U4998A HDMI 1.4a Protocol/Audio/Video Analyzer and Generator

User Guide

Agilent Technologies

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Contents

1
Introduction to U4998A HDMI 1.4a Protocol/Audio/Video Analyzer and Generator

This chapter provides information on the hardware and software components of U4998A HDMI 1.4a Protocol/Audio/Video Analyzer and Generator. This chapter also describes its features and various roles in testing HDMI sink and source devices.

What is U4998A HDMI 1.4a Protocol/Audio/Video Analyzer and Generator

The Agilent U4998A HDMI 1.4a Protocol/Audio/Video Analyzer and Generator (hereafter referred to as U4998A) is a test and debug tool that provides features for testing the HDMI sink and source devices. You can use it to perform HDMI compliance testing and debugging on HDMI devices.

U4998A can test a HDMI source device by capturing the data transmitted by this device and analyzing the captured data for compliance to HDMI Compliance Test Specifications (CTS). It can also test a HDMI sink device by transmitting audio and video frames to this device to analyze if the device passes the HDMI CTS sink tests.

Features

This topic lists the key features of U4998A.

- Provides debug as well as compliance testing features to test a HDMI DUT as per the HDMI 1.4 and 1.4a compliance test specifications.
- Provides HDMI IN as well as HDMI OUT connectors to act as a receiver and a transmitter over a HDMI link.
- Supports HDMI CTS 1.4a sink and source tests. All the source tests except 7-1 till 7-15 and 7-20 till 7-22 are supported. For running sink tests, it provides the required audio/video files for all sink tests except 8-2, 8-27, and 8-28.
- Supports a maximum memory depth of 4GB for capturing the data received from DUT.
- Supports offline evaluation of the data received from source DUT for testing compliance to HDMI CTS. This data can be stored in .cap files.
- As a HDMI sink device, U4998A can accept any audio and video format from the source DUT and capture it in a .cap file.
- As a HDMI source device, U4998A provides a set of predefined video files in the .vgf format and audio files in the .aaf format for transmission to a sink DUT. This set of audio and video files are provided as per the HDMI sink tests requirements so that you can run various sink tests for the DUT.

Components

The following is a list of hardware and software components of U4998A.

Hardware Components

U4998A HDMI 1.4a Protocol/Audio/Video Analyzer and Generator module

The U4998A HDMI 1.4a Protocol/Audio/Video Analyzer and Generator is a module installed in an Agilent Digital Test Console chassis, for example, the Agilent U4002A portable 2-slot chassis. The module can emulate a HDMI sink or source device and can transmit or receive data over a HDMI link. The module is connected to the DUT using a HDMI cable. You need a Category-2 Certified HDMI cable (supporting transfer rates of up to 340Mhz or 10.2gbps).

Chassis

The portable 2-slot chassis has two slots which you can use to install application modules such as U4998A module.

Controller PC

The Controller PC hosts the U4998A software to allow you to set up, configure, and use the U4998A module using GUIs/APIs.

The controller PC is connected to Agilent Digital Test Console chassis via a PCIe x4 Host Interface board.

For more information about these hardware components, refer to the U4998A HDMI 1.4a Protocol/Audio/Video Analyzer and Generator Installation guide. For more information on how to set up and connect these hardware components, refer to the Agilent DTC Installation guide. These guides are located in the following highlighted folder at the install location of Agilent Logic Analyzer

:

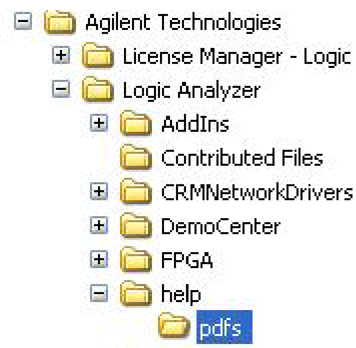


Figure 1 Location of U4998A Guides

Software Components

All these software components are installed on the controller PC.

Agilent Logic Analyzer

NOTE You do not need the Agilent Logic Analyzer hardware for HDMI testing.

The Agilent Logic Analyzer software provides a GUI interface to set up, configure, and use the frame generator and capture capabilities of the U4998A module. In the context of this module, you can use the Agilent Logic Analyzer software to:

- configure and establish a connection between the U4998A module and HDMI DUT.
- configure the settings that control how and where the data received from DUT is captured for evaluation and analysis.
- configure the settings that control the audio/video frames that the U4998A module transmits to HDMI DUT.
- define the EDID block of U4998A when it acts as a terminator.
- start and stop the transmission of frames to HDMI DUT.

The topics that follow in this guide describe these tasks in detail.

HDMI Evaluator

The HDMI Evaluator software is used to perform offline evaluation on the captured HDMI data that a source DUT transmitted to U4998A.

You can capture the data transmitted by a source HDMI DUT using the Agilent Logic Analyzer software and store it in a .cap file. You can then evaluate the data from this file using HDMI Evaluator for testing DUT’s compliance to HDMI specifications. HDMI Evaluator provides a number of HDMI source tests that you can run on the captured data to check if the source DUT passes these tests.

In this release, only the HDMI Evaluator tab of the HDMI Evaluator GUI is used. All other tabs are not applicable for U4998A and instead the Logic Analyzer GUI is used to perform all other tasks except the evaluation task. However, the other tabs of the HDMI Evaluator GUI are applicable if you are using and are connected to the N5998A HDMI Analyzer hardware.

U4998A HDMI Video Generator Files software

When you install this software component,

- a set of predefined Video and Audio Generator files (.vgf and .aaf) are installed. You can transmit any of these predefined video files to a HDMI sink DUT from U4998A using the Agilent Logic Analyzer GUI.

  To know more, refer to the topic, “Using the Predefined Audio and Video Files for transmission" on page 73.

- a set of EDID sample data files (.edi files) are installed. You can use any of these files to define the EDID of U4998A when emulating a sink device.

  To know more, refer to the topic, “Defining the EDID Block of U4998A" on page 30.

Agilent Generate Module CSV from HDMI Capture File utility

This utility is an optional software component and requires a software license. This utility converts the HDMI capture file (.cap file) that has the data received from HDMI source DUT into a module CSV file. You can import the converted module CSV file into the Agilent Logic Analyzer GUI for deeper analysis of the captured data.

To know more about this utility and how to use it, refer to the topic "Importing Captured Data into Agilent Logic Analyzer for further Analysis" on page 53 in this guide.

For more information on how to install these software components, refer to the *U4998A HDMI 1.4a Protocol/Audio/Video Analyzer and Generator Installation guide* located at *<Install location of Logic Analyzer>\help\pdfs*.

Sample Setup of U4998A

The following is a setup of U4998A with all its software and hardware components.

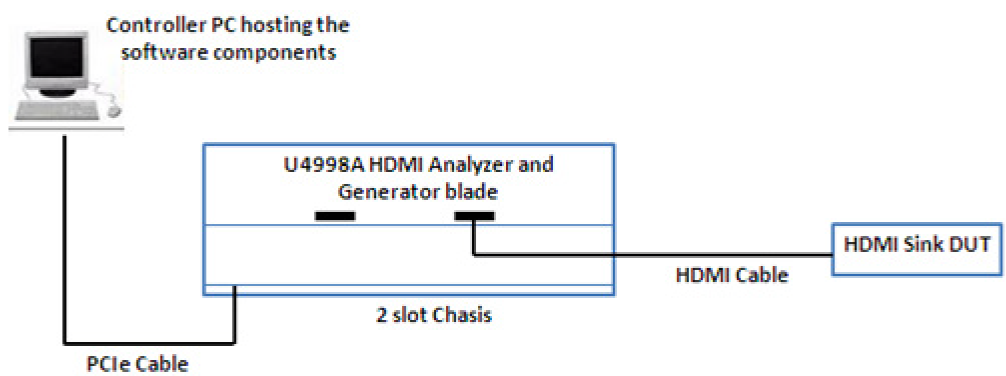


Figure 2 U4998A Sample Setup

Roles and Usage Scenarios

U4998A can emulate a HDMI source and sink device to test HDMI devices. This topic illustrates and briefly describes its role and usage as a terminator and generator.

As a Terminator

As a Terminator, U4998A acts as a HDMI sink device and receives the data transmitted by the source DUT over a HDMI link.

The following figure illustrates a typical configuration of U4998A as a Terminator.

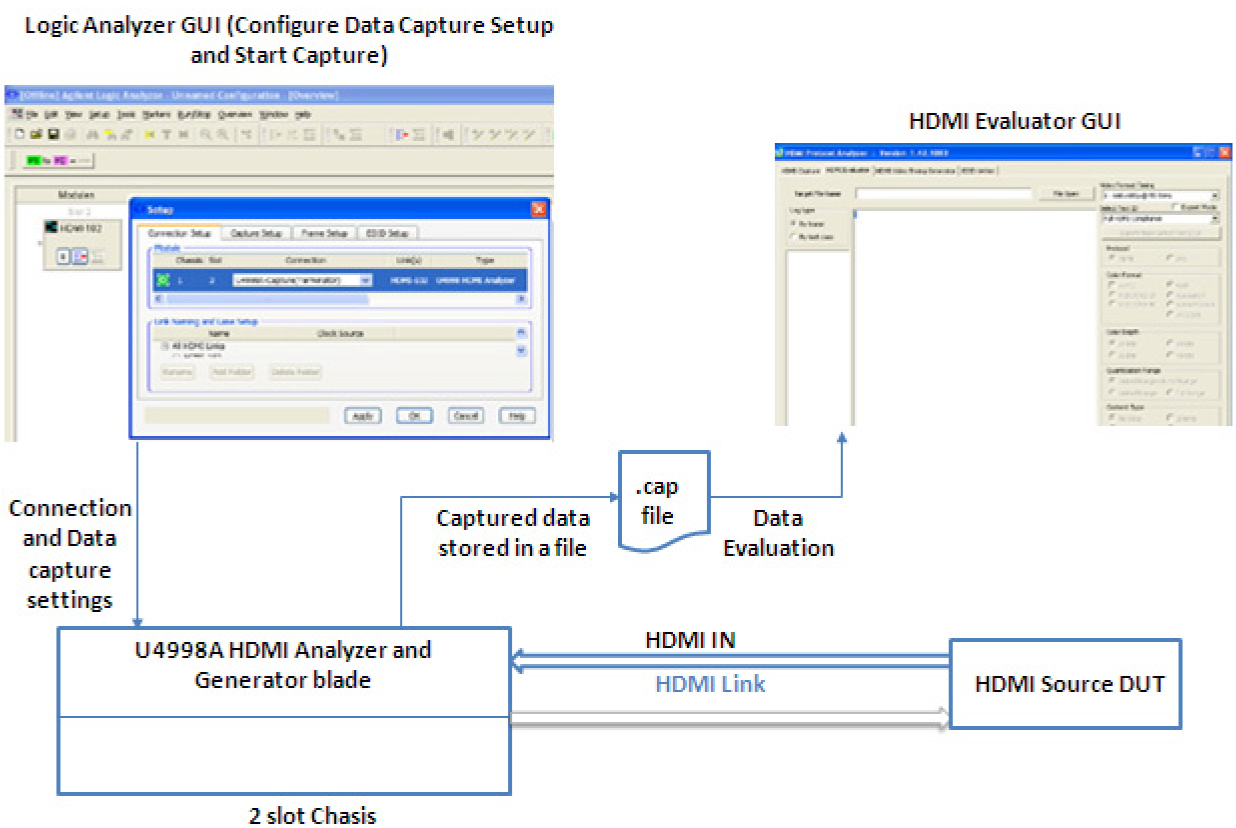


Figure 3 Usage as a Terminator

As illustrated in the above figure, the Logic Analyzer GUI is used to configure the HDMI connection and data capture settings. When you configure the HDMI connection as a Terminator, U4998A emulates the role of a HDMI sink device. When the DUT transmits data to U4998A, the transmitted data is stored in a .cap file as per the configured data capture settings. This captured data is then used in the HDMI Evaluator GUI to evaluate the DUT as per the HDMI specifications.

Refer to the “Testing a HDMI Source Device chapter to know more about the usage of U4998A as a Terminator.

As a Generator

As a Generator, U4998A acts as a HDMI source device and transmits the specified audio/video frames to the sink DUT over a HDMI link.

The following figure illustrates a typical configuration of U4998A as a Generator.

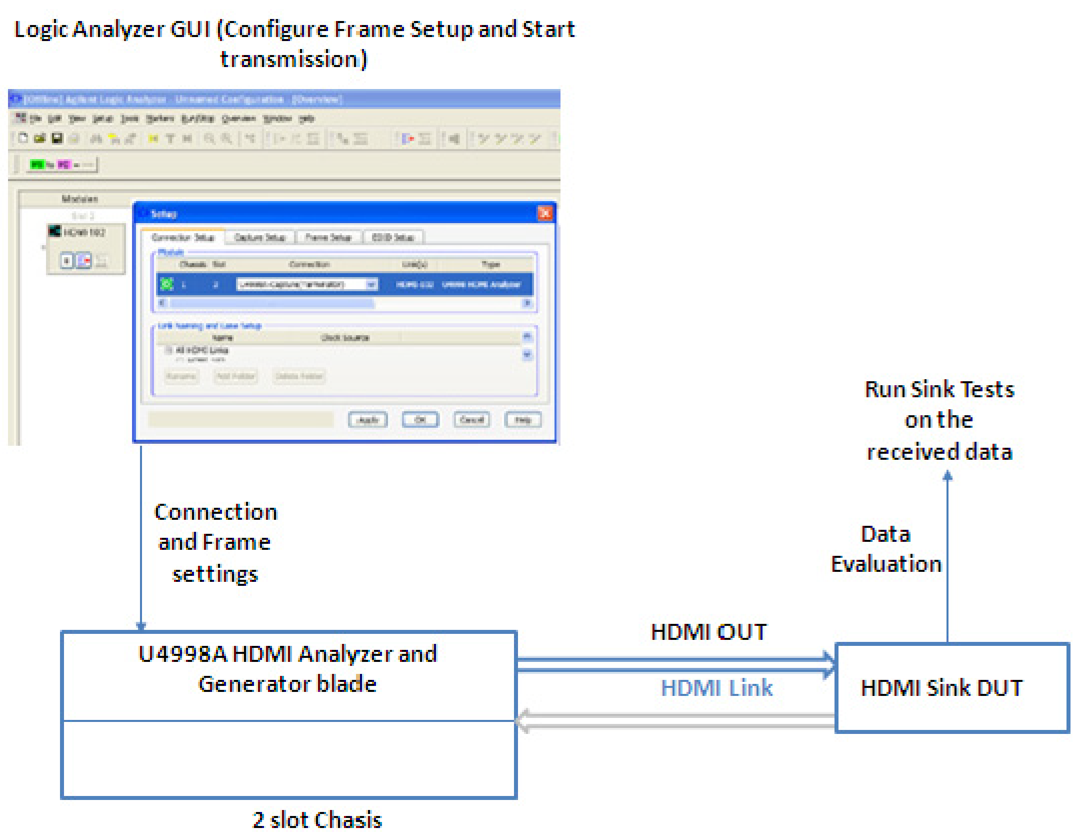


Figure 4 Usage as a Generator

As illustrated in the above figure, the Logic Analyzer GUI is used to configure the HDMI connection and frame settings. When you configure the HDMI connection as a Generator, U4998A emulates the role of a HDMI source device. It transmits the configured audio and video frames to DUT when you start the data transmission using the Logic Analyzer GUI. You can evaluate the data received at the DUT end to check if the DUT passes the sink tests as per the HDMI specifications.

Refer to the “Testing a HDMI Sink Device chapter to know more about the usage of U4998A as a Generator.

2
Establishing a Connection between U4998A and DUT

This chapter provides information on how you can create an appropriate connection between U4998A and DUT to perform HDMI testing.

Before you start

Before you start configuring connection settings between the U4998A and DUT, ensure that you have:

- Installed the U4998A module into the Agilent Digital Test Console chassis. Refer to the *Agilent Digital Test Console Installation Guide* to know more.
- Installed the required software (Agilent Logic Analyzer and HDMI Evaluator) on Controller PC. Refer to the *U4998A HDMI 1.4a Protocol/Audio/Video Analyzer and Generator Installation guide* to know more.
- Connected the Agilent Digital Test Console chassis to the Controller PC via a PCI Express cable.

  Refer to the *Agilent Digital Test Console Installation Guide* to know more.
- Connected the HDMI DUT to U4998A module using a HDMI cable. It is recommended that you define the EDID block of the U4998A (acting as the sink device) before connecting it to a source DUT. This is because the source DUT immediately reads the EDID of U4998A on getting connected. Absence of the desired EDID for U4998A can cause problems in data transmission as per the U4998A capabilities.

Accessing the Agilent Logic Analyzer GUI

You use the Agilent Logic Analyzer GUI to configure connection settings between U4998A and DUT and to configure settings needed for HDMI testing.

This topic describes how you can access this GUI in offline and online modes to set up a connection and to perform configuration tasks for HDMI testing.

Online mode

In this mode, the Agilent Logic Analyzer software (hosted on the Controller PC) is connected to U4998A module. This mode is preferred when you want to perform the HDMI configuration and testing tasks while being connected to the U4998A module. For tasks, such as starting the transmission of frames to HDMI DUT or capturing data transmitted by DUT, a connection to U4998A module is needed. Therefore, for such tasks, you need to access the Agilent Logic Analyzer GUI in the online mode.

Offline mode

In this mode, there is no connection between the U4998A module and Controller PC hosting the Logic Analyzer software. This mode is preferred for setting up and saving HDMI testing configurations without being connected to the U4998A module. These configurations can later be used to perform HDMI testing when the Agilent Logic Analyzer GUI is connected to the U4998A module in an online mode.

Accessing the Agilent Logic Analyzer GUI in offline mode

1. Click **Start** > **Programs** > **Agilent Logic Analyzer** > **Agilent Logic Analyzer** option on the Windows task bar.

   The **Offline Startup Options** dialog box is displayed.

2. Click **Continue Offline** to start the Agilent Logic Analyzer application in the offline mode, that is, not connected to the U4998A module.

   The **Create a New Configuration** dialog box is displayed.

3. Select the type of analysis hardware which you want to configure in offline mode. In this case, select the **U4998A HDMI Protocol/Audio/Video Analyzer and Generator**

option from the **Type of Card** listbox to configure U4998A in offline mode.

4 From the **Number of Cards in** listbox, select the number of cards in the hardware module. For U4998A, you can select One Card Module.

5 Select the starting slot for U4998A.

6 Click **OK**.

The Agilent Logic Analyzer GUI is displayed with a module added for U4998A in the Overview window. You can use this module to configure and use the U4998A module for HDMI testing.

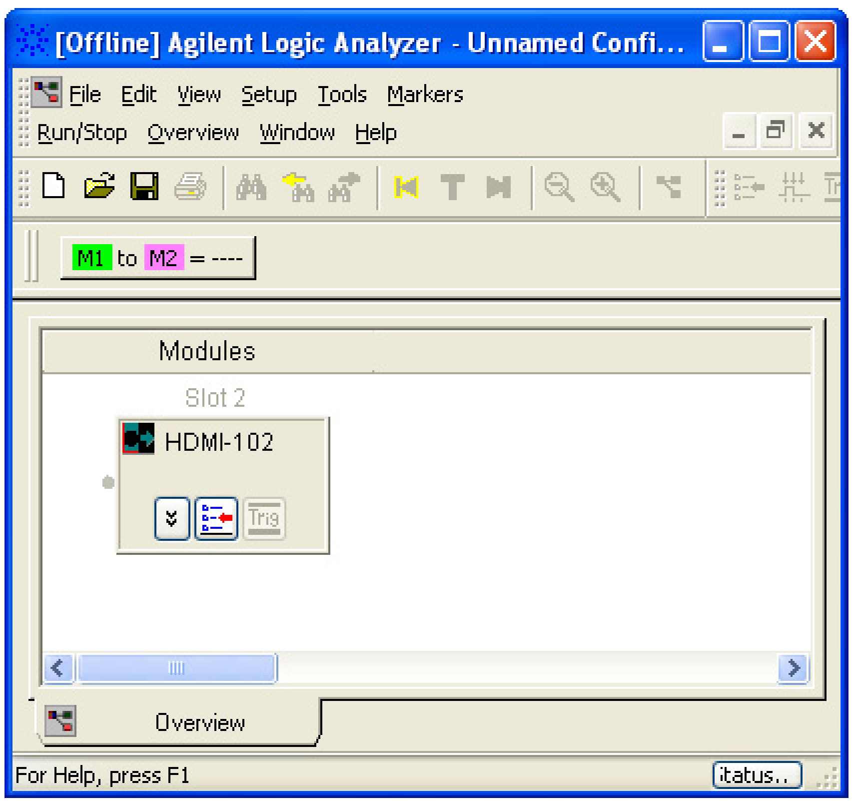


Figure 5 HDMI module added in offline mode

Accessing the Agilent Logic Analyzer GUI in online mode

1 Click **Start** > **Programs** > **Agilent Logic Analyzer** > **Agilent Logic Analyzer** option on the Windows task bar.

The Agilent Logic Analyzer GUI is displayed. Due to the existence of a connection between Logic Analyzer and U4998A in online mode, a module is automatically added for

U4998A in the Overview window of Logic Analyzer. You can use this module to configure and use U4998A for HDMI testing.

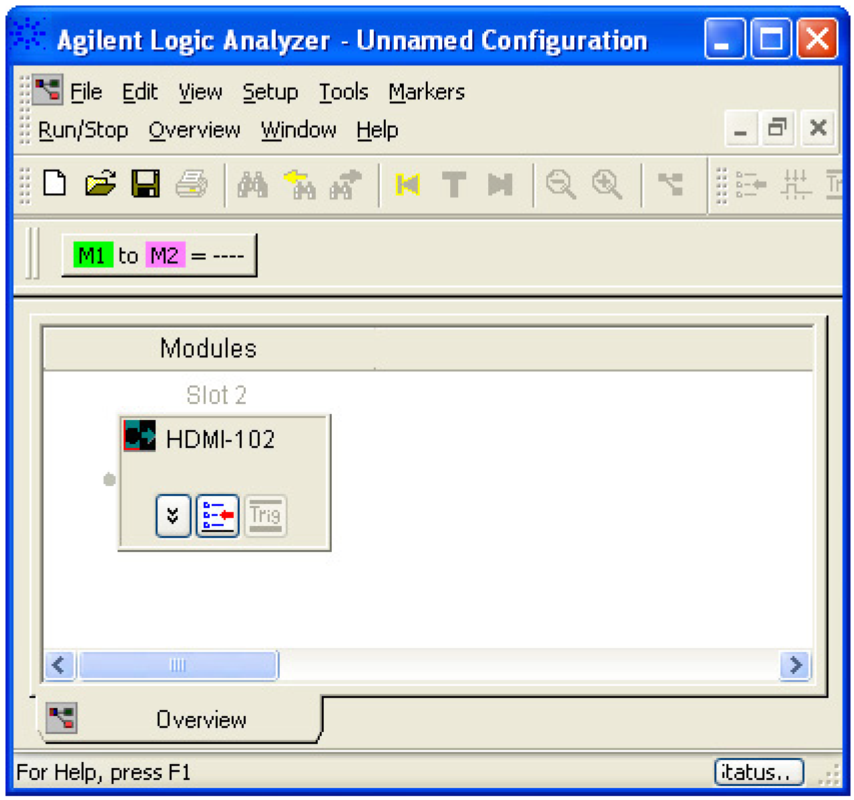


Figure 6 HDMI module added in online mode

Setting up a Connection between U4998A and DUT

To perform HDMI compliance testing on a DUT, you first need to set up a connection between U4998A and HDMI DUT.

When you connect U4998A and HDMI DUT using a HDMI cable, the two devices get connected through a Hot Plug Detect mechanism. Once the devices are connected, you need to configure the connection settings. The connection settings primarily indicate how you want to use U4998A for testing a HDMI DUT. U4998A can emulate a source, or a sink HDMI device. Each of these emulation modes of U4998A has a corresponding connection mode available to ensure that an appropriate connection is established based on the specific HDMI testing scenario. The following section describes these connection modes of U4998A.

Connection modes

- **U4998A- Frame Generator** - You use this connection mode when you want U4998A to emulate a HDMI source device and test a HDMI sink device. In this mode, U4998A can transmit the configured audio and video frames to a HDMI sink DUT over the HDMI link.
- **U4998A- Capture (Terminator)** - You use this connection mode when you want U4998A to emulate a HDMI sink device and test a HDMI source device. In this mode, U4998A can capture the data transmitted by a HDMI source DUT to analyze and evaluate the DUT's compliance to HDMI specifications.

Setting up a Connection between U4998A and DUT

You use the Agilent Logic Analyzer GUI to configure the connection settings between U4998A and DUT. You can access this GUI in either online or offline mode to accomplish this task.

NOTE

Ensure that you have the appropriate license for the required connection mode to use U4998A in that mode. The following are the licenses available for these connection modes.

- U4998A-CMP Capture/Compliance testing license

- U4998A-GEN Generator license

These are included in the U4998A Standard license.

To set up a HDMI connection

1 Access the Agilent Logic Analyzer GUI with appropriate U4998A hardware configurations. Refer to the topic “Accessing the Agilent Logic Analyzer GUI" on page 19 to know more.

2 Click the HDMI module displayed in the **Overview** window of Logic Analyzer GUI.

3 Select **Setup** -> **Setup** from the menu displayed on clicking the HDMI module.

   The **Setup** dialog box is displayed.

4 Click the **Connection Setup** tab to configure the connection settings between U4998A and DUT.

5 From the **Connection** listbox, select the appropriate connection type needed based on the HDMI testing scenario. Refer to the topic “Connection modes" on page 22 to know more.

6 Based on the connection type selected, you can get a visual representation of the HDMI connection by clicking the **Connection diagram** button.

7 In the **Link Naming and Lane Setup** group box, select the **Clock Source** that you want to use for the HDMI link. The following options are available for selecting a clock source:

   - **TMDS** - This is applicable if U4998A emulates a terminator. You should select this option if you want U4998A to use the TMDS clock transmitted by the sink DUT as a frequency reference for the data recovery on the three TMDS data channels. The TMDS clock runs at a rate corresponding to the pixel rate of the video transmitted from DUT.

- **Internal** - This is applicable if U4998A emulates a generator. You should select this option if you want U4998A to transmit an internal clock to the sink DUT to recover the transmitted data as per that clock frequency reference.
- **External** - This is applicable if U4998A emulates a terminator or a generator. You should select this option if you want to use an external clock source to provide clock reference to U4998A and DUT. On selecting this clock source, the **Detected TMDS Clock** field is not applicable in the **Capture Setup** tab.

8 If required, you can change the name of the HDMI link between U4998A and DUT. To do this, select the HDMI Link from the **Link Naming and Lane Setup** group box and click **Rename**.

9 You can add multiple HDMI links using the **Add Folder** button displayed in the **Link Naming and Lane Setup** group box. You may want to add folders to organize the HDMI Links folder specially when the number of frames are large.

10 Click **Apply** and then **OK**.

3
Testing a HDMI Source Device

This chapter describes how you can configure U4998A to test a HDMI source DUT. It also describes how you can capture, evaluate, and analyze the data that U4998A receives from DUT.

Overview

The following figure illustrates the broad steps that you need to perform to test a HDMI source DUT using U4998A.

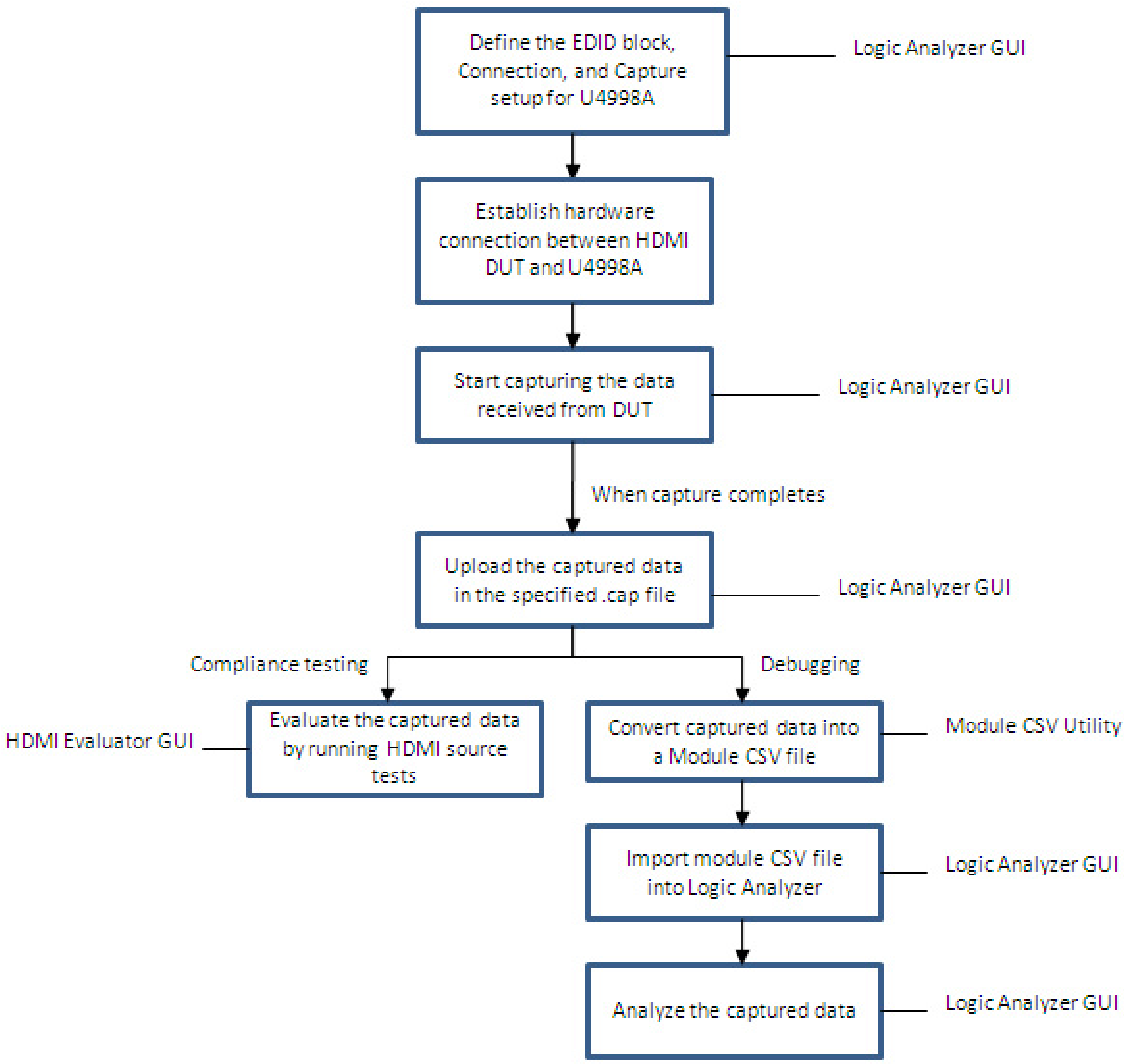


Figure 7 HDMI Capture flow

The topics that follow describe each of these tasks in detail.

Refer to the topic “Roles and Usage Scenarios" on page 13 to get a pictorial representation of U4998A as a terminator.

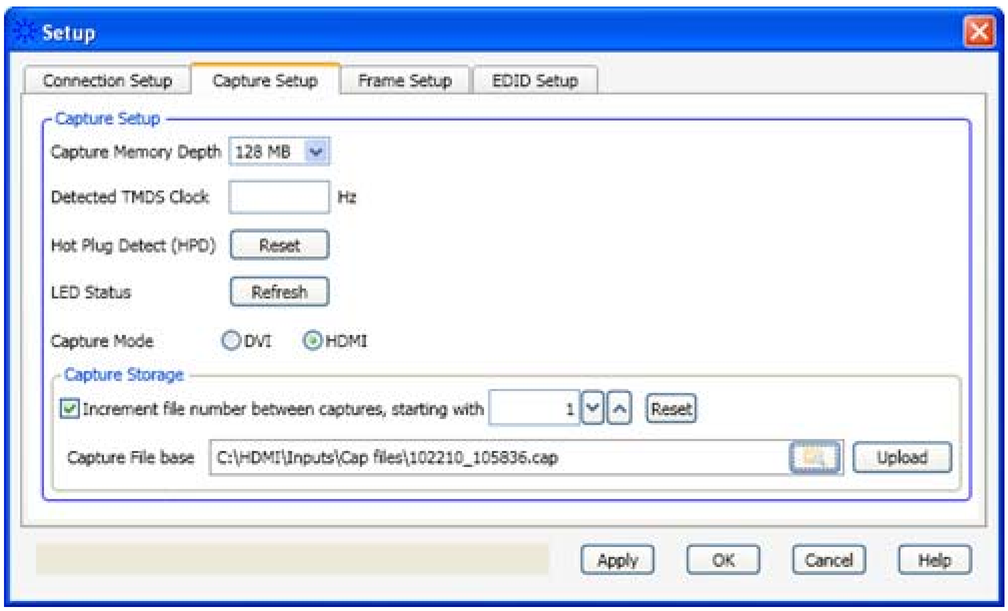
Configuring U4998A Data Capture Settings

NOTE

To test a HDMI source DUT, U4998A needs to emulate a HDMI sink device that can receive data from DUT. Therefore, ensure that you select the connection type as **U4998A -Capture (Terminator)** while setting up a connection between U4998A and DUT.

The data capture settings control how and where you want to capture the data received from a HDMI source DUT for compliance evaluation and analysis.

You use the Logic Analyzer GUI to configure the capture setup.



To configure the data capture settings:

1 Access the **Setup** dialog box by clicking **Setup** > **Setup** from the drop-down menu displayed for the HDMI module.

2 Click the **Capture Setup** tab.

3 From the **Capture Memory Depth** listbox, select the memory depth of U4998A that you want to use for capturing the data received from DUT. By default, **128 MB** is the default allocation for capturing data in U4998A module memory. You can increase it to a maximum of **4 GB** capture memory depth. When the selected capture memory depth is full, the U4998A module stops capturing

the data. Consider the following points when selecting capture memory depth:

- Out of the maximum capture memory available, some part is consumed by internal logic.
- A pixel requires eight bytes in the capture memory of U4998A module and subsequently in the capture file. For source audio tests, you calculate the memory depth required to capture at least two seconds of sample time.

NOTE

The TMDS clock frequency is detected and displayed in the **Detected TMDS Clock** field. This field displays the current frequency of the TMDS clock based on the pixel rate of the transmitted video from DUT. You need to specify this frequency value in the HDMI Evaluator GUI while running some of the HDMI Source tests on the captured data. You can view this frequency value before or after the data capture.

This field is not applicable if you have selected **External** clock in the **Connection Setup** tab.

4 Click the **Reset** button displayed with the **Hot Plug Detect** field to force the emulation of the Hot Plug Detect mechanism. On clicking Reset, DUT reperforms the initialization sequence without going through the Hot Plug Detect with U4998A. This is particularly useful in instances such as forcing the DUT to read the updated or changed EDID block of U4998A as a part of the initialization sequence. DUT reads the EDID block of U4998A immediately on getting connected. If you have updated the EDID block after connection, then clicking **Reset** before starting the capture can serve the purpose of forcing the DUT to read the updated EDID.
5 Click the **Refresh** button displayed with the **LED Status** field to manually refresh the status of the TMDS data channel LEDs for the HDMI IN connector on the front panel of the U4998A module.
6 From the **Capture Mode** options, select the protocol (DVI or HDMI) to indicate whether you want to capture DVI or HDMI data. The default option is **HDMI**.
7 The fields in the **Capture storage** group control where you want to save the captured data for evaluation and analysis. For capture storage, you have the following two options:

- Specify the location and name of the .cap file in the **Capture File Base** field. This ensures that whenever you click Upload, the captured data stored in the memory of U4998A module is uploaded in the specified .cap file. If the .cap file already exists due to a previous capture run, then the contents of the file gets overwritten by the current upload.
- Specify the location and name of the .cap file to be used as a base in the **Capture File Base** field. Additionally, select the **Increment File Number between Captures**, **starting with** checkbox and specify an integer value for the increment. This ensures that whenever you click Upload, the captured data stored in the memory of U4998A module is uploaded in a new .cap file with the same base name but appended by the applicable incremented number.

NOTE

When the capture completes, you use the **Upload** button to upload the data stored in the memory of the U4998A module to the specified .cap file. If you click Upload before starting the data capture, either a .cap file of 0 KB is created at the specified location or a .cap file with the data from some previous capture in the memory is created.

8 Click **Apply** and then **OK**.

Defining the EDID Block of U4998A

When U4998A emulates a sink device, HDMI source DUT needs to read its EDID (Extended Display Identification Data) block. Therefore, while testing a source DUT, you need to define the EDID block of U4998A. Defining this block ensures that the source DUT can adjust the data transmission based on U4998A's configurations and capabilities as defined in this block.

Defining the EDID block also helps you test and analyze if the source DUT can read the EDID block of the sink device (U4998A in this case) and can transmit audio and video formats as per the capabilities of the sink device.

U4998A provides a number of predefined EDID sample data files. To get this set of predefined files, you need to install the U4998A HDMI Video Generator Files software component. On installing this component, a set of .edi files is installed at a default location or a location that you specify while installation. The following figure displays the default location for the installation of sample EDID data files.

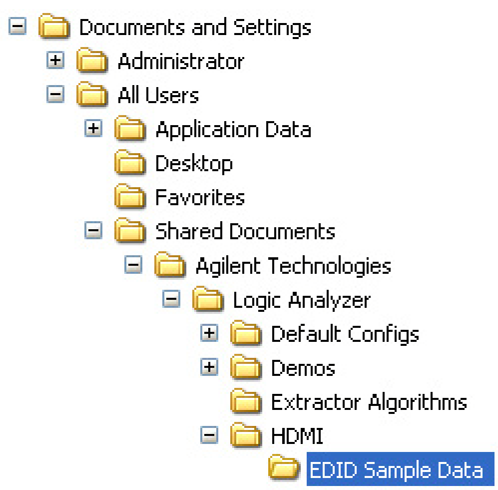


Figure 8 Default location of EDID sample data files

You can choose one of these predefined EDID files to define the EDID block structure for U4998A. If needed, you can also use your own EDID file for this purpose.

EDID Files Corresponding to HDMI Source Tests

The set of predefined EDID files are as per the requirements of the HDMI source tests. The following table lists the EDID files that are provided for each of the supported HDMI source tests. For the tests that require multiple EDID files, more than one EDID files are listed in the table.

Table 1 HDMI Compliance Tests and Corresponding EDID Files

Test*	Test Name	EDID01.EDI	EDID02.EDI	EDID03.EDI	EDID04.EDI	EDID05.EDI	EDID06.EDI	EDID07.EDI	EDID08.EDI	EDID09.EDI	EDID10.EDI	EDID11.EDI	EDID12.EDI	EDID14.EDI	DVI01.EDI
Source Protocol															
7-16	Legal Codes	•													
7-17	Basic Protocol	•													
7-18	Extended Control Period	•													
7-19	Packet Types	•		•											
Source Video															
7-23	Pixel Encoding. RGB to RGB-only Sink		•										•		
7-24	Pixel Encoding. YCbCr to YCbCr Sink	•										•			
7-25	Video Format Timing	•													
7-26	Pixel Repetition	•													
7-27	AVI InfoFrame	•								•					
Source Audio															
7-28	Audio IEC Compliance	•		•											
7-29	ACR	•		•											
7-30	Audio Packet Jitter	•		•											
7-31	Audio InfoFrame	•		•											
7-32	Audio Layout	•		•											
Source Interoperability with DVI															
7-33	Interoperability with DVI	•	•	•											•
Source Advanced Features															
7-34	Deep Color				•										
7-35	Gamut Metadata Transmission					•									
7-36	High Bitrate Audio						•	•							
7-37	One Bit Audio								•						
7-38	3D Video Format Timing	•	•							•					

Test*	Test Name	EDID01.EDI	EDID02.EDI	EDID03.EDI	EDID04.EDI	EDID05.EDI	EDID06.EDI	EDID07.EDI	EDID08.EDI	EDID09.EDI	EDID10.EDI	EDID11.EDI	EDID12.EDI	EDID14.EDI	DVI01.EDI
7-39	4k X 2k Video Format Timing													•	
7-40	Extended Colorimetry										•				

* Where multiple EDIDs are listed, refer to "Using Multiple EDIDs for U4998A" on page 38.

The following table lists the video formats supported by each EDID file.

.

Table 2 Video Format and Corresponding EDIDs (Sheet 1 of 2)

Format	CEA Video ID Code	EDID01.EDI	EDID02.EDI	EDID03.EDI	EDID04.EDI	EDID05.EDI	EDID06.EDI	EDID07.EDI	EDID08.EDI	EDID09.EDI	EDID10.EDI	EDID11.EDI	EDID12.EDI	EDID14.EDI	DVI01.EDI
640 x 480 @ 59.94 / 60 Hz	1	•	•	•	•	•				•	•	•	•		
720 x 480 @ 59.94 / 60 Hz	2, 3	•	•	•	•	•				•	•	•	•		
720 x 480p @ 119.88 / 120 Hz	48, 49														
720 x 480p @ 239.76 / 240 Hz	56, 57														
720 x 576p @ 50Hz	17, 18	•	•	•	•	•				•	•	•	•		
720 x 576p @ 100 Hz	42, 43														
720 x 576p @ 200 Hz	52, 53														
720 (1440) x 240p @ 59.94 / 60 Hz	8, 9														
720 (1440) x 288p @ 50 Hz	23, 24														
720 (1440) x 480i @ 119.88 / 120 Hz	50, 51														
720 (1440) x 480i @ 239.76 / 240 Hz	58, 59														
720 (1440) x 576i @ 100 Hz	44, 45														
720 (1440) x 576i @ 200 Hz	54, 55														
1280 x 720p @ 23.98 / 24 Hz	60														
1280 x 720p @ 25 Hz	61														
1280 x 720p @ 29.97 / 30 Hz	62														
1280 x 720p @ 50Hz	19	•	•	•	•	•				•	•	•	•		
1280 x 720 @ 59.94 / 60 Hz	4	•	•	•	•	•				•	•	•	•		
1280 x 720p @ 100 Hz	41														
1280 x 720p @ 119.88 / 120 Hz	47														
1440 x 480i @ 59.94 / 60 Hz	6, 7	•	•	•	•	•				•	•	•	•		
1440 x 480p @ 59.94 / 60 Hz	14, 15								•						
720 (1440) x 576i @ 50 Hz	21, 22	•	•	•	•	•				•	•	•	•		
1440 x 576p @ 50 Hz	29, 30								•						
1920 x 1080p @ 23.98 / 24 Hz	32									•	•				
1920 x 1080p @ 25 Hz	33														
1920 x 1080p @ 29.97 / 30 Hz	34														

Table 2 Video Format and Corresponding EDIDs (Sheet 2 of 2)

Format	CEA Video ID Code	EDID01.EDI	EDID02.EDI	EDID03.EDI	EDID04.EDI	EDID05.EDI	EDID06.EDI	EDID07.EDI	EDID08.EDI	EDID09.EDI	EDID10.EDI	EDID11.EDI	EDID12.EDI	EDID14.EDI	DVI01.EDI
1920 x 1080i @ 50 Hz	20	•	•	•	•	•				•	•	•	•		
1920 x 1080p @ 50 Hz	31	•	•	•	•	•				•	•	•	•		
1920 x 1080i @ 59.94 / 60 Hz	5	•	•	•	•	•				•	•	•	•		
1920 x 1080p @ 59.94 / 60 Hz	16	•	•	•	•	•				•	•	•	•		
1920 x 1080i (1250 total) @ 50 Hz	39														
1920 x 1080i @ 100 Hz	40														
1920 x 1080i @ 119.88 / 120 Hz	46														
2880 x 240p @ 59.94 / 60 Hz	12, 13														
2880 x 288p @ 50 Hz	27, 28														
2880 x 480i @ 59.94 / 60 Hz	10, 11														
2880 x 480p @ 59.94 / 60 Hz	35, 36						•	•							
2880 x 576i @ 50 Hz	25, 26														
2880 x 576p @ 50 Hz	37, 38						•	•							
3840 x 2160p @ 23.98/ 24,/25/ 29.97/ 30 Hz	H01, H02, H03													•	
4096 x 2160p @ 24 Hz	H04													•	

The following table lists the contents of each of the predefined EDID file.

Table 3 EDID File Contents

File Name	Formats	Video Data Block (VIC No)	Audio Data Block	Speaker Allocation Data Block	VSDB (Vendor Specific Data Block)	VCDB (Video Capability Data Block)	Colorimetry Data Block
EDID01.EDI	Basic Audio YCbCr 422/444	1, 2, 3, 4, 5, 6, 7, 16, 17, 18, 19, 20, 21, 22, 31	LPCM 2ch 48/44/32 kHz 16 bit		Length: 5		
EDID02.EDI	Basic Audio RGB	1, 2, 3, 4, 5, 6, 7, 16, 17, 18, 19, 20, 21, 22, 31	LPCM 2ch 48/44/32 kHz 16 bit		Length: 5		
EDID03.EDI	Basic Audio YCbCr 422/444	1, 2, 3, 4, 5, 6, 7, 16, 17, 18, 19, 20, 21, 22, 31	LPCM 8ch 192/176/96/88/48/44/32 kHz 24/20/16 bit	RLC/RRC, FLC/FRC, RC, RL/RR, FC, LFE, FL/FR	Length: 6 Supports_AI = 1		
EDID04.EDI	Basic Audio YCbCr 422/444	1, 2, 3, 4, 5, 6, 7, 16, 17, 18, 19, 20, 21, 22, 31	LPCM 2ch 48/44/32 kHz 16 bit	FL/FR	Length: 7 Supports_AI = 1 DC_36 bit [*] CD_Y444 [†] Max TMDS Clock: 225 MHz		
EDID05.EDI	Basic Audio YCbCr 422/444	1, 2, 3, 4, 5, 6, 7, 16, 17, 18, 19, 20, 21, 22, 31	LPCM 2ch 48/44/32 kHz 16 bit	FL/FR	Length: 7 Supports_AI = 1 DC_36 bit [a] CD_Y444 [b] Max TMDS Clock: 225 MHz		xyYCC709 xyYCC601 Metadata0
EDID06.EDI	Basic Audio YCbCr 422/444	35, 36, 37, 38	DTS=HD 2ch Byte 1: 0x59 192 (x4) kHz Byte 2: 0x40 Byte 3: 0x01		Length: 6 Supports_AI = 1		
EDID07.EDI	Basic Audio YCbCr 422/444	35, 36, 37, 38	MAT 2ch Byte 1: 0x61) 192/96/48 (x4) kHz Byte 2: 0x54 Byte 3: 0x00		Length: 6 Supports_AI = 1		

Table 3 EDID File Contents

File Name	Formats	Video Data Block (VIC No)	Audio Data Block	Speaker Allocation Data Block	VSDB (Vendor Specific Data Block)	VCDB (Video Capability Data Block)	Colorimetry Data Block
EDID08.EDI	Basic Audio YCbCr 422/444	14, 15, 29, 30	One Bit Audio 8ch Byte 1: 0x40 44.1 kHz Byte 2: 0x02 Byte 3: 0x00		Length: 6 Supports_AI = 1		
EDID09.EDI	Basic Audio YCbCr 422/444	1, 2, 3, 4, 5, 6, 7, 16, 17, 18, 19, 20, 21, 22, 31, 32	LPCM 2ch 48/44/32 kHz 16 bit	FL/FR	Length: 14 Supports_AI = 1 DC_36 bit [a] Max TMDS Clock: 225 MHz HDMI_Video _present: = 1 3D_present = 1 HDMI_VIC _LEN = 0 HDMI_3D _LEN = 0 CNC3..0 = 0,0,0,1		
EDID10.EDI	Basic Audio YCbCr 422/444	1, 2, 3, 4, 5, 6, 7, 16, 17, 18, 19, 20, 21, 22, 31, 32	LPCM 2ch 48/44/32 kHz 16 bit	FL/FR	Length: 7 Supports_AI = 1 DC_36 bit [a] Max TMDS Clock: 225 MHz		AdobeRGB AdobeYCC601 sYCC601 xvYCC601 xvYCC709 Byte #3 = 0
EDID10a.EDI	Basic Audio YCbCr 422/444	1, 2, 3, 4, 5, 6, 7, 16, 17, 18, 19, 20, 21, 22, 31, 32	LPCM 2ch 48/44/32 kHz 16 bit	FL/FR	Length: 7 Supports_AI = 1 DC_36 bit [a] Max TMDS Clock: 225 MHz		Byte #3 = 0
EDID11.EDI	Basic Audio YCbCr 422/444	1, 2, 3, 4, 5, 6, 7, 16, 17, 18, 19, 20, 21, 22, 31	LPCM 2ch 48/44/32 kHz 16 bit		Length: 5	QY = 0 QS = 0	
EDID12.EDI	Basic Audio RGB	1, 2, 3, 4, 5, 6, 7, 16, 17, 18, 19, 20, 21, 22, 31	LPCM 2ch 48/44/32 kHz 16 bit		Length: 5	QY = 0 QS = 0	

Table 3 EDID File Contents

File Name	Formats	Video Data Block (VIC No)	Audio Data Block	Speaker Allocation Data Block	VSDB (Vendor Specific Data Block)	VCDB (Video Capability Data Block)	Colorimetry Data Block
EDID13.EDI	Basic Audio YCbCr 422/444	1 through 62	LPCM 2ch 48/44/32 kHz 16 bit, 20 bit, 24 bit	FL/FR	Length: 26 A=1, B=0, C=0, D=0 Supports_AI = 1 DC_36 bit [a] Max TMDS Clock: 225 MHz CNC3...0 = 0,0,0,1 HDMI_Video _present: = 1 3D_present = 1,, 3D_Mult_present = 2 HDMI_VIC _LEN = 0 HDMI_3D _LEN = 16 3D_Structure_ALL = 0x01, 0x41 3D_MASK = 0x01, 0x12 Supports HDMI 1.4a primary 3D video formats		

Table 3 EDID File Contents

File Name	Formats	Video Data Block (VIC No)	Audio Data Block	Speaker Allocation Data Block	VSDB (Vendor Specific Data Block)	VCDB (Video Capability Data Block)	Colorimetry Data Block
EDID14.EDI	Basic Audio YCbCr 422/444	1, 2, 3, 4, 5, 6, 7, 16, 17, 18, 19, 20, 21, 22, 31, 32, 34, 60, 62	LPCM 2ch 48/44/32 kHz 16 bit, 20 bit, 24 bit	FL/FR	Length: 14 A=1, B=0, C=0, D=0 Supports_AI = 1 Max TMDS Clock: 300 MHz CNC3...0 = 0,0,0,1 HDMI_Video_present = 1 3D_present = 1, 3D_Mult_present = 0 HDMI_VIC_Len =4, HDMI_3D_LEN = 0 HDMI_VIC_1, 2, 3, 4 Supports HDMI 1.4a primary 3D video formats		
DVI01.EDI							

* Indicates support for RGB 4:4:4 at the specified pixel size.

† Indicates YCbCr 4:4:4 is supported for all modes indicated by DC_36 bit.

Setting up the EDID for U4998A

It is recommended to define the EDID block of U4998A before connecting it to DUT because the DUT reads the EDID block immediately after getting connected. However, if you want to define the EDID block of U4998A after connecting the two devices, then you need to use the **Hot Plug Detect -> Reset** button in the **Capture Setup** tab before starting the capture. Clicking Reset ensures that the DUT reads the updated EDID information while redoing the initialization tasks.

To define the EDID block of U4998A

1 Access the **Setup** dialog box for the HDMI module added in the Agilent Logic Analyzer GUI.

2 Click the **EDID Setup** tab.

3 Click the  button.

4 Browse to the location where you have stored the EDID file or browse to the location where the predefined EDID files are located.

5 Select the .edi file and click **Open**.

6 Click **Apply** and then **OK**.

Using Multiple EDIDs for U4998A

There are some source tests that require data to be captured and analyzed with multiple EDIDs. For such tests, you can change the EDID file set for U4998A and then click **Reset** in the **Capture Setup** tab to force DUT to read the updated EDID block. The following screen highlights this option.

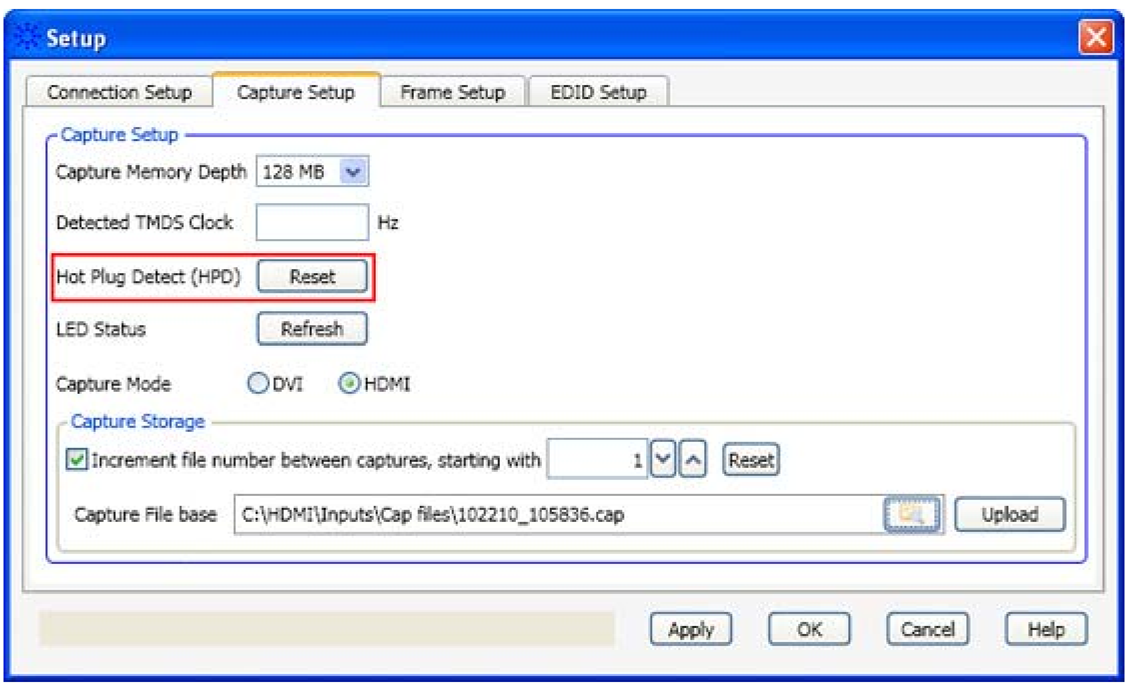


Figure 9 Resetting the EDID file

The following table lists the broad steps for using the multiple EDIDs in the context of specific source tests that require multiple EDIDs as per specifications.

Test	Multiple EDID Files Usage
Test 7-19 Packet Types	Use the EDID files EDID01.edi and EDID03.edi. First use EDID file EDID03.edi, and run the test. Review the test results. If the source device transmitted an ACP, ISRC1, or ISRC2 packet, use EDID file EDID01.edi and repeat the test.
Test 7-28 Audio IEC Compliance	Use the EDID files EDID01.edi and EDID03.edi. First use EDID file EDID03.edi. if the source device has the capability of outputting multi-channel audio. Else, use EDID01.edi.
Test 7-29, 7-30, 7-31, and 7-32	Use the EDID files EDID01.edi and EDID03.edi. Use EDID file EDID03.edi if the source device has the capability of outputting MAT audio. Else, use EDID01.edi.
Test 7-33 Interoperability with DVI	Use EDID files EDID01.edi, EDID02.edi, EDID03.edi, and DVI01.edi. According to the compliance test specification: - In step 1 of the specification, use EDID file DVI01.edi. This EDID configures the U4998A to appear as a DVI sink device. - In step 5, as the specification calls for an EDID that has an HDMI VSDB length of 5, use EDID01.edi (for YCbCr 422/444 color space) or EDID02.edi (for RGB color space). These two EDID files meet the required VSDB length. - In step 7, an EDID with a VSDB length greater than 5 is required. Use EDID03.edi.
Test 7-36 High Bitrate Audio	Use EDID files EDID06.edi and EDID07.edi. Use EDID file EDID06.edi, if source device has the capability of outputting DTD-HD audio. If source device has the capability of outputting MAT audio, use EDID07.edi.
Test 7-38 3D Video Format Timing	Use the EDID Files EDID09.edi and EDID01.edi or EDID02.edi. First, use the EDID file EDID09.edi and run the test. For the "Change HDMI VSDB in Protocol Analyzer to length = 5" step, use the EDID01.edi (for YCbCr 422/444 color space) or EDID02.edi (for RGB color space). These two EDID files meet the required VSDB length.

Starting the Data Capture

This topic describes how to start capturing the data received from DUT over the HDMI link.

Before you start the data capture, ensure that:

- the data capture setup is ready.
- the EDID block of U4998A is defined so that the DUT transmits as per the capabilities and configurations of U4998A. To ensure that the DUT reads the latest and updated EDID information, you can click **Hot Plug Detect > Reset** in the **Capture Setup** tab.
- the source DUT is connected to the HDMI IN Connector on the U4998A module.
- the source DUT is switched on and configured to provide HDMI data output.
- you have the U4998A-CMP Capture/Compliance testing license to capture data.
- the Logic Analyzer GUI is in the online mode.

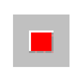
To start the data capture

1 Access the Logic Analyzer GUI.
2 Click the  **Run** toolbar button.

When you start the data capture, the captured data is stored in the memory of the U4998A module from where you can upload it into a specified .cap file.

The TMDS data channel LEDs for the HDMI IN connector on the front panel of U4998A module turns green indicating the start of capture. If the LEDs turn orange, it indicates the reception of HDMI data but the three TMDS data channels are not aligned. The LEDs turn red if non HDMI data is received.

The data capture stops:

- when you manually stop the data capture using the  **Stop Acquisition** toolbar button in Logic Analyzer.
- when the capture memory depth of U4998A module is full.
- when the transmission from DUT stops.

Uploading the Captured data in a File

Once the data capture is complete, you need to upload the captured data from the memory of U4998A to the .cap file that you specified in the Capture setup.

To upload data

1 Access the **Setup** dialog box for the HDMI module in the Logic Analyzer GUI.

2 Click the **Capture Setup** tab.

3 Click **Upload** displayed with the **Capture file base** field.

If you have selected the **Increment File number between Captures** option in the **Capture setup** tab, then clicking **Upload** creates a new .cap file appended with the applicable incremented number. All the data that exist at that time in the memory of U4998A is uploaded in this new file.

If you have not selected the **Increment File number between Captures** option in the **Capture setup** tab, then clicking **Upload** overwrites the specified .cap file with the data that exist at that time in the memory of U4998A.

Evaluating the Captured Data for Compliance to HDMI CTS

When you have uploaded the captured data in the specified .cap file, you can run various HDMI source compliance tests on the data stored in this file.

You use the **HDMI Evaluator** tab in the **HDMI Evaluator** GUI to run HDMI compliance tests for offline evaluation of the source DUT. You do not need connectivity to U4998A or DUT while doing the evaluation.

Using the HDMI Evaluator GUI, you can run:

- full HDMI CTS tests on the data in the .cap file.
- or a specific HDMI CTS source test on the data in the .cap file.

Refer to the *U4998A HDMI 1.4a Protocol/Audio/Video Analyzer and Generator Installation guide* to know how to install HDMI Evaluator.

When you run a source test, the frames in the .cap file are evaluated and the test status (Pass/Fail) is displayed for each frame. The failed tests are displayed in red.

The following screen displays Full HDMI Compliance test results in the HDMI Evaluator GUI.

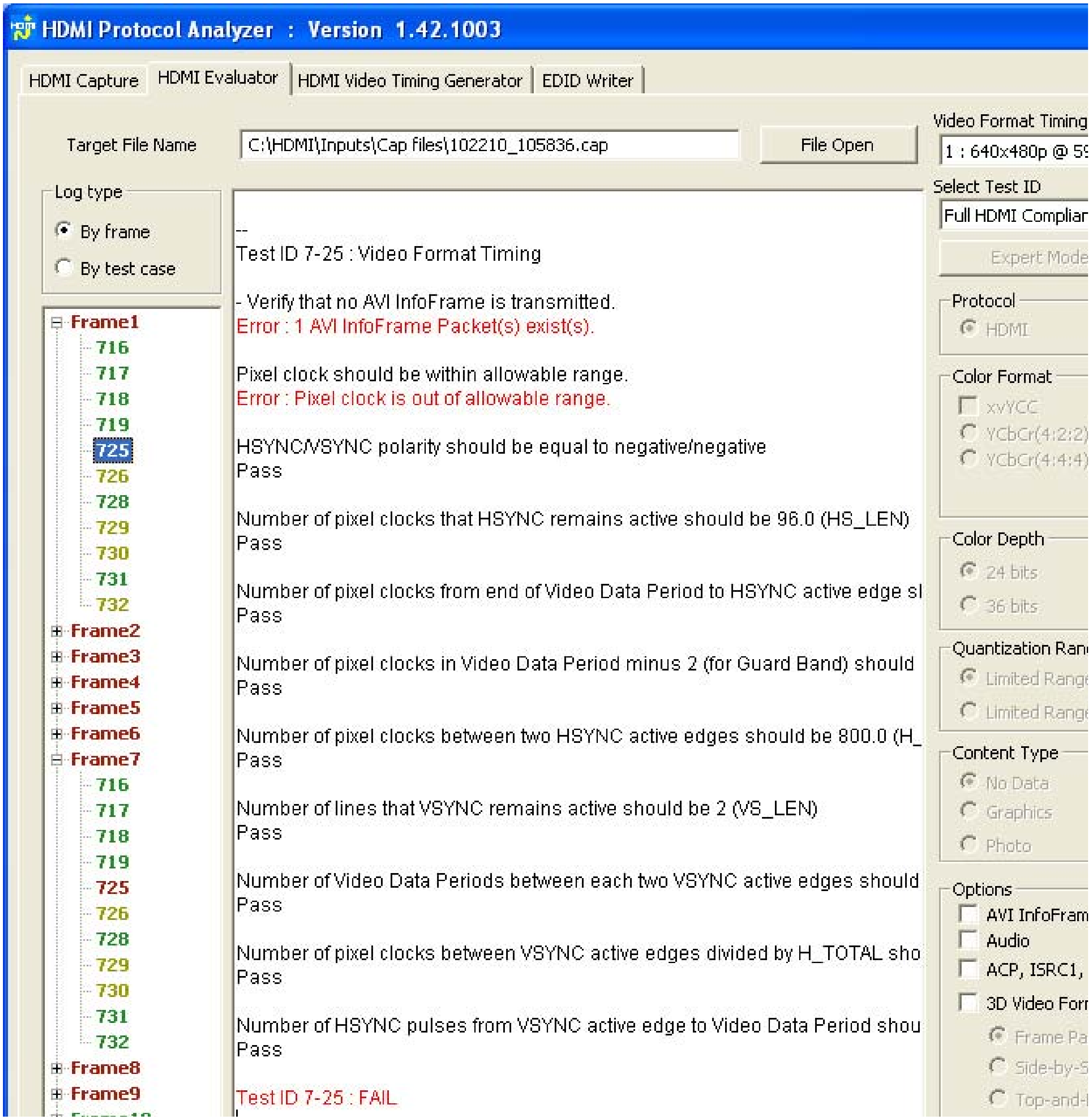


Figure 10 Failed source test in HDMI Evaluator

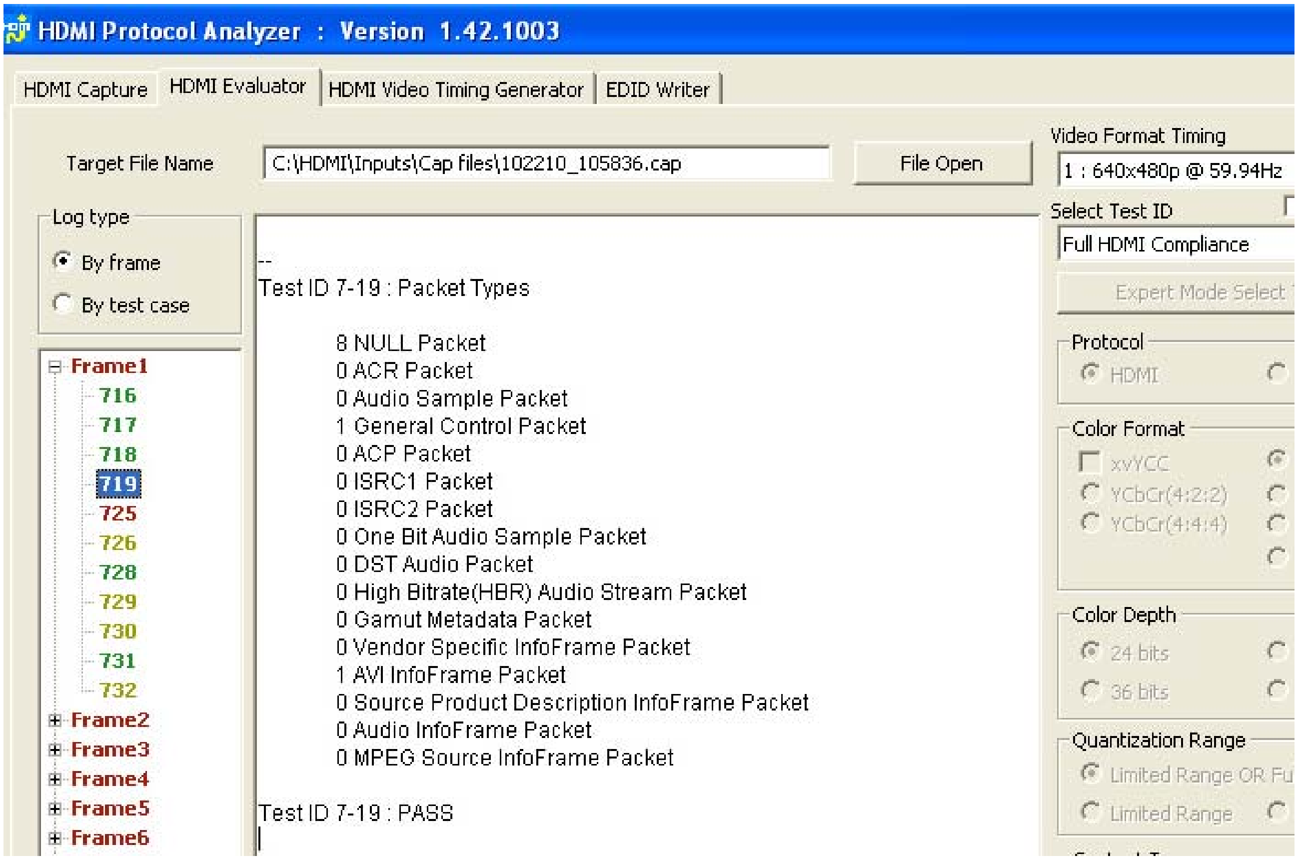


Figure 11 Passed source test in HDMI Evaluator

NOTE

You can use only the HDMI Evaluator tab in the HDMI Evaluator GUI when working with U4998A. All other tabs in this GUI are not applicable for use with U4998A. For all other HDMI testing tasks, you use the Agilent Logic Analyzer GUI.

The other tabs in the HDMI Evaluator GUI are applicable for use with the Agilent N5998A HDMI hardware.

Supported Source Tests

All the source tests except 7-1 till 7-15 and 7-20 till 7-22 are supported in this release.

The following table lists the supported source tests and the settings that you need to do for each of these tests in the HDMI Evaluator GUI.

Table 4 Supported Source Tests

Test ID	Test Name	Included in Full Compliance Evaluation	Requires Measurement of TMDS Clock	Settings Available in HDMI Evaluator Window: Protocol	Color Format	Color Depth	Quantization Range	Content Type	Options
Source Protocol									
7-16	Legal Codes	•							•
7-17	Basic Protocol	•							•
7-18	Extended Control Period	•							•
7-19	Packet Types	•							•
Source Video									
7-23	Pixel Encoding. RGB to RGB-only Sink				•				•
7-24	Pixel Encoding. YCbCr to YCbCr Sink				•				•
7-25	Video Format Timing	•	•						•
7-26	Pixel Repetition	•							•
7-27	AVI InfoFrame				•			•	•
Source Audio									
7-28	Audio IEC Compliance	•							•
7-29	ACR	•	•						•
7-30	Audio Packet Jitter	•							•
7-31	Audio InfoFrame	•							•
7-32	Audio Layout	•							•
Source Interoperability with DVI									
7-33	Interoperability with DVI			•					•
Source Advanced Features									
7-34	Deep Color		•		•	•			•
7-35	Gamut Metadata Transmission								•
7-36	High Bitrate Audio								•
7-37	One Bit Audio								•
7-38	3D Video Format Timing		•		•			•	•
7-39	4K X 2K Video Format Timing								•
7-40	Extended Colorimetry				•		•	•	•

Starting the Evaluation of Captured Data

NOTE

You can use only the **HDMI Evaluator** tab in the HDMI Evaluator GUI when working with U4998A. All other tabs in this GUI are not applicable for use with U4998A. For all other HDMI testing tasks, you use the Agilent Logic Analyzer GUI.

The other tabs in the HDMI Evaluator GUI are applicable for use with the Agilent N5998A HDMI hardware.

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1 Access the HDMI Evaluator GUI by clicking **Start** > **Programs** > **HDMI Evaluator** > **HDMI Evaluator** option on the Windows task bar.
2 Click the **HDMI Evaluator** tab.
3 Click **File Open** to open a captured HDMI data file (.cap file).
4 From the **Video Format Timing** listbox, select the Video Format Timing applicable for the data in the .cap file.
5 From the **Select Test ID** listbox, select the source test that you want to run. You can:
   - either select the **Full HDMI Compliance** option to run full HDMI CTS tests on the data in the .cap file. Refer to "Supported Source Tests" on page 44 to get a list of source tests included in the Full HDMI Compliance option.
   - or a specific HDMI CTS source test on the data in the .cap file.
6 Enter the **TMDS clock frequency**, if enabled for the selected tests.
7 For each source test, you need to specify the values for the expected parameters. These parameters are available as editable field in the HDMI Evaluator tab when you select a test. The actual parameter values are stored in the .cap file. Based on the actual and expected values, the test results are derived and displayed. Refer to "Supported Source Tests" on page 44 to get a list of parameters/settings applicable for each source test.
8 Click **Start**.

When you click Start, the selected tests are run on each frame repeatedly from the beginning of the first complete frame in the captured file. As captured data usually begins in the middle of a frame, the data in the beginning incomplete frame is not tested. Frames are defined as starting from the first pixel of the vertical blanking. For Test ID 7-29, 7-30, 7-36, and 7-37, the target .cap file must have the HDMI data for more than 2 seconds.

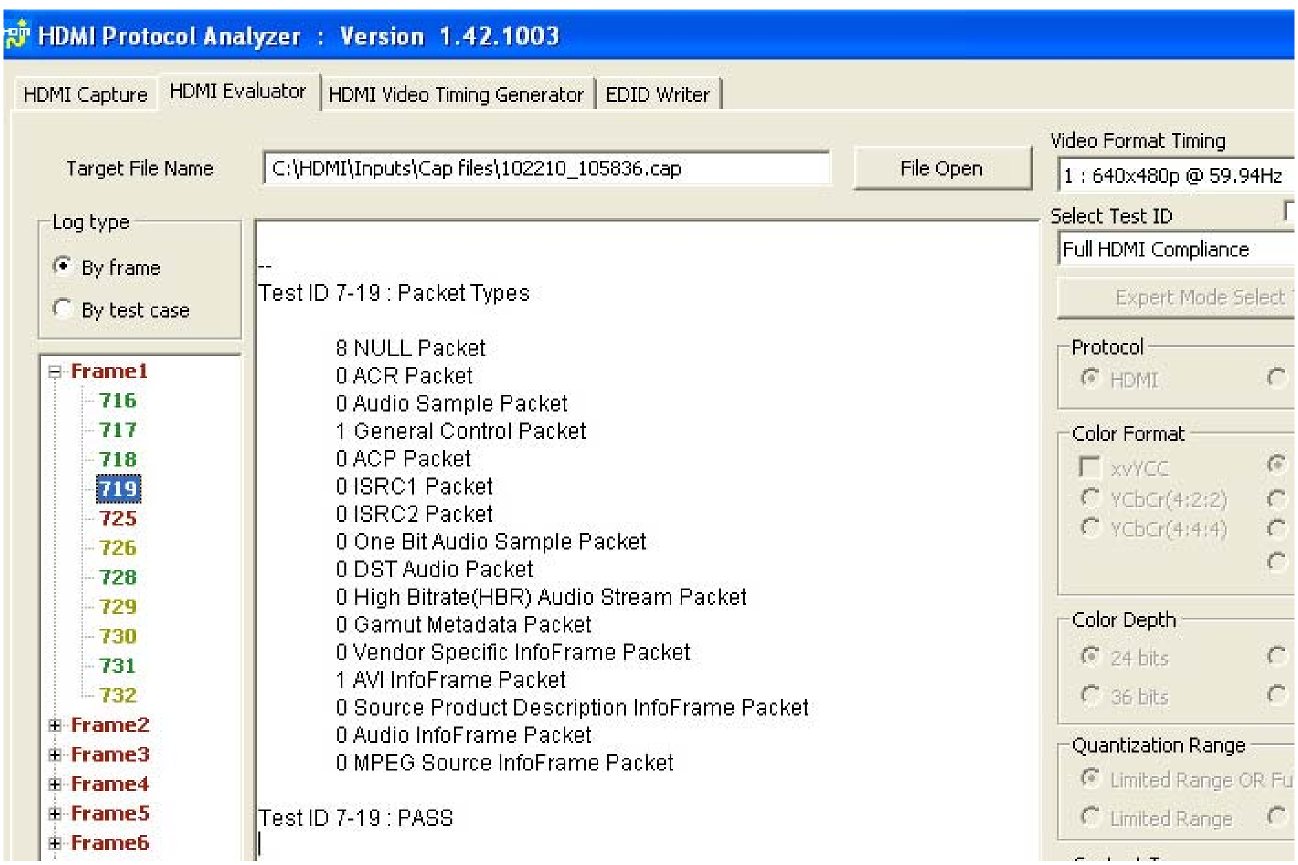
NOTE

You can select the **Expert Mode** checkbox to get complete control on which tests to run on the captured data. As the name implies, this feature is not required for normal testing but is provided for troubleshooting and experimenting by advanced users. Selecting this checkbox enables the **Expert Mode Select Test ID(s)** button which you can use to select the tests to run.

Viewing Test Results

On running a test, the test results are displayed in the Test Results pane of the HDMI Evaluator tab.

The following screen displays the results of a test.



Use the Navigator pane on the left to jump to specific sections in the Test Results pane. In the Navigator pane, double click either a test or a frame to jump to the corresponding data for that test or frame in the Test Results pane. The following color convention is followed:

- A green colored test or frame label indicates a pass condition.
- A red colored label represents a failure
- A yellow colored label represents a skipped item.

Test numbers shown in the Navigator pane do not include the hyphen character. For example, test 7-16 is listed as 716.

Use the Log Type selections at any time to change the organization of the Navigator pane between tests and frames.

Test Data Log File

When you click Start to run a test, all the information shown in the window's Test Results pane is saved to a text log file. This file is saved in the same folder as the captured data file. The name of the file is formed using the current year, month, day, hour, minute, and second as in yyyymmddHHMMSS.txt. For example, 20091023163205.txt.

Packet Log File

If you select `Full HDMI Compliance` or `(7-19) Packet Types`, a log of data packets is saved to a text packet log file. Click **Packet LOG** in the HDMI Evaluator tab and select the types of packets that you want recorded. This log file is saved in the same folder as the captured data file. The name of the file is formed using the current year, month, day, hour, minute, and second as in logPacketyyyymmddHHMMSS.txt. For example, logPacket20091023163205.txt.

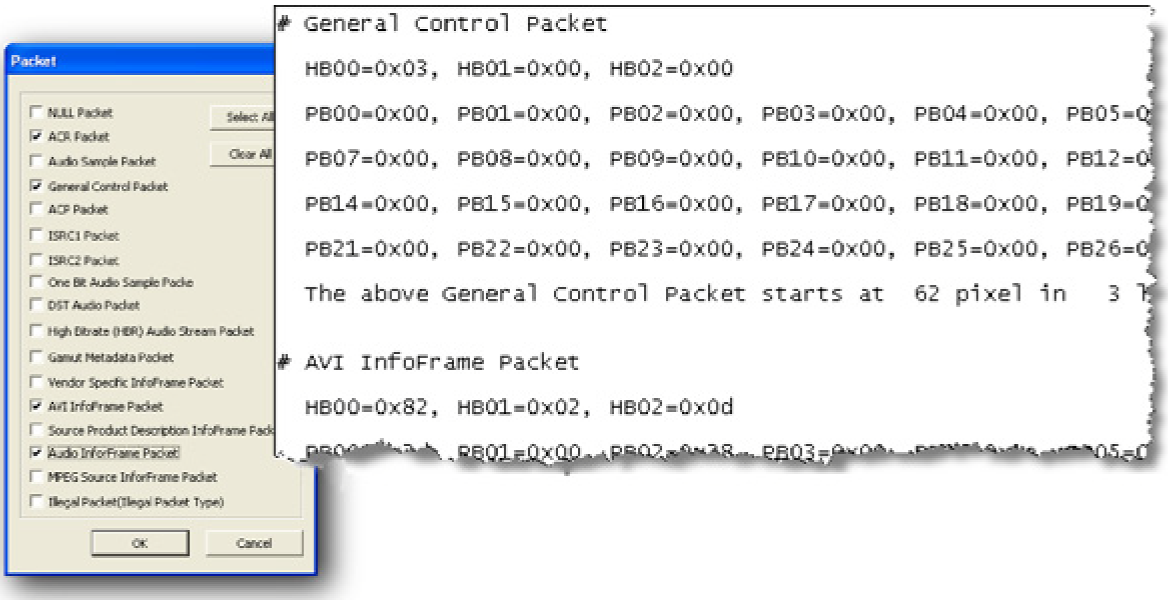


Figure 12 Packets Selected for Packet Log and Example Log File

Viewing the Video Image

When you run test 7-23, 7-24, 7-27, 7-34, 7-38, or 7-40, a video Image window appears for every frame. This window allows you to visually inspect the video. The following figure shows the Image window for tests 23 and 24. The windows for tests 27 and 34 are very similar. For each displayed image, confirm the integrity of the image. Then click NEXT Frame or Finish.

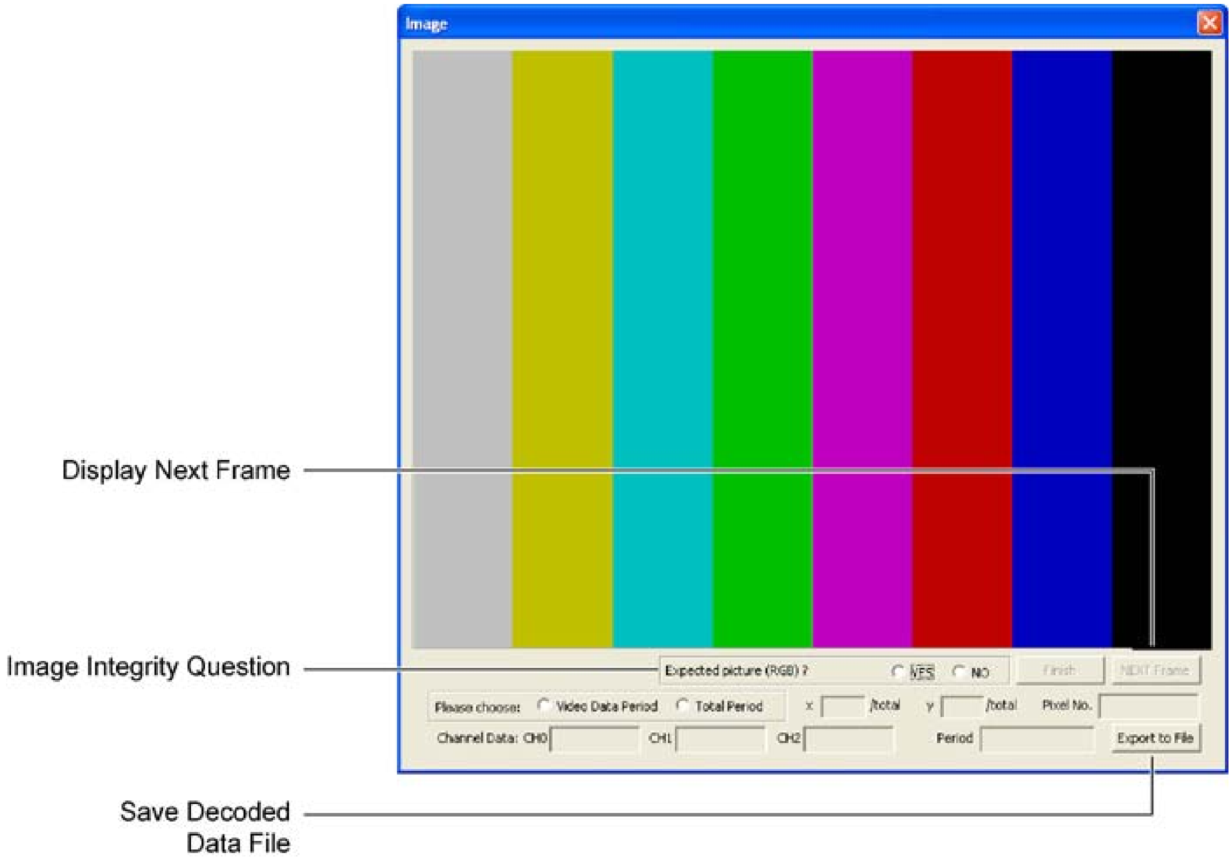


Figure 13 Video Image Window for Test 23 and Test 24

In the Image window, you can specify the period of the pixel you are interested in. Select Video Data Period for video period only or Total Period for all the periods. You can also specify the coordinate of the pixel. The data of the three channels are decoded and displayed as binary value, and the data period is displayed as well.

Saved Image Files

When you click NEXT, the video image is saved to a file (bmp format). The file is saved to the same folder as the captured data file. The picture file's name is comprised of the name of the captured data file, an index number for the image, and the current year, month, day, hour, minute, and second. For example, it the first image was named,

VIC034_RGB_8Bit_30Hz_0_20091023163205.bmp

the second image could be named

VIC034_RGB_8Bit_30Hz_1_20091023163257.bmp

Saved Decoded Data File

Click Export to File to save a text file (.txt) that has all of the decoded data of the frame by pixel index. The files is saved to the same folder as the captured data file. The file is given the same name as the captured data file with "_Frame_x" appended, where the x stands for the frame number. For example, if the captured data file is named

VIC034_RGB_8Bit_30Hz.cap

the text file for the first frame will be named

VIC034_RGB_8Bit_30Hz_Frame_1.txt

Tests 7-23 and 7-24

The video image is decoded according to the color format selected in the HDMI Evaluator window. The saved graphics file is created according to the aspect ratio and size of the captured frame.

Test 7-27

The video image is decoded according to AVI InfoFrame Packet. The video image window will not appear if the Video Format Timing selection doesn't match the video format timing of the data file. The saved graphics file is created according to the aspect ratio and size of the captured frame. When video image window appears, you can change the aspect ratio of video image by clicking 4:3 or 16:9.

Test 7-34

The video image is decoded by the color format selected in the HDMI Evaluator window. The video image window will not appear if:

- the Color Depth selection doesn't match the color depth of data file.
- the Video Format Timing selection doesn't match the video format timing of the data file

For 30-bit color depth, the TMDS clock frequency should be 33.75 MHz. For 36-bit color depth, the TMDS Clock frequency should be 40.5 MHz, which is 1.5 x 27 MHz. For 48-bit color depth, the TMDS Clock frequency should be 54 MHz, which is 2 x 27 MHz.

The saved graphics file is created according to the aspect ratio and size of the captured frame.

Audio Jitter

When tests 7-30, 7-36, 7-37, or `Full HDMI Compliance` are performed, the result of audio jitter appear every two seconds. In case of video format 720 x 480p at 60/59.94Hz, the result of audio jitter appears on every 120 frames. For other formats:

- 1920 x 1080i at 60/59.94 Hz: Every 60 frames
- 720 x 576p at 50 Hz: Every 100 frames
- 1920 x 1080i at 50 Hz: Every 50 frames

Importing Captured Data into Agilent Logic Analyzer for further Analysis

You can debug and perform deeper analysis on the captured data by importing the captured data into Agilent Logic Analyzer GUI. The captured data is stored in a specified .cap file. You can convert the .cap file into a Module CSV (Comma Separated Values) file. You can then import this Module CSV file in Agilent Logic Analyzer GUI as a data import module to analyze the data.

You use the **Generate CSV** utility to convert a .cap file to a module CSV file. Refer to the *U4998A HDMI 1.4a Protocol/Audio/Video Analyzer and Generator Installation guide* to know about the installation of this utility. You can use this utility if you have the required software license. You can obtain a software license for this utility by clicking the **Software Licensing** button in the Generate Module CSV dialog box.

The following screen displays the dialog box for this utility.

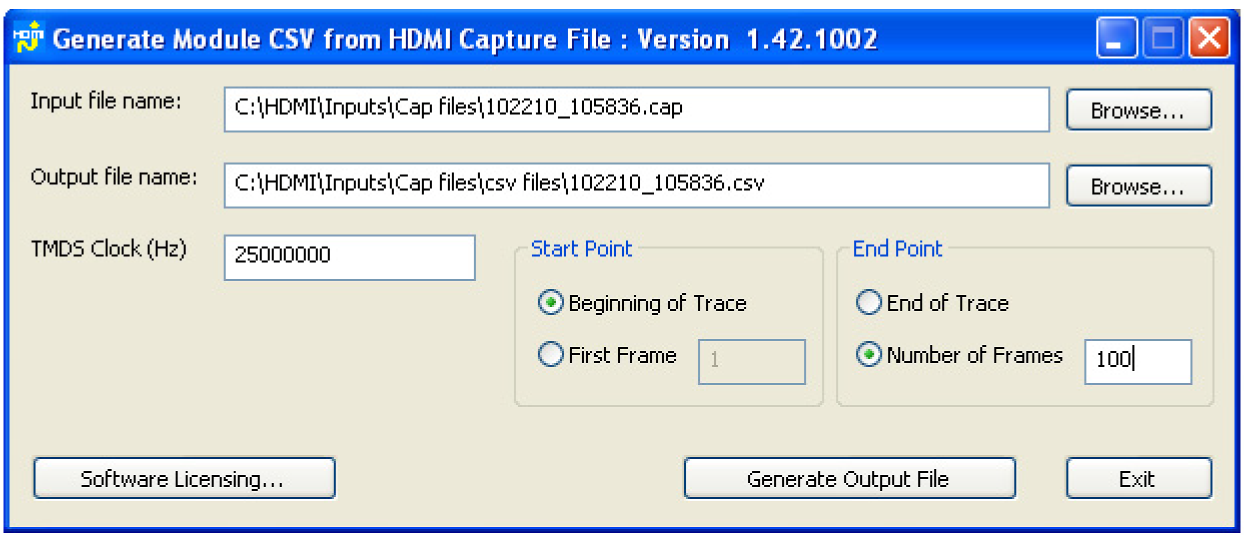


Figure 14 Generate CSV Utility

NOTE You do not need the Agilent Logic Analyzer hardware or U4998A hardware to use this utility.

While performing conversion of a .cap file to a module CSV file, you have the option of converting the entire .cap file or specific frames from the .cap file to a module CSV file. If you want to inspect and debug specific frames, then it is recommended to specify only those frame numbers while conversion to reduce the conversion time and the CSV file size.

Converting a .cap file to a module CSV file

1. Click **Start** > **Programs** > **HDMI Evaluator > Generate CSV** option on the Windows task bar.

   The **Generate Module CSV from HDMI Capture File** dialog box is displayed.

2. In the **Input file name** field, specify the name and location of the .cap file that you want to convert.
3. In the **Output file name** field, specify the name and location where you want the utility to store the converted module CSV file.
4. In the **TMDS Clock (Hz)** field, specify the TMDS clock frequency applicable for the data captured in the specified .cap file. The conversion utility uses this frequency value to generate timestamps for display of the data in different views in Agilent Logic Analyzer GUI. It is recommended that you specify the value of this field based on the frequency value displayed in the **Detected TMDS Clock** field in the Capture Setup tab of Logic Analyzer GUI. By doing this, you can ensure that correct timestamps are generated for the captured data which may be useful in some debugging scenarios.
5. In the **Start point** section, select the start point in the .cap file from where the conversion of captured data should start. You can either start the conversion of captured data from the start of trace or from a specific frame number.
6. In the **End point** section, select the end point in the .cap file at which you want to stop the conversion of the captured data. You can instruct the conversion to be done either till the end of trace or till the number of specified frames from the start point.

NOTE

To properly evaluate an interlaced frame, always include the frame before and after the desired frame in the conversion. For example, to analyzer frame 86, specify frame 85 as the first frame and 3 as the Number of frames to include frame 87 also in the conversion. For each extra frame that you wish to convert, add 2 to the number you specify in the Number of Frames field.

If you're converting only one frame, specify 2 in the Number of Frames field. Entering 1 would only convert half of the frame.

7 Click **Generate Output File**.

NOTE

When an entire .cap file is converted, conversion time can be quite long and requires up to 25 GB of free space on the computer's hard drive. Although the application may appear to stall, an hour glass indicates that the conversion is still progressing.

The module CSV file is created at the specified location.

Importing the Module CSV file into Logic Analyzer GUI

1 Access the Agilent Logic Analyzer GUI in offline or online mode.
2 Click **File** > **Import**.

   The **Import** dialog box is displayed.
3 Select the **Module CSV Text File** option and click **OK**.
4 Specify the name and location of the Module CSV file that you want to import.
5 Click **Import**.

A Data Import module is added in the Overview window of Logic Analyzer GUI. The specified module CSV file is loaded in this module.

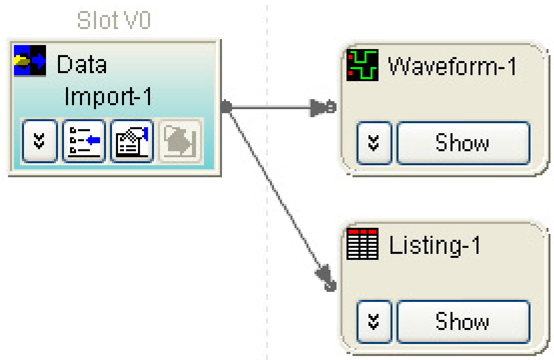


Figure 15 Data import module in Logic Analyzer

For viewing and analyzing the data in the CSV file, you can add data viewing and analysis tools available in Logic Analyzer such as Waveform View and Listing View. Refer to the topic "Viewing the Converted Data in Logic Analyzer" on page 64 to know more.

These views allow you to navigate using markers and Zoom in /Zoom out features. In these views, you can locate a frame that you want to inspect and mark that frame by clicking the Markers > New option.

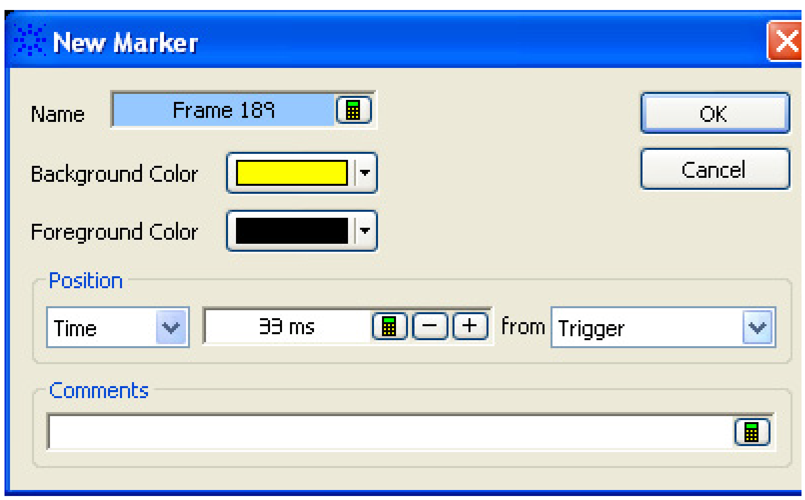


Figure 16 New Marker Dialog Box

Drag the marker to the beginning of the frame as shown in the following figure. The beginning of a frame occurs at the last falling edge of the VDP to precede a Vsync. When the cursor gets close to the falling edge of VDP, it snaps to the edge.

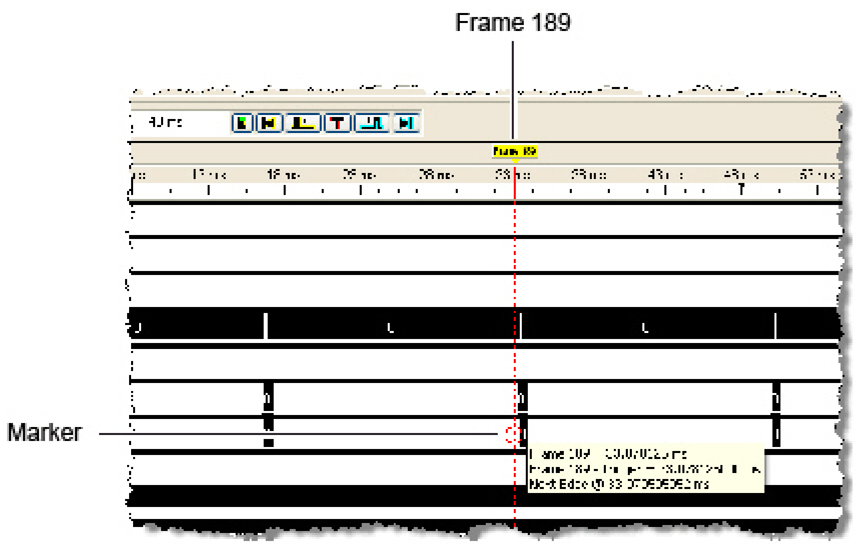


Figure 17 Dragging a Marker Onto a Frame

Using these markers, you can view a specific frame in the Listing View of Logic Analyzer. Right click anywhere in the Listing view and select the frame you wish to view.

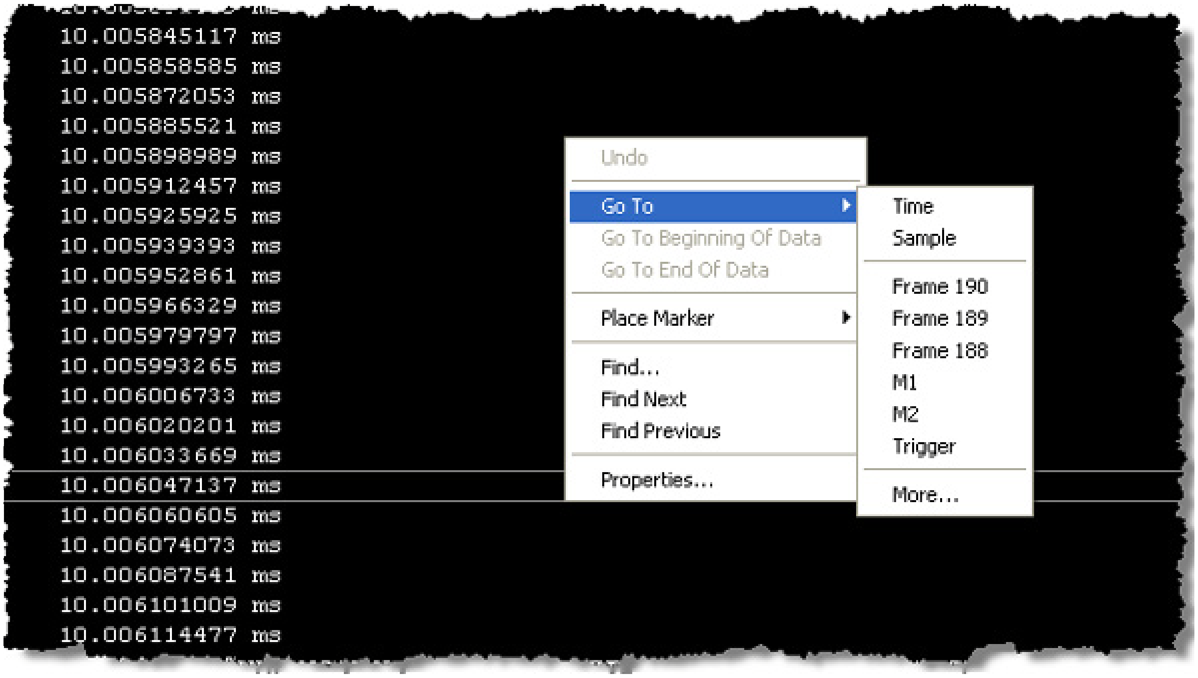


Figure 18 Shortcut Menu with Markers

From the sample line where the frame begins, move forward through pixels to get to the line you want. Use the ratio of pixels-per-line that is appropriate to your format. For example, to reach the beginning of line 2, move forward 2200 pixels (there are 2200 pixel-per-line). Therefore, add 2200 to the current sample #, 2473085, and get 2475285. Click Go To > Sample and enter 745149 to view line 2.

A pixel is marked the same way as a line. Go to the beginning of the line you want. Then, move forward to the pixel number you want.

Determining Frame Numbers in the Converted CSV File

If you want to inspect a specific frame, the following section describes how to determine the number of that frame in the converted CSV file.

Progressive formatted data

For progressive formatted video data, finding a frame in the converted CSV file is simple because there is a direct correspondence between frame numbers in the captured and converted data files.

Interlaced formatted data

For interlaced formatted data, there are two converted frames for each frame in the .cap file. Therefore, the frame numbers in the captured and converted data files no longer correspond and you need to calculate the frame numbers for viewing frames in the converted file as described below.

1 In a text editor, open the test evaluation log file that corresponds to the .cap file. This .txt file is created in the same folder as the .cap file when you run evaluation on the .cap file using HDMI Evaluator.
2 At the top of the file, locate the number of pixels discarded as shown in the following figure. This is the pixel offset for the first frame.

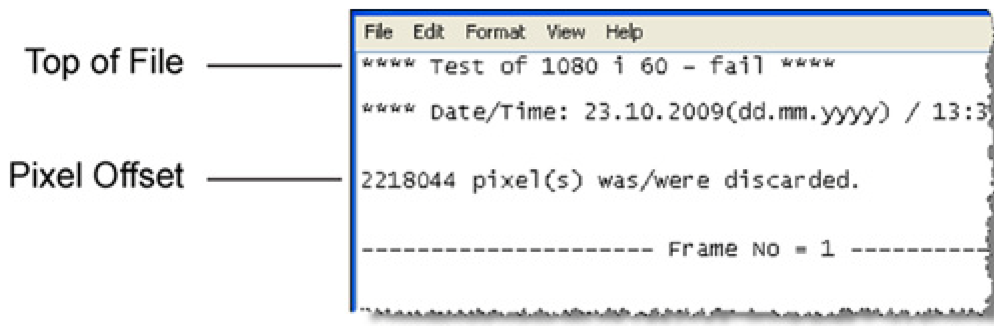


Figure 19 Pixel Offset to First Frame

3 Locate any frame in the log file. At the end of the listing for the frame, a line lists how many pixels were discarded. This value is the number of pixel-per-frame as shown in the following figure.

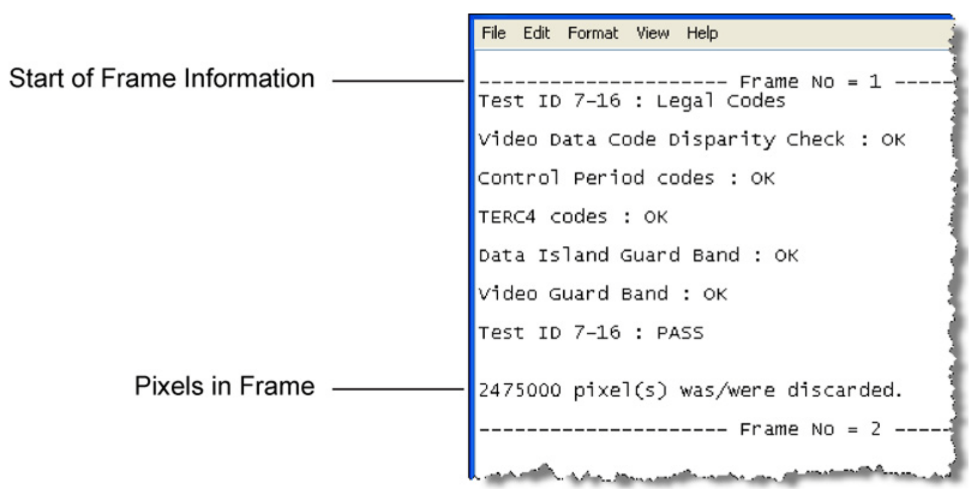


Figure 20 Pixels-Per-Frame Value

4 If the pixel offset to frame 1 is less than half of the pixels-per-frame, use the following equation to determine the number to enter into the First Frame field:

$$F_{converted file} = (F_{data file} \times 2) - 1$$

where $F_{data\ file}$ is the frame number in the captured data file that you want to inspect. $F_{converted\ file}$ is the corresponding frame in the converted CSV data file. For example, if you wanted to inspect the frame corresponding to frame 189 in the captured data file, you would need to view frame 377 in the converted data file.

5 If the pixel offset to frame 1 is greater than half of the pixels-per-frame, use the following equation to determine the number to enter into the First Frame field:

$$F_{converted file} = (F_{data file} \times 2)$$

where $F_{data\ file}$ is the frame number captured data file that you want to inspect. $F_{converted\ file}$ is the corresponding frame in the converted CSV data file. To inspect the frame corresponding to frame 189 in the captured data file, you would need to view frame 378 in the converted data file.

Locating Errors in the Converted CSV File

This topic describes how you can identify the precise pixel where an error occurs in a converted CSV file for inspection and analysis.

To identify an error location:

1 Open the test log (.txt file) that corresponds to the converted file. This .txt file is created in the same folder as the .cap file when you run evaluation on the .cap file using HDMI Evaluator.

2 Within the log file, identify the location of errors by the frame, line, and pixel as shown in the following figure. In

this figure, the first error is located in Frame 189, Line 924, at pixel 413.

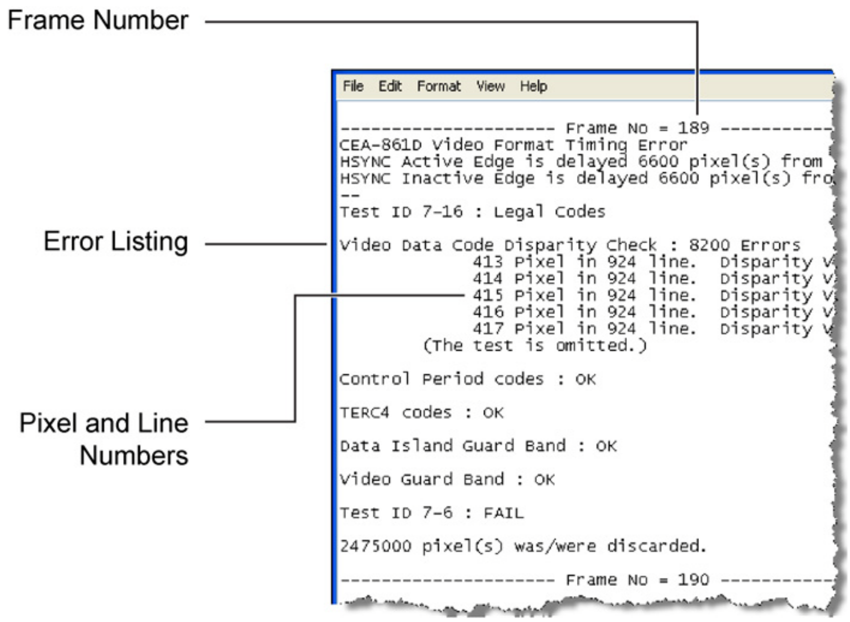


Figure 21 Error Pixel and Line Locations in Log File

3 Use the following equation to locate the corresponding pixel where the error occurs within the converted data file. The equation is valid for both progressive and interlaced formats.

$$Pixel = F_{\text{first}} + (F_{\text{error}} - 1)(\text{pixels/frame}) + (L_{\text{error}} - 1)(\text{pixels/line}) + (P_{\text{error}} - 1)$$

Where:

F_{first} is pixel offset to the first frame. At the *top* of the log file, locate the number of pixels discarded as shown in Figure 22. This is the pixel offset for the first frame.

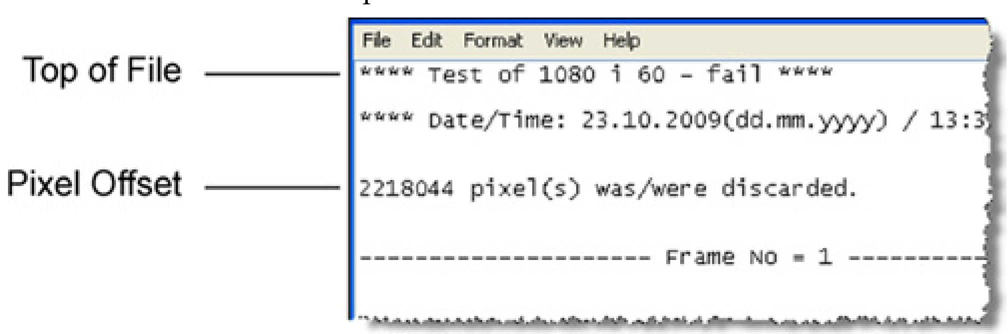


Figure 22 Pixel Offset to First Frame

F_{error} is number of the frame that contains the error.

L_{error} is the line number of the error.

P_{error} is the pixel where the error occurs. The pixel location of the error can be off a few pixels due to pixel errors in the data.

pixels/frame is listed at the *end* of a frame section in the log. It is noted as the number of discarded pixels. Refer the following figure.

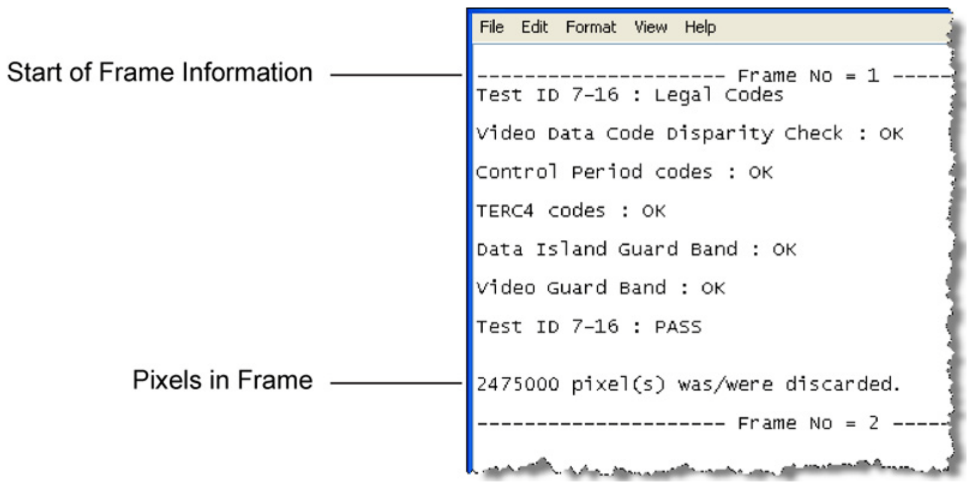


Figure 23 Pixels-Per-Frame Value

pixels/line is listed in Table 5 on page 63 for each video code. Pixels-per-line is not recorded in the log file.

Table 5 Pixels/Line per VIC (Sheet 1 of 2)

CEA Video ID Code	Format	Pixels/Line
1	640 x 480 @ 59.94 / 60 Hz	800
2, 3	720 x 480 @ 59.94 / 60 Hz	858
4	1280 x 720 @ 59.94 / 60 Hz	1650
5	1920 x 1080i @ 59.94 / 60 Hz	2200
6, 7	1440 x 480i @ 59.94 / 60 Hz	1716
8, 9	720 (1440) x 240p @ 59.94 / 60 Hz	1716
10, 11	2880 x 480i @ 59.94 / 60 Hz	3432
12, 13	2880 x 240p @ 59.94 / 60 Hz	3432
14, 15	1440 x 480p @ 59.94 / 60 Hz	1716
16	1920 x 1080p @ 59.94 / 60 Hz	2200
17, 18	720 x 576p @ 50Hz	864
19	1280 x 720p @ 50Hz	1980
20	1920 x 1080i @ 50 Hz	2640
21, 22	1440 x 576i @ 50 Hz	1728
23, 24	720 (1440) x 288p @ 50 Hz	1728
25, 26	2880 x 576i @ 50 Hz	3456
27, 28	2880 x 288p @ 50 Hz	3456
29, 30	1440 x 576p @ 50 Hz	1728
31	1920 x 1080p @ 50 Hz	2640
32	1920 x 1080p @ 23.98 / 24 Hz	2750
33	1920 x 1080p @ 25 Hz	2640
34	1920 x 1080p @ 29.97 / 30 Hz	2200
35, 36	2880 x 480p @ 59.94 / 60 Hz	3432
37, 38	2880 x 576p @ 50 Hz	3456
39	1920 x 1080i (1250 total) @ 50 Hz	2304
40	1920 x 1080i @ 100 Hz	2640
41	1280 x 720p @ 100 Hz	1980
42, 43	720 x 576p @ 100 Hz	864
44, 45	720 (1440) x 576i @ 100 Hz	1728
46	1920 x 1080i @ 119.88 / 120 Hz	2200
47	1280 x 720p @ 119.88 / 120 Hz	1650
48, 49	720 x 480p @ 119.88 / 120 Hz	858
50, 51	720 (1440) x 480i @ 119.88 / 120 Hz	1716
52, 53	720 x 576p @ 200 Hz	864
54, 55	720 (1440) x 576i @ 200 Hz	1728
56, 57	720 x 480p @ 239.76 / 240 Hz	858
58, 59	720 (1440) x 480i @ 239.76 / 240 Hz	1716

Table 5 Pixels/Line per VIC (Sheet 2 of 2)

CEA Video ID Code	Format	Pixels/Line
60	1280 x 720p @ 23.98 / 24 Hz	3300
61	1280 x 720p @ 25 Hz	3960
62	1280 x 720p @ 29.97 / 30 Hz	3300

Viewing the Converted Data in Logic Analyzer

Progressive Format

If the .cap file used for conversion has data in the progressive format, then the converted data is displayed in the logic analyzer as shown in the following figure. All the pixels up to the first frame have been discarded by U4998A, because these are not complete frames. The first complete frame, as shown in this figure, is considered frame 1.

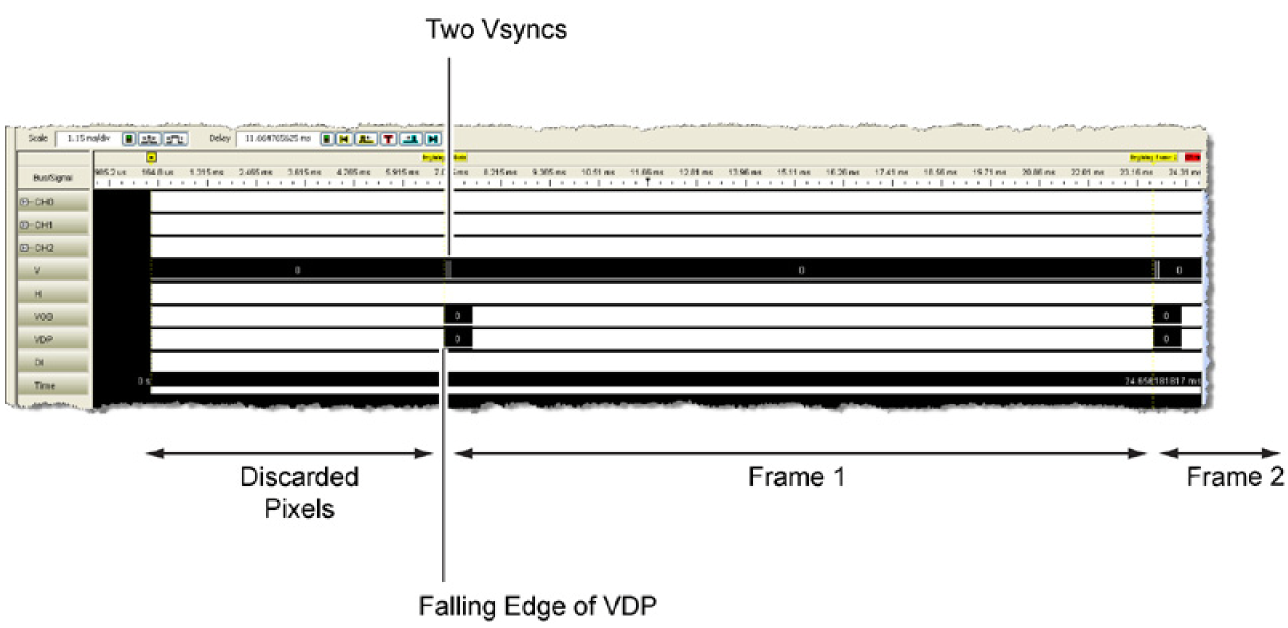


Figure 24 First Frame Displayed on Logic Analyzer

A Frame begins at the last falling edge of the VDP that precedes a VSYNC and continues until the next frame begins. Because the end of the data contains an incomplete frame (ignored by the U4998A), the last frame ends with the last falling edge of the VDP as shown in the following figure.

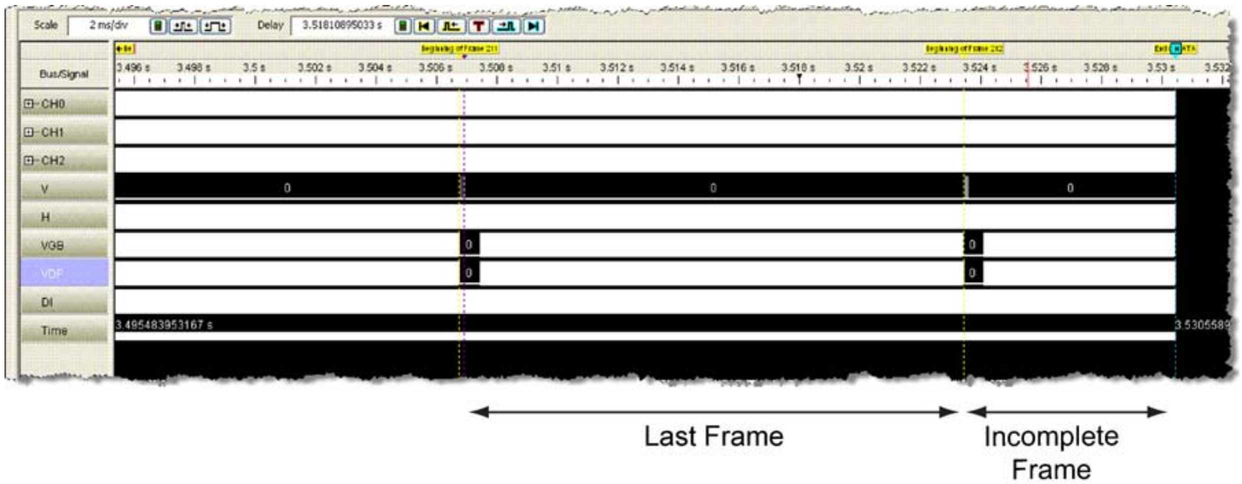


Figure 25 Last Frame Displayed on Logic Analyzer

The first line starts at a frame's first pixel and continues for the numbers of pixels in a line. See Figure 26. The pixels-per-line is unique to the format as listed in Table 5 on page 63. The beginning of a line falls a few pixels before the rising edge of the DI. There are two HSYNCs for every line. A pixel corresponds to a sample. Pixels are visible in waveform view and Listing view. See Figure 27 and Figure 28.

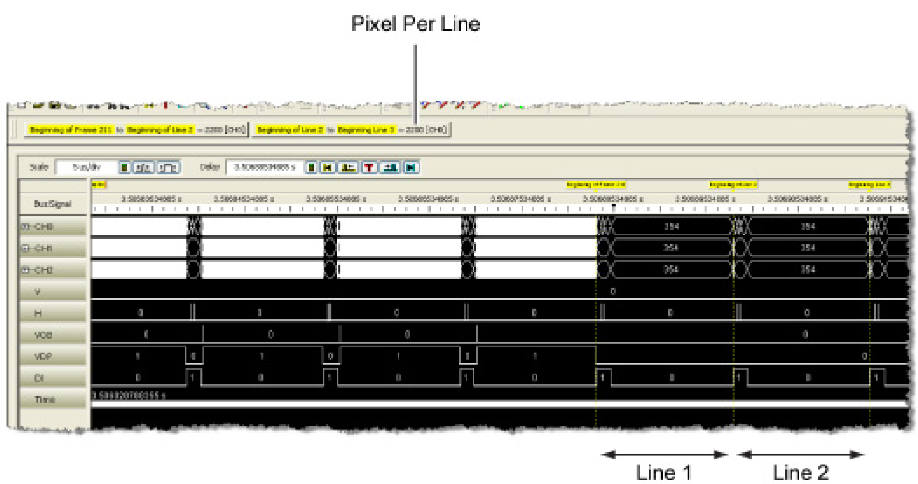


Figure 26 The Beginning of Line

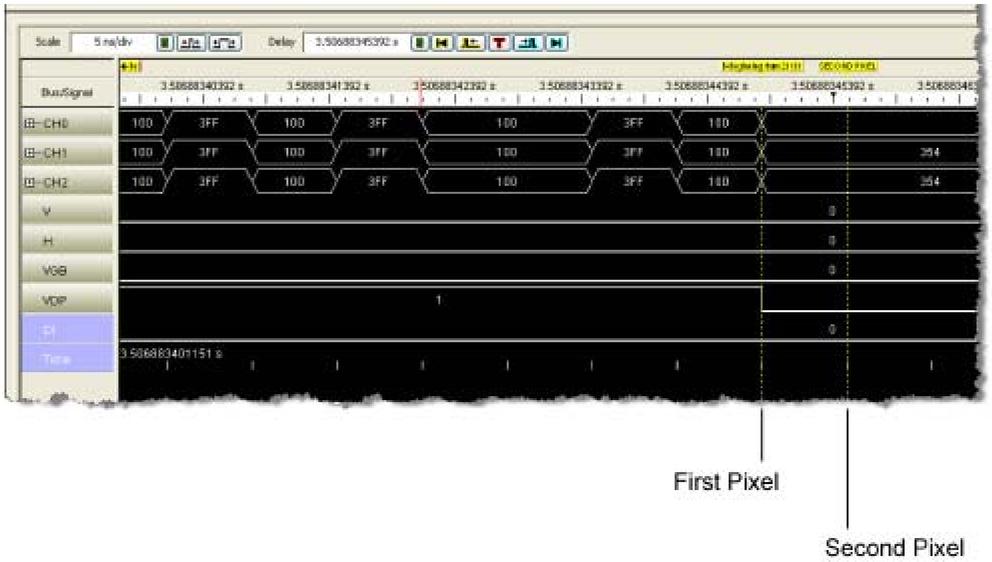


Figure 27 Pixels in Waveform View

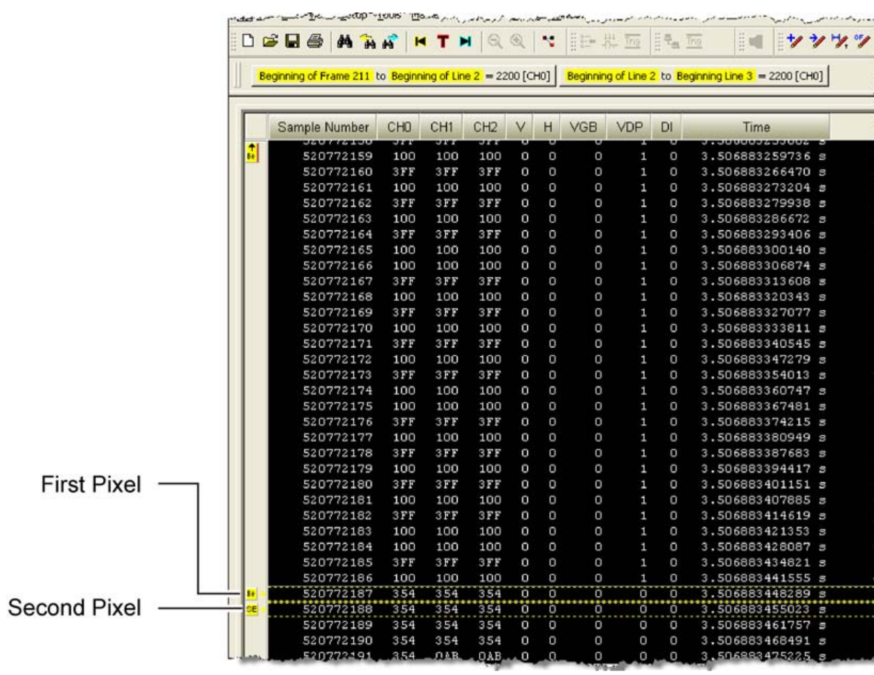


Figure 28 Pixels in Listing View

Interlaced Video Data

To determine the start of the first frame, if the pixel offset to the first frame is:

- less than 50% frame width, the first frame begins at the last falling edge of the VDP to precede the first VSYNC.
- greater than 50% of frame width, then the first frame begins at the last falling edge of the VDP to precede the third VSYNC. See Figure 29.

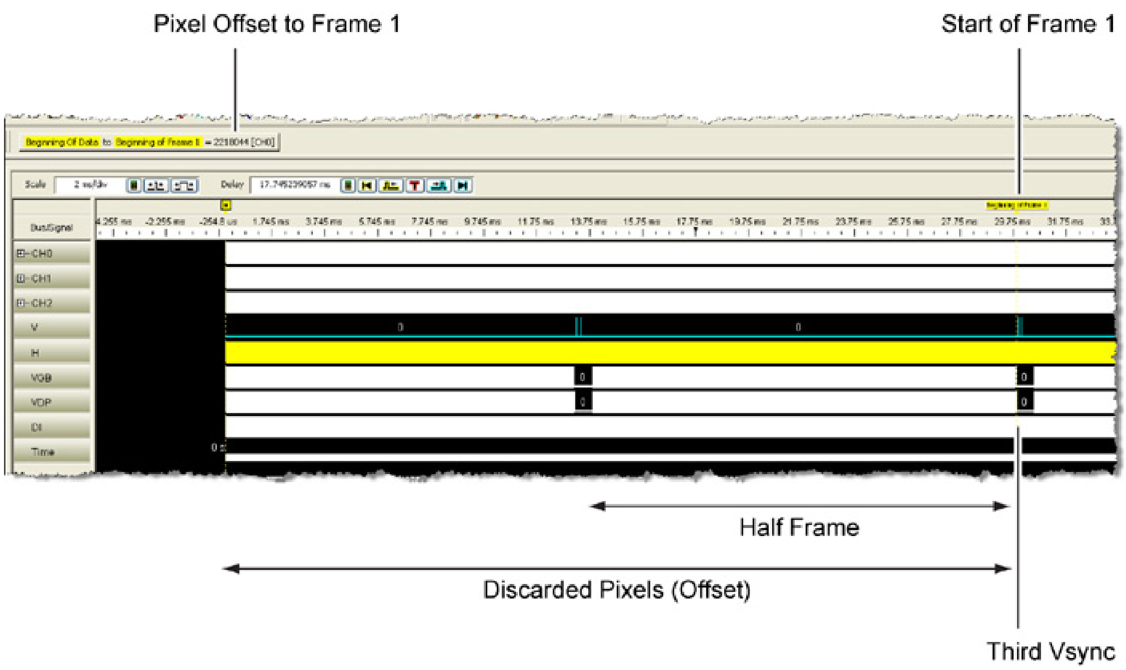


Figure 29 Pixel Offset is Greater than 50% of Frame Width

In interlaced formatted files, logic analyzer reads every half frame as a whole frame. Therefore, there are four VSYNCs-per-frame instead of the two VSYNCs-per-frame seen in progressive formats. See Figure 30.

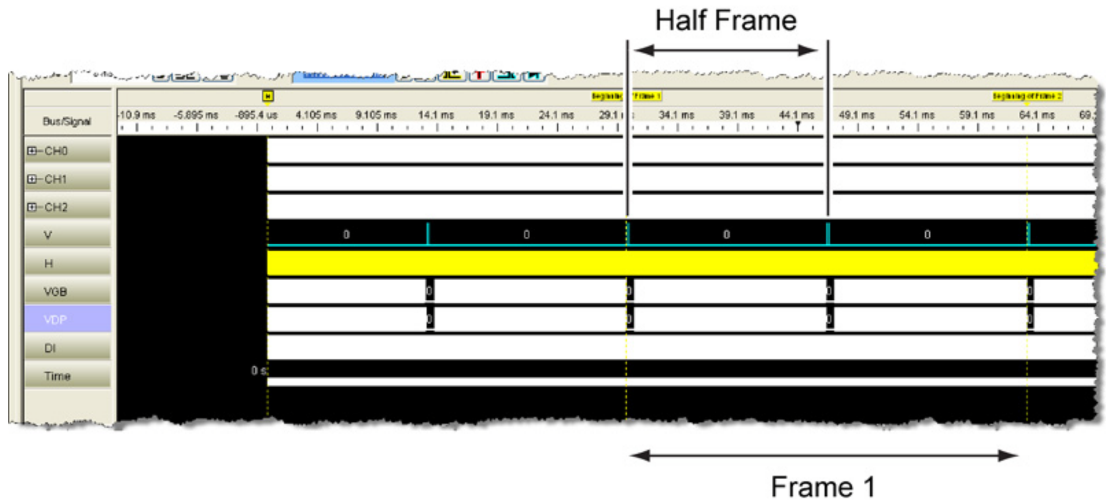


Figure 30 Interlaced Frame

The last frame ends at the last full (interlaced) frame and is located by counting full frames from frame 1 until the last full frame is reached.

The first line starts at a frame's first pixel and continues for the numbers of pixels in a line. See Figure 31. The pixels-per-line is unique to the format as listed in Table 5 on page 63. The beginning of a line falls a few pixels before the rising edge of the DI. There are two HSYNCs for every line.

A pixel corresponds to a sample and is visible in waveform view and Listing view. See Figure 32 and Figure 33.

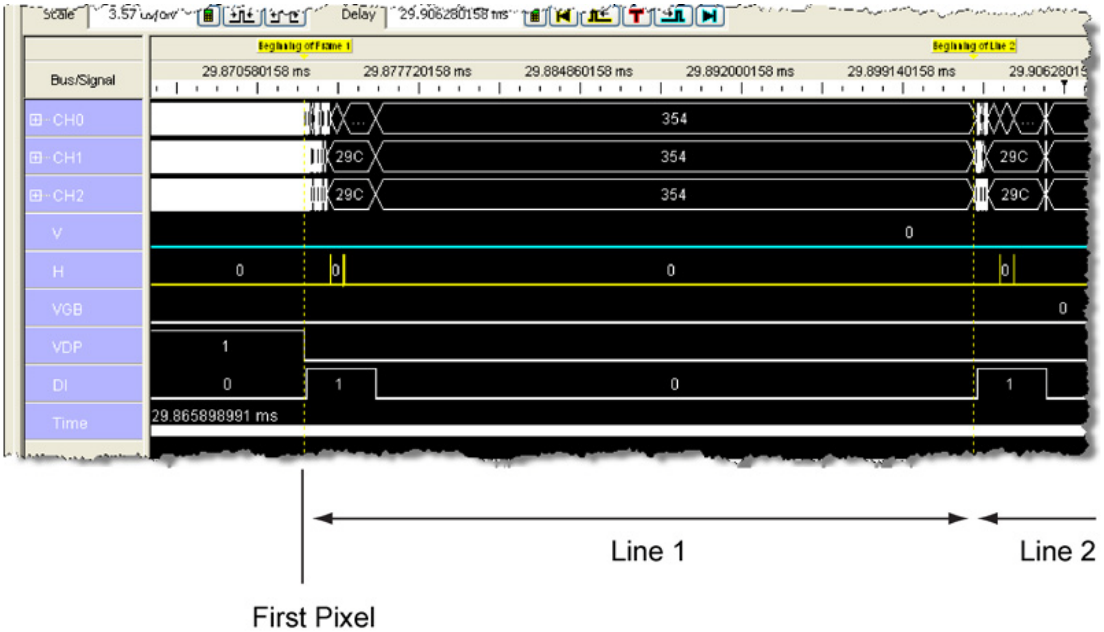


Figure 31 Displayed Lines

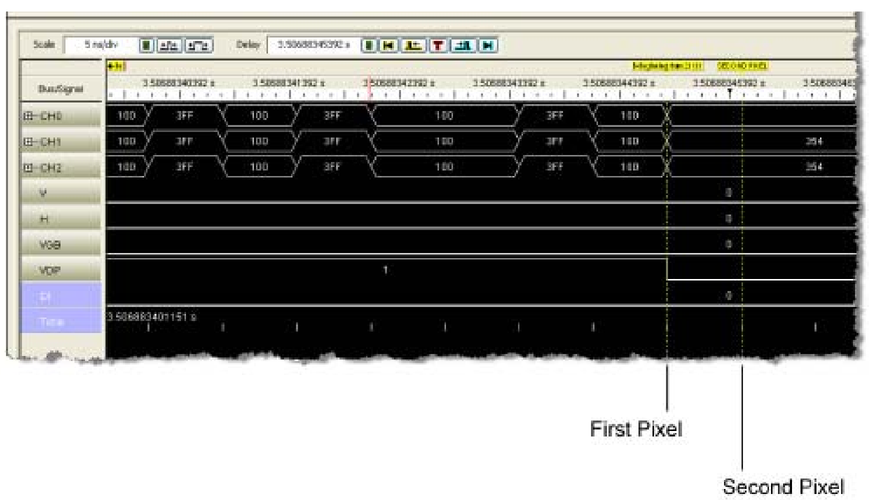


Figure 32 Start of First and Second Pixels of Frame 211 Shown in Waveform View

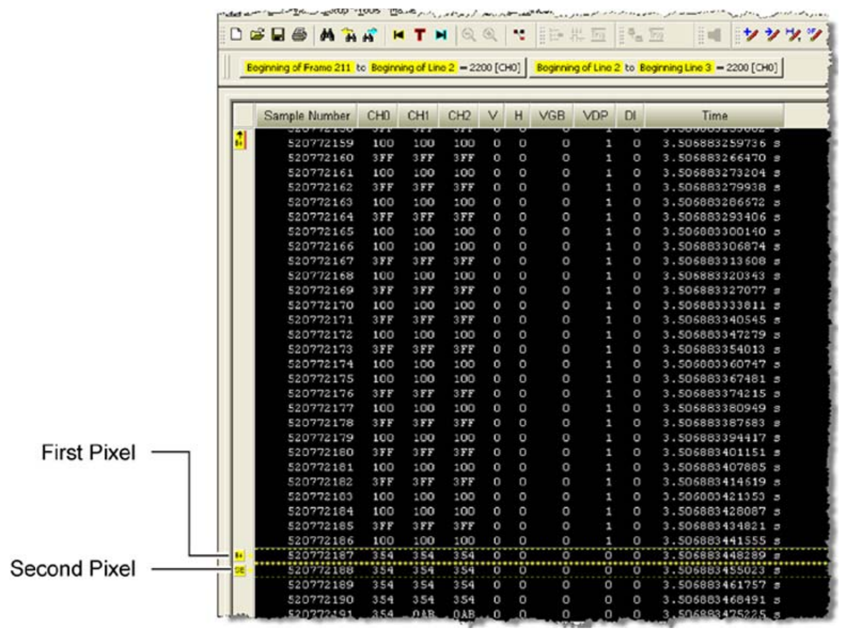


Figure 33 First and Second Pixels of Frame 211 Shown in List View

4
Testing a HDMI Sink Device

This chapter describes how you can configure U4998A to test a HDMI sink DUT. It also describes how you can transmit predefined audio/video frames from U4998A to a sink DUT for various sink tests.

Overview

The following figure illustrates the broad steps that you need to perform to test a HDMI sink DUT using U4998A.

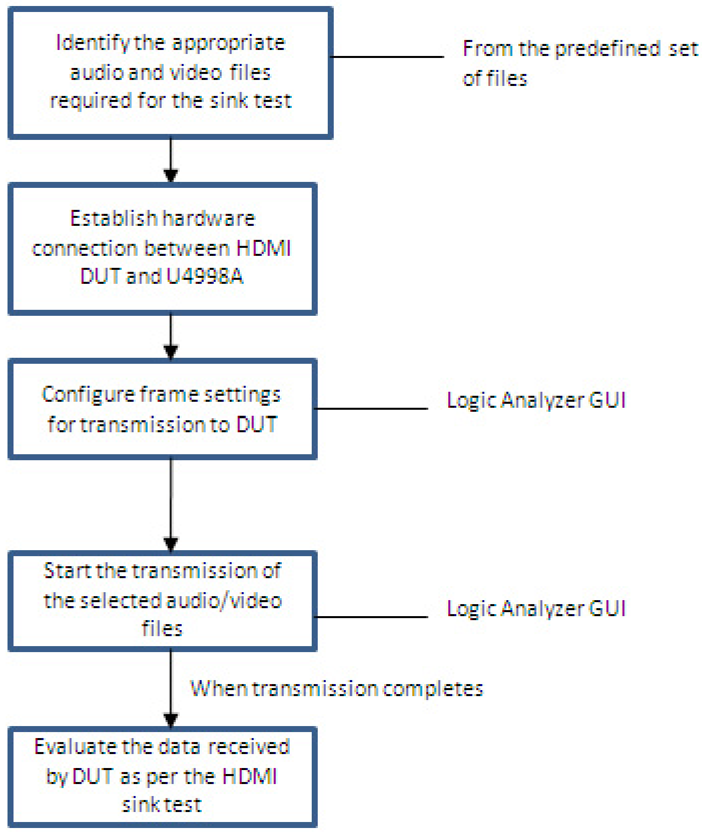


Figure 34 HDMI Generator flow

The topics that follow describe each of these tasks in detail.

Refer to the topic “Roles and Usage Scenarios" on page 13 to get a pictorial representation of U4998A as a generator.

Using the Predefined Audio and Video Files for transmission

While testing a sink DUT, U4998A emulates the role of a generator and transmits the audio and video files that you specify for transmission. It does not, however, read the EDID of the sink DUT for the transmission.

You can use U4998A to transmit any video/audio file from the set of predefined video (.vgf) and audio (.aaf) files. To get this set of predefined files, you need to install the U4998A HDMI Video Generator Files utility. This utility installs a set of predefined .vgf and .aaf files at the default location or a location that you specify while installation. The following figure displays the default location for the installation of these files.

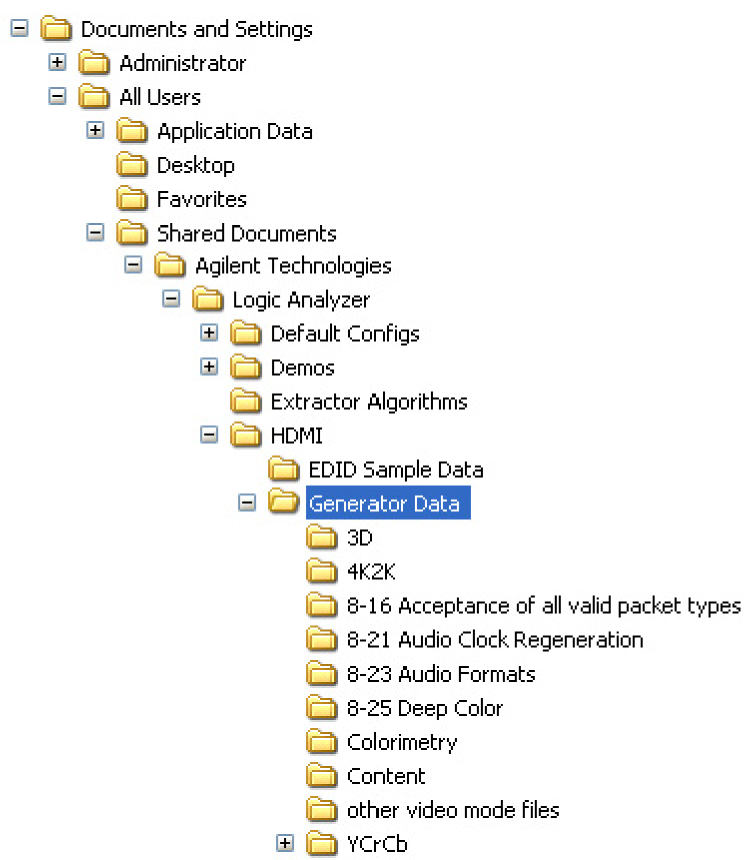
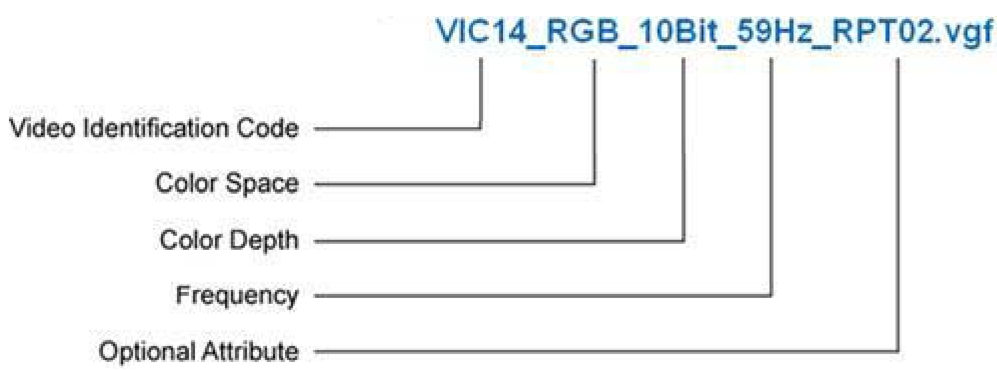


Figure 35 Default location of predefined Audio and Video files

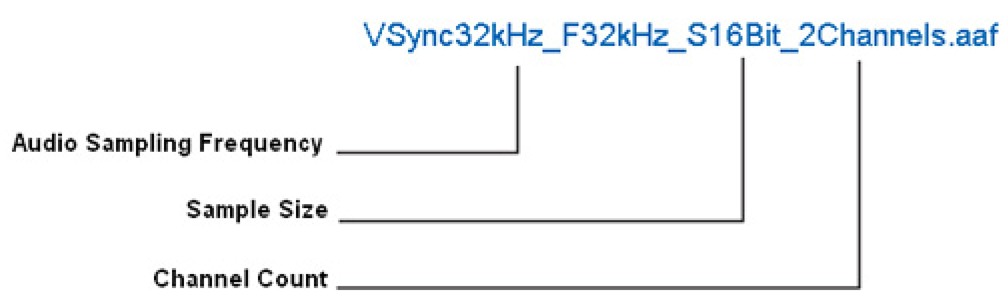
These audio/video files are as per the requirements of various HDMI CTS 1.4a sink tests to help you run these tests at the sink DUT end. The files are organized in subfolders on the basis of the correspond sink test. For instance, the Video and audio files for test 8- 23 are located in the **8-23 Audio Formats** folder.

Naming convention for the predefined audio and video files

The following is the naming convention used for the .vgf files.



The following is the naming convention used for the .aaf files.



Supported Sink Tests

U4998A provides the required audio/video files for all sink tests except for 8-22, 8-27, and 8-28 tests.

Video Format Timings supported by .vgf Files

The following table lists the video format timings supported by the .vgf files.

CEA Video Identification Code	Format
1	640 x 480 @ 59.94 / 60 Hz
2, 3	720 x 480 @ 59.94 / 60 Hz
4	1280 x 720 @ 59.94 / 60 Hz
5	1920 x 1080i @ 59.94 / 60 Hz
6, 7	1440 x 480i @ 59.94 / 60 Hz
8, 9	720 (1440) x 240p @ 59.94 / 60 Hz
10, 11	2880 x 480i @ 59.94 / 60 Hz
12, 13	2880 x 240p @ 59.94 / 60 Hz
14, 15	1440 x 480p @ 59.94 / 60 Hz
16	1920 x 1080p @ 59.94 / 60 Hz
17, 18	720 x 576p @ 50Hz
19	1280 x 720p @ 50Hz
20	1920 x 1080i @ 50 Hz
21, 22	720 (1440) x 576i @ 50 Hz
23, 24	720 (1440) x 288p @ 50 Hz
25, 26	2880 x 576i @ 50 Hz
27, 28	2880 x 288p @ 50 Hz
29, 30	1440 x 576p @ 50 Hz
31	1920 x 1080p @ 50 Hz
32	1920 x 1080p @ 23.98 / 24 Hz
33	1920 x 1080p @ 25 Hz
34	1920 x 1080p @ 29.97 / 30 Hz
35, 36	2880 x 480p @ 59.94 / 60 Hz
37, 38	2880 x 576p @ 50 Hz
39	1920 x 1080i (1250 total) @ 50 Hz
40	1920 x 1080i @ 100 Hz
41	1280 x 720p @ 100 Hz
42, 43	720 x 576p @ 100 Hz
44, 45	720 (1440) x 576i @ 100 Hz
46	1920 x 1080i @ 119.88 / 120 Hz
47	1280 x 720p @ 119.88 / 120 Hz
48, 49	720 x 480p @ 119.88 / 120 Hz
50, 51	720 (1440) x 480i @ 119.88 / 120 Hz
52, 53	720 x 576p @ 200 Hz
54, 55	720 (1440) x 576i @ 200 Hz
56, 57	720 x 480p @ 239.76 / 240 Hz
58, 59	720 (1440) x 480i @ 239.76 / 240 Hz
60	1280 x 720p @ 23.98 / 24 Hz

CEA Video Identification Code	Format
61	1280 x 720p @ 25 Hz
62	1280 x 720p @ 29.97 / 30 Hz
63	1920 x 1080p @ 119.88 / 120 Hz
64	1920 x 1080p @ 100 Hz
H01	3840 x 2160p @ 29.97 / 30 Hz
H02	3840 x 2160p @ 25 Hz
H03	3840 x 2160p @ 23.98/ 24 Hz
H04	4096 x 2160p @ 24 Hz

Configuring Frame Settings for Transmission to a Sink Device

NOTE To test a HDMI sink DUT, U4998A needs to emulate a HDMI source device that can transmit data to DUT. Therefore, ensure that you select the connection type as **U4998A -Frame Generator** while setting up a connection between U4998A and DUT.

The frame settings control which video and audio files (from the predefined set) you want to transmit to the sink DUT from U4998A.

You use the Agilent Logic Analyzer GUI to configure the frame settings.

To configure frame settings:

1 Access the **Setup** dialog box by clicking **Setup-> Setup** from the drop-down menu displayed for the HDMI module.

2 Click the **Frame Setup** tab.

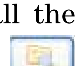
3 If needed, select the deviation from the standard TMDS clock frequency. You can choose **0%**, **-0.5%**, or **0.5%** as the deviation from the **Clock Deviation** listbox.

4 Click the  button displayed with **Video File** to browse and select a .vgf file from the predefined set of files for transmission. The default location for these files is **C:\Documents and Settings\All Users\Documents\Agilent Technologies\HDMI\Generator Data**. The location may slightly vary depending on your operating system.

   On selecting a video file, the format specific details of the selected file are displayed in the **Video Format** section.

   The selection of a video file also enables the **Audio Properties** section.

5 Some sink tests such as 8-21 and 8-23 require the presence of audio with video transmission. For such tests, you can send an audio file as well for transmission by selecting the **Enable Audio Properties** checkbox. This enables all the audio related fields in the tab.

6 Click the  button displayed with **Audio File** to browse and select an .aaf file from the predefined set of files for transmission. The default location for these files is **C:\Documents and Settings\All Users\Documents**

Agilent Technologies\HDMI\Generator Data. The location may slightly vary depending on your operating system.

On selecting an audio file, the format specific details of the selected audio file are displayed in the **Audio Format** section.

7 The fields in the **Clock Regeneration** section are used to regenerate the audio clock based on the ACR packet data. You can specify an integer value between **300** to **1500** in the **D** field based on which the N parameter (ACR packet data) is calculated and displayed in the N field.

8 Click **Apply** and then **OK**.

Starting and Stopping the Transmission of Frames

When you have selected the video and audio files for transmission to DUT, you can start the transmission of these files. You use the **Frame Setup** tab in the Logic Analyzer GUI to start the transmission of frames in the specified files.

Before starting the transmission, ensure that:

- the Logic Analyzer GUI is in the online mode.
- the sink DUT is connected to the HDMI OUTPUT Connector of U4998A module, switched on, and configured to accept HDMI data input.
- you have the U4998A-GEN Generator testing license to transmit data to DUT.

To start the transmission of frames

1 Access the **Setup** dialog box by clicking **Setup-> Setup** from the drop-down menu displayed for the HDMI module.
2 Click the **Frame Setup** tab.
3 Click the 

button.

On clicking **Start**, the Start button is disabled and the Stop button gets enabled. U4998A starts transmitting the selected vgf and aaf files continuously till you click the **Stop** button to manually stop the transmission.

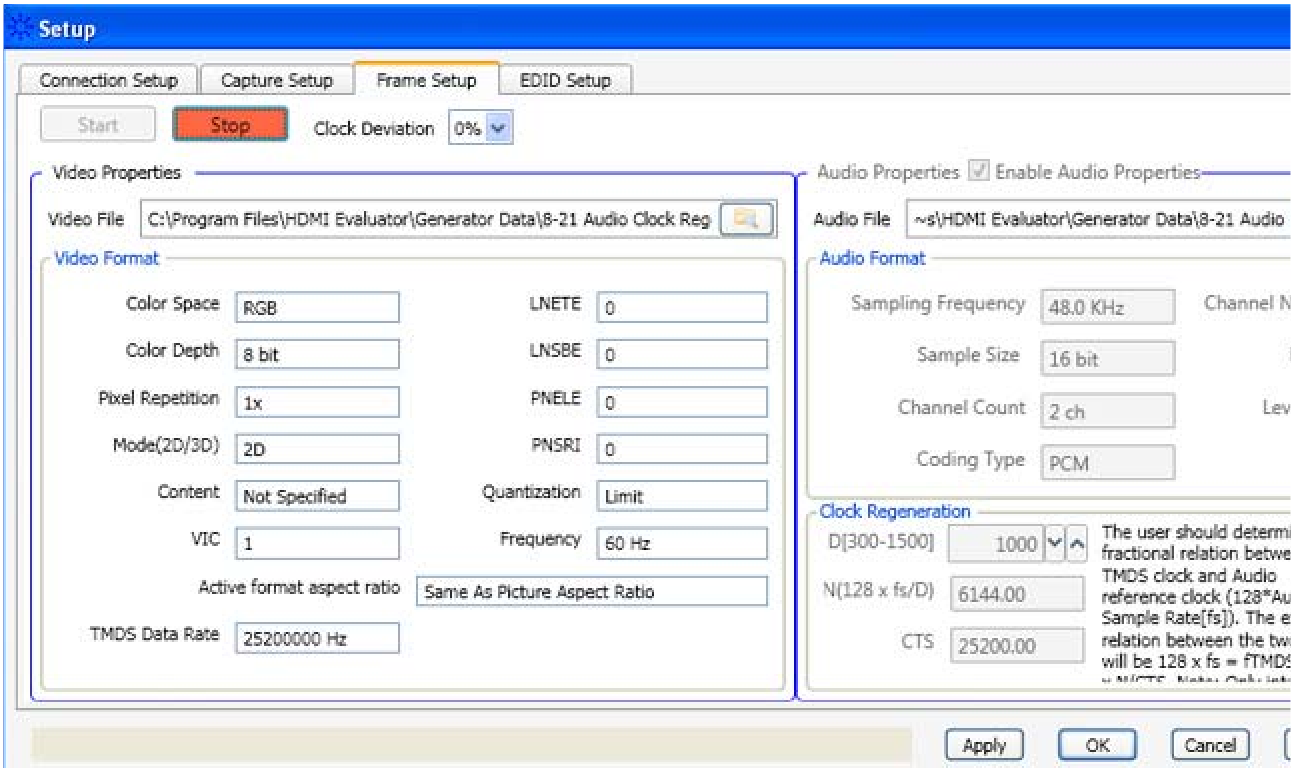


Figure 36 Start of transmission from U4998A

The TMDS Data Channel LEDs for the HDMI OUT connector on the front panel of U4998A turn green indicating the start of HDMI transmission. If the LEDs turn orange, it indicates the start of HDMI transmission but the three TMDS data channels are not aligned. The LEDs turn red if non HDMI data is transmitted.

4 To manually stop the transmission, click the **Stop** button.

Evaluating the Sink Device for Compliance to HDMI CTS

The audio and video files provided with U4998A are as per the requirements of the supported HDMI sink tests. When you transmit a specific audio and video file from U4998A to DUT, you can evaluate the DUT for the sink test corresponding to the transmitted files.

This topic lists which .vgf files are available for each of the supported sink test. It also lists the attributes such as Color format, Color depth, Repetition factor for these .vgf files.

8-16 Acceptance of all valid packet types

Video generator files for the test 8-16 are located in the folder shown in the following figure. Each file in the highlighted folder is dedicated for one of the packet types. The specific packet is sent repeatedly.

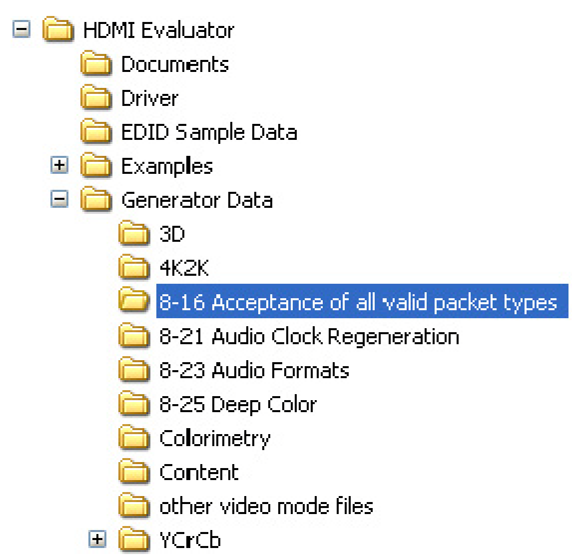


Figure 37 Location of 8-16 vgf files

The tables that follow list:

- the files provided for the two required video format timings: 720 x 480p or 720 x 576p.
- the packet type supported by each video generator file.
- the contents of each packet.

Table 6 Video Format Timings and Video Generator Files

CEA Video Identification Code	Video Format Timings	Color Space			File Name
		RGB	YCbCr	xvYCC	
2	720 x 480p, 60 Hz	•			VIC02_RGB_8Bit_60Hz_GC1.vgf
	720 x 480p, 60 Hz	•			VIC02_RGB_8Bit_60Hz._GC2.vgf
	720 x 480p, 60 Hz	•			VIC02_RGB_8Bit_60Hz_IS1.vgf
	720 x 480p, 60 Hz	•			VIC02_RGB_8Bit_60Hz_IS2.vgf
	720 x 480p, 60 Hz	•			VIC02_RGB_8Bit_60Hz_MPG.vgf
	720 x 480p, 60 Hz	•			VIC02_RGB_8Bit_60Hz_NUL.vgf
	720 x 480p, 60 Hz	•			VIC02_RGB_8Bit_60Hz_SPD.vgf
	720 x 480p, 60 Hz	•			VIC02_RGB_8Bit_60Hz_VSI.vgf
	720 x 480p, 60 Hz		•		VIC02_Y444_8Bit_60Hz_GC1.vgf
	720 x 480p, 60 Hz		•		VIC02_Y444_8Bit_60Hz._GC2.vgf
	720 x 480p, 60 Hz		•		VIC02_Y444_8Bit_60Hz_IS1.vgf
	720 x 480p, 60 Hz		•		VIC02_Y444_8Bit_60Hz_IS2.vgf
	720 x 480p, 60 Hz		•		VIC02_Y444_8Bit_60Hz_MPG.vgf
	720 x 480p, 60 Hz		•		VIC02_Y444_8Bit_60Hz_NUL.vgf
	720 x 480p, 60 Hz		•		VIC02_Y444_8Bit_60Hz_SPD.vgf
	720 x 480p, 60 Hz		•		VIC02_Y444_8Bit_60Hz_VSI.vgf
3	720 x 480p, 60 Hz			•	VIC03_xvYCC444_8Bit_60Hz.vgf
17	720 x 576p, 50 Hz	•			VIC17_RGB_8Bit_50Hz_GC1.vgf
	720 x 576p, 50 Hz	•			VIC17_RGB_8Bit_50Hz._GC2.vgf
	720 x 576p, 50 Hz	•			VIC17_RGB_8Bit_50Hz_IS1.vgf
	720 x 576p, 50 Hz	•			VIC17_RGB_8Bit_50Hz_IS2.vgf
	720 x 576p, 50 Hz	•			VIC17_RGB_8Bit_50Hz_MPG.vgf
	720 x 576p, 50 Hz	•			VIC17_RGB_8Bit_50Hz_NUL.vgf
	720 x 576p, 50 Hz	•			VIC17_RGB_8Bit_50Hz_SPD.vgf
	720 x 576p, 50 Hz	•			VIC17_RGB_8Bit_50Hz_VSI.vgf
	720 x 576p, 50 Hz		•		VIC17_Y444_8Bit_50Hz_GC1.vgf
	720 x 576p, 50 Hz		•		VIC17_Y444_8Bit_50Hz._GC2.vgf
	720 x 576p, 50 Hz		•		VIC17_Y444_8Bit_50Hz_IS1.vgf
	720 x 576p, 50 Hz		•		VIC17_Y444_8Bit_50Hz_IS2.vgf
	720 x 576p, 50 Hz		•		VIC17_Y444_8Bit_50Hz_MPG.vgf
	720 x 576p, 50 Hz		•		VIC17_Y444_8Bit_50Hz_NUL.vgf
	720 x 576p, 50 Hz		•		VIC17_Y444_8Bit_50Hz_SPD.vgf
	720 x 576p, 50 Hz		•		VIC17_Y444_8Bit_50Hz_VSI.vgf
18	720 x 576p, 50 Hz			•	VIC18_xvYCC444_8Bit_50Hz.vgf

Table 7 Video Generator Files with Supported Packets

Filename	Filename Suffix	Packet Type Checked packets are inserted in the HDMI stream.												
		Null	General Control Clear_AVMUTE = 1	General Control Set_AVMUTE = 1	Vendor-Specific Info Frame	MPEG Source Info Frame	Source Product Description	AVI Info Frame	Audio Info Frame	Auto Content Protection	ISRC1 ISRC_Cont = 0	ISRC1 ISRC_Cont = 1	ISRC 2	Metadata Packet
VIC02_RGB_8Bit_60Hz_NU1.vgf	NU1	•												
VIC17_RGB_8Bit_50Hz_NU1.vgf		•												
VIC02_RGB_8Bit_60Hz_GC1.vgf	GC1		•											
VIC17_RGB_8Bit_50Hz_GC1.vgf			•											
VIC02_RGB_8Bit_60Hz_GC2.vgf	GC2			•										
VIC17_RGB_8Bit_50Hz_GC2.vgf				•										
VIC02_RGB_8Bit_60Hz_VS1.vgf	VS1				•									
VIC17_RGB_8Bit_50Hz_VS1.vgf					•									
VIC02_RGB_8Bit_60Hz_MPG.vgf	MPG					•		1[*]	2[†]					
VIC17_RGB_8Bit_50Hz_MPG.vgf						•								
VIC02_RGB_8Bit_60Hz_SPD.vgf	SPD						•							
VIC17_RGB_8Bit_50Hz_SPD.vgf							•							
VIC02_RGB_8Bit_60Hz_IS1.vgf	IS1									•	•			
VIC17_RGB_8Bit_50Hz_IS1.vgf										•	•			
VIC02_RGB_8Bit_60Hz_IS2.vgf	IS2									•		•	•	
VIC17_RGB_8Bit_50Hz_IS2.vgf										•		•	•	
V1C03_xvYC444_8Bit_60Hz.vgf	none													•
V1C18_xvYC444_8Bit_50Hz.vgf														•

* Always output

† Always output when any audio generator file is selected

Table 8 Contents of Packet

Description	Header[*]	Body
Null	00 00 00	
General Control #1	03 00 00	10 00 00 00 00 00 00 10 00 00 00 00 00 00 10 00 00 00 00 00 00 10 00 00 00 00 00 00[†]
General Control #2	03 00 00	01 00 00 00 00 00 00 01 00 00 00 00 00 00 01 00 00 00 00 00 00 01 00 00 00 00 00 00[‡]
Vendor Specific Info Frame	81 01 17	CS 00 0C 03 41 67 69 6C 65 6E 74 20 54 65 63 68 6E 6F 6C 6F 67 69 65 73 (C-ID) Agilent Technologies[**]

Table 8 Contents of Packet

Description	Header*	Body
Source Product Description Info Frame	83 01 1A	CS 53 6F 75 72 63 65 20 50 72 6F 64 75 63 74 20 44 65 73 63 72 69 70 74 69 6F 6E Source Product Description
MPEG Source Info Frame	85 01 0A	CS 80 96 98 00 00 00 00 00 00 00
Audio Content Protection	04 00 00	00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
ISRC1	05 C2 00 or 05 42 00	00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
ISRC2	06 00 00	00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
Gamut Metadata	0A 80 30	91 9B A3 C5 95 63 62 A2 54 31 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00

* Packet data is shown in hexadecimal

† Clear_AVMUTE = 1

‡ Set_AVMUTE = 1

** Agilent company ID = 00 0C 03

8-21 Audio Clock Regeneration

Video and audio generator files for the test 8-21 are located in the following highlighted folder.

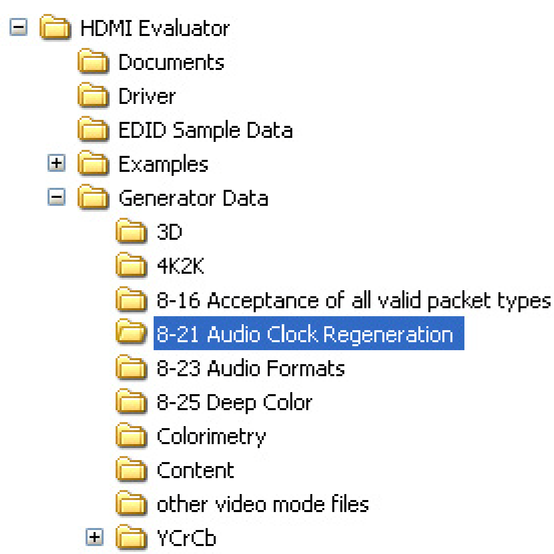


Figure 38 Location of Test 8-21 Folder

Test 8-21 verifies audio clock regeneration using a minimum and a maximum “N” parameter (ACR packet data). The following equation is used to derive the N parameter:

$$\text{N Parameter} = \frac{128 \times fs}{D}$$

where f_s is the audio sample rate and D set to 1500 for a minimum N parameter and D set to 300 for a maximum N parameter.

When transmitting the relevant audio file for the test 8-21, specify the value for D in the **Clock Regeneration** section in the Frame Setup tab in Logic Analyzer as displayed below.

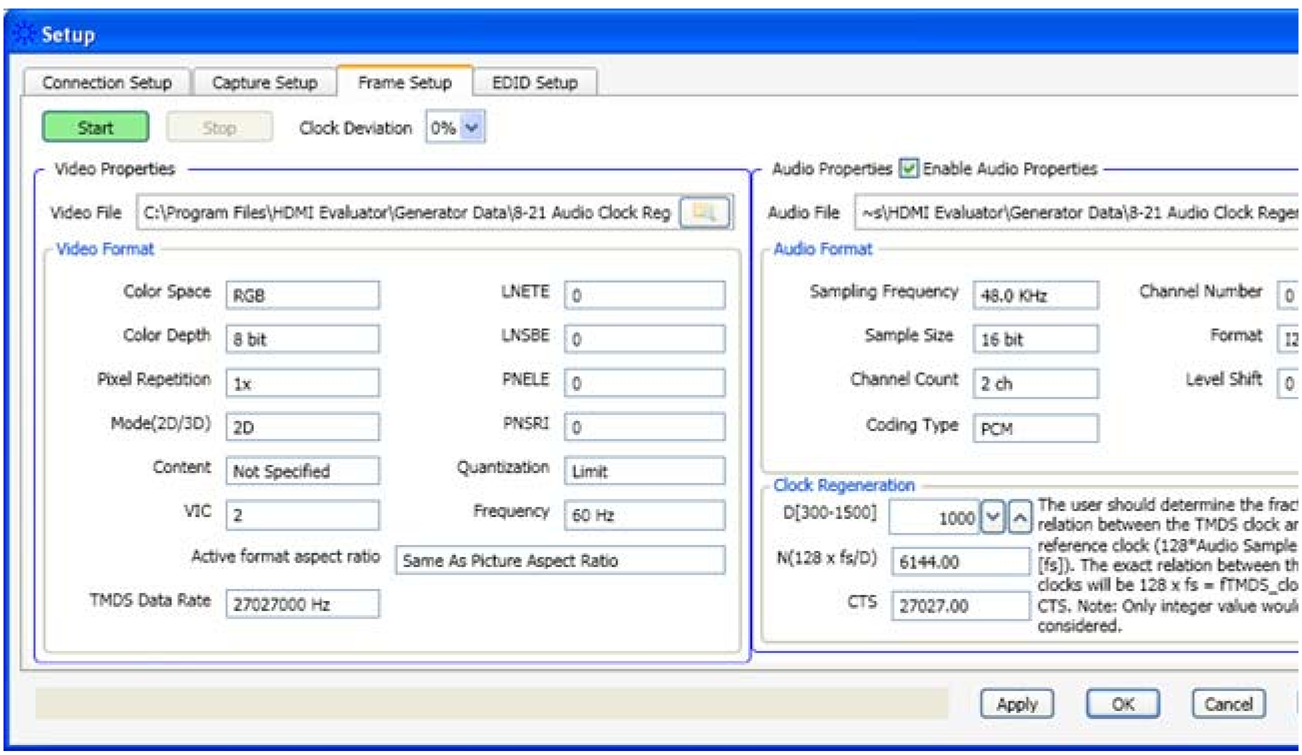


Figure 39 Value of D for test 8-21

Test 8-23. Audio Formats

Video and audio generator files for the test 8-23 are located in the following highlighted folder. One video format file and three types of two-channel L-PCM audio generator files (32 kHz, 44.1 kHz, and 48 kHz) are provided.

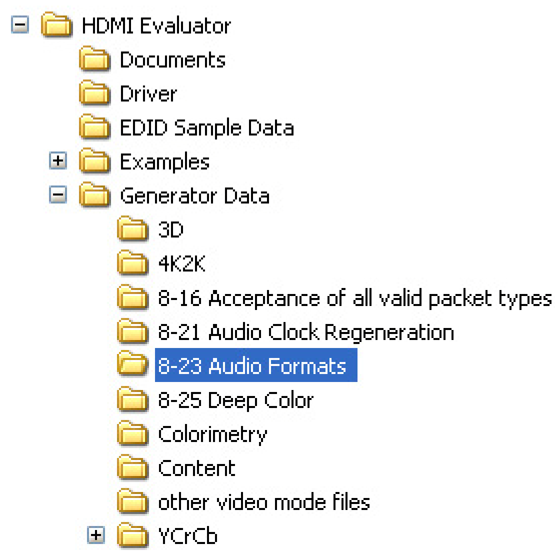


Figure 40 Location of Test 8-23 Folder

Test 8-25. Deep Color

Video and audio generator files for the test 8-25 are located in the following highlighted folders.

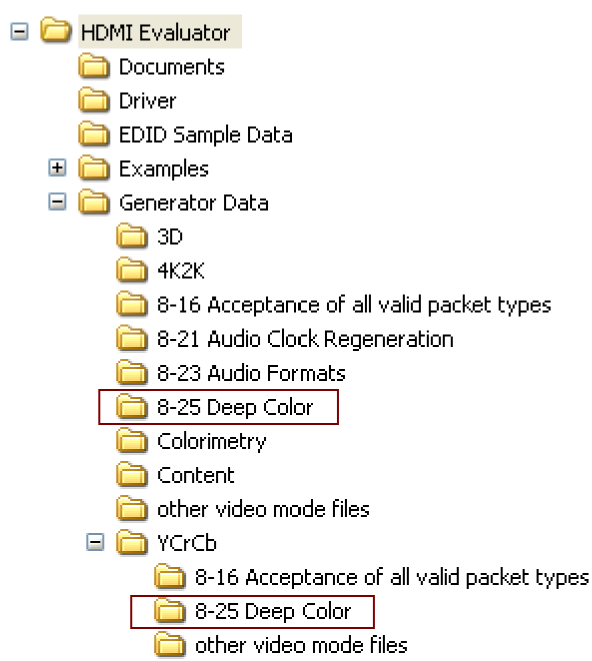


Figure 41 Location of Test 8-25 Folder

The following table lists the attributes such as color format and color depth supported by the video generator files for the test 8-25.

Table 9 Video Generator Files for Test ID 8–25 (Sheet 1 of 10)

CEA Video Identification Code	Video Format Timings	Color Format			Color Depth			Repetition Factor			File Name
		RGB	YCbCr 4:2:2	YCbCr 4:4:4	24 Bit	30 Bit	36 Bit	0	2	4	
1	640 x 480p, 59.94 Hz	•			•			•			VIC01_RGB_8Bit_59Hz.vgf
	640 x 480p, 60 Hz	•			•			•			VIC01_RGB_8Bit_60Hz.vgf
	640 x 480p, 59.94 Hz	•				•		•			VIC01_RGB_10Bit_59Hz.vgf
	640 x 480p, 60 Hz	•				•		•			VIC01_RGB_10Bit_60Hz.vgf
	640 x 480p, 59.94 Hz	•					•	•			VIC01_RGB_12Bit_59Hz.vgf
	640 x 480p, 60 Hz	•					•	•			VIC01_RGB_12Bit_60Hz.vgf
	640 x 480p, 59.94 Hz			•	•			•			VIC01_Y444_8Bit_59Hz.vgf
	640 x 480p, 60 Hz			•	•			•			VIC01_Y444_8Bit_60Hz.vgf
	640 x 480p, 59.94 Hz			•		•		•			VIC01_Y444_10Bit_59Hz.vgf
	640 x 480p, 60 Hz			•		•		•			VIC01_Y444_10Bit_60Hz.vgf
	640 x 480p, 59.94 Hz			•			•	•			VIC01_Y444_12Bit_59Hz.vgf
	640 x 480p, 60 Hz			•			•	•			VIC01_Y444_12Bit_60Hz.vgf
2	720 x 480p, 59.94 Hz	•			•			•			VIC02_RGB_8Bit_59Hz.vgf
	720 x 480p, 60 Hz	•			•			•			VIC02_RGB_8Bit_60Hz.vgf
	720 x 480p, 59.94 Hz	•				•		•			VIC02_RGB_10Bit_59Hz.vgf
	720 x 480p, 60 Hz	•				•		•			VIC02_RGB_10Bit_60Hz.vgf
	720 x 480p, 59.94 Hz	•					•	•			VIC02_RGB_12Bit_59Hz.vgf
	720 x 480p, 60 Hz	•					•	•			VIC02_RGB_12Bit_60Hz.vgf
	720 x 480p, 59.94 Hz			•	•			•			VIC02_Y444_8Bit_59Hz.vgf
	720 x 480p, 60 Hz			•	•			•			VIC02_Y444_8Bit_60Hz.vgf
	720 x 480p, 59.94 Hz			•		•		•			VIC02_Y444_10Bit_59Hz.vgf
	720 x 480p, 60 Hz			•		•		•			VIC02_Y444_10Bit_60Hz.vgf
	720 x 480p, 59.94 Hz			•			•	•			VIC02_Y444_12Bit_59Hz.vgf
	720 x 480p, 60 Hz			•			•	•			VIC02_Y444_12Bit_60Hz.vgf
3	720 x 480p, 59.94 Hz	•			•			•			VIC03_RGB_8Bit_59Hz.vgf
	720 x 480p, 60 Hz	•			•			•			VIC03_RGB_8Bit_60Hz.vgf
	720 x 480p, 59.94 Hz	•				•		•			VIC03_RGB_10Bit_59Hz.vgf
	720 x 480p, 60 Hz	•				•		•			VIC03_RGB_10Bit_60Hz.vgf
	720 x 480p, 59.94 Hz	•					•	•			VIC03_RGB_12Bit_59Hz.vgf
	720 x 480p, 60 Hz	•					•	•			VIC03_RGB_12Bit_60Hz.vgf
	720 x 480p, 59.94 Hz			•	•			•			VIC03_Y444_8Bit_59Hz.vgf
	720 x 480p, 60 Hz			•	•			•			VIC03_Y444_8Bit_60Hz.vgf
	720 x 480p, 59.94 Hz			•		•		•			VIC03_Y444_10Bit_59Hz.vgf
	720 x 480p, 60 Hz			•		•		•			VIC03_Y444_10Bit_60Hz.vgf

Table 9 Video Generator Files for Test ID 8–25 (Sheet 2 of 10)

CEA Video Identification Code	Video Format Timings	Color Format			Color Depth			Repetition Factor			File Name
		RGB	YCbCr 4:2:2	YCbCr 4:4:4	24 Bit	30 Bit	36 Bit	0	2	4	
	720 x 480p, 59.94 Hz			•			•	•			VIC03_Y444_12Bit_59Hz.vgf
	720 x 480p, 60 Hz			•			•	•			VIC03_Y444_12Bit_60Hz.vgf
4	1280 x 720p, 59.94 Hz	•			•			•			VIC04_RGB_8Bit_59Hz.vgf
	1280 x 720p, 60 Hz	•			•			•			VIC04_RGB_8Bit_60Hz.vgf
	1280 x 720p, 59.94 Hz	•				•		•			VIC04_RGB_10Bit_59Hz.vgf
	1280 x 720p, 60 Hz	•				•		•			VIC04_RGB_10Bit_60Hz.vgf
	1280 x 720p, 59.94 Hz	•					•	•			VIC04_RGB_12Bit_59Hz.vgf
	1280 x 720p, 60 Hz	•					•	•			VIC04_RGB_12Bit_60Hz.vgf
	1280 x 720p, 59.94 Hz			•	•			•			VIC04_Y444_8Bit_59Hz.vgf
	1280 x 720p, 60 Hz			•	•			•			VIC04_Y444_8Bit_60Hz.vgf
	1280 x 720p, 59.94 Hz			•		•		•			VIC04_Y444_10Bit_59Hz.vgf
	1280 x 720p, 60 Hz			•		•		•			VIC04_Y444_10Bit_60Hz.vgf
	1280 x 720p, 59.94 Hz			•			•	•			VIC04_Y444_12Bit_59Hz.vgf
	1280 x 720p, 60 Hz			•			•	•			VIC04_Y444_12Bit_60Hz.vgf
5	1920 x 1080i, 59.94 Hz	•			•			•			VIC05_RGB_8Bit_59Hz.vgf
	1920 x 1080i, 60 Hz	•			•			•			VIC05_RGB_8Bit_60Hz.vgf
	1920 x 1080i, 59.94 Hz	•				•		•			VIC05_RGB_10Bit_59Hz.vgf
	1920 x 1080i, 60 Hz	•				•		•			VIC05_RGB_10Bit_60Hz.vgf
	1920 x 1080i, 59.94 Hz	•					•	•			VIC05_RGB_12Bit_59Hz.vgf
	1920 x 1080i, 60 Hz	•					•	•			VIC05_RGB_12Bit_60Hz.vgf
	1920 x 1080i, 59.94 Hz			•	•			•			VIC05_Y444_8Bit_59Hz.vgf
	1920 x 1080i, 60 Hz			•	•			•			VIC05_Y444_8Bit_60Hz.vgf
	1920 x 1080i, 59.94 Hz			•		•		•			VIC05_Y444_10Bit_59Hz.vgf
	1920 x 1080i, 60 Hz			•		•		•			VIC05_Y444_10Bit_60Hz.vgf
	1920 x 1080i, 59.94 Hz			•			•	•			VIC05_Y444_12Bit_59Hz.vgf
	1920 x 1080i, 60 Hz			•			•	•			VIC05_Y444_12Bit_60Hz.vgf
6	720 (1440) x 480i, 59.94 Hz	•			•				•		VIC06_RGB_8Bit_59Hz.vgf
	720 (1440) x 480i, 60 Hz	•			•				•		VIC06_RGB_8Bit_60Hz.vgf
	720 (1440) x 480i, 59.94 Hz	•				•			•		VIC06_RGB_10Bit_59Hz.vgf
	720 (1440) x 480i, 60 Hz	•				•			•		VIC06_RGB_10Bit_60Hz.vgf
	720 (1440) x 480i, 59.94 Hz	•					•		•		VIC06_RGB_12Bit_59Hz.vgf
	720 (1440) x 480i, 60 Hz	•					•		•		VIC06_RGB_12Bit_60Hz.vgf
	720 (1440) x 480i, 59.94 Hz			•	•				•		VIC06_Y444_8Bit_59Hz.vgf
	720 (1440) x 480i, 60 Hz			•	•				•		VIC06_Y444_8Bit_60Hz.vgf
	720 (1440) x 480i, 59.94 Hz			•		•			•		VIC06_Y444_10Bit_59Hz.vgf

Table 9 Video Generator Files for Test ID 8–25 (Sheet 3 of 10)

CEA Video Identification Code	Video Format Timings	Color Format			Color Depth			Repetition Factor			File Name
		RGB	YCbCr 4:2:2	YCbCr 4:4:4	24 Bit	30 Bit	36 Bit	0	2	4	
	720 (1440) x 480i, 60 Hz			•		•			•		VIC06_Y444_10Bit_60Hz.vgf
	720 (1440) x 480i, 59.94 Hz			•			•		•		VIC06_Y444_12Bit_59Hz.vgf
	720 (1440) x 480i, 60 Hz			•			•		•		VIC06_Y444_12Bit_60Hz.vgf
7	720 (1440) x 480i, 59.94 Hz	•			•				•		VIC07_RGB_8Bit_59Hz.vgf
	720 (1440) x 480i, 60 Hz	•			•				•		VIC07_RGB_8Bit_60Hz.vgf
	720 (1440) x 480i, 59.94 Hz	•				•			•		VIC07_RGB_10Bit_59Hz.vgf
	720 (1440) x 480i, 60 Hz	•				•			•		VIC07_RGB_10Bit_60Hz.vgf
	720 (1440) x 480i, 59.94 Hz	•					•		•		VIC07_RGB_12Bit_59Hz.vgf
	720 (1440) x 480i, 60 Hz	•					•		•		VIC07_RGB_12Bit_60Hz.vgf
	720 (1440) x 480i, 59.94 Hz			•	•				•		VIC07_Y444_8Bit_59Hz.vgf
	720 (1440) x 480i, 60 Hz			•	•				•		VIC07_Y444_8Bit_60Hz.vgf
	720 (1440) x 480i, 59.94 Hz			•		•			•		VIC07_Y444_10Bit_59Hz.vgf
	720 (1440) x 480i, 60 Hz			•		•			•		VIC07_Y444_10Bit_60Hz.vgf
	720 (1440) x 480i, 59.94 Hz			•			•		•		VIC07_Y444_12Bit_59Hz.vgf
	720 (1440) x 480i, 60 Hz			•			•		•		VIC07_Y444_12Bit_60Hz.vgf
14	1440 x 480p, 59.94 Hz	•			•			•			VIC14_RGB_8Bit_59Hz.vgf
	1440 x 480p, 59.94 Hz	•			•				•		VIC14_RGB_8Bit_59Hz_RPT02.vgf
	1440 x 480p, 60 Hz	•			•			•			VIC14_RGB_8Bit_60Hz.vgf
	1440 x 480p, 60 Hz	•			•				•		VIC14_RGB_8Bit_60Hz_RPT02.vgf
	1440 x 480p, 59.94 Hz	•				•		•			VIC14_RGB_10Bit_59Hz.vgf
	1440 x 480p, 59.94 Hz	•				•			•		VIC14_RGB_10Bit_59Hz_RPT02.vgf
	1440 x 480p, 60 Hz	•				•		•			VIC14_RGB_10Bit_60Hz.vgf
	1440 x 480p, 60 Hz	•				•			•		VIC14_RGB_10Bit_60Hz_RPT02.vgf
	1440 x 480p, 59.94 Hz	•					•	•			VIC14_RGB_12Bit_59Hz.vgf
	1440 x 480p, 59.94 Hz	•					•		•		VIC14_RGB_12Bit_59Hz_RPT02.vgf
	1440 x 480p, 60 Hz	•					•	•			VIC14_RGB_12Bit_60Hz.vgf
	1440 x 480p, 60 Hz	•					•		•		VIC14_RGB_12Bit_60Hz_RPT02.vgf
	1440 x 480p, 59.94 Hz			•	•			•			VIC14_Y444_8Bit_59Hz.vgf
	1440 x 480p, 59.94 Hz			•	•				•		VIC14_Y444_8Bit_59Hz_RPT02.vgf
	1440 x 480p, 60 Hz			•	•			•			VIC14_Y444_8Bit_60Hz.vgf
	1440 x 480p, 60 Hz			•	•				•		VIC14_Y444_8Bit_60Hz_RPT02.vgf
	1440 x 480p, 59.94 Hz			•		•		•			VIC14_Y444_10Bit_59Hz.vgf
	1440 x 480p, 59.94 Hz			•		•			•		VIC14_Y444_10Bit_59Hz_RPT02.vgf
	1440 x 480p, 60 Hz			•		•		•			VIC14_Y444_10Bit_60Hz.vgf
	1440 x 480p, 60 Hz			•		•			•		VIC14_Y444_10Bit_60Hz_RPT02.vgf

Table 9 Video Generator Files for Test ID 8–25 (Sheet 4 of 10)

CEA Video Identification Code	Video Format Timings	Color Format			Color Depth			Repetition Factor			File Name
		RGB	YCbCr 4:2:2	YCbCr 4:4:4	24 Bit	30 Bit	36 Bit	0	2	4	
	1440 x 480p, 59.94 Hz			•			•	•			VIC14_Y444_12Bit_59Hz.vgf
	1440 x 480p, 59.94 Hz			•			•		•		VIC14_Y444_12Bit_59Hz_RPT02.vgf
	1440 x 480p, 60 Hz			•			•	•			VIC14_Y444_12Bit_60Hz.vgf
	1440 x 480p, 60 Hz			•			•		•		VIC14_Y444_12Bit_60Hz_RPT02.vgf
15	1440 x 480p, 59.94 Hz	•			•			•			VIC15_RGB_8Bit_59Hz.vgf
	1440 x 480p, 59.94 Hz	•			•				•		VIC15_RGB_8Bit_59Hz_RPT02.vgf
	1440 x 480p, 60 Hz	•			•			•			VIC15_RGB_8Bit_60Hz.vgf
	1440 x 480p, 60 Hz	•			•				•		VIC15_RGB_8Bit_60Hz_RPT02.vgf
	1440 x 480p, 59.94 Hz	•				•		•			VIC15_RGB_10Bit_59Hz.vgf
	1440 x 480p, 59.94 Hz	•				•			•		VIC15_RGB_10Bit_59Hz_RPT02.vgf
	1440 x 480p, 60 Hz	•				•		•			VIC15_RGB_10Bit_60Hz.vgf
	1440 x 480p, 60 Hz	•				•			•		VIC15_RGB_10Bit_60Hz_RPT02.vgf
	1440 x 480p, 59.94 Hz	•					•	•			VIC15_RGB_12Bit_59Hz.vgf
	1440 x 480p, 59.94 Hz	•					•		•		VIC15_RGB_12Bit_59Hz_RPT02.vgf
	1440 x 480p, 60 Hz	•					•	•			VIC15_RGB_12Bit_60Hz.vgf
	1440 x 480p, 60 Hz	•					•		•		VIC15_RGB_12Bit_60Hz_RPT02.vgf
	1440 x 480p, 59.94 Hz			•	•			•			VIC15_Y444_8Bit_59Hz.vgf
	1440 x 480p, 59.94 Hz			•	•				•		VIC15_Y444_8Bit_59Hz_RPT02.vgf
	1440 x 480p, 60 Hz			•	•			•			VIC15_Y444_8Bit_60Hz.vgf
	1440 x 480p, 60 Hz			•	•				•		VIC15_Y444_8Bit_60Hz_RPT02.vgf
	1440 x 480p, 59.94 Hz			•		•		•			VIC15_Y444_10Bit_59Hz.vgf
	1440 x 480p, 59.94 Hz			•		•			•		VIC15_Y444_10Bit_59Hz_RPT02.vgf
	1440 x 480p, 60 Hz			•		•		•			VIC15_Y444_10Bit_60Hz.vgf
	1440 x 480p, 60 Hz			•		•			•		VIC15_Y444_10Bit_60Hz_RPT02.vgf
	1440 x 480p, 59.94 Hz			•			•	•			VIC15_Y444_12Bit_59Hz.vgf
	1440 x 480p, 59.94 Hz			•			•		•		VIC15_Y444_12Bit_59Hz_RPT02.vgf
	1440 x 480p, 60 Hz			•			•	•			VIC15_Y444_12Bit_60Hz.vgf
	1440 x 480p, 60 Hz			•			•		•		VIC15_Y444_12Bit_60Hz_RPT02.vgf
16	1920 x 1080p, 59.94 Hz	•			•			•			VIC16_RGB_8Bit_59Hz.vgf
	1920 x 1080p, 60 Hz	•			•			•			VIC16_RGB_8Bit_60Hz.vgf
	1920 x 1080p, 59.94 Hz	•				•		•			VIC16_RGB_10Bit_59Hz.vgf
	1920 x 1080p, 60 Hz	•				•		•			VIC16_RGB_10Bit_60Hz.vgf
	1920 x 1080p, 59.94 Hz	•					•	•			VIC16_RGB_12Bit_59Hz.vgf
	1920 x 1080p, 60 Hz	•					•	•			VIC16_RGB_12Bit_60Hz.vgf
	1920 x 1080p, 59.94 Hz			•	•			•			VIC16_Y444_8Bit_59Hz.vgf

Table 9 Video Generator Files for Test ID 8–25 (Sheet 5 of 10)

CEA Video Identification Code	Video Format Timings	Color Format			Color Depth			Repetition Factor			File Name
		RGB	YCbCr 4:2:2	YCbCr 4:4:4	24 Bit	30 Bit	36 Bit	0	2	4	
	1920 x 1080p, 60 Hz			•	•			•			VIC16_Y444_8Bit_60Hz.vgf
	1920 x 1080p, 59.94 Hz			•		•		•			VIC16_Y444_10Bit_59Hz.vgf
	1920 x 1080p, 60 Hz			•		•		•			VIC16_Y444_10Bit_60Hz.vgf
	1920 x 1080p, 59.94 Hz			•			•	•			VIC16_Y444_12Bit_59Hz.vgf
	1920 x 1080p, 60 Hz			•			•	•			VIC16_Y444_12Bit_60Hz.vgf
17	720 x 576p, 50 Hz	•			•			•			VIC17_RGB_8Bit_50Hz.vgf
	720 x 576p, 50 Hz	•				•		•			VIC17_RGB_10Bit_50Hz.vgf
	720 x 576p, 50 Hz	•					•	•			VIC17_RGB_12Bit_50Hz.vgf
	720 x 576p, 50 Hz			•	•			•			VIC17_Y444_8Bit_50Hz.vgf
	720 x 576p, 50 Hz			•		•		•			VIC17_Y444_10Bit_50Hz.vgf
	720 x 576p, 50 Hz			•			•	•			VIC17_Y444_12Bit_50Hz.vgf
18	720 x 576p, 50 Hz	•			•			•			VIC18_RGB_8Bit_50Hz.vgf
	720 x 576p, 50 Hz	•				•		•			VIC18_RGB_10Bit_50Hz.vgf
	720 x 576p, 50 Hz	•					•	•			VIC18_RGB_12Bit_50Hz.vgf
	720 x 576p, 50 Hz			•	•			•			VIC18_Y444_8Bit_50Hz.vgf
	720 x 576p, 50 Hz			•		•		•			VIC18_Y444_10Bit_50Hz.vgf
	720 x 576p, 50 Hz			•			•	•			VIC18_Y444_12Bit_50Hz.vgf
19	1280 x 720p, 50 Hz	•			•			•			VIC19_RGB_8Bit_50Hz.vgf
	1280 x 720p, 50 Hz	•				•		•			VIC19_RGB_10Bit_50Hz.vgf
	1280 x 720p, 50 Hz	•					•	•			VIC19_RGB_12Bit_50Hz.vgf
	1280 x 720p, 50 Hz			•	•			•			VIC19_Y444_8Bit_50Hz.vgf
	1280 x 720p, 50 Hz			•		•		•			VIC19_Y444_10Bit_50Hz.vgf
	1280 x 720p, 50 Hz			•			•	•			VIC19_Y444_12Bit_50Hz.vgf
20	1920 x 1080i, 50 Hz	•			•			•			VIC20_RGB_8Bit_50Hz.vgf
	1920 x 1080i, 50 Hz	•				•		•			VIC20_RGB_10Bit_50Hz.vgf
	1920 x 1080i, 50 Hz	•					•	•			VIC20_RGB_12Bit_50Hz.vgf
	1920 x 1080i, 50 Hz			•	•			•			VIC20_Y444_8Bit_50Hz.vgf
	1920 x 1080i, 50 Hz			•		•		•			VIC20_Y444_10Bit_50Hz.vgf
	1920 x 1080i, 50 Hz			•			•	•			VIC20_Y444_12Bit_50Hz.vgf
21	720 (1440) x 576i, 50 Hz	•			•			•			VIC21_RGB_8Bit_50Hz.vgf
	720 (1440) x 576i, 50 Hz	•				•		•			VIC21_RGB_10Bit_50Hz.vgf
	720 (1440) x 576i, 50 Hz	•					•	•			VIC21_RGB_12Bit_50Hz.vgf
	720 (1440) x 576i, 50 Hz			•	•			•			VIC21_Y444_8Bit_50Hz.vgf
	720 (1440) x 576i, 50 Hz			•		•		•			VIC21_Y444_10Bit_50Hz.vgf
	720 (1440) x 576i, 50 Hz			•			•	•			VIC21_Y444_12Bit_50Hz.vgf

Table 9 Video Generator Files for Test ID 8–25 (Sheet 6 of 10)

CEA Video Identification Code	Video Format Timings	Color Format			Color Depth			Repetition Factor			File Name
		RGB	YCbCr 4:2:2	YCbCr 4:4:4	24 Bit	30 Bit	36 Bit	0	2	4	
22	720 (1440) x 576i, 50 Hz	•			•			•			VIC22_RGB_8Bit_50Hz.vgf
	720 (1440) x 576i, 50 Hz	•				•		•			VIC22_RGB_10Bit_50Hz.vgf
	720 (1440) x 576i, 50 Hz	•					•	•			VIC22_RGB_12Bit_50Hz.vgf
	720 (1440) x 576i, 50 Hz			•	•			•			VIC22_Y444_8Bit_50Hz.vgf
	720 (1440) x 576i, 50 Hz			•		•		•			VIC22_Y444_10Bit_50Hz.vgf
	720 (1440) x 576i, 50 Hz			•			•	•			VIC20_Y444_12Bit_50Hz.vgf
29	1440 x 576p, 50 Hz	•			•			•			VIC29_RGB_8Bit_50Hz.vgf
	1440 x 576p, 50 Hz	•			•				•		VIC29_RGB_8Bit_50Hz_RPT02.vgf
	1440 x 576p, 50 Hz	•				•		•			VIC29_RGB_10Bit_50Hz.vgf
	1440 x 576p, 50 Hz	•				•			•		VIC29_RGB_10Bit_50Hz_RPT02.vgf
	1440 x 576p, 50 Hz	•					•	•			VIC29_RGB_12Bit_50Hz.vgf
	1440 x 576p, 50 Hz	•					•		•		VIC29_RGB_12Bit_50Hz_RPT02.vgf
	1440 x 576p, 50 Hz			•	•			•			VIC29_Y444_8Bit_50Hz.vgf
	1440 x 576p, 50 Hz			•	•				•		VIC29_Y444_8Bit_50Hz_RPT02.vgf
	1440 x 576p, 50 Hz			•		•		•			VIC29_Y444_10Bit_50Hz.vgf
	1440 x 576p, 50 Hz			•		•			•		VIC29_Y444_10Bit_50Hz_RPT02.vgf
	1440 x 576p, 50 Hz			•			•	•			VIC29_Y444_12Bit_50Hz.vgf
	1440 x 576p, 50 Hz			•			•		•		VIC29_Y444_12Bit_50Hz_RPT02.vgf
30	1440 x 576p, 50 Hz	•			•			•			VIC30_RGB_8Bit_50Hz.vgf
	1440 x 576p, 50 Hz	•			•				•		VIC30_RGB_8Bit_50Hz_RPT02.vgf
	1440 x 576p, 50 Hz	•				•		•			VIC30_RGB_10Bit_50Hz.vgf
	1440 x 576p, 50 Hz	•				•			•		VIC30_RGB_10Bit_50Hz_RPT02.vgf
	1440 x 576p, 50 Hz	•					•	•			VIC30_RGB_12Bit_50Hz.vgf
	1440 x 576p, 50 Hz	•					•		•		VIC30_RGB_12Bit_50Hz_RPT02.vgf
	1440 x 576p, 50 Hz			•	•			•			VIC30_Y444_8Bit_50Hz.vgf
	1440 x 576p, 50 Hz			•	•				•		VIC30_Y444_8Bit_50Hz_RPT02.vgf
	1440 x 576p, 50 Hz			•		•		•			VIC30_Y444_10Bit_50Hz.vgf
	1440 x 576p, 50 Hz			•		•			•		VIC30_Y444_10Bit_50Hz_RPT02.vgf
	1440 x 576p, 50 Hz			•			•	•			VIC30_Y444_12Bit_50Hz.vgf
	1440 x 576p, 50 Hz			•			•		•		VIC30_Y444_12Bit_50Hz_RPT02.vgf
31	1920 x 1080p, 50 Hz	•			•			•			VIC31_RGB_8Bit_50Hz.vgf
	1920 x 1080p, 50 Hz	•				•		•			VIC31_RGB_10Bit_50Hz.vgf
	1920 x 1080p, 50 Hz	•					•	•			VIC31_RGB_12Bit_50Hz.vgf
	1920 x 1080p, 50 Hz			•	•			•			VIC31_Y444_8Bit_50Hz.vgf
	1920 x 1080p, 50 Hz			•		•		•			VIC31_Y444_10Bit_50Hz.vgf

Table 9 Video Generator Files for Test ID 8–25 (Sheet 7 of 10)

CEA Video Identification Code	Video Format Timings	Color Format			Color Depth			Repetition Factor			File Name
		RGB	YCbCr 4:2:2	YCbCr 4:4:4	24 Bit	30 Bit	36 Bit	0	2	4	
	1920 x 1080p, 50 Hz			•			•	•			VIC31_Y444_12Bit_50Hz.vgf
32	1920 x 1080p, 23.98 Hz	•			•			•			VIC32_RGB_8Bit_23Hz.vgf
	1920 x 1080p, 24 Hz	•			•			•			VIC32_RGB_8Bit_24Hz.vgf
	1920 x 1080p, 23.98 Hz	•				•		•			VIC32_RGB_10Bit_23Hz.vgf
	1920 x 1080p, 24 Hz	•				•		•			VIC32_RGB_10Bit_24Hz.vgf
	1920 x 1080p, 23.98 Hz	•					•	•			VIC32_RGB_12Bit_23Hz.vgf
	1920 x 1080p, 24 Hz	•					•	•			VIC32_RGB_12Bit_24Hz.vgf
	1920 x 1080p, 23.98 Hz			•	•			•			VIC32_Y444_8Bit_23Hz.vgf
	1920 x 1080p, 24 Hz			•	•			•			VIC32_Y444_8Bit_24Hz.vgf
	1920 x 1080p, 23.98 Hz			•		•		•			VIC32_Y444_10Bit_23Hz.vgf
	1920 x 1080p, 24 Hz			•		•		•			VIC32_Y444_10Bit_24Hz.vgf
	1920 x 1080p, 23.98 Hz			•			•	•			VIC32_Y444_12Bit_23Hz.vgf
	1920 x 1080p, 24 Hz			•			•	•			VIC32_Y444_12Bit_24Hz.vgf
35	2880 x 480p, 59.94 Hz	•			•			•			VIC35_RGB_8Bit_59Hz.vgf
	2880 x 480p, 59.94 Hz	•			•				•		VIC35_RGB_8Bit_59Hz_RPT02.vgf
	2880 x 480p, 59.94 Hz	•			•					•	VIC35_RGB_8Bit_59Hz_RPT04.vgf
	2880 x 480p, 60 Hz	•			•			•			VIC35_RGB_8Bit_60Hz.vgf
	2880 x 480p, 60 Hz	•			•				•		VIC35_RGB_8Bit_60Hz_RPT02.vgf
	2880 x 480p, 60 Hz	•			•					•	VIC35_RGB_8Bit_60Hz_RPT04.vgf
	2880 x 480p, 59.94 Hz	•				•		•			VIC35_RGB_10Bit_59Hz.vgf
	2880 x 480p, 59.94 Hz	•				•			•		VIC35_RGB_10Bit_59Hz_RPT02.vgf
	2880 x 480p, 59.94 Hz	•				•				•	VIC35_RGB_10Bit_59Hz_RPT04.vgf
	2880 x 480p, 60 Hz	•				•		•			VIC35_RGB_10Bit_60Hz.vgf
	2880 x 480p, 60 Hz	•				•			•		VIC35_RGB_10Bit_60Hz_RPT02.vgf
	2880 x 480p, 60 Hz	•				•				•	VIC35_RGB_10Bit_60Hz_RPT04.vgf
	2880 x 480p, 59.94 Hz	•					•	•			VIC35_RGB_12Bit_59Hz.vgf
	2880 x 480p, 59.94 Hz	•					•		•		VIC35_RGB_12Bit_59Hz_RPT02.vgf
	2880 x 480p, 59.94 Hz	•					•			•	VIC35_RGB_12Bit_59Hz_RPT04.vgf
	2880 x 480p, 60 Hz	•					•	•			VIC35_RGB_12Bit_60Hz.vgf
	2880 x 480p, 60 Hz	•					•		•		VIC35_RGB_12Bit_60Hz_RPT02.vgf
	2880 x 480p, 60 Hz	•					•			•	VIC35_RGB_12Bit_60Hz_RPT04.vgf
	2880 x 480p, 59.94 Hz			•	•			•			VIC35_Y444_8Bit_59Hz.vgf
	2880 x 480p, 59.94 Hz			•	•				•		VIC35_Y444_8Bit_59Hz_RPT02.vgf
	2880 x 480p, 59.94 Hz			•	•					•	VIC35_Y444_8Bit_59Hz_RPT04.vgf
	2880 x 480p, 60 Hz			•	•			•			VIC35_Y444_8Bit_60Hz.vgf

Table 9 Video Generator Files for Test ID 8–25 (Sheet 8 of 10)

CEA Video Identification Code	Video Format Timings	Color Format			Color Depth			Repetition Factor			File Name
		RGB	YCbCr 4:2:2	YCbCr 4:4:4	24 Bit	30 Bit	36 Bit	0	2	4	
	2880 x 480p, 60 Hz			•	•				•		VIC35_Y444_8Bit_60Hz_RPT02.vgf
	2880 x 480p, 60 Hz			•	•					•	VIC35_Y444_8Bit_60Hz_RPT04.vgf
	2880 x 480p, 59.94 Hz			•		•		•			VIC35_Y444_10Bit_59Hz.vgf
	2880 x 480p, 59.94 Hz			•		•			•		VIC35_Y444_10Bit_59Hz_RPT02.vgf
	2880 x 480p, 59.94 Hz			•		•				•	VIC35_Y444_10Bit_59Hz_RPT04.vgf
	2880 x 480p, 60 Hz			•		•		•			VIC35_Y444_10Bit_60Hz.vgf
	2880 x 480p, 60 Hz			•		•			•		VIC35_Y444_10Bit_60Hz_RPT02.vgf
	2880 x 480p, 60 Hz			•		•				•	VIC35_Y444_10Bit_60Hz_RPT04.vgf
	2880 x 480p, 59.94 Hz			•			•	•			VIC35_Y444_12Bit_59Hz.vgf
	2880 x 480p, 59.94 Hz			•			•		•		VIC35_Y444_12Bit_59Hz_RPT02.vgf
	2880 x 480p, 59.94 Hz			•			•			•	VIC35_Y444_12Bit_59Hz_RPT04.vgf
	2880 x 480p, 60 Hz			•			•	•			VIC35_Y444_12Bit_60Hz.vgf
	2880 x 480p, 60 Hz			•			•		•		VIC35_Y444_12Bit_60Hz_RPT02.vgf
	2880 x 480p, 60 Hz			•			•			•	VIC35_Y444_12Bit_60Hz_RPT04.vgf
36	2880 x 480p, 59.94 Hz	•			•			•			VIC36_RGB_8Bit_59Hz.vgf
	2880 x 480p, 59.94 Hz	•			•				•		VIC36_RGB_8Bit_59Hz_RPT02.vgf
	2880 x 480p, 59.94 Hz	•			•					•	VIC36_RGB_8Bit_59Hz_RPT04.vgf
	2880 x 480p, 60 Hz	•			•			•			VIC36_RGB_8Bit_60Hz.vgf
	2880 x 480p, 60 Hz	•			•				•		VIC36_RGB_8Bit_60Hz_RPT02.vgf
	2880 x 480p, 60 Hz	•			•					•	VIC36_RGB_8Bit_60Hz_RPT04.vgf
	2880 x 480p, 59.94 Hz	•				•		•			VIC36_RGB_10Bit_59Hz.vgf
	2880 x 480p, 59.94 Hz	•				•			•		VIC36_RGB_10Bit_59Hz_RPT02.vgf
	2880 x 480p, 59.94 Hz	•				•				•	VIC36_RGB_10Bit_59Hz_RPT04.vgf
	2880 x 480p, 60 Hz	•				•		•			VIC36_RGB_10Bit_60Hz.vgf
	2880 x 480p, 60 Hz	•				•			•		VIC36_RGB_10Bit_60Hz_RPT02.vgf
	2880 x 480p, 60 Hz	•				•				•	VIC36_RGB_10Bit_60Hz_RPT04.vgf
	2880 x 480p, 59.94 Hz	•					•	•			VIC36_RGB_12Bit_59Hz.vgf
	2880 x 480p, 59.94 Hz	•					•		•		VIC36_RGB_12Bit_59Hz_RPT02.vgf
	2880 x 480p, 59.94 Hz	•					•			•	VIC36_RGB_12Bit_59Hz_RPT04.vgf
	2880 x 480p, 60 Hz	•					•	•			VIC36_RGB_12Bit_60Hz.vgf
	2880 x 480p, 60 Hz	•					•		•		VIC36_RGB_12Bit_60Hz_RPT02.vgf
	2880 x 480p, 60 Hz	•					•			•	VIC36_RGB_12Bit_60Hz_RPT04.vgf
	2880 x 480p, 59.94 Hz			•	•			•			VIC36_Y444_8Bit_59Hz.vgf
	2880 x 480p, 59.94 Hz			•	•				•		VIC36_Y444_8Bit_59Hz_RPT02.vgf
	2880 x 480p, 59.94 Hz			•	•					•	VIC36_Y444_8Bit_59Hz_RPT04.vgf

Table 9 Video Generator Files for Test ID 8–25 (Sheet 9 of 10)

CEA Video Identification Code	Video Format Timings	Color Format			Color Depth			Repetition Factor			File Name
		RGB	YCbCr 4:2:2	YCbCr 4:4:4	24 Bit	30 Bit	36 Bit	0	2	4	
	2880 x 480p, 60 Hz			•	•			•			VIC36_Y444_8Bit_60Hz.vgf
	2880 x 480p, 60 Hz			•	•				•		VIC36_Y444_8Bit_60Hz_RPT02.vgf
	2880 x 480p, 60 Hz			•	•					•	VIC36_Y444_8Bit_60Hz_RPT04.vgf
	2880 x 480p, 59.94 Hz			•		•		•			VIC36_Y444_10Bit_59Hz.vgf
	2880 x 480p, 59.94 Hz			•		•			•		VIC36_Y444_10Bit_59Hz_RPT02.vgf
	2880 x 480p, 59.94 Hz			•		•				•	VIC36_Y444_10Bit_59Hz_RPT04.vgf
	2880 x 480p, 60 Hz			•		•		•			VIC36_Y444_10Bit_60Hz.vgf
	2880 x 480p, 60 Hz			•		•			•		VIC36_Y444_10Bit_60Hz_RPT02.vgf
	2880 x 480p, 60 Hz			•		•				•	VIC36_Y444_10Bit_60Hz_RPT04.vgf
	2880 x 480p, 59.94 Hz			•			•	•			VIC36_Y444_12Bit_59Hz.vgf
	2880 x 480p, 59.94 Hz			•			•		•		VIC36_Y444_12Bit_59Hz_RPT02.vgf
	2880 x 480p, 59.94 Hz			•			•			•	VIC36_Y444_12Bit_59Hz_RPT04.vgf
	2880 x 480p, 60 Hz			•			•	•			VIC36_Y444_12Bit_60Hz.vgf
	2880 x 480p, 60 Hz			•			•		•		VIC36_Y444_12Bit_60Hz_RPT02.vgf
	2880 x 480p, 60 Hz			•			•			•	VIC36_Y444_12Bit_60Hz_RPT04.vgf
37	2880 x 576p, 50 Hz	•			•			•			VIC37_RGB_8Bit_50Hz.vgf
	2880 x 576p, 50 Hz	•			•				•		VIC37_RGB_8Bit_50Hz_RPT02.vgf
	2880 x 576p, 50 Hz	•			•					•	VIC37_RGB_8Bit_50Hz_RPT04.vgf
	2880 x 576p, 50 Hz	•				•		•			VIC37_RGB_10Bit_50Hz.vgf
	2880 x 576p, 50 Hz	•				•			•		VIC37_RGB_10Bit_50Hz_RPT02.vgf
	2880 x 576p, 50 Hz	•				•				•	VIC37_RGB_10Bit_50Hz_RPT04.vgf
	2880 x 576p, 50 Hz	•					•	•			VIC37_RGB_12Bit_50Hz.vgf
	2880 x 576p, 50 Hz	•					•		•		VIC37_RGB_12Bit_50Hz_RPT02.vgf
	2880 x 576p, 50 Hz	•					•			•	VIC37_RGB_12Bit_50Hz_RPT04.vgf
	2880 x 576p, 50 Hz			•	•			•			VIC37_Y444_8Bit_50Hz.vgf
	2880 x 576p, 50 Hz			•	•				•		VIC37_Y444_8Bit_50Hz_RPT02.vgf
	2880 x 576p, 50 Hz			•	•					•	VIC37_Y444_8Bit_50Hz_RPT04.vgf
	2880 x 576p, 50 Hz			•		•		•			VIC37_Y444_10Bit_50Hz.vgf
	2880 x 576p, 50 Hz			•		•			•		VIC37_Y444_10Bit_50Hz_RPT02.vgf
	2880 x 576p, 50 Hz			•		•				•	VIC37_Y444_10Bit_50Hz_RPT04.vgf
	2880 x 576p, 50 Hz			•			•	•			VIC37_Y444_12Bit_50Hz.vgf
	2880 x 576p, 50 Hz			•			•		•		VIC37_Y444_12Bit_50Hz_RPT02.vgf
	2880 x 576p, 50 Hz			•			•			•	VIC37_Y444_12Bit_50Hz_RPT04.vgf
38	2880 x 576p, 50 Hz	•			•			•			VIC38_RGB_8Bit_50Hz.vgf
	2880 x 576p, 50 Hz	•			•				•		VIC38_RGB_8Bit_50Hz_RPT02.vgf

Table 9 Video Generator Files for Test ID 8–25 (Sheet 10 of 10)

CEA Video Identification Code	Video Format Timings	Color Format			Color Depth			Repetition Factor			File Name
		RGB	YCbCr 4:2:2	YCbCr 4:4:4	24 Bit	30 Bit	36 Bit	0	2	4	
	2880 x 576p, 50 Hz	•			•					•	VIC38_RGB_8Bit_50Hz_RPT04.vgf
	2880 x 576p, 50 Hz	•				•		•			VIC38_RGB_10Bit_50Hz.vgf
	2880 x 576p, 50 Hz	•				•			•		VIC38_RGB_10Bit_50Hz_RPT02.vgf
	2880 x 576p, 50 Hz	•				•				•	VIC38_RGB_10Bit_50Hz_RPT04.vgf
	2880 x 576p, 50 Hz	•					•	•			VIC38_RGB_12Bit_50Hz.vgf
	2880 x 576p, 50 Hz	•					•		•		VIC38_RGB_12Bit_50Hz_RPT02.vgf
	2880 x 576p, 50 Hz	•					•			•	VIC38_RGB_12Bit_50Hz_RPT04.vgf
	2880 x 576p, 50 Hz			•	•			•			VIC38_Y444_8Bit_50Hz.vgf
	2880 x 576p, 50 Hz			•	•				•		VIC38_Y444_8Bit_50Hz_RPT02.vgf
	2880 x 576p, 50 Hz			•	•					•	VIC38_Y444_8Bit_50Hz_RPT04.vgf
	2880 x 576p, 50 Hz			•		•		•			VIC38_Y444_10Bit_50Hz.vgf
	2880 x 576p, 50 Hz			•		•			•		VIC38_Y444_10Bit_50Hz_RPT02.vgf
	2880 x 576p, 50 Hz			•		•				•	VIC38_Y444_10Bit_50Hz_RPT04.vgf
	2880 x 576p, 50 Hz			•			•	•			VIC38_Y444_12Bit_50Hz.vgf
	2880 x 576p, 50 Hz			•			•		•		VIC38_Y444_12Bit_50Hz_RPT02.vgf
	2880 x 576p, 50 Hz			•			•			•	VIC38_Y444_12Bit_50Hz_RPT04.vgf

5
Using COM Interface for HDMI Testing

This chapter describes how you can configure, control, and use U4998A using COM interface for performing automated HDMI testing.

Overview

Besides using the U4998A's GUI components, you can also use the COM interface to configure, control, and use U4998A. The COM Interface allows you to write programs to automate HDMI testing.

This chapter describes the COM APIs as per the following three broad areas of their usage in the context of HDMI testing.

- Generate HDMI data
- Capture HDMI data
- Evaluate the captured data for HDMI compliance

The topics that follow describe how to use COM APIs to perform these tasks.

The following is the list of methods described in this chapter.

- "DoCommands
- "ExportCapture
- "GetBitmapFiles
- "StartCapture
- "StartGenerator
- "StartEvaluate
- "Status
- "StopGenerator
- "WaitReady
- "WriteEDID

Before you start

To use the COM interface, you need to ensure that the following software components of U4998A are installed:

- **Agilent Logic Analyzer** - You need this software component for capturing as well as generating HDMI data.
- **HDMI Evaluator** - You need this component for evaluating the captured HDMI data in an offline mode, that is without connecting to U4998A hardware.
- **U4998A HDMI Video Generator Files** - You need this component to get a set of predefined .vgf and .aaf files that you can transmit to DUT.

COM Servers

The following two COM servers are applicable to automate HDMI testing.

- **Agilent Logic Analyzer COM Server -** This is typically installed at:

  C:\Program Files (x86)\Agilent Technologies\Logic Analyzer\agClientSvr.dll

  While using this COM Server, ensure that:

  - The COM server connects to a local instance of the Agilent Logic Analyzer application. If the Logic Analyzer application is not started, the COM server's Connect command starts it.
  - You store the capture (.cap) files and the Generator (.vgf and .aaf) files on the PC that is connected to the U4998A module. Typically, you store these files on the controller PC that has all the required software components of U4998A and is connected to the Agilent Digital Test Console chassis via a PCIe interface. This is important to remember when you are using a remote connection to the U4998A hardware.

- **HDMI Evaluator COM Server -** This COM server is embedded in the HDMI Evaluator application, which is typically installed in the following folder:

  C:\Program Files\HDMI Evaluator\HDMIProtocolAnalyzer.exe

When you create an HDMI Evaluator COM object, it starts the HDMIProtocolAnalyzer.exe in the COM Server mode without a graphical user interface. While using this COM Server, ensure that:

- Only one instance of HDMIProtocolAnalyzer.exe is running.
- If you try to create an HDMI Evaluator COM object and run the HDMI Evaluator application simultaneously, the operation will fail.

Examples on Usage

For examples on using the COM servers, refer to the following folders:

Logic Analyzer COM Server (for capturing and transmitting HDMI data)	C:\Program Files (x86)\Agilent Technologies\Logic Analyzer\LA COM Automation\Visual C++ Examples\HDMI
HDMI Evaluator COM Server (for offline evaluation of captured data)	C:\Program Files\HDMI Evaluator\Examples

Method for Configuring U4998A Settings

DoCommands

Applicable COM Server Object

Use this method with the Agilent Logic Analyzer COM Server and HDMI Evaluator COM Server objects as per the following table.

To configure HDMI connection, capture, and generator settings	Logic Analyzer COM Server object
To configure settings for the offline evaluation of captured data	HDMI Evaluator COM Server object

Syntax

```
VARIANT_BOOL DoCommands([in] BSTR XMLCommand);
```

Description

This method configures the settings needed to create the HDMI connection and to capture, evaluate, and generate HDMI data. For instance, this method configures the U4998A module's memory depth that you want to use for storing the captured data.

The DoCommands method requires an XMLCommand argument that is formed from XML elements which are described as follows.

XML Elements Hierarchy for DoCommands

The DoCommands method requires an XML-based string as the argument, XMLCommand. The XMLCommand string configures the HDMI settings for capture, evaluate, and generate tasks. You build the XML string using the elements documented in this section. If you're not familiar with writing XML, there are many widely available introductory books as well as web sites.

Element Hierarchy

The following list displays the hierarchy of the XML elements. The element `<Module>` is the root element. Under `<Module>`, there are `<Connection>`, `<Capture>`,

<Evaluate>, and <Generate> elements to configure the connection, capture, evaluate, and generate settings respectively. Each of these elements has its own descendants, for example, <Add/> is a descendant of <Evaluate> but not of <Generate>.

```
<Module>
  <Connection> See "<Connection> Element,
  page 106
  <Capture> See "<Capture> Element, page 107
  <Evaluate> See "<Evaluate> Element and its
  Descendants, page 108
    <Protocol/>
    <TestID>
      <Add/>
      <Clear/>
      <Full/>
      <Remove>
      <Set>
    <Color/>
    <Options>
  <Generate> See "<Generate> Element and its
  Descendants, page 117
    <Audio/>
    <Vidio/>
```

Creating XML Command Strings

The XMLCommand string must start and end with the root element <Module>.

```
<Module Name='MyModule'>
  …
<Module>
```

The <Module> element must include the attribute Name. Note that this attribute is parsed but not used.

Elements that have content, like <Module>, must use both an open tag and a closed tag with all of their content between the tags.

Empty elements are elements that have no content (child elements or text, for example). You can optionally write an empty element by closing the start tag with /> and omitting an end tag. For example, the <Set> element has no content

```
<Set></Set>
```

and can be optionally written as:

```
<Set/>
```

Element attributes are used to set specify specific settings. In the following example, the attribute `Format` has a value of `RGB`. Notice the required quotes on the attribute value. These can be double or single quotes.

```
<Color Format='RGB' Depth='24'/>
```

Notice that `<Color>` is considered an empty element (has no child element), even though it has attributes.

XML is case sensitive, so be sure to create your strings using the exact upper and lower-case letters shown in this section.

Four elements are children of the `<Module>` element: `<Connection>`, `<Capture>`, `<Evaluate>`, and `<Generate>`. These elements and their descendants configure the settings in the U4998A's connection, Capture, and Generator windows respectively.

In the following example fragment, an XML command string is initialized and used in a `DoCommands` method. Since double quotes are used to declare the string, single quotes must be used to specify all attribute values within the XML. Notice that indented code lines indicate element parent-child relationships. For example, `<Evaluate>` has the `<TestID>` child and the `<Clear>` descendant (grandchild) element.

```
<Module Name='MyModule'>
  <Capture Clock='25' Size='100' File='C:\
  MyFile.cap'/>
  <Generate>
    …
  </Generate>
  <Evaluate>
    <TestID>
      <Clear/>
    </TestID>
    …
  </Evaluate>
</Module>
"
…
DoCommands([in] xml_command_string);
```

<Module> Element

<Module> is the root element. It contains child elements of <Connection>, <Capture>, <Evaluate>, and <Generate>.

Child Elements - <Connection>, <Capture>, <Evaluate>, <Generate>

Parent Elements - none

Attributes

Name	Value	Description
Name	HDMI Evaluator MyModule	Required attribute. This attribute is parsed but not used.

Example

```
<Module Name='MyModule'>
  <Evaluate>
    <Protocol Name='HDMI'/>
  </Evaluate>
</Module>
```

<Connection> Element

NOTE

Check that you have installed the Agilent Logic Analyzer software to configure the connection capabilities. Refer to the *U4998A HDMI 1.4a Protocol/Audio/Video Analyzer and Generator Installation Guide* to know more about installation.

The <Connection> element sets the HDMI connection type.

This element does not have any children.

Child Elements - none

Parent Element - <Module>

Attributes

Name	Value	Description
Setup	Generate	U4998A-Frame Generator
	Capture	U4998A-Capture

Example

```
<Module Name='MyModule'>
<Connection Setup='Generate'/>
</Module>
```

<Capture> Element

NOTE Check that you have installed the Agilent Logic Analyzer software to configure the capture capabilities. Refer to the *U4998A HDMI 1.4a Protocol/Audio/Video Analyzer and Generator Installation Guide* to know more about installation.

The `<Capture>` element selects HDMI capture settings such as HDMI Pixel Clock frequency and the memory depth of U4998A module for storing the captured data. The `<Capture>` element does not have any children.

Child Elements - none

Parent Element - `<Module>`

Attributes

Name	Value	Description
Clock		The Clock attribute is parsed but not used in U4998A.
	25	25 to 74.999 MHz HDMI pixel clock
	75	75 to 129.999 MHz HDMI pixel clock
	130	130 to 164.999 MHz HDMI pixel clock
	165	165 to 224.999 MHz HDMI pixel clock
Size	*integer*	Size in megabytes (MB).
Mode	DVI HDMI	The protocol (DVI or HDMI) to indicate whether you want to capture DVI or HDMI data. The default is HDMI.

Example

```
<Module Name='MyModule'>
  <Capture Clock='25' Size='100' Mode='HDMI'/>
</Module>
```

<Evaluate> Element and its Descendants

NOTE

Check that you have installed the HDMI Evaluator software to run source tests for HDMI compliance. Refer to the *U4998A HDMI 1.4a Protocol/Audio/Video Analyzer and Generator Installation Guide* to know more about installation.

The `<Evaluate>` element contains child elements that are used to specify settings for HDMI evaluation. The `<Evaluate>` element's attributes are used to specify the captured HDMI data file for evaluation, the Video Identification Code (VIC), and the TMDS clock frequency.

Child Elements

The following element hierarchy displays all the available elements:

```
<Evaluate>
  <Color/>
  <Content/>
  <Options>
  <PacketLog>
    <Add/>
    <Clear/>
    <Remove/>
    <Set/>
  <Protocol/>
  <Quantization/>
  <TestID>
    <Add/>
    <Clear/>
    <Full/>
    <Remove>
    <Set>
```

Parent Element - `<Module>`

Attributes

Name	Value	Description
Clock	*frequency*	TMDS clock frequency between 25 MHz and 225 MHz in Hertz. Example: 27027000
File	*file name*	File name including path. Example: C:\Capture\MyFile.cap
Format	Refer to Table 10 on page 110 for a listing of attribute values.	Video identification code string

Example

```
<Module Name='HDMI Evaluator'>
  <Evaluate Clock='27027000' Format='1 :
  640x480p  59.94Hz'
    File='C:\Capture\MyFile.cap'>
    <TestID>
      <Set/>
      <Clear/>
      <Full/>
      <Remove Name='7-16'/>
      <Add Name='7-34'/>
      <Add Name='7-36'/>
    </TestID>
    <PacketLog>
      <Set/>
      <Clear/>
      <Add Name='NUL'/>
      <Remove Name='NULL'/>
    </PacketLog>
    <Content Type='None'/>
    <Quantization Range='Either'/>
    <Protocol Name='DVI'/>
    <Color Format='RGB' Depth='24'/>
    <Options AVI='1' Audio='0' ACP='0'
  ThreeD='0' VSDB='0'
      Colorimetry='0'GreaterTwo='0'/>
  </Evaluate>
</Module>
```

Table 10 VIC Attribute Values for <Evaluate> and <Video> Elements (Sheet 1 of 2)

CEA Video ID Code	Format Attribute Value	CEA Video ID Code	Format Attribute Value
1	1 : 640x480p @ 59.94 Hz	22	22 : 720(1440)x576i @ 50 Hz
	1 : 640x480p @ 60 Hz	23	23 : 720(1440)x288p @ 50 Hz
2	2 : 720x480p @ 59.94 Hz	24	24 : 720(1440)x288p @ 50 Hz
	2 : 720x480p @ 60 Hz	25	25 : 2880x576i @ 50 Hz
3	3 : 720x480p @ 59.94 Hz	26	26 : 2880x576i @ 50 Hz
	3 : 720x480p @ 60 Hz	27	27 : 2880x288p @ 50 Hz
4	4 : 1280x720p @ 59.94 Hz	28	28 : 2880x288p @ 50 Hz
	4 : 1280x720p @ 60 Hz	29	29 : 1440x576p @ 50 Hz
5	5 : 1920x1080i @ 59.94 Hz	30	30 : 1440x576p @ 50 Hz
	5 : 1920x1080i @ 60 Hz	31	31 : 1920x1080p @ 50 Hz
6	6 : 720(1440)x480i @ 59.94 Hz	32	32 : 1920x1080p @ 23.98 Hz
	6 : 720(1440)x480i @ 60 Hz		32 : 1920x1080p @ 24 Hz
7	7 : 720(1440)x480i @ 59.94 Hz	33	33 : 1920x1080p @ 25 Hz
	7 : 720(1440)x480i @ 60 Hz	34	34 : 1920x1080p @ 29.97 Hz
8	8 : 720(1440)x240p @ 59.94 Hz		34 : 1920x1080p @ 30 Hz
	8 : 720(1440)x240p @ 60 Hz	35	35 : 2880x480p @ 59.94 Hz
9	9 : 720(1440)x240p @ 59.94 Hz		35 : 2880x480p @ 60 Hz
	9 : 720(1440)x240p @ 60 Hz	36	36 : 2880x480p @ 59.94 Hz
10	10 : 2880x480i @ 59.94 Hz		36 : 2880x480p @ 60 Hz
	10 : 2880x480i @ 60 Hz	37	37 : 2880x576p @ 50 Hz
11	11 : 2880x480i @ 59.94 Hz	38	38 : 2880x576p @ 50 Hz
	11 : 2880x480i @ 60 Hz	39	39 : 1920x1080i (1250 total) @ 50 Hz
12	12 : 2880x240p @ 59.94 Hz	40	40 : 1920x1080i @ 100 Hz
	12 : 2880x240p @ 60 Hz	41	41 : 1280x720p @ 100 Hz
13	13 : 2880x240p @ 59.94 Hz	42	42 : 720x576p @ 100 Hz
	13 : 2880x240p @ 60 Hz	43	43 : 720x576p @ 100 Hz
14	14 : 1440x480p @ 59.94 Hz	44	44 : 720(1440)x576i @ 100 Hz
	14 : 1440x480p @ 60 Hz	45	45 : 720(1440)x576i @ 100 Hz
15	15 : 1440x480p @ 59.94 Hz	46	46 : 1920x1080i @ 119.88 Hz
16	16 : 1920x1080p @ 59.94 Hz		46 : 1280x720p @ 120 Hz
	16 : 1920x1080p @ 60 Hz	47	47 : 1920x1080i @ 119.88 Hz
17	17 : 720x576p @ 50 Hz		47 : 1280x720p @ 120 Hz
18	18 : 720x576p @ 50 Hz	48	48 : 720x480p @ 119.88 Hz
19	19 : 1280x720p @ 50 Hz		48 : 720x480p @ 120 Hz
20	20 : 1920x1080i @ 50 Hz	49	49 : 720x480p @ 119.88 Hz
21	21 : 720(1440)x576i @ 50 Hz		49 : 720x480p @ 120 Hz

Table 10 VIC Attribute Values for <Evaluate> and <Video> Elements (Sheet 2 of 2)

CEA Video ID Code	Format Attribute Value	CEA Video ID Code	Format Attribute Value
50	50 : 720(1440)x480i @ 119.88H Hz	64	64 : 1920x1080p @ 100Hz
	50 : 720(1440)x480i @ 120 Hz	H01	H01 : 3840x2160p @ 29.97Hz
51	51 : 720(1440)x480i @ 119.88H Hz		H01 : 3840x2160p @ 30Hz
	51 : 720(1440)x480i @ 120 Hz	H02	H02 : 3840x2160p @ 25Hz
52	52 : 720x576p @ 200 Hz	H03	H03 : 3840x2160p @ 23.98Hz
53	53 : 720x576p @ 200 Hz		H03 : 3840x2160p @ 24Hz
54	54 : 720(1440)x576i @ 200 Hz	H04	H04 : 40896x2160p @ 24Hz
55	55 : 720(1440)x576i @ 200 Hz		
56	56 : 720x480p @ 239.76 Hz		
	56 : 720x480p @ 240 Hz		
57	57 : 720x480p @ 239.76 Hz		
	57 : 720x480p @ 240 Hz		
58	58 : 720(1440)x480i @ 239.76 Hz		
	58 : 720(1440)x480i @ 240 Hz		
59	59 : 720(1440)x480i @ 239.76 Hz		
	59 : 720(1440)x480i @ 240 Hz		
60	60 : 1280x720p @ 23.98 Hz		
	60 : 1280x720p @ 24 Hz		
61	61 : 1280x720p @ 25 Hz		
62	62 : 1280x720p @ 29.97 Hz		
	62 : 1280x720p @ 30 Hz		
63	63 : 1920x1080p @ 119.88Hz		
	63 : 1920x1080p @ 120Hz		

<Add> Element

Adds a test for evaluation.

Child Elements - none

Parent Elements - <TestID>, <PacketLog>

Attributes

Name	Values	Description
When <Add> is child of <TestID>		
Name	7-16 | 7-17 | 7-18 |7-19 | 7-23 | 7-24 | 7-25 | 7-26 | 7-27 | 7-28 | 7-29 | 7-30 | 7-31 | 7-32 | 7-33 | 7-34 | 7-35 | 7-36 | 7-37 | 7-38 | 7-39 | 7-40	A single Test ID. Example: 7-16
When <Add> is child of <PacketLog>		
Name	NUL	Null Packet
	ACP	ACP Packet
	ACR	ACR Packet
	AIF	Audio InfoFrame Packet
	ASP	Audio Sample Packet
	AVI	Auxiliary Video InfoFrame Packet
	DST	Direct Stream Transport Audio Packet
	GCP	General Control Packet
	GMP	Gamut Metadata Packet
	HBR	High Bit Rate Audio Stream Packet
	ILL	Illegal Packet Type
	IS1	ISRC1 Packet
	IS2	ISRC2 Packet
	MPG	MPEG Source InfoFrame Packet
	OBA	One Bit Audio Sample Packet
	SPD	Source Product Description InfoFrame Packet
	VSI	Vendor Specific InfoFrame Packet

Example

```
<Add Name='7-16'/>
```

<Clear> Element

Clears all tests from HDMI evaluation. Clears all packet selections from the Packet Log.

Child Elements - none

Parent Elements - `<TestID>, <PacketLog>`

Attributes - none

<Color> Element

Sets the color format and depth for HDMI evaluation.

Child Elements - none

Parent Elements - `<Evaluate>`

Attributes

Name	Value	Description
Format	AdobeRGB	Color space used in video.
	AdobeYCC601	
	RGB	
	sYCC601	
	xvYCC	
	YCbCr(4:2:2)	
	YCbCr(4:4:4)	
Depth	24	24 bit color depth
	30	30 bit color depth
	36	36 bit color depth
	48	48 bit color depth

Example

```
<Color Format='RGB' Depth='24'/>
```

<Content> Element

Sets the type of video content.

Child Elements - none

Parent Elements - <Evaluate>

Attributes

Name	Value	Description
Type	None	Type of video content.
	Cinema	
	Game	
	Graphics	
	Photo	

Example

```
<Content Type='Cinema'/>
```

<Full> Element

Specifies a set of full HDMI compliance tests for evaluation, which is defined as the following tests: 7-16, 7-17, 7-18, 7-19, 7-25, 7-26, 7-28, 7-29, 7-30, 7-31, and 7-32.

Child Elements - none

Parent Elements - `<TestID>`

Attributes - none

<Options> Element

Sets various options for evaluation HDMI data, including AVI InfoFrame Packet, Audio, ACP, ISRC1, ISRC2 Packet, and 3D Video Format.

Child Elements - none

Parent Elements - `<Evaluate>`

Attributes

Name	Value	Description (Select or Disables)
AVI	0 or 1	AVI InfoFrame packet
Audio	0 or 1	Audio
ACP	0 or 1	ACP, ISRC1, and ISRC2 packet
ThreeD	0-3	0 = 2D video format 1 = Frame Packing 3D video format 2 = Side-by-Side (Half) 3D video format 3 = Top-and-Bottom 3D video format
VSDB	0 or 1	HDMI VSDB Length = 5
Colorimetry	0 or 1	Colorimetry Data Block Byte #3 = 0
GreaterTwo	0 or 1	2-Channel PCM Audio

Example

```
<Options AVI='1' Audio='0' ACP='0' ThreeD='0'
  VSDB='0' Colorimetry='0'GreaterTwo='0' />
```

<PacketLog> Element

Container element for selections for the packet log.

Child Elements - `<Add>, <Clear>, <Remove>, <Set>`

Parent Elements - `<Evaluate>`

Attributes - none

<Protocol> Element

Sets the HDMI or DVI protocol for captured data.

Child Elements - none

Parent Elements - `<Evaluate>`

Attributes

Name	Value	Description
Name	DVI	Digital Visual Interface protocol
	HDMI	HDMI protocol

Example

```
<Protocol Name='HDMI'/>
```

<Quantization> Element

Sets the range of quantization (lossy compression) present on the video.

Child Elements - none

Parent Elements - `<Evaluate>`

Attributes

Name	Value	Description
Range	Either	Can be either limited range or full range.
	Full	Full quantization range
	Limited	Limited quantization range

Example

```
<Quantization Range='Either'/>
```

<Remove> Element

Removes a test from HDMI evaluation. Removes a packet type from the Packet Log.

Child Elements - none

Parent Elements - `<TestID>, <PacketLog>`

Attributes

Name	Value	Description
When <Remove> is child of <TestID>		
Name	7-16 | 7-17 | 7-18 |7-19 | 7-23 | 7-24 | 7-25 | 7-26 | 7-27 | 7-28 | 7-29 | 7-30 | 7-31 | 7-32 | 7-33 | 7-34 | 7-35 | 7-36 | 7-37 | 7-38 | 7-39 | 7-40	A single Test ID. For example: 7-16
When <Remove> is child of <PacketLog>		
Name	NUL	Null Packet
	ACP	ACP Packet
	ACR	ACR Packet
	AIF	Audio InfoFrame Packet
	ASP	Audio Sample Packet
	AVI	Auxiliary Video InfoFrame Packet
	DST	Direct Stream Transport Audio Packet
	GCP	General Control Packet
	GMP	Gamut Metadata Packet
	HBR	High Bit Rate Audio Stream Packet
	ILL	Illegal Packet Type
	IS1	ISRC1 Packet
	IS2	ISRC2 Packet
	MPG	MPEG Source InfoFrame Packet
	OBA	One Bit Audio Sample Packet
	SPD	Source Product Description InfoFrame Packet
	VSI	Vendor Specific InfoFrame Packet

Example

```
<Remove Name='7-16'/>
```

<Set> Element

Selects all Test IDs for HDMI evaluation. Selects all packet types for the Packet Log.

Child Elements - none

Parent Elements - `<TestID>, <PacketLog>`

Attributes - none

<TestID> Element

Container element for evaluation test selection.

Child Elements - `<Add>, <Clear>, <Full>, <Remove>, <Set>`

Parent Elements - `<Evaluate>`

Attributes - none

<Generate> Element and its Descendants

NOTE

Check that you have installed the U4998A HDMI Video Generator Files software to use the .vgf and .aaf files mentioned in this section. Refer to the *U4998A HDMI 1.4a Protocol/Audio/Video Analyzer and Generator Installation Guide* to know more about installation.

The `<Generate>` element contains child elements that are used to specify settings for the HDMI video timing generator.

Child Elements

The following element hierarchy shows all the available elements:

```
<Generate>
  <Video>
  <Audio>
```

Parent Elements - `<Module>`

Attributes - none

Example

```
<Module Name='MyModule'>
  <Generate>
    <Video File='C:\Capture\MyFile.vgf'
  Deviation='+'/>
    <Audio With='0'/>
  </Generate>
</Module>
```

<Audio> Element

Enables (and disables) audio output and selects an audio data file. You can specify the audio files (.aaf files) from the set of predefined audio files installed at the following folders:

```
C:\Program Files\HDMI Evaluator\Generator Data\
  8-21 Audio Clock Regeneration
```

```
C:\Program Files\HDMI Evaluator\Generator Data\
  8-23 Audio Formats
```

Child Elements - none

Parent Elements -<Generate>

Attributes

Name	Value	Description
File	<file name>	Example: C:\Program Files\HDMI Evaluator\ Generator Data\8-23 Audio Formats[16bit]L=1kHz_R= 1kHz@32kHz_No1.agf
With	0 or 1	Generate with audio enable or disable
D	300 - 1500	D parameter used in (128 x fs / D)

Example

```
<Audio File='C:\Program Files\HDMI Evaluator\
  Generator Data\8-23 Audio
  Formats[16bit]L=1kHz_R=1kHz@32kHz_No1.agf'
  With='1' D='300'/>
```

<Video> Element

Specifies video file and Video Identification Code (VIC) for HDMI video timing generator output.

Child Elements - none

Parent Elements - <Generate>

Attributes

Name	Value	Description
File	<file name>	Example: C:\Capture\MyFile.vgf
Deviation	0 or + or –	Sets the deviation from the standard TMDS clock frequency to 0%, +0.5%, or –0.5%.

Example

```
<Video File='C:\Capture\MyFile.vgf'
  Deviation='+'/>
```

Methods for Capturing HDMI Data

NOTE Check that you have installed Agilent Logic Analyzer software to use the methods described in this topic. Refer to the *U4998A HDMI 1.4a Protocol/Audio/Video Analyzer and Generator Installation Guide* to know more about installation.

WriteEDID

Applicable COM Server Object

Use this method with the Agilent Logic Analyzer COM server object.

Syntax

```
VARIANT_BOOL WriteEDID([in] BSTR EDIDFileName);
```

Description

Defines the EDID for the U4998A module when it emulates a sink device. The method defines the EDID as per the specified .edi file. This method returns when the write is complete.

Parameter	Description
[in] BSTR`EDIDFileName`	The full path and name of the EDID file that you want to use to define the EDID for the U4998A module.

Failures can occur with the following causes:

- The specified EDIDFileName is not valid.
- U4998A module is not connected to the controller PC.

StartCapture

Applicable COM Server Object

Use this method with the Agilent Logic Analyzer COM Server object.

Syntax

```
VARIANT_BOOL StartCapture();
```

Description

Starts capturing HDMI data from the source DUT into the U4998A module memory. When connected, the U4998A module is ready to capture data. Therefore, the capture starts immediately without any waiting time needed for the hardware to be ready for capture.

This method returns when the capture is complete. Failures can occur when the U4998A module is not connected to the controller PC.

You can use the Status() to find out if the capture has completed.

NOTE You cannot simultaneously generate and capture data.

ExportCapture

Applicable COM Server Object

Use this method with the Agilent Logic Analyzer COM Server object.

Syntax

```
VARIANT_BOOL ExportCapture([in] BSTR
  ExportFileName);
```

Description

Exports the captured data to the specified .cap file. ExportCapture() returns when the export completes or when a write to ExportFileName fails. Failures can occur with the following causes:

- ExportFileName is not valid.
- Upload size is less than 1 or greater than 4096 MB.
- U4998A hardware is not connected to the controller PC.

- No data has been captured

Parameter	Description
[in] BSTR ExportFileName	The full path and name of the .cap file in which you want to export the data captured from a source DUT.

Methods for Evaluating the Captured Data

NOTE Check that you have installed the HDMI Evaluator software to use the methods described in this topic. Refer to the *U4998A HDMI 1.4a Protocol/Audio/Video Analyzer and Generator Installation Guide* to know more about installation.

GetBitmapFiles

Applicable COM Server Object

You need to use this method with the HDMI Evaluator COM Server object. If you use this method with the Agilent Logic Analyzer COM server object, it returns an empty string.

Syntax

```
BSTR GetBitmapFiles();
```

Description

The tests 7-23, 7-24, 7-27, 7-34, 7-38, and 7-40 can generate image files. The GetBitmapFiles method returns the names of any image files created in the last call to StartEvaluate(). Only one of these tests should be run per call to StartEvaluate(). The file names (in the order created) are returned in an XML string as shown in this example:

```
<Bitmap>
<File Name='C:\Capture\
  MyFile_0_20091020134237.bmp'/>
<File Name='C:\Capture\
  MyFile_1_20091020134239.bmp'/>
</Bitmap>
```

StartEvaluate

Applicable COM Server Object

Use this method with the HDMI Evaluator COM Server object. If you use this method with the Agilent Logic Analyzer COM server object, it always returns false.

Syntax

```
VARIANT_BOOL StartEvaluate([in] BSTR
  EvaluatorFileName, [in] BSTR
  PacketLogFileName, [in] VARIANT_BOOL
  ImageDialog);
```

Description

Starts the HDMI Evaluator. Use the DoCommands method to specify the input filename of captured data and all options.

Parameter	Description
[in] BSTR EvaluatorFileName	The path and name of the file where the evaluation results will be saved.
[in] BSTR PacketLogFileName	The path and name of the file where the packet log results will be saved. The packet log is produced only for the test 7-19.
[in] VARIANT_BOOL ImageDialog	Set the argument to **true** to enable the Video Image window so that you can visually inspect each video frame. Set the argument to **false** to disable the Video Image window. Video Image window applies to tests 7-23, 7-24, 7-27, 7-34, 7-38, and 7-40.

This method returns when the evaluation completes. However, if you set the ImageDialog parameter to true, this method will not return until you complete input to the Video Image window.

The method fails if you do not set up any tests to run on the captured data using the DoCommands method. Refer to “Viewing the Video Image" on page 49 to learn about the Image window.

NOTE You do not need U4998A module or any license to evaluate a captured data file. The evaluation is done in an offline mode using HDMI Evaluator.

Methods for Generating HDMI Data

NOTE

Check that you have installed Agilent Logic Analyzer and U4998A HDMI Video Generator Files software components to use the methods described in this topic. Refer to the *U4998A HDMI 1.4a Protocol/Audio/Video Analyzer and Generator Installation Guide* to know more about installation.

StartGenerator

Applicable COM Server Object

Use this method with the Agilent Logic Analyzer COM server object.

Syntax

```
VARIANT_BOOL StartGenerator();
```

Description

Starts the transmission of frames to the sink DUT.

Use the "DoCommands method to specify the video and audio generator (.vgf and .aaf) files that you want to transmit to the DUT. Failures can occur with the following causes:

- The specified Video Generator File (.vgf) not found or not valid.
- The specified Audio Generator File not found or not valid (if audio is enabled by specifying With == 1 in DoCommands)
- U4998A hardware is not connected to the controller PC.

When connected, the U4998A module is ready to transmit data to DUT. Therefore, the transmission starts immediately without any waiting time needed for the hardware to be ready for transmission.

You can use the Status() to find out if the transmission from U4998A has started.

NOTE

You cannot simultaneously generate and capture data.

StopGenerator

Applicable COM Server Object

Use this method with the Agilent Logic Analyzer COM server object.

Syntax

```
VARIANT_BOOL StopGenerator();
```

Description

Stops the transmission of data from U4998A module to DUT.

Status

Applicable COM Server Object

Use this method with the Agilent Logic Analyzer COM server object.

Syntax

```
BSTR Status();
```

Description

Returns a status string from the U4998A module indicating the current status of capture/generator activity on the module. The status string may contain the substrings shown in the following table.

Substring	Description
Running	U4998A is currently capturing data from DUT.
Stopped	No measurement (capture) is occurring, measurement has stopped.
Generating	U4998A module is currently generating signals on its HDMI OUTPUT.

WaitReady

Applicable COM Server Object

Use this method with the Agilent Logic Analyzer COM server object.

Syntax

```
void WaitReady([in] long Seconds);
```

Description

When connected, U4998A module is ready to capture data. Therefore, WaitReady() always returns true for U4998A module.

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