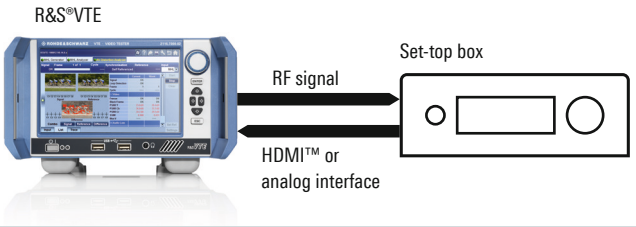
A/V quality testing of set-top boxes and TVs

The R&S®VTC/VTE video testers analyze and evaluate the quality of set-top boxes and TVs on the DUT's A/V interfaces from a user perspective. They provide the necessary quality tests from Go/NoGo tests to long-term stability tests. The RF input signals required for the DUT are generated by the R&S®VTC/VTE.

A/V quality testing of a set-top box



Your requirements

Implementing the latest technical standards, continuous improvement and development of new features and consistent flawless audio/video (A/V) quality are essential for being successful in the TV receiver market. A/V quality testing is required for set-top boxes and RF tuners integrated in TVs in the event of new developments and firmware updates. Besides Go/NoGo tests, which are frequently performed during production, long-term stability tests, temperature tests, standard compliance tests and A/V delay tests are necessary. Depending on where they are being used, set-top boxes and TVs receive a wide variety of combinations of RF signal, transport stream (TS) and video format that need to be tested. This can be done by visual inspection and BER measurements.

Visual inspection is done by a person who constantly and concentratedly evaluates A/V quality. However, this method does not allow reliable reproduction of tests (adding to cost and uncertainty, especially with long-term tests), and only errors perceptible to the human eye are detected.

A bit error ratio (BER) measurement is often carried out instead of visual inspection. This measurement can be automated and detects every type of error. However, for BER measurements, the required test point must be accessible in the receiver. Any hardware and software errors located behind the test point will not be detected. The measurement also does not reveal whether errors are perceptible to the user.

T&M solution

The R&S®VTC/VTE video testers were designed to combine the advantages of both test methods: They deliver reproducible and automatable tests from a user perspective. Measurements are performed directly at the receiver's A/V interfaces (analog, HDMI™). Errors not perceptible to the human eye, e.g. frame loss, are also detected. The R&S®VTC/VTE video testers generate high-quality, high-precision RF test signals for the relevant TV standards for DUT stimulation.

A/V quality measurement (A/V distortion analysis) is based on a difference analysis between the A/V signal to be tested and a previously recorded reference signal. The reference signal is a brief A/V sequence (e.g. 20 s) that can be repeated any number of times for automatic testing. The reference signal used for difference analysis must be taken from the same video processing chain and the same A/V material as the signal being tested. The R&S®VTC/VTE video testers, therefore, do not measure absolute A/V quality but the deviation from a recorded reference. This ensures that the DUT performance and not, for example, the encoder performance is tested. Difference analysis can also be employed to examine the influence of different TS formats, video formats and RF parameters

on the A/V output quality. The RF module of the R&S®VTC/VTE enables simple RF tests using different TV standards, levels and C/N values. Extended RF tests for measuring A/V quality requiring fading or adjacent channel occupation, for example, are conducted with the R&S®BTC broadcast test center. The R&S®BTC can also be equipped with video interfaces on a modular basis.

Quality parameters (peak signal-to-noise ratio (PSNR), structural similarity (SSIM) and mean opinion score (MOS)) are used for A/V analysis to reliably assess video quality and detect any deviation from a reference signal. Errors are assigned to categories such as picture freeze, black frames, dropped frames and visible errors. Using the visible error setting, users can define what errors are to be interpreted as errors perceptible to the human eye. Audio dropouts are also detected in addition to video errors.

The R&S®VTC/VTE can be operated via a touchscreen. A/V quality parameter measurement and logging are started and stopped at the touch of a button. Quality of service (QoS) can be measured easily, quickly, objectively and reproducibly with only one instrument.

The R&S®VTC/VTE video testers support HDMI protocol analysis and tests in line with the HDMI compliance test specification (CTS).

Ordering information

Designation	Type
Products	
Video Test Center	R&S®VTC
Video Tester	R&S®VTE
Interfaces	
HDMI RX 225 MHz [1]	R&S®VT-B2360
HDMI RX 300 MHz [1]	R&S®VT-B2361
Analog A/V RX [1]	R&S®VT-B2370
Software options	
A/V Inspection	R&S®VT-K2110
A/V Distortion Analysis [2]	R&S®VT-K2111
RF signal generation	
Broadcast TX Modulator	R&S®VT-B600

[1] Only one of these options is required, depending on the DUT interface.
[2] Requires A/V inspection.

Applications

For Go/NoGo tests in production, a reference signal is recorded once using a golden device from the same series as the devices being tested. For long-term stability, temperature, standard compliance and A/V delay tests, the reference signal can be generated with the DUT prior to starting the tests.

Quality assurance

The R&S®VTC/VTE can be used for automated long-term stability testing of RF tuners integrated in TVs (prerequisite: SCART interface is available). The TV is supplied with an RF signal generated by the R&S®VTC/VTE. The signal received and processed by the TV can be captured using a SCART-to-RGB adapter and delivered to the analog module of the R&S®VTC/VTE. The A/V quality value is lower [1] because of the noise effects present on analog interfaces and the lower resolution (HD videos are downscaled). Difference analysis can be carried out despite the lower value, as it is not the absolute A/V quality value but the occurrence of signal interference, e.g. picture freeze, that is decisive. This enables reliable, automated long-term stability testing.

Production testing

R&S®VTC/VTE video testers can be used to verify proper functioning of the receive section, signal processing and HDMI interface of set-top boxes. The R&S®VTC/VTE video tester successively generates different combinations of TS format, video format and RF parameters and delivers them to the set-top box. The A/V quality analysis integrated in the R&S®VTC/VTE checks if the tested signal corresponds to the reference signal.

[1] As compared to HDMI interfaces.

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