**Introduction**

Testing digital video disc (DVD) players can be complicated at design and validation stages. It requires a whole range of instruments to test and verify the performance. In manufacturing, where cost and test time are important factors, testing has been simplified to several selected measurement verifications. The measurements are made to check all the video and audio outputs of a DVD player.

**Description**

Modern DVD players have multiple audio and video outputs including Blu-ray DVD. Most DVD players have the following output connectors:

- Video: composite video (CVBS), component video, Super-video (S-Video), High-Definition Multimedia Interface (HDMI)
- Audio: RCA stereo analog audio, Dolby 5.1, Digital audio IEC-958 Type II RCA coax, Raw digital audio Dolby 5.1 DTS

Each of these outputs will be measured with an oscilloscope to check for their amplitude levels, frequencies, and waveform purity. Since there is no signal input port for DVD player, source of the test signals come from a test disc playback.

**Measurement Test Setup**

Typically there are total of 15 video and audio outputs to be routed to the oscilloscope for measurement, as shown in Figure 1.

![Figure 1. DVD outputs measurement test setup](image)

Using Keysight modular instruments, configuration with two U2751A USB Modular Switch Matrix modules and two U2701A USB Modular Oscilloscopes are sufficient to make the measurements. Figure 2 shows the U2751A switch matrix soft front panel of the Keysight Measurement Manager. It is a 4x8 matrix that can be used to connect four sources to eight test points.

![Figure 2. U2751A switch matrix soft front panel](image)
Figure 3 shows the diagram of two switch matrix modules. R11 through R24 are connected to four channel inputs of two modular U2701A oscilloscopes. At any one time, four outputs of a DVD player can be measured simultaneously.

![Diagram of two switch matrix modules](image)

Figure 3. The diagram of two switch matrix

Table 1. The configurations of two U2751A switch matrix modules

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</table>

| V_6 – Video Out | ARL – Left Audio Out |
| S_1 – S Video SC Level | ABR – Right Audio Out |
| S_2 – S Video Y Level | ARL – Front Left 5.1 Audio |
| V_1 – Component Video Out, Y | ABR – Front Right 5.1 Audio |
| V_1 – Component Video Out, B-Y | ARL – Back Left 5.1 Audio |
| V_3 – Component Video Out, R-Y | ABR – Back Right 5.1 Audio |
| D – Digital Out Coaxial | AC – Center Audio |
|                    | AW – Sub Woofer |

Figure 4. Measurement test configuration of the instrument with the U2751A switch matrix and U2701A oscilloscope
Measurement Test

1. Audio output tests

Modern DVD players support multiple audio formats. Most DVD players are fully compatible with standard audio Compact Disc Digital Audio (CD-DA), Super Audio CD (SACD) in addition to DVD-Audio (DVD-A).

It is fairly simple to verify audio outputs. A test disc will be played while the audio outputs are measured with an oscilloscope. The test disc usually contains tones of 100 Hz, 250 Hz, 440 Hz, 1 kHz, and 10 kHz.

An oscilloscope is used to check for the waveform amplitude and frequency as well as to check the waveform for any undesired distortion. The frequency and amplitude of the output signal represent the pitch and loudness of the sound respectively.

Test signals with multiple audio formats such as DVD-A, SACD and CD-DA are used to check the player compatibility with the formats.

1.1 RCA stereo analog audio output test

DVD players have two RCA analog audio outputs; left and right channels. Figure 5 shows an example of the channel outputs measurement with the U2701A oscilloscope.

Types of Output:

- Left-Channel (L-Ch)
- Right-Channel (R-Ch)

The U2701A oscilloscope provides you a convenient measurement-reading capability. It shows all the desired measurements in a single screen.

**NOTE**
Muting the DVD player should read no signal from the oscilloscope, and muting L-Ch or R-Ch should read no signal at the corresponding output.
1.2 5.1 channel analog audio output test

5.1 channel analog audio output has six independent channels. Each of the audio jack outputs is tested to ensure that it is at the appropriate level.

Types Output:
- Front Left, Right
- Rear Left, Right
- Center
- Sub Woofer

1.3 Digital audio output test

Digital audio output enables DVD players to connect to any device with a coaxial digital input. The coaxial digital audio output test checks for the signal level, waveform, and signal rise time or fall time.

Figure 6. An example of the left channel of a 5.1 channel analog audio output

Figure 7. An example of digital audio output
2. Video output test

Video output is tested with playback of a 100% color bar test pattern. The test signal is a full field of color bars composed of a 100% white bar (meaning 100% amplitude), 100% saturation, and 100% color bars (yellow cyan, green, magenta, red, blue, and black).

2.1 Composite video output test

CVBS, also known as composite video, is a format of an analog television signal before it is combined with sound and modulated for a radio frequency (RF) carrier. It consists of a luminance signal with synchronization pulses, and a chrominance signal. Luminance represents the brightness of the picture and chrominance carries color information.

An Agilent Modular oscilloscope with a built-in TV triggering feature allows you to select either vertical or horizontal sync pulses so that a stable video waveform may be observed on the oscilloscope display.

By triggering on a specific line of video, you can check on the signal video sync level as well as the color burst level. An incorrect color burst level will cause the display color to be too dark or too weak.

Color bars are the most widely used video test signal. It is often used to test video levels and chrominance relationships.

All the DVD player analog video outputs which include CVBS, component video and S-Video can be measured with oscilloscope.
2.2 Component video output test

Component video offers the best analog video interface between video signal source and video display. Unlike composite signal, which carries all the video data in a single signal, component video carries sync pulse, luminance, and chrominance signals as 3 separate signals; Y, B-Y and R-Y.

In production testing, each of the component video output is checked with an oscilloscope while the 100% color bar is being played back.

2.2.1 Component video Y output test

The Y video signal is tested to ensure that it is correct. An incorrect output level directly affects the brightness of the video signal, causing the display to be too bright or too dark.

The correct output video level of 100% color bars playback should be 1 Vp-p as shown in Figure 10.
2.2.2 Component video B-Y output test

The B-Y video output is tested to ensure that the video level is correct. The correct B-Y video output level is 700 mVp-p, as shown in Figure 11.

**Figure 11.** B-Y channel of component video output

2.2.2 Component video B-Y output test

The B-Y video output is tested to ensure that the video level is correct. The correct B-Y video output level is 700 mVp-p, as shown in Figure 11.

**Figure 12.** R-Y channel of component video output
2.3 S-video video output test

S-Video carries brightness and color information as two separate signals, the Y or C signals. Y carries the brightness information and sync pulse, while C carries color information.

2.3.1 S-C level test

S-Video output S-C level is tested to ensure it is correct. The correct burst signal level of S-C is approximately 300 mV. If it is adjusted incorrectly, the color will be too dark or too weak.

Figure 13. An example of S-C channel S-video output
2.3.2 Y level test

S-Video output Y level is tested to ensure it is correct. The correct Y level is 1 Vp-p.

Conclusion

In DVD player manufacturing testing, cost, speed and space utilization are vital factors of consideration. Keysight modular instruments are low in cost, small, portable, and fast. These advantages provide a good fit in testing DVD players’ multiple video and audio outputs.
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Published in USA, December 1, 2017
5989-9568EN
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