro-optical transfer function of a display. This function describes the luminance at a gray level gradually changing from black to white.
- **Gamut** The gamut is the available color space of a display. It is defined as the color coordinates of the three primary colors red, green and blue; their mixture allows all other colors to be reproduced.
- **Homogeneity** Another essential display parameter is the homogeneity of the displayed picture. Displays must always reproduce uniform luminance and color values at any position on the panel (FIG 4).

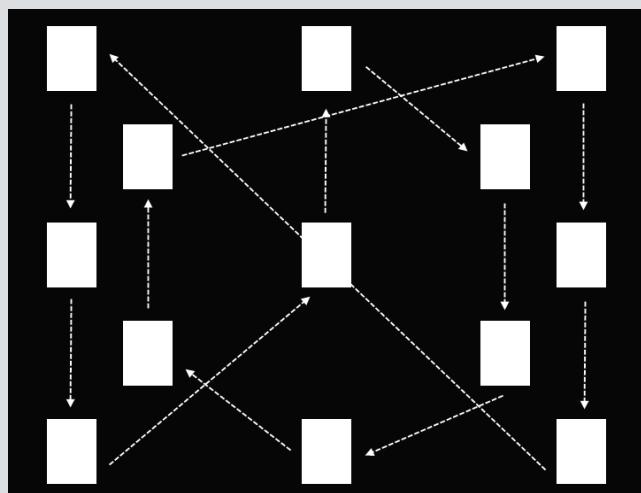


FIG 4 EBU test sequence for measuring display homogeneity.

- **Angle-of-view dependence** This parameter describes the luminance and chrominance values of a picture depending on the horizontal and vertical angle of view.