

# 3D TV test signals in accordance with the HDMI 1.4a interface standard

3D, the runaway hit in cinemas, can now be enjoyed at home. The 3D sensation requires state-of-the-art TV sets that are able to process the corresponding pictures and provide suitable panels. As a result, R&D departments and quality assurance are going to face new challenging tasks. The R&S®DVSG digital video signal generator, which already creates all the required signals, is the ideal tool to meet such requirements.

## Depth perception through a second perspective

3D TV is a technology that makes motion pictures or television images appear to be three-dimensional. Two perspectives of the same scene are offset by the distance between one's eyes and reproduced on the screen in a defined sequence. Today's TV sets are unable to show these images, which is why new 3D TV sets are being developed. The content intended for each eye is delivered synchronously either via active shutter glasses with alternating frame replay or via passive polarization glasses with alternating polarized picture information. As a result, a three-dimensional effect is produced.

The latest high-definition multimedia interface (HDMI) standard, 1.4a, defines new picture formats and timings that transmit the stereoscopic picture information to TV sets using players or set-top boxes.

Frame-compatible formats are based on conventional picture resolutions. The two perspectives share the resolution horizontally (side by side) or vertically (top and bottom) (FIG 1). These picture formats are used primarily in the TV transmission of 3D content. In this case, the existing infrastructure for high-definition transmission (HD) can be used. Yet, the resulting resolution is a drawback, since the individual picture sections are simply scaled up to the entire display area.

In contrast, frame-packing formats offer sequential pictures in full resolution. These formats are used primarily in combination with Blu-ray disc players and – compared to frame-compatible formats – offer optimum picture quality.

## New T&M challenges

The first 3D TV sets are mainly systems with active shutter glasses. Faulty synchronization mechanisms in such glasses might cause ghosting effects, i.e. crosstalk of the picture information for the left eye to the right and vice versa. If the exposure time per eye is too low, brightness will be drastically reduced. This means that R&D as well as production have to face new challenging T&M tasks.

Suitable signal generators and T&M instruments are required to provide precise and reproducible test results. When equipped with the R&S®DVSG-K10 AV signal generator option, the R&S®DVSG is able to create all common primary 2D and 3D video formats, uncompressed and without interfering compression artifacts, in accordance with HDMI 1.4a. Using the R&S®DVSG-B10 AV signal generator extension (hardware expansion), long 3D sequences can be output, since this option expands the video memory to 4 Gbyte and provides sequences with up to 387 individual RGB pictures at 1080p and 36 bit color depth. At lower resolutions or lower bit depths, the sequence length increases proportionally. A test signal library for the various 2D and 3D picture formats is part of the equipment supplied. The library contains moving sequences for subjective picture quality assessment as well as test sequences, which, together with spectroradiometers, can be used to analyze the luminance or crosstalk (FIG 2).

The AVG pattern import software, which is part of the R&S®DVSG-K10 AV signal generator option, enables users to create their own 3D test scenarios from any uncompressed original picture in the formats BMP, TIFF and YUV10 (FIG 3). The software generates the appropriate AVG files based on picture pairs for the left and right eye. The import function for uncompressed PCM audio files with up to eight channels completes the scope of functions provided by the Windows™ application. It can be run on the signal generator or on a separate PC.

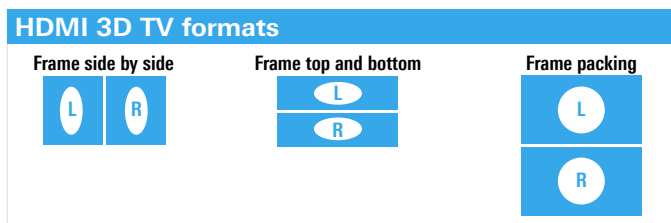
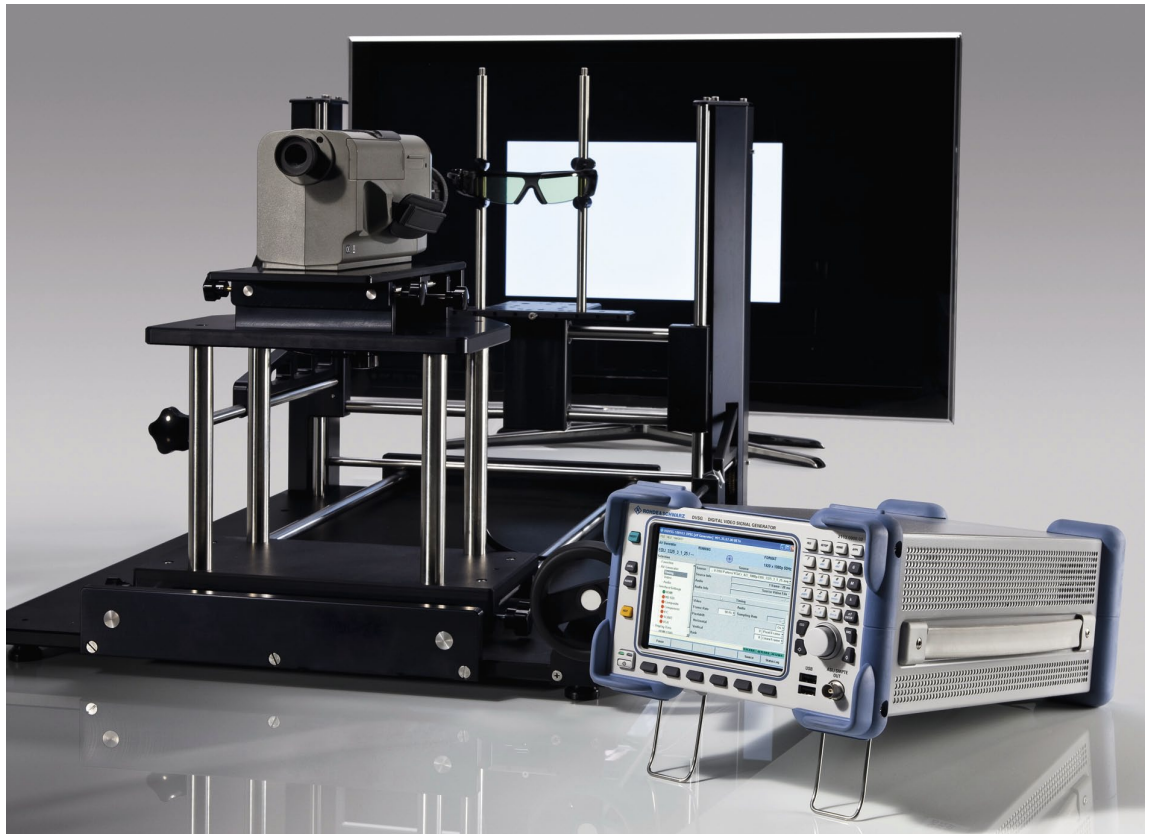


FIG 1 3D TV video formats in accordance with HDMI 1.4a.

FIG 2 Typical test setup to measure the luminance of 3D TV sets (including a positioning system from Instrument Systems and a spectroradiometer from Konica Minolta).



### Display test under real conditions

The R&S®DVSG can be equipped with the R&S®DVSG-B30 AV signal player option. This option lets users check how compressed 3D TV signals occurring in typical broadcast transmissions are processed. Users can play 3D live signals based on MPEG-2 transport streams that contain complex scene cuts and pictures, blocking and other compression artifacts. Supporting both MPEG-2-coded video and MPEG-4 advanced video coding (AVC), the R&S®DVSG is also able to decode all current audio standards.

The R&S®DVSG digital video signal generator is an outstanding tool for use in R&D departments and for quality assurance of 3D TV sets. Offering a scope of functions unique on the market, it enables users to reproducibly perform all required measurements to meet highest quality standards.

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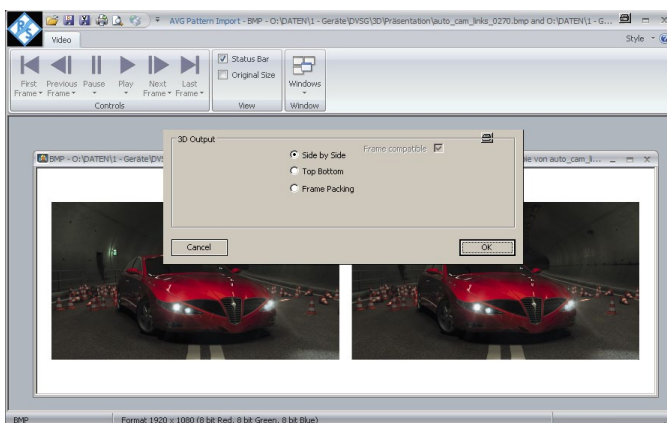


FIG 3 The AVG pattern import software enables users to conveniently configure specific 3D test patterns.