

Lip-Sync Measurement (AV Delay) for TV Displays

Application Note

Products:

| R&S®DVSG | Hameg®HMO3524

This application note describes the measurement of AV delay on TVs and monitors.

Determining the delay of the video signal in relation to the audio signal aids evaluation of the quality of screens with an audio output.

In some cases, such delays can reach as much as 100 ms, which can cause significant irritation. This delay occurs because video-signal processing requires more computing power than audio-signal processing.

The measurement procedure described here analyzes delays of up to ± 400 ms at a resolution in the order of μ s.

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1 Overview

This application note describes the measurement of AV delay on TVs and monitors. Important factors affecting the results of the measurement are the screen's settings (e.g. brightness, contrast, and technologies designed to optimize motion depiction) and the chosen video input (including the signal type).

Examples:

- Video processors in the TV are used, for example, to achieve sharpness enhancement, resolution conversion (scaling), or the required de-interlacing of interlaced video material.
- The use of video processors in the TV can result in a time offset between the sound and picture.
- The length of the delay for the picture can vary, depending on the picture settings and, therefore, the complexity of the required video processing. Chapter 4 of this application note illustrates these differences with a series of measurements.

With its LipSync test signal, Rohde & Schwarz's R&S® DVSG video generator provides a test sequence suitable for all HD resolutions and numerous frame rates.

This document is structured as follows:

- Chapter 2: Describes the measurement setup and lists the required devices.
- Chapter 3: Explains the measurement procedure and the individual measurements to be taken.
- Chapter 4: Gives a set of example measurements.

2 Test setup

The following equipment is required for the AV delay measurements:

- Video signal generator R&S®DVSG
- Hameg®HMO3524 or an equivalent dual channel storage oscilloscope
- Light-to-voltage converter (see link in Chapter 5)
- Optional: Measurement microphone

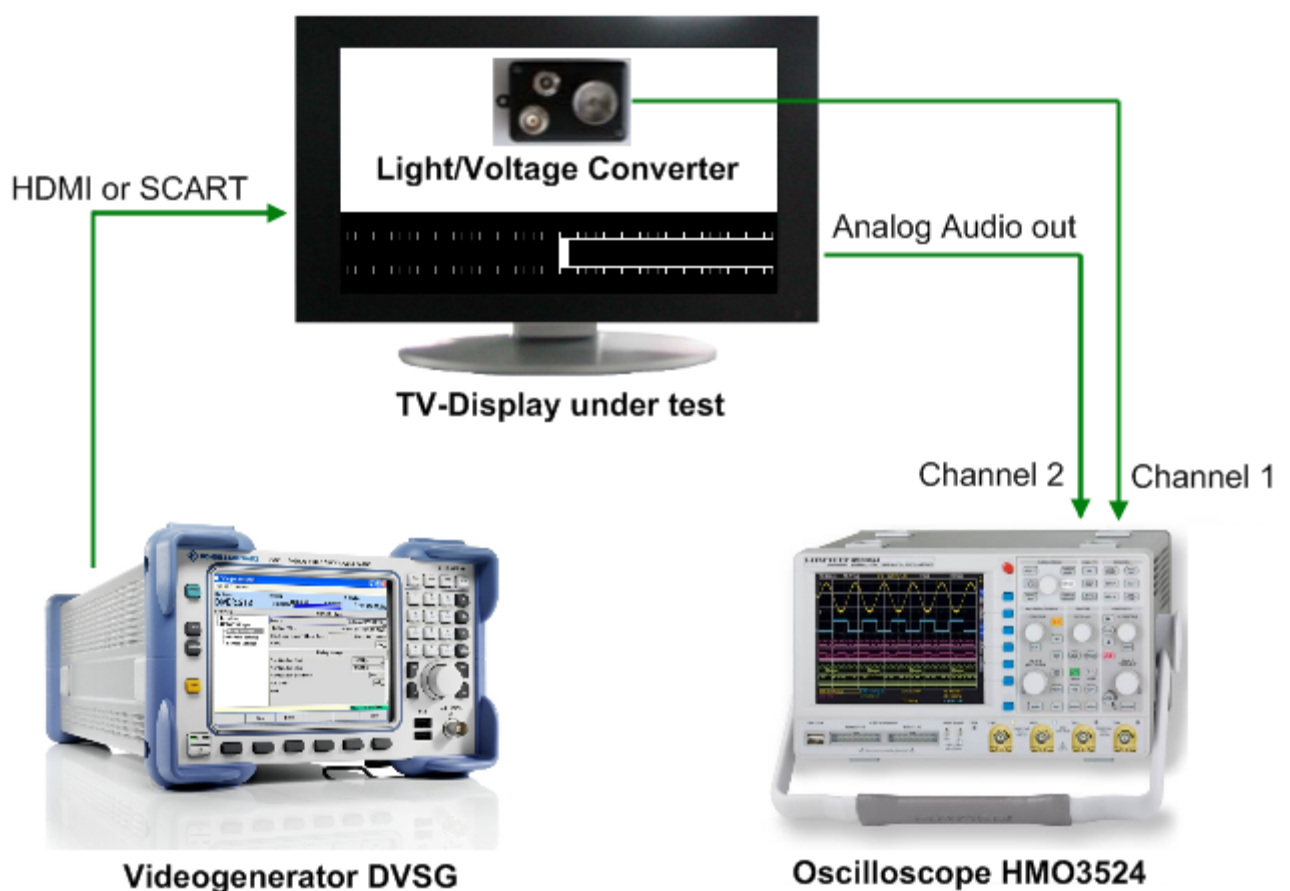


Figure 1: Test setup for measuring AV delay

Connect the R&S®DVSG to the TV under test via the HDMI output. Fix the light-to-voltage converter to the upper half of the screen and connect it to Channel 1 on the oscilloscope. Feed the signal from the TV's left or right analog cinch output into Channel 2.

Optional use of the TV's speakers output requires use of a measurement microphone. The measurement process, however, remains the same.

3 Measurements

Audio–video delay measurements on TV displays involve precise determination of the time offset between the output audio and video signals. For these purposes, the R&S® DVSG video generator provides the so-called LipSync test signal. In this, a white image with a 1 kHz audio signal flashes over a black background with no audio signal. When fed to the tested TV via the HDMI input, this sequence allows the user to determine the time delay by presenting the resulting audio and video signals simultaneously on the oscilloscope.

For more sophisticated evaluation of the AV delay, the tester should prepare a series of measurements with various picture settings and input formats. Especially technologies designed to enhance motion clarity can affect the measured values.

The available audio outputs usually consist of:

- Analog cinch and/or SCART
- Headphone output via mini jack
- Integrated speakers (measured using a microphone)
- Digital audio via cinch and/or optical connection.
(requires a D/A converter for representation on the oscilloscope)

3.1 Measurement procedure

1. Start the LipSync signal on the R&S® DVSG with the desired resolution and frame rate
2. Check the representation on the TV
3. Set the correct levels for the signal on the oscilloscope (according to section 2.1)

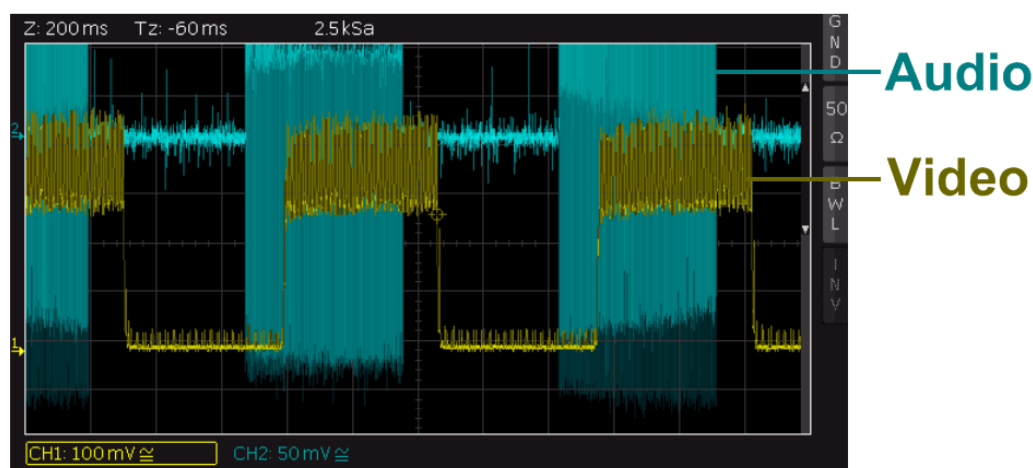


Figure 3: Representing the audio and video signals on the oscilloscope, with levels adjusted appropriately

4. Freeze the display

5. Use the difference marker to determine the time delay (the separation of the 1 kHz audio pulse from the nearest brightness pulse):

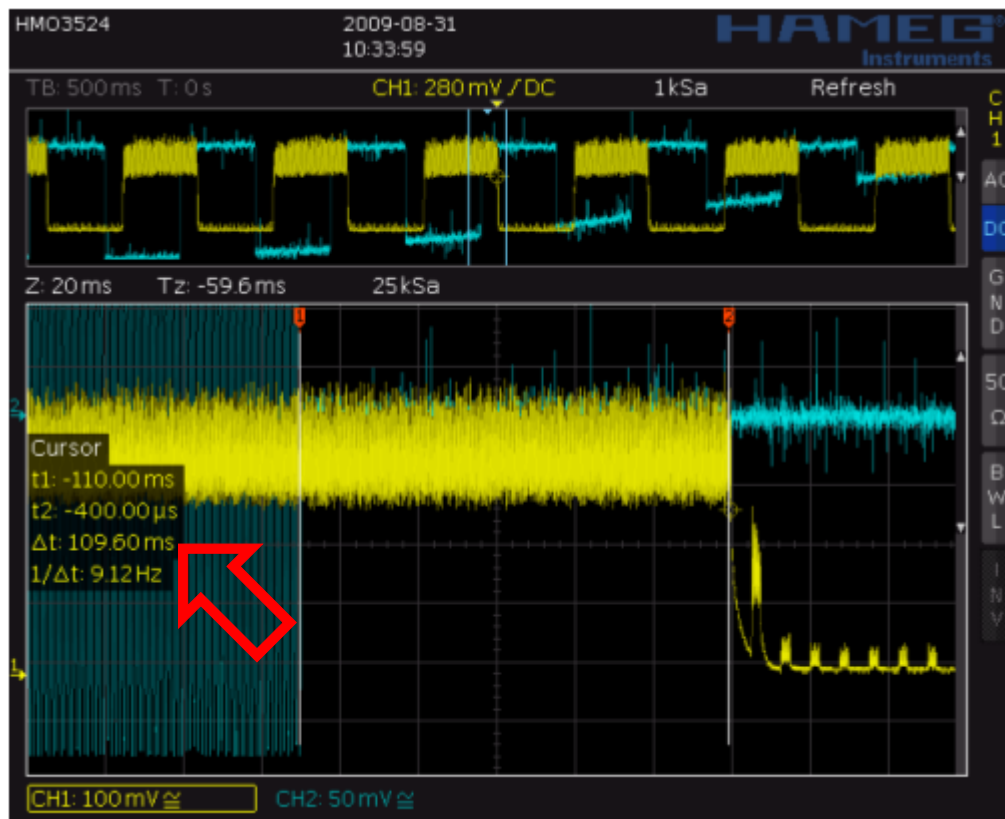


Figure 4: Determination of the AV time delay using the difference marker (here: 109.60 ms)

6. Repeat the measurement, varying the input format, display settings, and audio output

Important notes:

- Modern TVs typically exhibit delay times of up to 200 ms for the video signal. Some TVs, however, already offer settings for delaying the audio signal, so that delays of 0 ms, or even negative values, are also possible.
- Some oscilloscopes allow users to display two channels time-shifted relative to one another. This option should either be deactivated or accounted for in the calculation, since it directly affects the measured value.
- The length of the white pulse with sound and of the silent black interval are each at least 400 ms in all LipSync test signals. Since an audio pulse can only be measured in relation to the next video pulse, this length of time also defines the maximum measurable delay: ± 400 ms.
- The delay of the light-to-voltage converter will not affect the measurement results, since it lies in the order of μ s.

4 Example measurements

The following table presents the AV delay values for a TV tested according to this application note, clearly showing the influence of the video format and the effect of the video optimizations:

Video format	Settings on the tested TV					
	Standard	100% brightness	100% contrast	Optimized motion clarity	All optimizations activated	All optimizations deactivated
1080p 24 Hz	28 ms	24 ms	24 ms	27 ms	31 ms	20 ms
1080p 50 Hz	12 ms	12 ms	14 ms	16 ms	15 ms	16 ms

Table 1: Example measurements from a TV tested according to the above method

5 Literature

- [1] Construction manual for a light-to-voltage converter to measure response times and delay of monitors and TV displays.
<http://avtop.de/downloads/constructionmanuallighttovoltageconverter.pdf>

6 Additional Information

Our Application Notes are regularly revised and updated. Check for any changes at <http://www.rohde-schwarz.com>.

Please send any comments and suggestions about this Application Note to Broadcasting-TM-Applications@rohde-schwarz.com.

7 Ordering Information

Designation	Type	Order No.
Base unit		
Digital Video Signal Generator	R&S®DVSG	2113.0008.02
Required options		
AV Signal Generator	R&S®DVSG -K10	2113.0314.02
Recommended options		
AV Signal Generator Extension	R&S®DVSG -B10	2113.0208.02
AV Signal Player	R&S®DVSG -B30	2113.0237.02
TS Player and Recorder	R&S®DVSG -K20	2113.0320.02
Stream libraries		
HDTV sequences	R&S®DV-HDTV	2085.7650.02
H.264 stream Library	R&S®DV-H264	2085.9052.02
DVB-H stream Library	R&S®DV-DVBH	2085.8704.02
Test Card M Sequences	R&S®DV-TCM	2085.7708.02
ISDB-T stream Library	R&S®DV-ISDBT	2085.9146.02
MEDIAFLO streams	R&S®SFU-K222	2110.2968.02
ISDB-T streams	R&S®SFU-K224	2110.4777.02
CMMB streams	R&S®SFU-K225	2112.3649.02
ATSC mobile DTV streams	R&S®SFU-K226	2110.3812.02
TS creation tool		
Advanced Stream Combiner (dongle for USB interface)	R&S®DV-ASC	2085.8804.03

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