Agilent N5998A HDMI Protocol Analyzer and Generator

(Covers both HDMI 1.3 and 1.4 Compliance Testing)

User's Guide

Agilent Technologies

Notices

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STANDBY and AC symbols. The STANDBY marks the position of the instrument power line switch. The AC symbol is used to indicate the required nature of the line module input power.

The CE mark is a registered trademark of the European Community. ISM GRP 1-A denotes the instrument is an Industrial Scientific and Medical Group 1 Class A product. ICES/NMB-001 indicates product compliance with the Canadian Interference-Causing Equipment Standard.

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CAUTION. A **CAUTION** notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in damage to the product or loss of important data. Do not proceed beyond a **CAUTION** notice until the indicated conditions are fully understood and met.

WARNING. A WARNING notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in personal injury or death. Do not proceed beyond a WARNING notice until the indicated conditions are fully understood and met.

Contents

1 Introduction

The N5998A is a reference, high-speed protocol analyzer, video timing analyzer, video picture analyzer, audio timing analyzer, and audio and video protocol generator for High Definition Multi-Media Interface (HDMI) compliance testing. The N5998A supports the source and sink tests listed in Table 2 on page 10. Table 3 on page 12 lists the supported video format timings.

The standard N5998A supports testing to the HDMI 1.3 standard. An N5998A with upgrade N5998U-R14 supports testing to the HDMI 1.4 standard. The optional N5998U-DBG license add the capability to convert N5998A data files to a format that can be imported into a logic analyzer.

- To install the HDMI analysis application, refer to Chapter 2, "Installing the N5998A".
- To perform tests, refer to Chapter 3 and to Chapter 4.
- To perform testing via a program instead of the application's user interface, refer to Chapter 6, "Remote Operation".

N5998A is controlled from the HDMI Protocol Analyzer and Generator application that runs on a PC. The application is provided with the N5998A. The external PC is not provided with the N5998A. Table 1 lists the requirements for the PC.

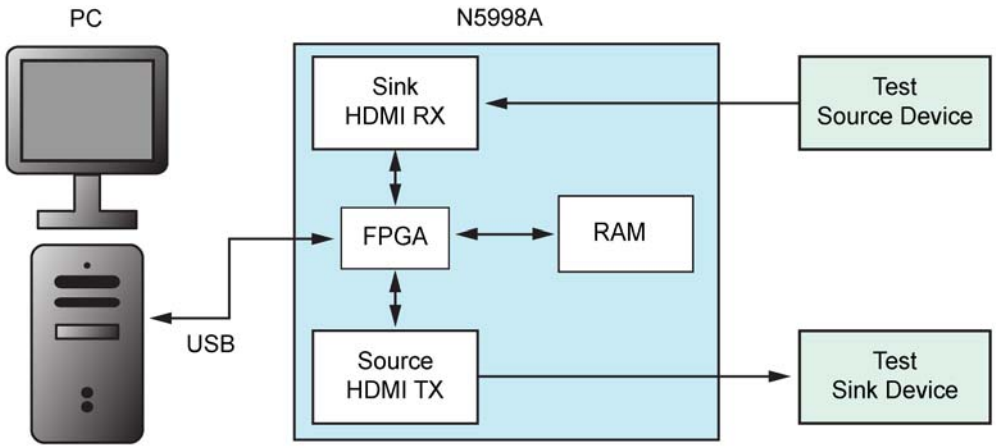


Figure 1 N5998A Block Diagram

Table 1 PC Requirements[a]

Item	Description
Hardware	Pentium® processor 1 GHz or equivalent 512 MB available RAM VGA resolution 1024 x 768 5 GB or more free disc space USB 2.0 interface
Operating System	Windows® XP

a Not included with the N5998A.

NOTE Is your product software up-to-date? Periodically, Agilent releases software updates to fix known defects and incorporate product enhancements. To search for software updates for your product, go to the Agilent Technical Support website at www.agilent.com/find/TechSupport.

General Safety Considerations

This product has been designed and tested in accordance with the standards listed in the Manufacturer's Declaration of Conformity, and has been supplied in a safe condition. The documentation contains information and s which must be followed by the user to ensure safe operation and to maintain the product in a safe condition.

WARNING **If this product is not used as specified, the protection provided by the equipment could be impaired. This product must be used in a normal condition (in which all means for protection are intact) only.**

WARNING **No operator serviceable parts inside. Refer servicing to qualified service personnel. To prevent electrical shock do not remove covers.**

WARNING **This is a Safety Class 1 Product (provided with a protective earthing ground incorporated in the power cord). The mains plug shall only be inserted in a socket outlet provided with a protective earth contact. Any interruption of the protective conductor inside or outside of the product is likely to make the product dangerous. Intentional interruption is prohibited.**

CAUTION This product is designed for use in INSTALLATION CATEGORY II and POLLUTION DEGREE 2 per IEC61010-1 and IEC60664 respectively.

NOTE Install the instrument according to the enclosure protection provided. This instrument does not protect against the ingress of water. This instrument protects against finger access to hazardous parts within the enclosure.

Supported Compliance Tests

Table 2 Compliance Tests Supported by the N5998A (Sheet 1 of 2)

Test ID	Test Name	Requires N5998U-R14 Upgrade	Included in Full Compliance Evaluation
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 [a]	Video Format Timing		•
7-26	Pixel Repetition		•
7-27	AVI InfoFrame		
Source Audio			
7-28	Audio IEC Compliance		•
7-29 [a]	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 [a]	Deep Color		

Table 2 Compliance Tests Supported by the N5998A (Sheet 2 of 2)

Test ID	Test Name	Requires N5998U-R14 Upgrade	Included in Full Compliance Evaluation
7-35	Gamut Metadata Transmission		
7-36	High Bitrate Audio		
7-37	One Bit Audio		
7-38 [a]	3D Video Format Timing	•	
7-40	Extended Colorimetry	•	
Sink Protocol			
8-16	Acceptance of all Valid Packet Types		
Sink Audio			
8-21	Audio Clock Regeneration		
8-22	Audio Sample Packet Jitter		
8-23	Audio Formats		
Sink Interoperability with DVI			
8-24	Interoperability with DVI		
Sink Advanced Features			
8-25[b]	Deep Color		
8-29	3D Video Format Timing	•	
8-31	AVI InfoFrame Colorimetry	•	

a Tests 7-25, 7-29, 7-34, 7-38, and full compliance requires frequency counter.

b Test 8-25 requires an N5998A and an E4887A TMDS Signal Generator.

Supported Video Identification Codes

Table 3 Supported Video Format Timings (Sheet 1 of 2)

CEA Video ID Code	Format	Requires N5998U-R14 Upgrade
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	•

Table 3 Supported Video Format Timings (Sheet 2 of 2)

CEA Video ID Code	Format	Requires N5998U-R14 Upgrade
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	•
61	1280 x 720p @ 25 Hz	•
62	1280 x 720p @ 29.97 / 30 Hz	•

N5998A Front and Rear Panels

The front-panel status lights indicate the following conditions:

- System Ready (green): indicates the N5998A is ready.
- Capture (red): indicates capturing HDMI data
- Upload (red): indicates uploading HDMI data
- Output (orange): indicates download and output of generator data

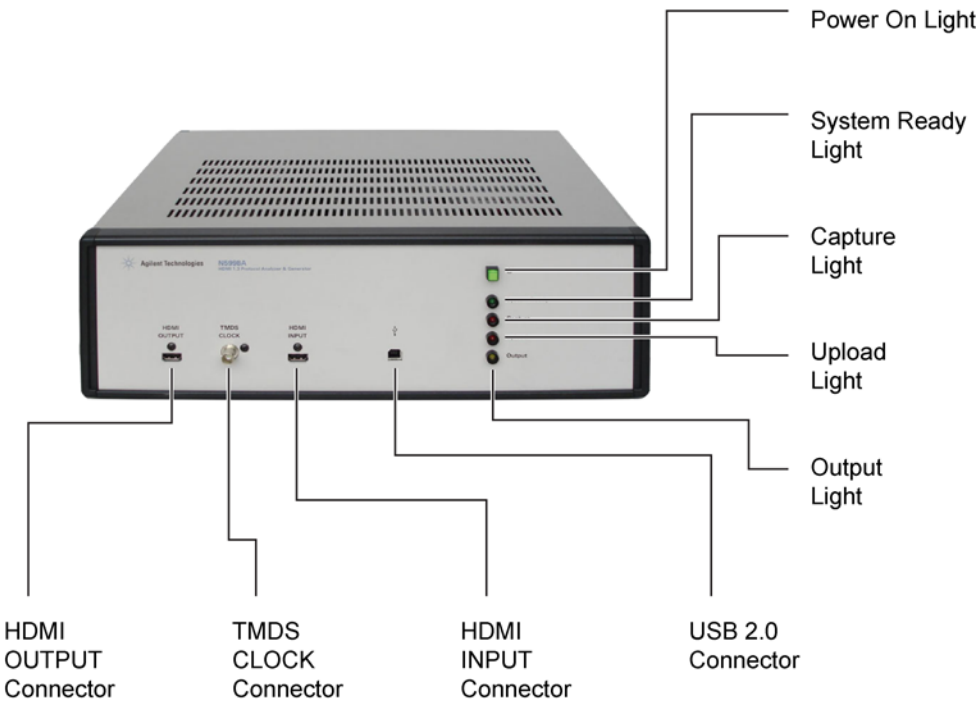


Figure 2 N5998A Front Panel

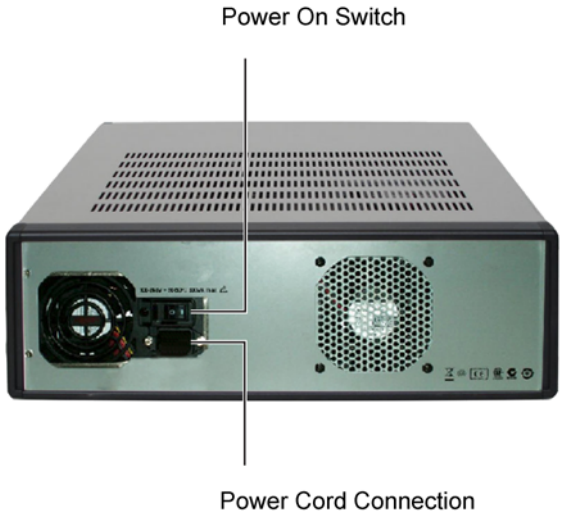


Figure 3 N5998A Rear Panel

Cleaning the N5998A

Clean the N5998A using a soft cloth slightly dampened with a mild soap and water solution.

WARNING **To prevent electrical shock, disconnect the Agilent Technologies model N5998A from mains before cleaning. Use a dry cloth or one slightly dampened with water to clean the external case parts. Do not attempt to clean internally.**

CAUTION Do not use too much liquid in cleaning the instrument. Water can enter the front panel, damaging sensitive electronic components.

System Characteristics

Table 4 N5998A Characteristics

Item	Description
Power requirements	100 – 240 V∿ (max. voltage fluctuation 10%) 300 VA maximum 50/60 Hz
TMDS clock output	3.3V LVTTL
Memory analyzer	4 GB
Temperature	Operating: 0°C to +55°C Storage: –40°C to +70°C
Humidity	Operation: 15% – 95% @ 40°C (non-condensing) Storage: 90% @ 65°C
Safety & EMC Standards	IEC 61010-1/EN 61010-1 IEC 61326-1/EN61326-1 Installation category II, Pollution degree: 2
Dimensions and Weight	Width: 43 cm (16.9 in) Depth: 35 cm (13.8 in) Height: 14 cm (5.5 in) Weight: 6 kg (13.2 lbs)
HDMI connectors	Type A receptacle
USB connector (PC controller)	USB 2.0
Operating System	Windows® XP

Regulatory Information

Compliance with German Noise Requirements

This is to declare that this instrument is in conformance with the German Regulation on Noise Declaration for Machines (Laermangabe nach der Maschinenlaermverordnung –3.GSGV Deutschland).

Table 5 German Noise Requirements

Acoustic Noise Emission	Geraeuschemission
LpA < 70 dB	LpA < 70 dB
Operator position	am Arbeitsplatz
Normal position	normaler Betrieb
Per ISO 7779/ISO 3744	nach ISO 7779/ISO 3744

Compliance with Canadian EMC Requirements

This ISM device complies with Canadian ICES-001. Cet appareil ISM est conforme a la norme NMB-001 du Canada.

Returning the Instrument for Service

The instructions in this section show you how to properly package the instrument for return to an Agilent Technologies service office. If the instrument is still under warranty or is covered by an Agilent maintenance contract, it will be repaired under the terms of the warranty or contract. If the instrument is no longer under warranty or is not covered by an Agilent maintenance plan, Agilent will notify you of the cost of the repair after examining the unit.

When an instrument is returned to an Agilent service office for servicing, it must be adequately packaged and have a complete description of the failure symptoms attached.

When describing the failure, please be as specific as possible about the nature of the problem. Include copies of any instrument failure settings and data related to instrument failure along with the instrument being returned.

Please notify the service office before returning your instrument for service. Any special arrangements for the instrument can be discussed at this time. This will help the Agilent service office repair and return your instrument as quickly as possible.

Contacting Agilent Technologies

For technical assistance, contact your local Agilent Call Center.

- In the Americas, call 1 (800) 829-4444
- In other regions, visit http://www.agilent.com/find/assist

Before returning an instrument for service, you must first call the Call Center at 1 (800) 829-4444

Preparing the instrument for shipping

1 Write a complete description of the failure and attach it to the instrument. Include any specific performance

details related to the problem. The following information should be returned with the instrument.

- Type of service required.
- Date instrument was returned for repair.
- Description of the problem:
  - Whether problem is either constant or intermittent.
  - Whether instrument is temperature-sensitive.
  - Whether instrument is vibration-sensitive.
  - Instrument settings required to reproduce the problem.
  - Performance data.
- Company name and return address.
- Name and phone number of technical contact person.
- Model number of returned instrument.
- Full serial number of returned instrument.
- List of any accessories returned with instrument.

2 Cover all front or rear-panel connectors that were originally covered when you first received the instrument.

CAUTION Cover electrical connectors to protect sensitive components from electrostatic damage.

CAUTION Instrument damage can result from using packaging materials other than the original materials. Never use styrene pellets as packaging material. They do not adequately cushion the instrument or prevent it from shifting in the carton. They may also cause instrument damage by generating static electricity.

3 Pack the instrument. Use original packaging or comparable. Original materials are available through any Agilent office. Or, use the following guidelines:

- Wrap the instrument in antistatic plastic to reduce the possibility of damage caused by electrostatic discharge.
- For instruments weighing less than 54 kg (120 lb), use a double-walled, corrugated cardboard carton of 159 kg (350 lb) test strength.

- The carton must be large enough to allow approximately 7 cm (3 inches) on all sides of the instrument for packing material, and strong enough to accommodate the weight of the instrument.
- Surround the equipment with approximately 7 cm (3 inches) of packing material, to protect the instrument and prevent it from moving in the carton. If packing foam is not available, the best alternative is S.D-240 Air Cap™ from Sealed Air Corporation (Commerce, California 90001). Air Cap looks like a plastic sheet filled with air bubbles. Use the pink (antistatic) Air Cap™ to reduce static electricity. Wrapping the instrument several times in this material will protect the instrument and prevent it from moving in the carton.

4 Seal the carton with strong nylon adhesive tape.

5 Mark the carton “FRAGILE, HANDLE WITH CARE”.

6 Retain copies of all shipping papers.

2
Installing the N5998A

This chapter shows you how to install the N5998A and its software application.

Step 1. Inspect the Shipment

1 Inspect the shipping container and instrument for damage. Keep the shipping container and cushioning material until you have inspected the contents of the shipment for completeness and have checked the instrument mechanically and electrically.

2 Locate the shipping list. Verify that you received all the accessories on this list, and all the options that you ordered. The following list shows some of the items that may be on the shipping list. The information on your actual shipping list is more accurate and should supersede the information in this list.

- N5998A
- Power cord
- USB cable
- Installation CD-ROM (for Windows)

If anything is missing or defective, refer to "Returning the Instrument for Service" on page 18. If the shipment was damaged, contact the carrier, then contact the nearest Agilent Sales Office. Keep the shipping materials for the carrier's inspection. The Agilent Sales Office will arrange for repair or replacement at Agilent's option without waiting for claim settlement.

Step 2. Check the Capability of the N5998A

1. Inspect the N5998A's rear panel for a sticker indicating that the FPGA version is greater than 0x0141.
2. If the sticker is present, the N5998A includes full HDMI 1.4 testing capability.
3. If the sticker is not present and you want full HDMI 1.4 testing capability, you must purchase an N5998U-R14 upgrade. This upgrade requires that the N5998A be sent to your local Agilent Service Center. Go to www.agilent.com/find/contactus.

The N5998U-R14 upgrade updates the N5998A's internal field-programmable gate array (FPGA). Whenever an N5998A is connected to the PC and is turned on, the application automatically confirms if the N5998A has been upgraded. Information on upgrading the FPGA version is documented in Service Note N5998A-03, FPGA Upgrade, on Agilent's web site.

Step 3. Install the Application

NOTE To avoid installation problems, log in to the PC using Administrator permissions and install the application on a local drive. Do not install the application on a networked drive. If an older version of the application is installed on the PC, uninstall the older version before installing the new version.

1 If connected, disconnect the USB cable between the N5998A and the PC.

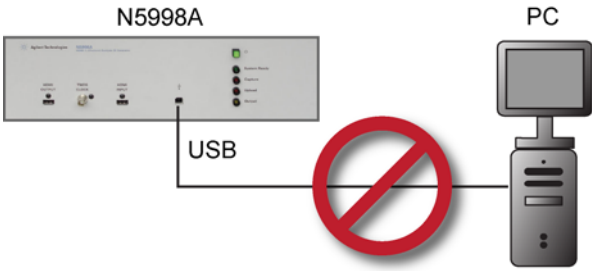


Figure 4 Disconnect the N5998A USB Cable

2 Turn on the PC, log in with Administrator permissions, and close all open applications. Table 1 on page 8 lists the requirements for the PC.

3 Use your web browser to open Agilent's home page at www.agilent.com

4 On Agilent's web page, enter N5998A into the search field and click Search.

5 When the search results appear, click Product Overview.

6 Click the Downloads & Trials tab. At the bottom of the page, select and download the latest software version of the N5998A.

7 Open the downloaded zip file and run the included exe file.

8 Complete the steps in the installation wizard.

Step 4. Connect the Power

Connect the line cord to the N5998A. The N5998A automatically adjusts for line input voltages of 100 VAC and 230 VAC. There is no voltage selection switch. The line cord provided is matched to the country in which the order originates.

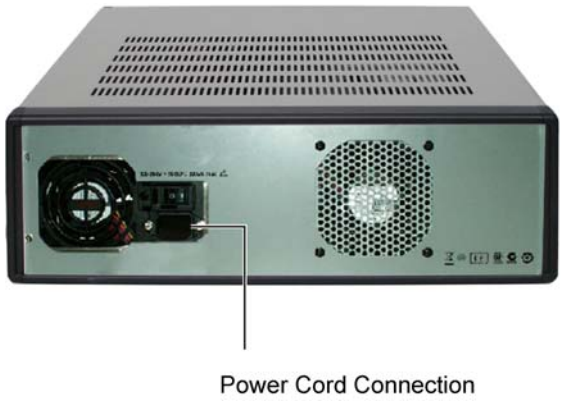


Figure 5 Power Cord

Table 6 Installation Requirements

Item	Description
Power Requirements	100 – 240 V∿ (max. voltage fluctuation 10%) 300 VA maximum 50/60 Hz
Temperature	Operating: 0°C to +55°C Storage: –40°C to +70°C
Humidity	Operation: 15% – 95% @ 40°C (non-condensing) Storage: 90% @ 65°C

CAUTION *Do not* connect ac power until you have verified the line voltage is correct as described in Table 6. Damage to the equipment could result.

CAUTION Always use the three-prong AC power cord supplied with this instrument. Failure to ensure adequate earth grounding by not using this cord may cause product damage.

CAUTION This instrument has autoranging line voltage input. Be sure the supply voltage is within the specified range shown in Table 6.

NOTE Install the instrument so that the detachable power cord is readily identifiable and is easily reached by the operator. The detachable power cord is the instrument disconnecting device. It disconnects the mains circuits from the mains supply before other parts of the instrument. The front panel switch is only a standby switch and is not a LINE switch. Alternatively, an externally installed switch or circuit breaker (which is readily identifiable and is easily reached by the operator) may be used as a disconnecting device.

Step 5. Install the Device Driver

1 Connect the supplied USB cable between the N5998A's front-panel USB connector and the PC.

2 Turn on the N5998A using the rear-panel power switch.

Figure 6 Power On Switch

3 Restart the PC.

4 The Found New Hardware Wizard starts automatically.

Figure 7 Found New Hardware Wizard

5 Click "Install from a list of specific location (Advanced)". Click Next.

6 As shown in Figure 8, select “Search for the best driver in these locations” and “select Include this location in the search”.

7 Browse to the driver folder: C:\Program Files\HDMI Evaluator\Driver.

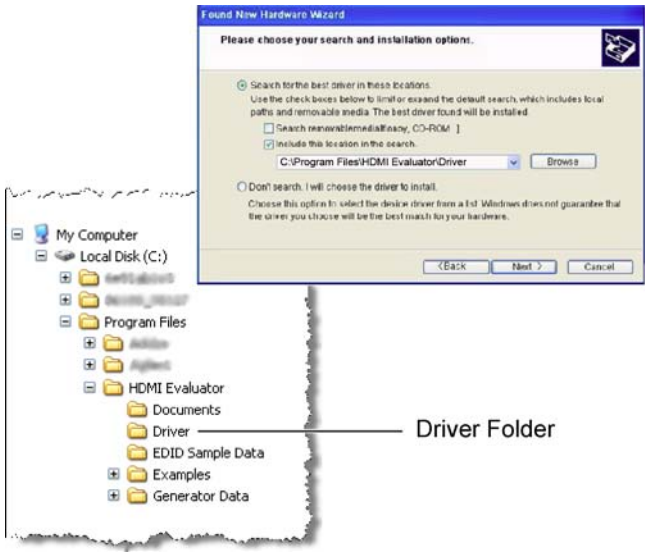


Figure 8 Installation Options

8 Click Next to begin installation.

9 Click Finish to complete the driver installation.

If the Device Driver Installation Fails

Sometimes the Agilent N5998A cannot be discovered by the PC when the USB cable is plugged into a different USB port in the same PC. This occurs because Agilent N5998A doesn’t have a separate serial number of its own.

To resolve this issue, re-install the driver. If it still doesn't work, perform the following steps to get the Instance ID of the Agilent N5998A from the Device Manager:

1. Right-click the My Computer icon on the desktop and select Properties.
2. In the System Properties dialog box, click the Device Manager button in the Hardware tab.
3. Double-click the Universal Serial Bus controllers item in the tree structure.
4. Locate the USB Device item in the expanded tree structure. Right-click this item and select Properties.
5. In the USB Device Properties dialog box, select the Details tab and select the Device Instance ID option from the list box. The Instance ID of the USB device appears in the text box below.
6. Record the value of the Instance ID. For example, for a Device Instance Id of `USB\Vid_054c&Pid_02d0\5&3b8933dc&0&5`, the Instance ID value would be `5&3b8933dc&0&5`.
7. In the file, Driver.reg, replace the string `INSTANCEID` with the Instance ID value you have just recorded.
8. Double-click the Driver.bat file to refresh the Windows registry.

Step 6. Install the Conversion Utility (Optional)

Before you can use the optional conversion utility, you must purchase and install the N5998U-DBG software license upgrade for debug explorer.

The optional Generate Module CSV from HDMI Capture File utility converts N5998A data files into files that can be imported into logic analyzers. The conversion utility is installed with the HDMI Protocol Analyzer and is accessed from the Window's Start menu. To learn how to use this utility, refer to Chapter 5, "Importing Captured Data into a Logic Analyzer," starting on page 103.

1 On the Windows Start menu, select All Programs > HDMI Evaluator > Generate CSV to open the conversion utility.

2 In the application, click Software Licensing.

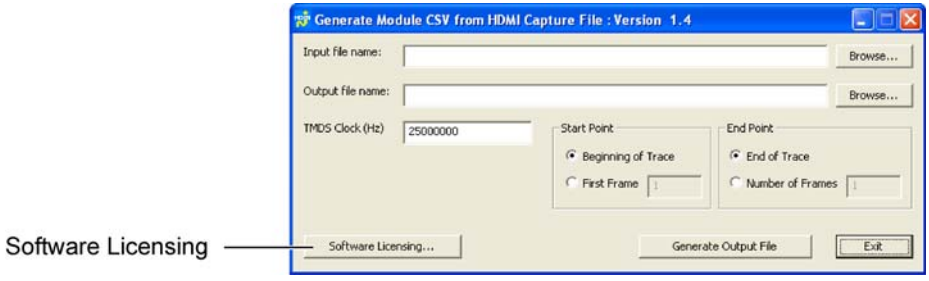


Figure 9 Conversion Utility Application

3 In the Software Licensing dialog box, click the Activation tab.

4 Note the Licensing Host ID. You will need this code to activate your license.

5 Close the Software Licensing dialog box.

6 Close the Generate Module CSV from HDMI Capture File utility window.

7 On your web browser, open the Agilent Software Licensing System at:

http://www.agilent.com/find/softwarelicense

8 On the web site, follow the instructions to generate your license file. When prompted, enter the following information:

- Host ID of application
- Agilent Order Number that is printed on the entitlement certificate.

9 Agilent will email you a license file. Open the email and follow the installation instructions that explain how to copy the license file to a specific folder on your computer or floating license server.

NOTE If you installed the license on a floating license server, more steps are required. In the conversion utility application, click Software Licensing and then Help. As shown in Figure 10, the online help provides complete documentation for using the License Manager.

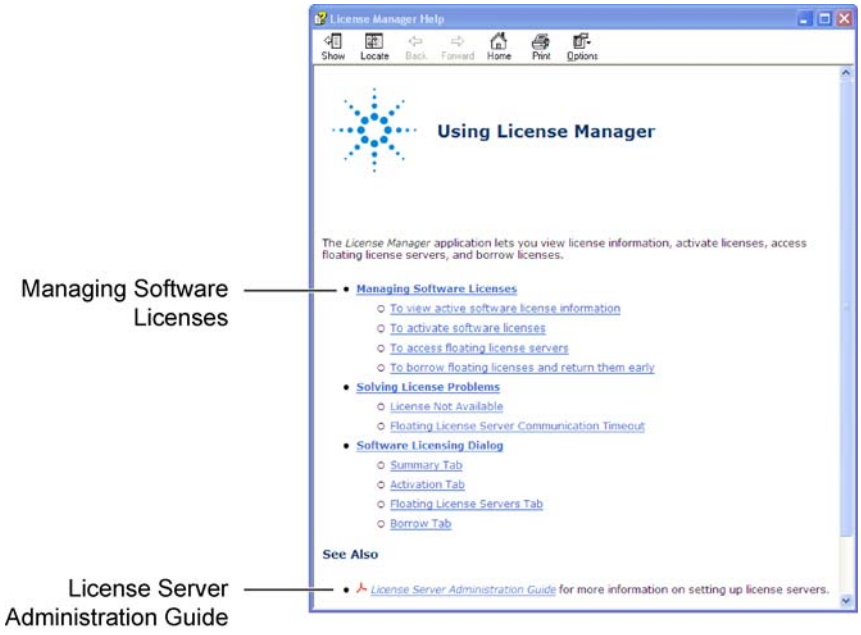


Figure 10 License Manager Help

3 Testing Source Devices

When testing sources, you'll use the application's EDID Writer, HDMI Capture, and HDMI Evaluator windows. Table 2 on page 10 lists the source compliance tests supported by the N5998A.

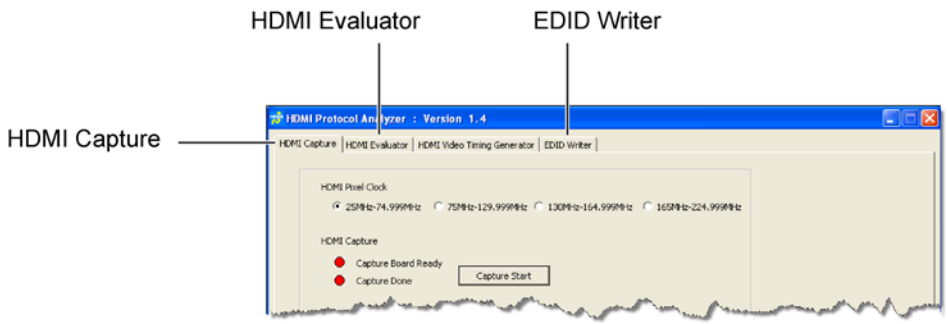


Figure 11 Windows Used for Testing Sources

These are the general steps for testing sources:

1. Use the EDID Writer window to download an EDID file to the N5998A. The EDID data allows the N5998A to represent a sink with specific video support to the device under test (DUT).
2. Connect the DUT to the N5998A.
3. Use the HDMI Capture window to capture video from the DUT and upload the video to the computer.
4. Use the HDMI Evaluator window to open the uploaded file and perform the source compliance tests.

To Test a Source Device

This procedure describes the general steps for performing a source test. It shows you how to operate the N5998A to accomplish your testing. Always familiarize yourself with the HDMI compliance test specification before testing, to learn about any special test requirements. For example, test 7-33 requires that the video data be captured and tested twice, using two separate EDIDs.

NOTE Always refer to the HDMI Compliance Test Specification for exact testing requirements.

Step 1. Download EDID Data to the N5998A

1 Connect the devices as shown in Figure 12.

NOTE The source device, when connected to the N5998A's HDMI INPUT connector, immediately reads the current EDID. Therefore, do not connect the source device to the N5998A until the desired EDID is downloaded to the N5998A.

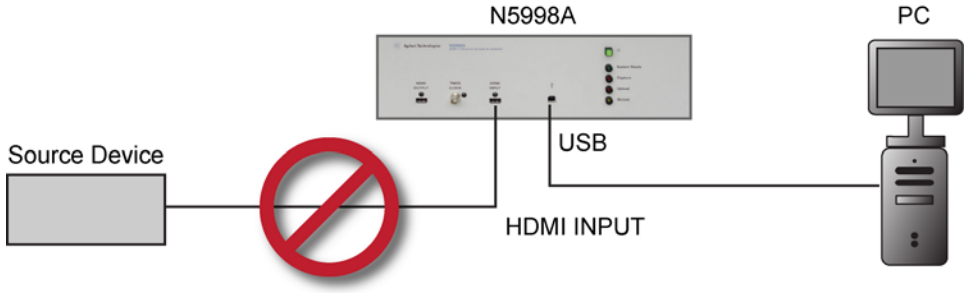


Figure 12 EDID Writer Setup

2 On the computer, double click the HDMI Protocol Analyzer Generator icon on the desktop to start the application.

3 In the application, click the EDID Writer tab to view the EDID Writer window.

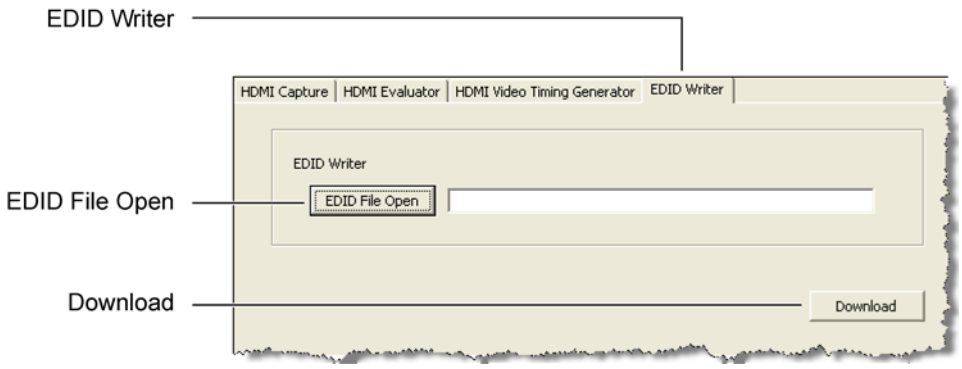


Figure 13 EDID Writer Window

4 Click EDID File Open, and select an EDID File. EDID files use the .edi file extension and are located in the application folder shown in Figure 14. Refer to Table 7 on page 49 for a listing of compliance tests and corresponding EDID files.

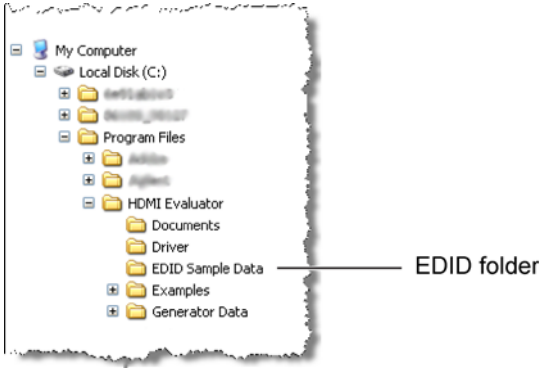


Figure 14 Location of EDID Files

5 Click Download.

Step 2. Capture the HDMI Data

1 Connect the devices as shown in Figure 15.

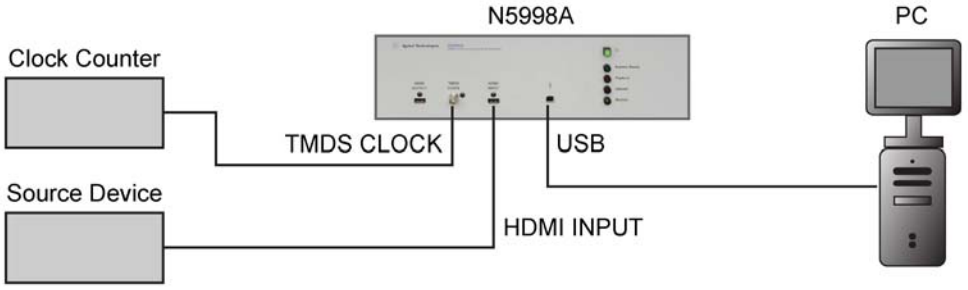


Figure 15 HDMI Capture Setup

NOTE Table 2 on page 10 indicates which compliance tests require a measurement of the TMDS clock frequency. When testing the captured data, you must enter this frequency value as explained in "Step 3. Run the Evaluation" on page 40.

2 Turn on the source device. Configure the source device for HDMI data output. The HDMI data must be unprotected (without HDCP protection).

3 In the application, click the HDMI Capture tab to view the HDMI Capture window.

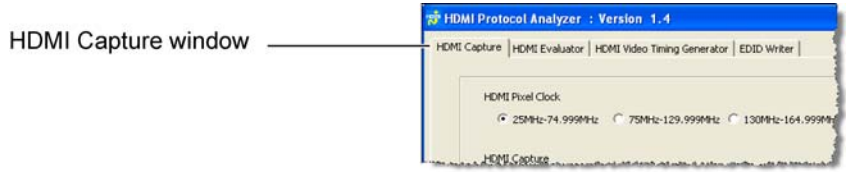
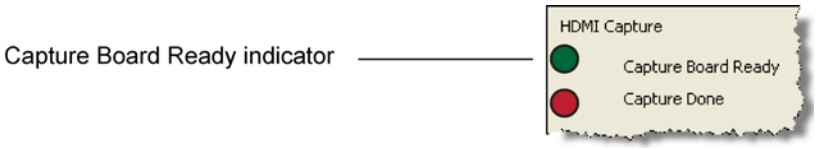


Figure 16 HDMI Capture Window

4 In the HDMI Capture window, select the appropriate HDMI Pixel Clock range for the HDMI data that you want to capture.

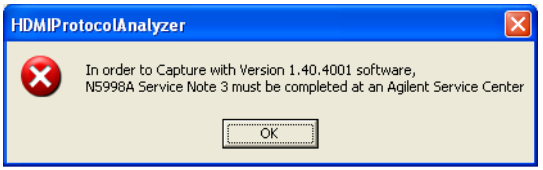
5 In the HDMI Capture window, confirm that the Capture Board Ready indicator is green.



NOTE If you selected an incorrect HDMI Pixel Clock range in step 4, the Capture Board Ready indicator will not turn green. For example, if you select 25 MHz to 74.999 MHz range while receiving a 148.5 MHz pixel clock, the Capture Board Ready will never turn green.

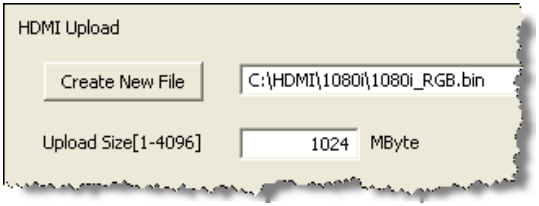
6 Click Capture Start. A progress bar shows the progress of the capture.

NOTE If the following dialog box opens, you need to purchase upgrade N5998U-R14 for the N5998A. Refer to "Step 2. Check the Capability of the N5998A" on page 23.



7 When the capture is finished, confirm that the Capture Done indicator is green.

8 Click Create New File and specify a folder and file name to save the captured data. Or, enter the path directly into the text field. Use a .cap file name extension.



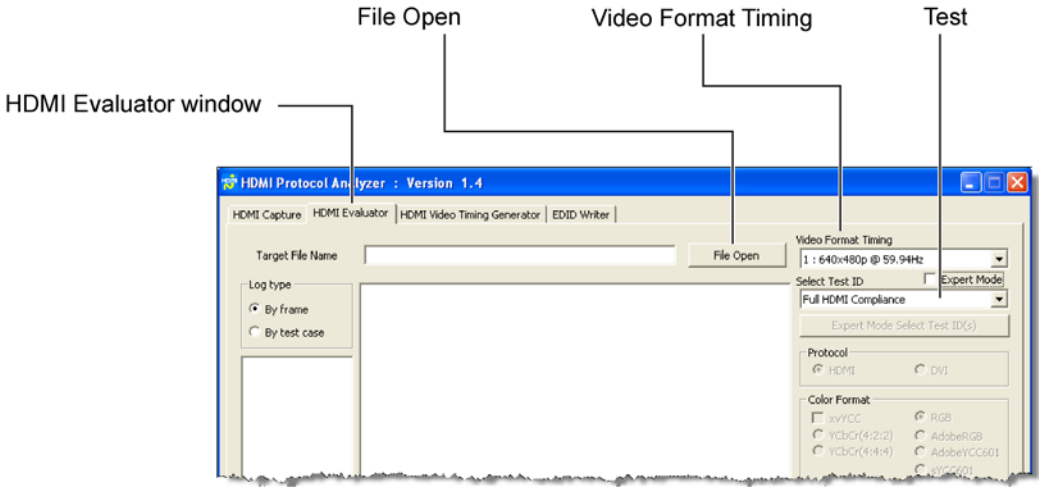
9 Enter an upload size for the file (up to 4096 MB). Refer to Table 10 on page 58 for recommended minimum file sizes for the different video formats.

10 Click Upload to save the data file on the computer.

Step 3. Run the Evaluation

1 In the application, click the HDMI Evaluator tab to view the HDMI Evaluator window.

2 Click File Open to select the file that you captured.



3 In the Video Format Timing field, select the video format of the data.

NOTE If the selected video format timing does not match the captured data, several tests will fail and an error message similar to "CEA–861D Video Format Timing Error" or "CEA–861E Video Format Timing Error" will appear in the test results pane. Refer to "To Determine Video Format Timing of Video" on page 44 to determine the correct video format timing of the data.

4 In the Test ID field, select either an individual test or `Full HDMI Compliance`. Full HDMI Compliance automatically runs all of the tests listed in Table 2 on page 10 that are marked "Included in Full Compliance Evaluation".

5 If you selected `Full HDMI Compliance` or `(7-19) Packet Types`, a log of data packets can be saved to a file when the evaluation is run. To cause the file to be

created, click Packet LOG and select the types of packets that you want recorded.

NOTE The packet log file is saved to the same folder as the evaluated 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.

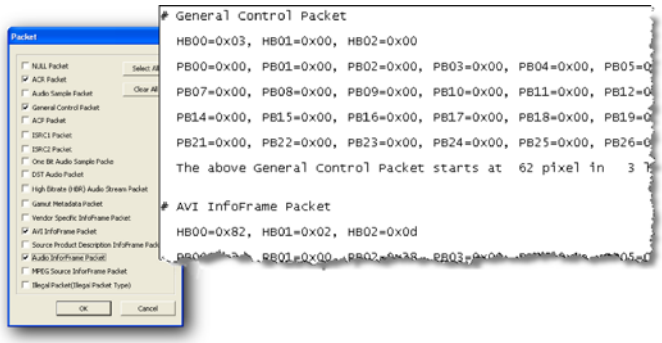


Figure 17 Packets Selected for Log and Example Log File

6 Enter the TMDS Clock frequency, if the TMDS Clock(Hz) field is available for data entry. This frequency was measured when the data was captured. Refer to Table 11 on page 66 for a list of tests which require the TMDS clock frequency.

NOTE Entering an incorrect value in the TMDS field will cause test 7-25 to fail and generate the error "Pixel clock is out of allowable range."

7 On the right side of HDMI evaluator window, you can change any testing parameters that are available for selection. Table 11 on page 66 shows which selections are available for each test.

8 Click Start to run the evaluation.

NOTE When the evaluation completes, the test results that are displayed in the window are also written to a text log file. The file is saved to the same folder as the evaluated data file. The name of the file is formed using the the current year, month, day, hour, minute, and second as in yyyymmddHHMMSS.txt. For example, 20091023163205.txt.

9 If test 7-23, 7-24, 7-27, or 7-34 is selected, the video image window will be displayed for each frame scanned. This window allows you to inspect the actual image. For more information, refer to "Video Image Window" on page 63.

Step 4. Interpret the Evaluation Results

- The log results pane shows test evaluations and indicates if each test passed or failed.
- Click By frame or By test to change the view in the Log Navigator pane.
- In the log navigator pane, double click a frame or test listing to view the corresponding data in the log results pane. Green listings indicate a pass condition, red represents a failure, and yellow represents a skipped item. Notice that the hyphen is not shown for tests. For example, test 7-16 is listed as 716.
- If test 7-19 was performed with Packet Logs selected, a text packet log file was written to the same folder as the data file.

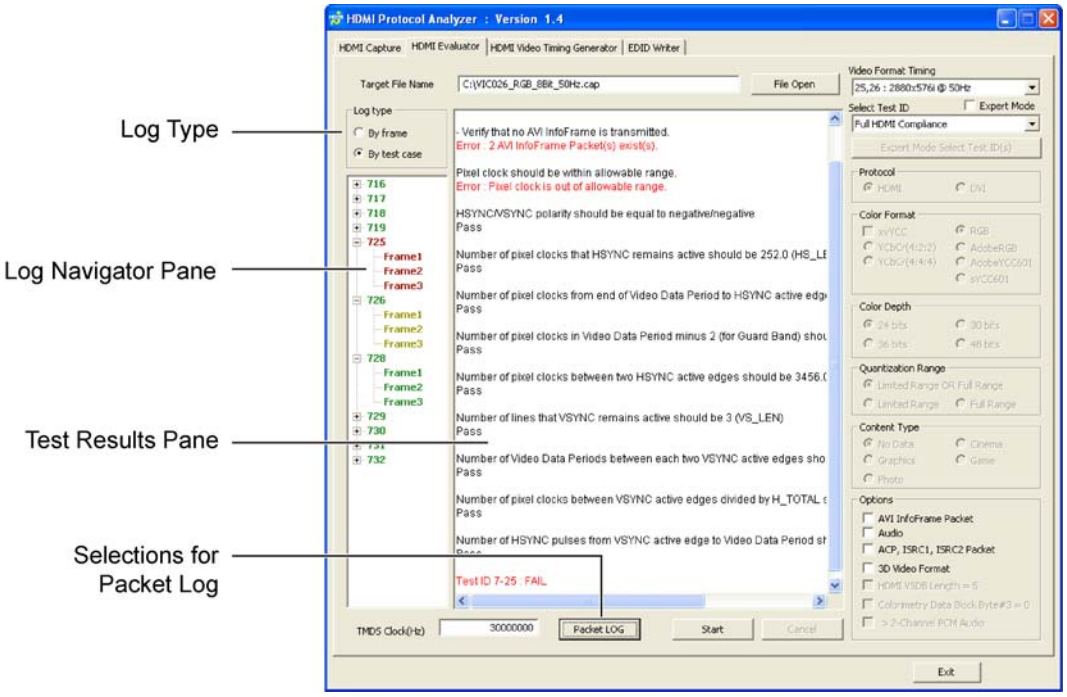


Figure 18 Example Test Results

To Determine Video Format Timing of Video

Use this procedure if you do not know the video format timing of the video output of a source device. During the evaluation of captured data, selecting an incorrect video format timing may result in test failures and the reporting of an error message similar to “CEA–861D Video Format Timing Error” or “CEA–861E Video Format Timing Error”.

NOTE This procedure requires that the video include an AVI InfoFrame.

1. Capture video data from the source device.
2. In the application’s HDMI Evaluator window, click File Open and open the captured data.
3. In the Video Format Timing field, select any Video Identification Code.
4. In the Test ID field, select `(7-27) AVI InfoFrame` which is test 7-27 as shown on Figure 19 on page 45.
5. In the Window’s Options area, select AVI InfoFrame Packet.
6. Click Start and run the test for at least two frames.
7. In the test results pane, look within the log area for a frame for the line Video Format Identification Code. In the example shown in Figure 19, you can see that VIC 10 is identified.
8. In the Video Format Timing field, select the identified video format timing and re-run the test. The test results should not list any video format timing errors.

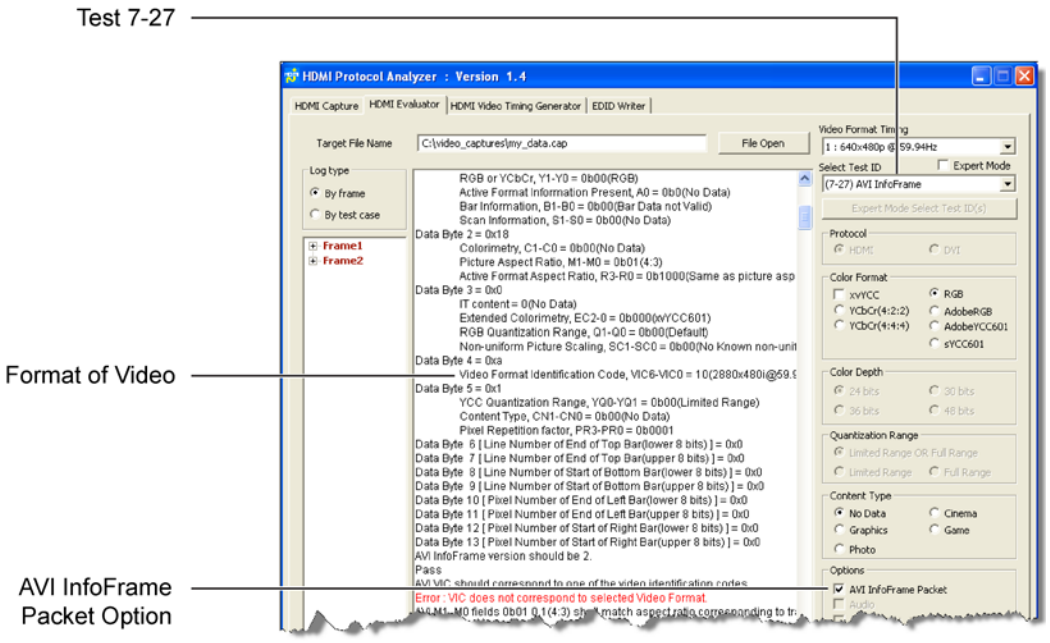


Figure 19 Video Format Shown in Test Results Pane

EDID Writer Window

Use the EDID Writer window to send Extended Display Identification Data (EDID) information to the Device Under Test (DUT) as called out in the HDMI Compliance Test Specification. The 256 bytes of EDID data (block 0 and block 1), indicate to the DUT the capability of the sink device (in this case the N5998A). The EDID data files use the .edi file extension and are installed in the folder shown in Figure 20.

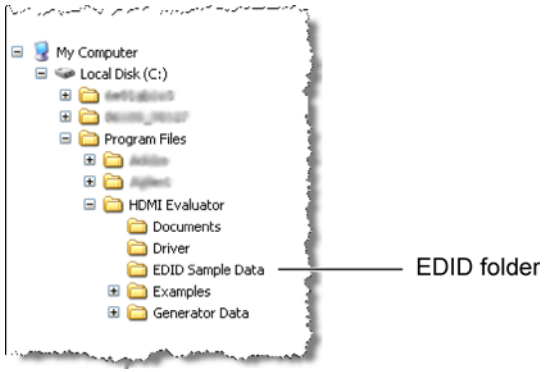


Figure 20 Location of EDID Files

Figure 21 on page 47 shows the EDID Writer window. Click EDID File Open to select an EDID file from the EDID Sample Data folder. Click Download to send the file to the N5998A.

Refer to Table 7 on page 49 for a listing of compliance tests and corresponding EDIDs. Refer to Table 8 on page 51 for a listing of video formats and corresponding EDIDs. For information on the contents of each EDID file, refer to Table 9 on page 53.

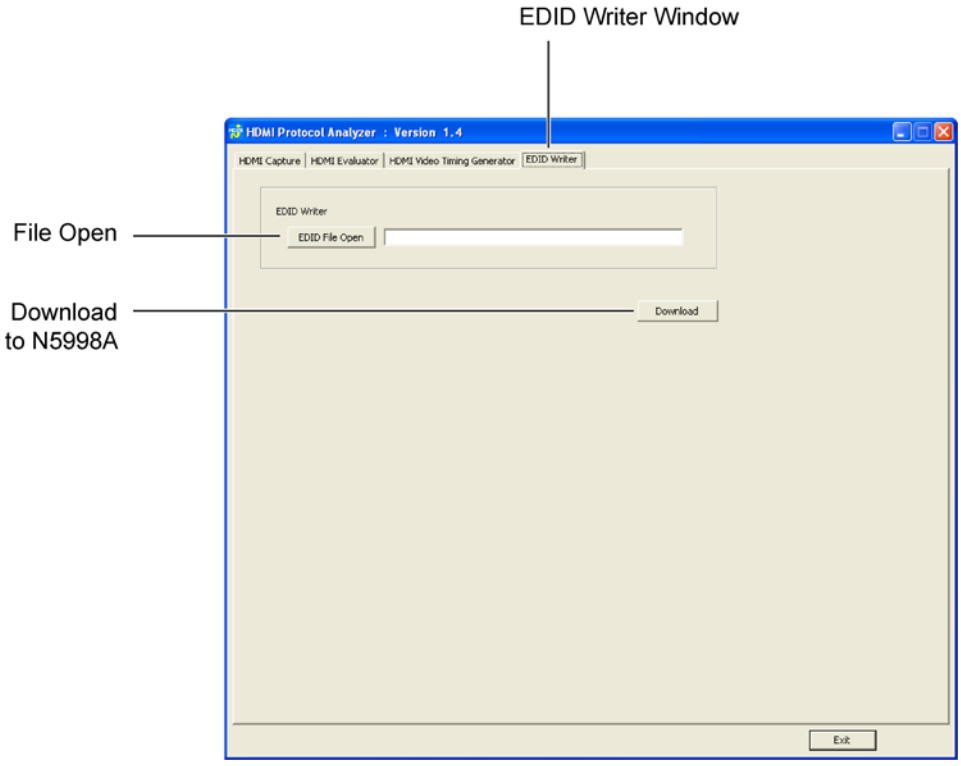


Figure 21 EDID Writer Window

Tests that Use Multiple EDIDs

As shown in Table 7 on page 49, some tests require the use of different EDIDs as called out in the High-Definition Multimedia Interface Compliance Test Specification.

Test 7-19 Packet Types

Table 7 lists EDID files EDID01.edi and EDID03.edi. Download EDID file EDID03.edi, and run the test. Review the test results. If the source device transmitted an ACP, ISRC1, or ISRC2 packet, download EDID file EDID01.edi and repeat the test.

Test 7-28 Audio IEC Compliance

Table 7 lists EDID files EDID01.edi and EDID03.edi. Download EDID file EDID03.edi, if the source device has the capability of outputting multi-channel audio. Else, download EDID01.edi.

Test 7-29, 7-30, 7-31, and 7-32

Table 7 lists EDID files EDID01.edi and EDID03.edi. Download EDID file EDID03.edi, if the source device has the capability of outputting MAT audio. Else, download EDID01.edi.

Test 7-33 Interoperability with DVI

Table 7 lists EDID files EDID01.edi, EDID02.edi, EDID03.edi, and DVI01.edi are used in the test. According to the compliance test specification:

- In step 1 of the specification, download EDID file DVI01.edi. This EDID configures the N5998A 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, download EDID01.edi (for YCbCr 422/444 color space) or EDID02.edi (for RGB color space). Table 9 lists these two EDID files as meeting the required VSDB length.
- In step 7, an EDID with a VSDB length greater than 5 is required. Download EDID03.edi.

Test 7-36 High Bitrate Audio

Table 7 lists EDID files EDID06.edi and EDID07.edi. Download 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, download EDID07.edi.

Table 7 Compliance Tests and Corresponding EDID Files (Sheet 1 of 2)

Test[a]	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	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								•					

Table 7 Compliance Tests and Corresponding EDID Files (Sheet 2 of 2)

Test[a]	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	DVI01.EDI
7-38	3D Video Format Timing *(Requires N5998U-R14 upgrade)*									•				
7-40	Extended Colorimetry *(Requires N5998U-R14 upgrade)*										•			

a Where multiple EDIDs are listed, refer to "Tests that Use Multiple EDIDs" on page 47.

Table 8 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	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 *(Requires N5998U-R14 upgrade)*	8, 9													
720 (1440) x 288p @ 50 Hz *(Requires N5998U-R14 upgrade)*	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									•	•			

Table 8 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	DVI01.EDI
1920 x 1080p @ 25 Hz *(Requires N5998U-R14 upgrade)*	33													
1920 x 1080p @ 29.97 / 30 Hz *(Requires N5998U-R14 upgrade)*	34													
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 *(Requires N5998U-R14 upgrade)*	39													
1920 x 1080i @ 100 Hz *(Requires N5998U-R14 upgrade)*	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						•	•						

Table 9 EDID File Contents (Sheet 1 of 3)

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 [a] CD_Y444 [b] 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		

Table 9 EDID File Contents (Sheet 2 of 3)

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
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		
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

Table 9 EDID File Contents (Sheet 3 of 3)

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
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	
DVI01.EDI							

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

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

HDMI Capture Window

The HDMI Capture window returns HDMI data from the source device and uploads it to the computer. The captured data (up to 4 GB) is saved in a file which can be analyzed using the HDMI Evaluator Window. Refer to "HDMI Evaluator Window" on page 60. To ensure accurate data capture, you must download the EDID information to the N5998A prior to capturing data.

If you need to capture data for testing HDMI 1.4 compliance, the N5998A must have the optional N5998U-R14 upgrade installed. Refer to "Step 2. Check the Capability of the N5998A" on page 23.

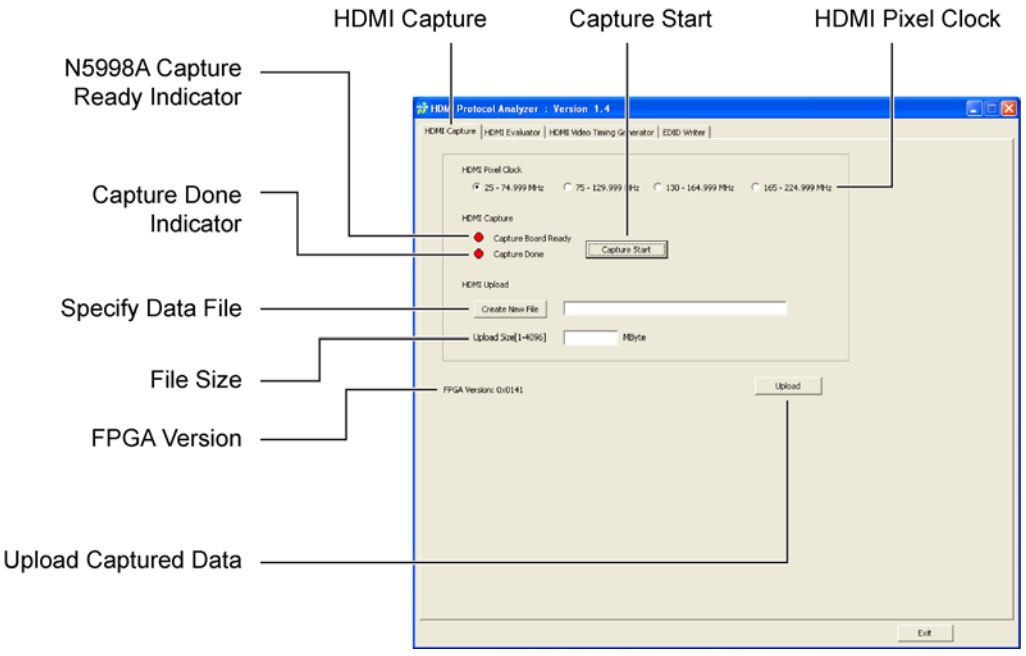


Figure 22 HDMI Capture Window

NOTE To ensure accurate data capture, always download the proper EDID information to the N5998A prior to capturing data. Afterwards, cycle the source device's power or disconnect and then reconnect the HDMI cable from the N5998A's HDMI INPUT connector to force the source device to read the current EDID from the N5998A.

In the HDMI Capture window, the red HDMI Capture indicator turns green when the N5998A is ready to capture data. The Capture Done indicator shows when the capture has completed. Click Capture Start to obtain the data and click Upload to transfer the data to the computer. Captured data file use the file name extension .cap.

Before capturing the data, you must enter the calculated file size in the Upload Size field. The file size should be set between the minimum recommended size shown in Table 10 on page 58 and 4096 MB. The values listed in Table 10 meet the minimum 2-second sample time for the compliance test specification's source audio tests.

File Size Calcuations

The files sizes listed in Table 10 were calculated using the following two equations. A 10% margin is included, because the data file does not typically start exactly at the beginning of a frame. One pixel requires 64 bits (8 bytes) in the target file. For progressive formats:

$$2\text{s file size} = (H_{\text{total}} \times V_{\text{total}} \times 8)(V_{\text{frequency}} \times 2)(1.1)$$

For interlaced formats:

$$2\text{s file size} = (H_{\text{total}} \times V_{total} \times 8)(V_{\text{frequency}})(1.1)$$

The H_{total}, V_{total}, and $V_{frequency}$ values are listed in the HDMI Standard. For 30-bit deep color, the 2-second file size is multiplied by 1.25. For 36-bit deep color, file size is multiplied by 1.5. For 48-bit deep color, file size is multiplied by 2.0.

For example, a 476 MB file size is required for testing 2 seconds of 720 x 480p at 60 Hz with a standard color depth:

$$475{,}675{,}200 \text{ bytes} = 858 \times 525 \times 8 \times 60 \times 2 \times 1.10$$

Table 10 Recommended Minimum Capture File Size in MB (Sheet 1 of 2)

CEA Video ID Code	Format[a]	File Size for Minimum Two-Second Sample[b]			
		Standard Color Depth	30-Bit Deep Color	36-Bit Deep Color	48-Bit Deep Color
1	640 x 480 @ 59.94 / 60 Hz	444 MB	555 MB	666 MB	888 MB
2, 3	720 x 480 @ 59.94 / 60 Hz	476 MB	595 MB	714 MB	952 MB
4	1280 x 720 @ 59.94 / 60 Hz	1307 MB	1634 MB	1961 MB	2614 MB
5	1920 x 1080i @ 59.94 / 60 Hz	654 MB	818 MB	981 MB	1308 MB
6, 7	1440 x 480i @ 59.94 / 60 Hz	238 MB	298 MB	357 MB	476 MB
8, 9	720 (1440) x 240p @ 59.94 / 60 Hz	477 MB	597 MB	716 MB	954 MB
10, 11	2880 x 480i @ 59.94 / 60 Hz	476 MB	595 MB	714 MB	952 MB
12, 13	2880 x 240p @ 59.94 / 60 Hz	954 MB	1193 MB	1431 MB	1908 MB
14, 15	1440 x 480p @ 59.94 / 60 Hz	952 MB	1190 MB	1428 MB	1904 MB
16	1920 x 1080p @ 59.94 / 60 Hz	2614 MB	3268 MB	3921 MB	5228 MB
17, 18	720 x 576p @ 50Hz	476 MB	595 MB	714 MB	952 MB
19	1280 x 720p @ 50Hz	1307 MB	1634 MB	1961 MB	2614 MB
20	1920 x 1080i @ 50 Hz	654 MB	818 MB	981 MB	1308 MB
21, 22	720 (1440) x 576i @ 50 Hz	238 MB	298 MB	357 MB	476 MB
23, 24	720 (1440) x 288p @ 50 Hz	478 MB	598 MB	717 MB	956 MB
25, 26	2880 x 576i @ 50 Hz	476 MB	595 MB	714 MB	952 MB
27, 28	2880 x 288p @ 50 Hz	955 MB	1194 MB	1433 MB	1910 MB
29, 30	1440 x 576p @ 50 Hz	951 MB	1189 MB	1427 MB	1902 MB
31	1920 x 1080p @ 50 Hz	2614 MB	3268 MB	3921 MB	5228 MB
32	1920 x 1080p @ 23.98 / 24 Hz	1307 MB	1634 MB	1961 MB	2614 MB
33	1920 x 1080p @ 25 Hz	1307 MB	1634 MB	1961 MB	2614 MB
34	1920 x 1080p @ 29.97 / 30 Hz	1307 MB	1634 MB	1961 MB	2614 MB
35, 36	2880 x 480p @ 59.94 / 60 Hz	1903 MB	2379 MB	2855 MB	3806 MB
37, 38	2880 x 576p @ 50 Hz	1901 MB	2377 MB	2852 MB	3802 MB
39	1920 x 1080i (1250 total) @ 50 Hz	634 MB	793 MB	951 MB	1268 MB
40	1920 x 1080i @ 100 Hz	1307 MB	1634 MB	1961 MB	2614 MB
41	1280 x 720p @ 100 Hz	2614 MB	3268 MB	3921 MB	5228 MB
42, 43	720 x 576p @ 100 Hz	951 MB	1189 MB	1427 MB	1902 MB

Table 10 Recommended Minimum Capture File Size in MB (Sheet 2 of 2)

CEA Video ID Code	Format[a]	File Size for Minimum Two-Second Sample[b]			
		Standard Color Depth	30-Bit Deep Color	36-Bit Deep Color	48-Bit Deep Color
44, 45	720 (1440) x 576i @ 100 Hz	951 MB	1189 MB	1427 MB	1902 MB
46	1920 x 1080i @ 119.88 / 120 Hz	2614 MB	3268 MB	3921 MB	5228 MB
47	1280 x 720p @ 119.88 / 120 Hz	2614 MB	3268 MB	3921 MB	5228 MB
48, 49	720 x 480p @ 119.88 / 120 Hz	952 MB	1190 MB	1428 MB	1904 MB
50, 51	720 (1440) x 480i @ 119.88 / 120 Hz	952 MB	1190 MB	1428 MB	1904 MB
52, 53	720 x 576p @ 200 Hz	1901 MB	2377 MB	2851 MB	3802 MB
54, 55	720 (1440) x 576i @ 200 Hz	1901 MB	2377 MB	2851 MB	3802 MB
56, 57	720 x 480p @ 239.76 / 240 Hz	1903 MB	2379 MB	2855 MB	3806 MB
58, 59	720 (1440) x 480i @ 239.76 / 240 Hz	1903 MB	2379 MB	2855 MB	3806 MB
60	1280 x 720p @ 23.98 / 24 Hz	1046 MB	1308 MB	1569 MB	2092 MB
61	1280 x 720p @ 25 Hz	1307 MB	1634 MB	1961 MB	2614 MB
62	1280 x 720p @ 29.97 / 30 Hz	1307 MB	1634 MB	1961 MB	2614 MB

a The letter "p" indicates progressive format. The letter "i" indicates interlaced format. If "p" or "i" is not indicated, the values listed are for progressive format.

b Includes 10% margin.

NOTE **Unsupported Video**. Video can not be captured if it uses video ID code 16, 40, 41, 46, or 48 *and* contains 48-bit deep color or 3D video.

NOTE **FPGA Version.** When the N5998A is connected to the PC and is turned on, the application reads the version number of the N5998A's field-programmable gate array (FPGA) and displays the version number on the Capture window as seen in Figure 22 on page 56. This information is used by Agilent for troubleshooting purposes. In addition, certain HDMI 1.4 sink tests require an FPGA version greater than 0x0141, as explained in "Test 8-25. Deep Color" on page 88. To upgrade the FPGA version, purchase the N5998U-R14 upgrade as described in "Step 2. Check the Capability of the N5998A" on page 23.

HDMI Evaluator Window

Use the application's HDMI Evaluator window to test previously captured HDMI data. No equipment is required as the evaluation is performed on data files that have been saved on the computer. Non-861D format is supported for test 7-33 Interoperability with DVI only.

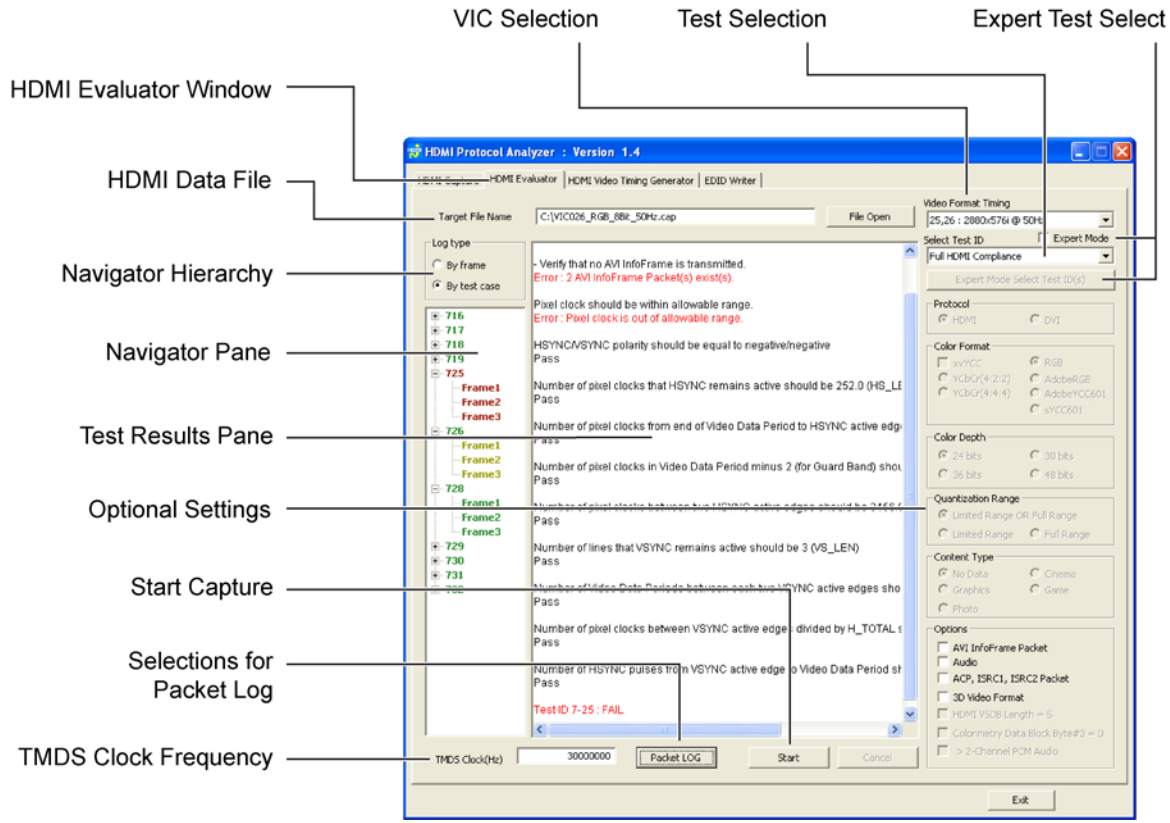


Figure 23 Evaluator Window with Test Results

To evaluate captured data, you need perform the following steps within the Capture window:

1 Open a captured HDMI data file.

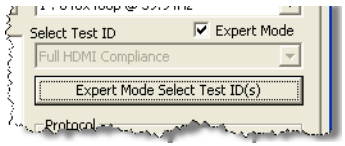
2 Select the Video Format Timing used to format the data.

3 Select the tests that you want to run.

4 Enter the TMDS clock frequency, if enabled for the selected tests.

5 Click Start.

In the window's Test ID field, selecting Full HDMI Compliance runs the tests indicated in column two of Table 11 on page 66. Depending on the tests selected, you may need to enter the TMDS clock frequency for the data and have the ability to select optional settings.



Selecting Expert Mode enables the Expert Mode Select Test ID(s) button which allows you to have complete control of which tests to run on the data. As the name implies, this feature is not required for normal testing but is provided for troubleshooting and experimenting by advanced users.

When you click Start, the tests are performed in every frame repeatedly from the beginning of the first complete frame. 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 file must have the HDMI data for more than 2 seconds.

Navigator and Test Results Panes

The test results are shown in the Capture window's Test Results pane as seen in Figure 23. Use the Navigator pane to jump to sections of the Test Results pane. In the Navigator pane, double click either a test or frame to select the data to view. A green colored test or frame label indicates a pass condition, red colored label represents a failure, and 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

Click Start to run an evaluation and all of 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 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.

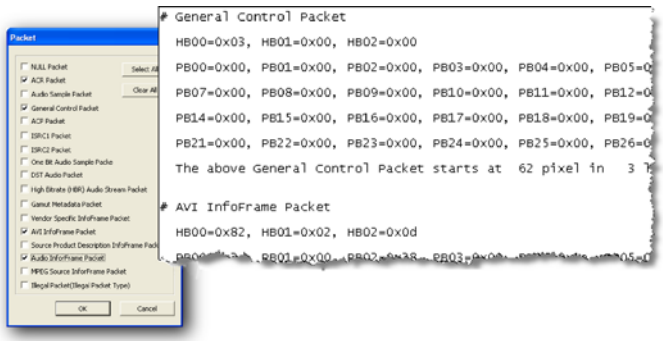


Figure 24 Packets Selected for Packet Log and Example Log File

Video Image Window

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. Figure 25 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.

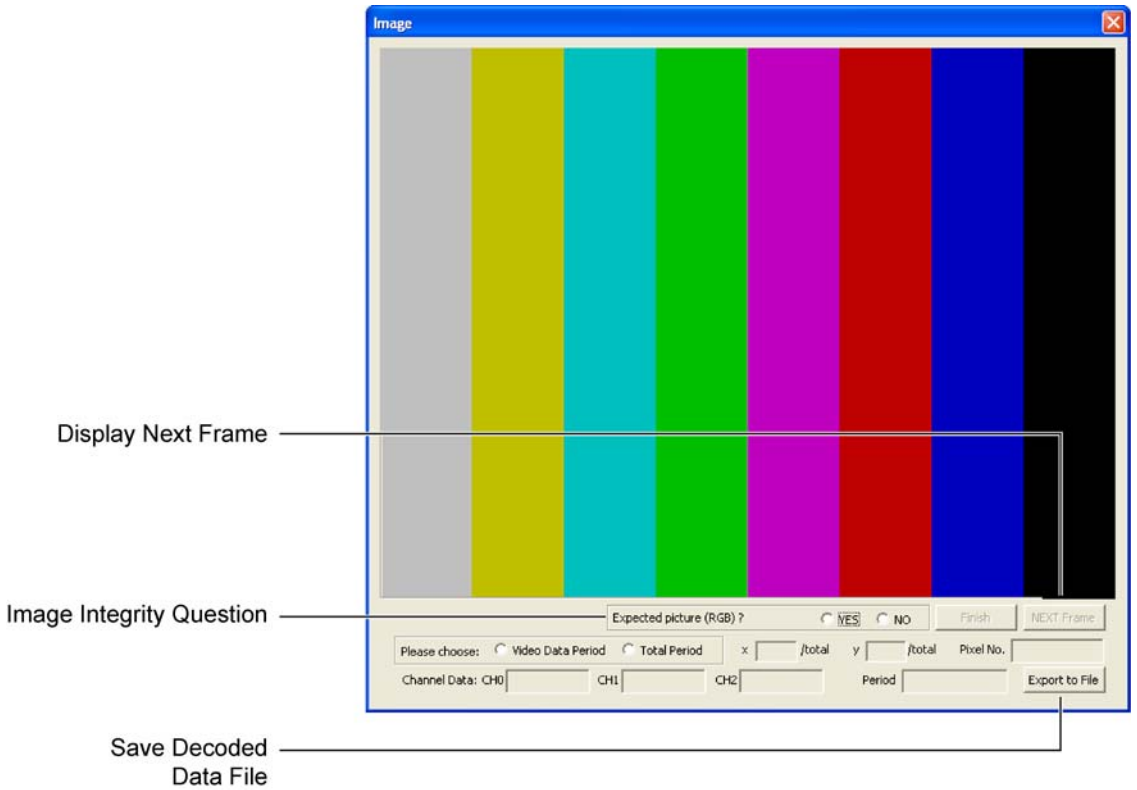


Figure 25 Video Image Window for Test 23 and Test 24

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

Table 11 Source Tests (Sheet 1 of 2)

Test ID	Test Name	Requires N5998U-R14 Upgrade	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									•

Table 11 Source Tests (Sheet 2 of 2)

Test ID	Test Name	Requires N5998U-R14 Upgrade	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
7-37	One Bit Audio									•
7-38	3D Video Format Timing	•		•		•			•	•
7-40	Extended Colorimetry	•				•		•	•	•

4 Testing Sink Devices

Use the HDMI Video Timing Generator window to run the supported Compliance Test Specification's sink tests. Refer to Table 12 on page 71 for a list of supported tests. Figure 26 on page 70 identifies various items found on the HDMI Video Timing Generator window. After configuring the video, click Start and the N5998A generates the signal at the front-panel HDMI OUTPUT connector.

If you need full capability to test sink devices for HDMI 1.4 compliance, the N5998A must have the optional N5998U-R14 upgrade installed. Refer to "Step 2. Check the Capability of the N5998A" on page 23.

These are the general steps for testing sinks:

1. Select the folder with the appropriate video generator files.
2. Select the Video Format Timing.
3. Select a specific video generator file.
4. Select Audio, if needed.
5. Click Start.

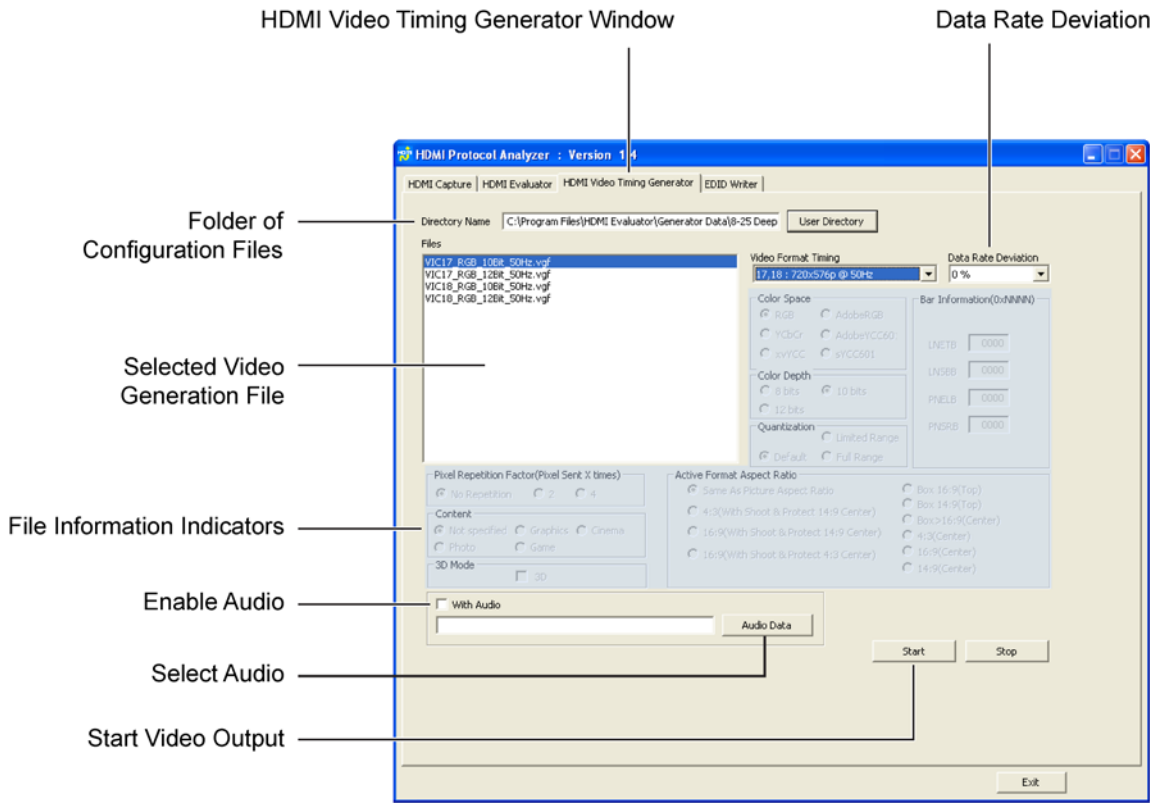


Figure 26 HDMI Video Timing Generator Window

When you select a video generator file, the file's attributes are displayed in the portion of the window labeled File Information Indicators in Figure 26. The video generator files (.vgf file extension) and audio generator files (.agf file extension) are installed in the folders shown in Figure 27 on page 72.

NOTE For a given test, some video format timing selections do not result in a listing of generator files. Select a proper video format timing for the test.

Table 12 Sink Tests Supported by the N5998A

Test ID	Test Name	Requires N5998U-R14 Upgrade
Sink Protocol		
8-16	Acceptance of all Valid Packet Types	
Sink Audio		
8-21	Audio Clock Regeneration	
8-22	Audio Sample Packet Jitter	
8-23	Audio Formats	
Sink Interoperability with DVI		
8-24	Interoperability with DVI	
Sink Advanced Features		
8-25 [a]	Deep Color	
8-29	3D Video Format Timing	•
8-31	AVI InfoFrame Colorimetry	•

a Test 8-25 requires an N5998A and an E4887A TMDS Signal Generator.

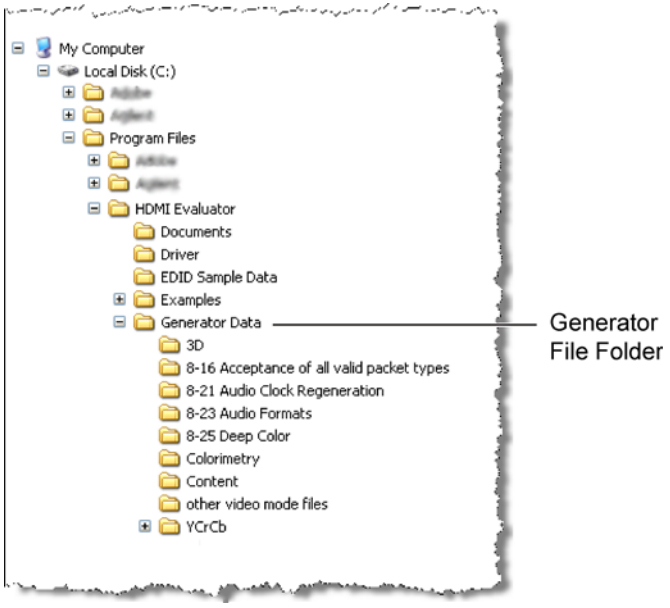


Figure 27 Location of Video and Audio Generator Files

Video and audio generator files use the naming convention shown in Figure 28 and Figure 29.

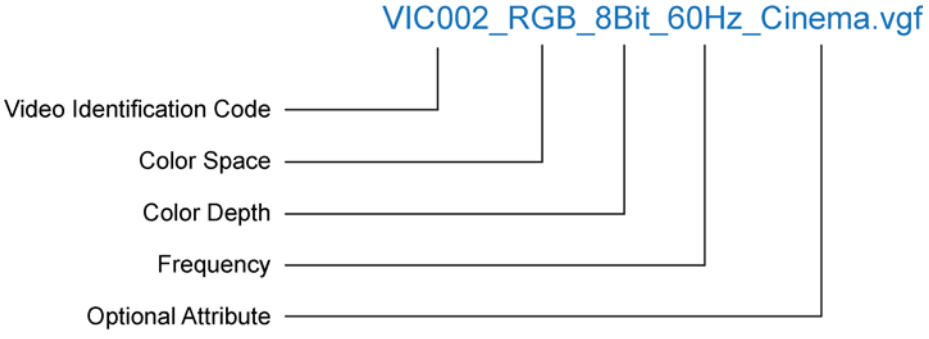


Figure 28 File Naming Convention for Video Generator Files

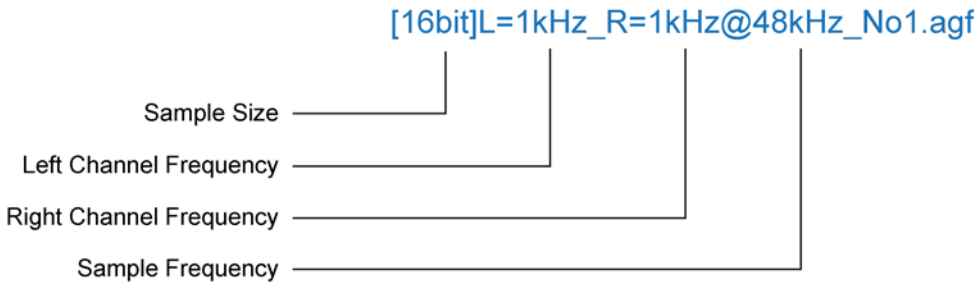


Figure 29 File Naming Convention for Audio Generator Files

Table 13 Supported Video Format Timings (Sheet 1 of 2)

CEA Video Identification Code	Format	Requires N5998U-R14 Upgrade
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	•

Table 13 Supported Video Format Timings (Sheet 2 of 2)

CEA Video Identification Code	Format	Requires N5998U-R14 Upgrade
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	•
61	1280 x 720p @ 25 Hz	•
62	1280 x 720p @ 29.97 / 30 Hz	•

To Test a Sink Device

1 Connect the devices as shown in Figure 30.

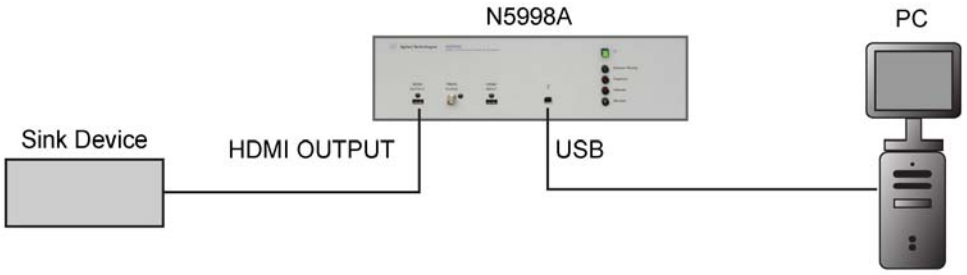


Figure 30 HDMI Video Timing Generator Setup

2 Start the HDMI Protocol Analyzer application and click the HDMI Video Timing Generator tab.

3 Click User Directory (① in Figure 31) and select the *folder* that contains the video generator files. Figure 32 shows how the generator file folders are organized in according to tests or types of video.

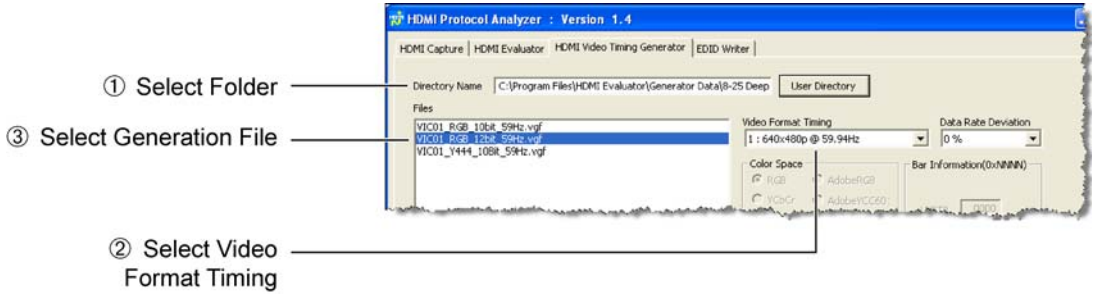


Figure 31 Selecting the Video

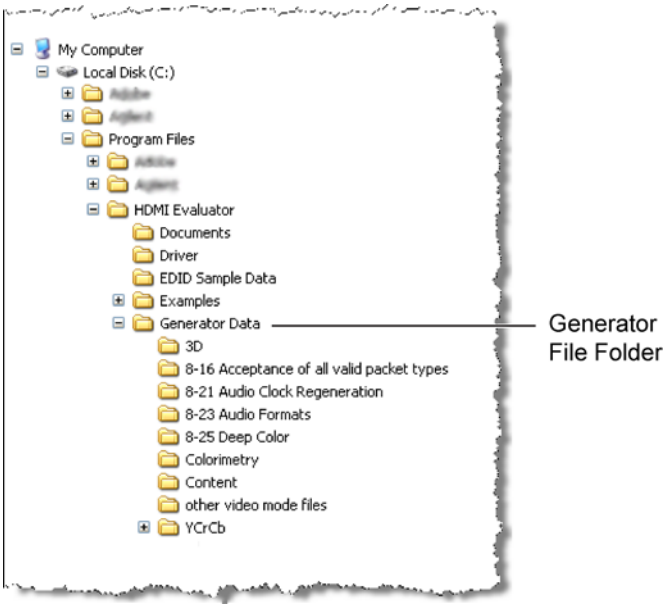


Figure 32 Location of Video and Audio Generator Files

4 Select the Video Format Timing (②) you want to generate.

5 Any available generator files appear in the Files list. From the Files list, select the desired video generator file (③).

NOTE For a given test, some video format timing selections do not result in a listing of generator files. Select a proper video format timing for the test.

NOTE When you select a video generator file, the file attributes are shown in the window.

6 If required, enter the Data Rate Deviation from the standard TMDS clock frequeny: 0%, +0.5%, or –0.5%.

7 For tests 8-21, 8-22, and 8-23, audio must be present on the video. Do the following steps.

a Select With Audio in the window.

b Click Audio Data to open the Audio Data Generator dialog box.

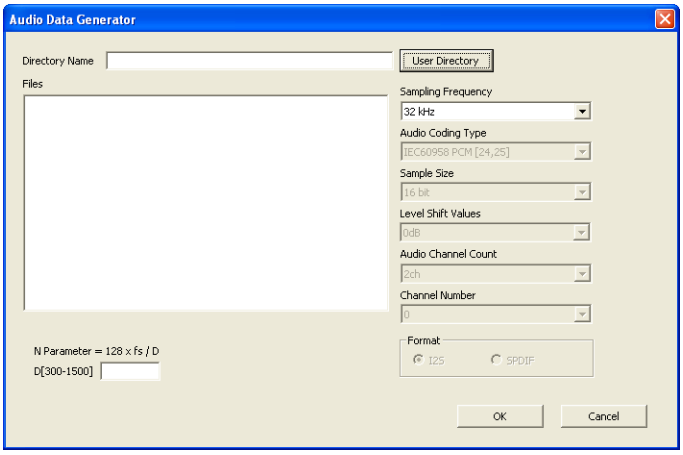


Figure 33 Audio Data Generator Dialog Box

c Click User Directory and select the folder which contains the audio generator files.

d In the Sampling Frequency field, select the required sampling frequency. The appropriate audio generator file appears in the Files list. For test 8-21 the file `16bit]L=1kHz_R=1kHz@48kHz_No1.agf` is selected. For test 8-23, the sample frequencies and files are used:
`16bit]L=1kHz_R=1kHz@32kHz_No1.agf` (32 kHz),
`[16bit]L=1kHz_R=1kHz@44kHz_No1.agf` (44.1 kHz), and
`[16bit]L=1kHz_R=1kHz@48kHz_No1.agf` (48 kHz).

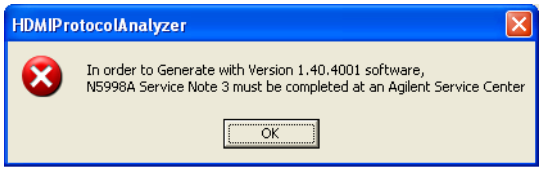
NOTE If a selected sampling frequency does not display a file, select a different sampling frequency.

NOTE The attributes of audio generator file are shown in the window.

e Click OK to close the Audio Data Generator dialog box.

8 Click Start. The N5998A's front-panel Output indicator light (yellow) turns on, and a progress bar appears as the video generator file is downloaded to the N5998A.

NOTE If the following dialog box opens, you need to purchase upgrade N5998U-R14 for the N5998A. Refer to "Step 2. Check the Capability of the N5998A" on page 23.



NOTE If no sink device is connected to N5998A's HDMI OUTPUT connector, Error no HPD appears. Connect the sink device and click OK.

9 Click Stop when you want to turn off the HDMI output on the N5998A.

Test 8-16. Acceptance of all Valid Packet Types

Video generator files for test 8-16 are located in installation folders shown in Figure 34. Each file is dedicated for one of the packet types. The specific packet is sent repeatedly.

Table 14 on page 81 lists the files provided for the two required video format timings: 720 x 480p or 720 x 576p.

Table 15 on page 83 lists the packet type supported by each video generator file.

Table 16 on page 84 lists the contents of each packet.

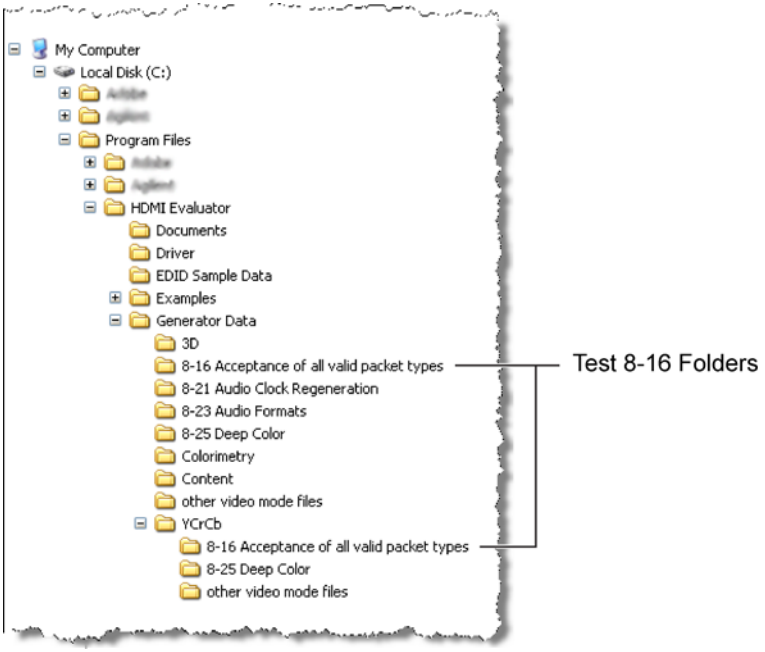


Figure 34 Location of Test 8-16 Folders

Table 14 Video Format Timings and Video Generator Files (Sheet 1 of 2)

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

Table 14 Video Format Timings and Video Generator Files (Sheet 2 of 2)

CEA Video Identification Code	Video Format Timings	Color Space			File Name
		RGB	YCbCr	xvYCC	
	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 15 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	•						1[a]	2[b]					
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					•								
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														•

a Always output

b Always output when any audio generator file is selected

Table 16 Contents of Packet

Description	Header[a]	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[b]
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[c]
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[d]
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

a Packet data is shown in hexadecimal

b Clear_AVMUTE = 1

c Set_AVMUTE = 1

d Agilent company ID = 00 0C 03

Test 8-21. Audio Clock Regeneration

Video and audio generator files for test 8-21 are located in the installation folder shown in Figure 35.

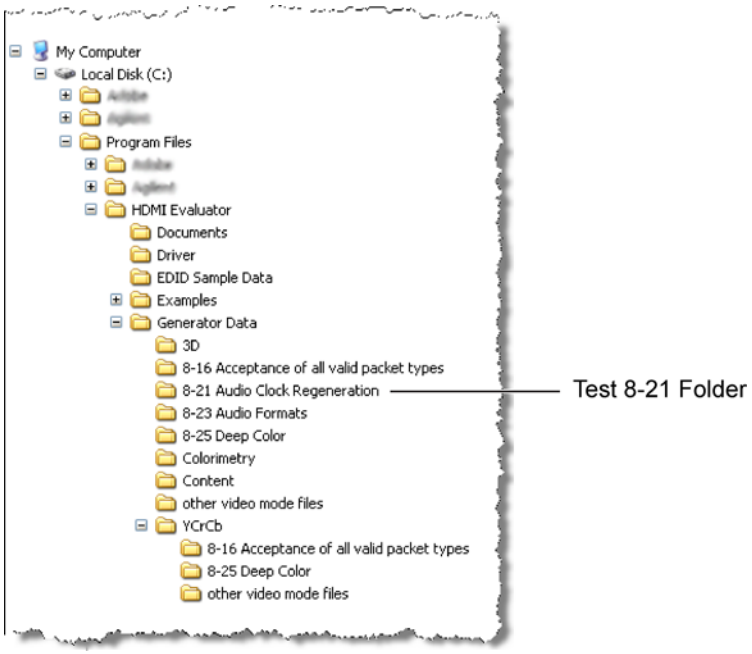


Figure 35 Location of Test 8-21 Folder

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.

Enter the *D* into the Audio Data Generator dialog box as shown in Figure 36.

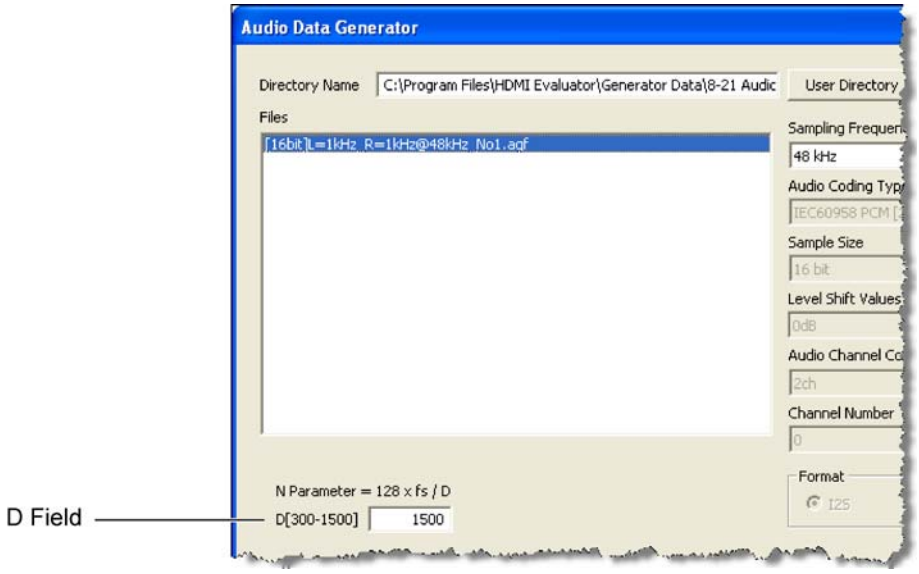


Figure 36 D Field of Audio Data Generator Dialog Box

Test 8-23. Audio Formats

Video and audio generator files for test 8-23 are located in the installation folder shown in Figure 37. 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.

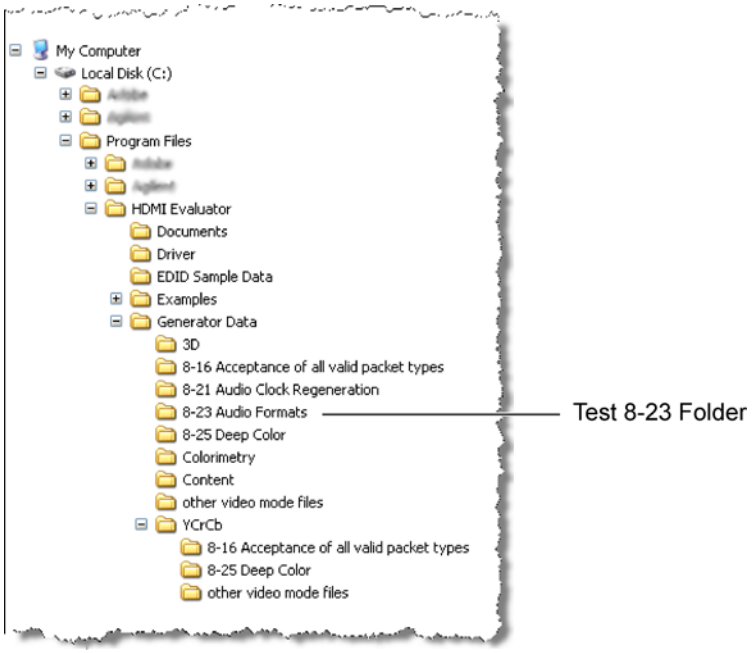


Figure 37 Location of Test 8-23 Folder

Test 8-25. Deep Color

Video and audio generator files for test 8-25 are located in the installation folder shown in Figure 38. Table 17 on page 89 lists the available video generator files.

NOTE **N5998U-R14 Upgrade.** HDMI 1.4 sink tests that use VIC 32 with 3D color require an N5998A that has upgrade N5998U-R14 installed. The N5998U-R14 upgrades the N5998A's field-programmable gate array (FPGA) to a version greater than 0x0141. When the upgrade is installed, a notification label is attched to the N5998A's rear panel. The application automatically confirms if the N5998A has been upgraded whenever an N5998A is connected to the PC and is turned on.

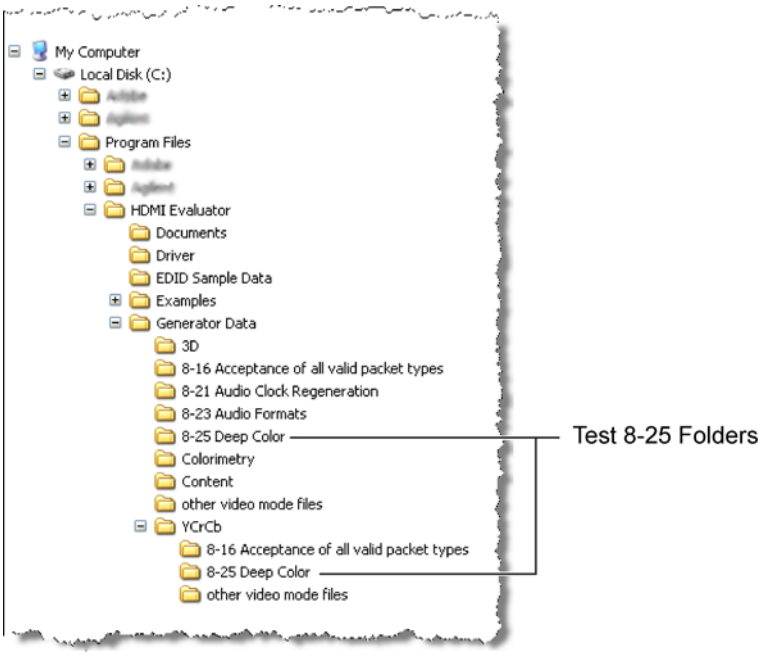


Figure 38 Location of Test 8-25 Folder

Table 17 Video Generator Files for Test ID 8–25 (Sheet 1 of 13)

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

Table 17 Video Generator Files for Test ID 8–25 (Sheet 2 of 13)

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_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
	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

Table 17 Video Generator Files for Test ID 8–25 (Sheet 3 of 13)

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 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
	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

Table 17 Video Generator Files for Test ID 8–25 (Sheet 4 of 13)

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, 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
	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

Table 17 Video Generator Files for Test ID 8–25 (Sheet 5 of 13)

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, 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

Table 17 Video Generator Files for Test ID 8–25 (Sheet 6 of 13)

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, 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
	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

Table 17 Video Generator Files for Test ID 8–25 (Sheet 7 of 13)

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	
	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
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

Table 17 Video Generator Files for Test ID 8–25 (Sheet 8 of 13)

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 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
	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

Table 17 Video Generator Files for Test ID 8–25 (Sheet 9 of 13)

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, 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

Table 17 Video Generator Files for Test ID 8–25 (Sheet 10 of 13)

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, 59.94 Hz			•	•					•	VIC35_Y444_8Bit_59Hz_RPT04.vgf
	2880 x 480p, 60 Hz			•	•			•			VIC35_Y444_8Bit_60Hz.vgf
	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

Table 17 Video Generator Files for Test ID 8–25 (Sheet 11 of 13)

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_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
	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

Table 17 Video Generator Files for Test ID 8–25 (Sheet 12 of 13)

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	•			•					•	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
	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

Table 17 Video Generator Files for Test ID 8–25 (Sheet 13 of 13)

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_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 Importing Captured Data into a Logic Analyzer

You can gain additional insights into video frames that have errors by inspecting the captured data in a logic analyzer. The Generate Module CSV from HDMI Capture File conversion utility converts captured N5998A data files into a CSV (comma separated values) file that can be imported into a logic analyzer.

Before you can use the conversion utility described in this chapter, you must purchase and install the N5998U-DBG software license upgrade for debug explorer. To install the license, refer to "Step 6. Install the Conversion Utility (Optional)" on page 30.

NOTE The conversion utility is installed with the HDMI Protocol Analyzer and Generator. On the Windows Start menu, select All Programs > HDMI Evaluator > Generate CSV.

Converting a Captured Data File

If the captured data file uses interlaced formatting and you want to convert a range of frames, read "Determining Frame Numbers for Interlaced Formats" on page 105.

1 On the Windows Start menu, select All Programs > HDMI Evaluator > Generate CSV to open the conversion utility.

2 In the Input file name field, browse for the capture file that you want to convert. The file should have the .cap file extension.

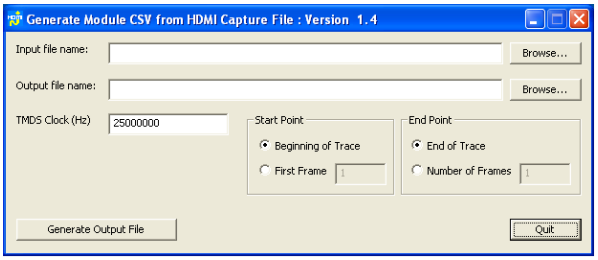


Figure 39 The Conversion Application

3 In the Output file name field, browse to a folder and enter a name for the converted file. Use the .csv file extension.

4 In the TMDS Clock (HZ) field, enter the TMDS clock frequency for the captured data file.

5 Use the Start Point and End Point fields to select the portion of the file to convert. Converting just the frames that need to be inspected can greatly reduce conversion times and the resulting file size.

- To convert the entire file, select Beginning of Trace and End of Trace.
- To convert a range of frames, enter the starting frame in the First Frame field. And, in the Number of Frames field, enter the number of frames to convert.

NOTE For progressive formatted video data, selecting a range of frames is simple because there is a direct correspondence between frame numbers in the captured and converted data files. For interlaced formatting, the frame numbers no longer correspond and you must calculate the frames as described in "Determining Frame Numbers for Interlaced Formats" on page 105.

NOTE To properly evaluate a frame, always include the frame before and after in the desired frame in the conversion. For example, to analyzer frame 86, set the First Frame field to 85 and the Number of Frames to 3.

NOTE When an entire data file is converted, conversion times can be quite long and require 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.

6 Click Generate Output File to convert the file.

Determining Frame Numbers for Interlaced Formats

In interlaced formats, there are two converted frames for every frame in the captured data file.

1 In a text editor, open the test evaluation log file that corresponds to the captured data file.

2 At the top of the file, locate the number of pixels discarded as shown in Figure 40. This is the pixel offset for the first frame.

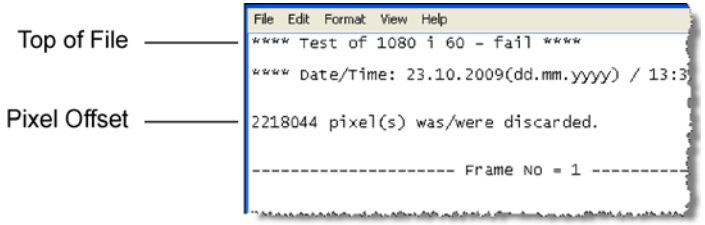


Figure 40 Pixel Offset to First Frame

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 pixels-per-frame as shown in Figure 41.

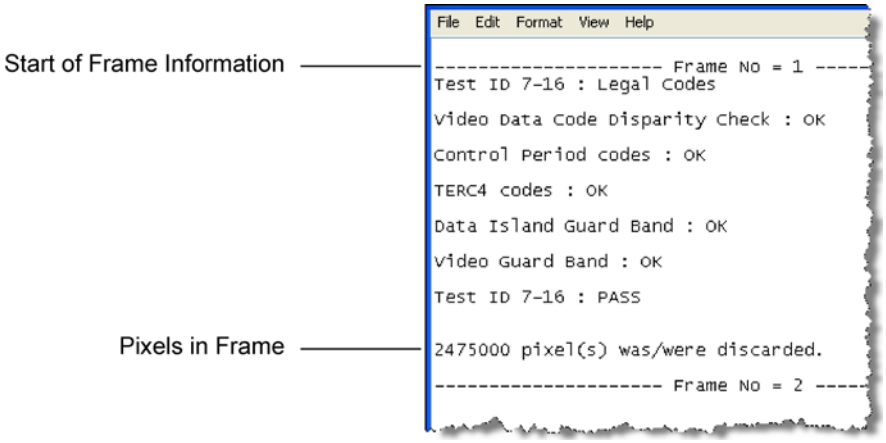


Figure 41 Pixels-Per-Frame Value

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:

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

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:

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

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.

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

NOTE For each extra frame that you wish to convert, add 2 to the number you enter in the Number of Frames field.

Locating Errors in a Converted File

After converting a file, you will need to identify the precise pixel where an error occurs within the converted data file. To identify an error location:

1 Open an N5998A compliance test log that corresponds to the converted data file.

2 Within the log file, identify the location of errors by the frame, line, and pixel as shown in Figure 42. In this figure, the first error is located in Frame 189, Line 924, at pixel 413.

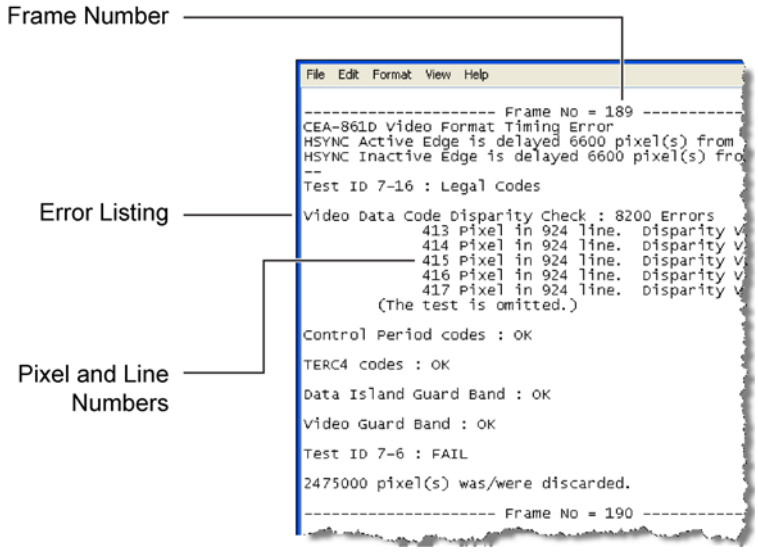


Figure 42 Error Pixel and Line Locations in Log File

3 Use the following equation to locate the 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 43. This is the pixel offset for the first frame.

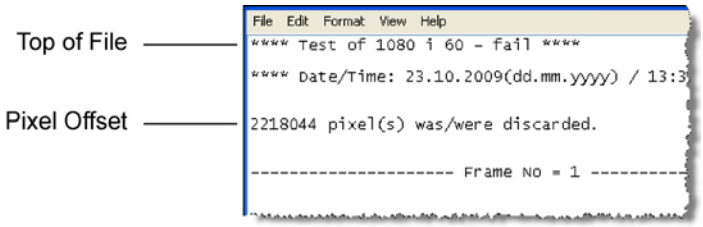


Figure 43 Pixel Offset to First Frame

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. See Figure 44, "Pixels-Per-Frame Value," on page 110.

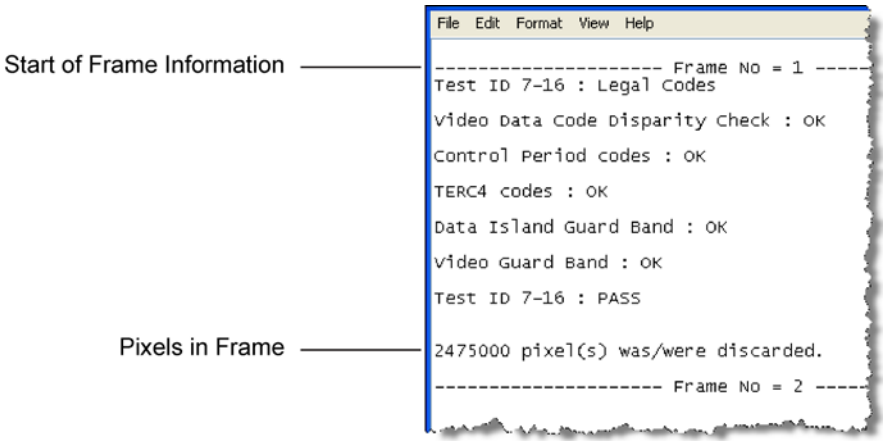


Figure 44 Pixels-Per-Frame Value

pixels/line is listed in Table 18 on page 111 for each video code. Pixels-per-line is not recorded in the log file.

Table 18 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

Table 18 Pixels/Line per VIC (Sheet 2 of 2)

CEA Video ID Code	Format	Pixels/Line
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
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 a Logic Analyzer

Progressive Format

If the original captured data file was a progressive format, the converted data will appear on the logic analyzer as shown in Figure 45. All the pixels up to the first frame have been discarded by the N5998A, because they are not a complete frame. The first complete frame, as shown in this figure, is considered frame 1.

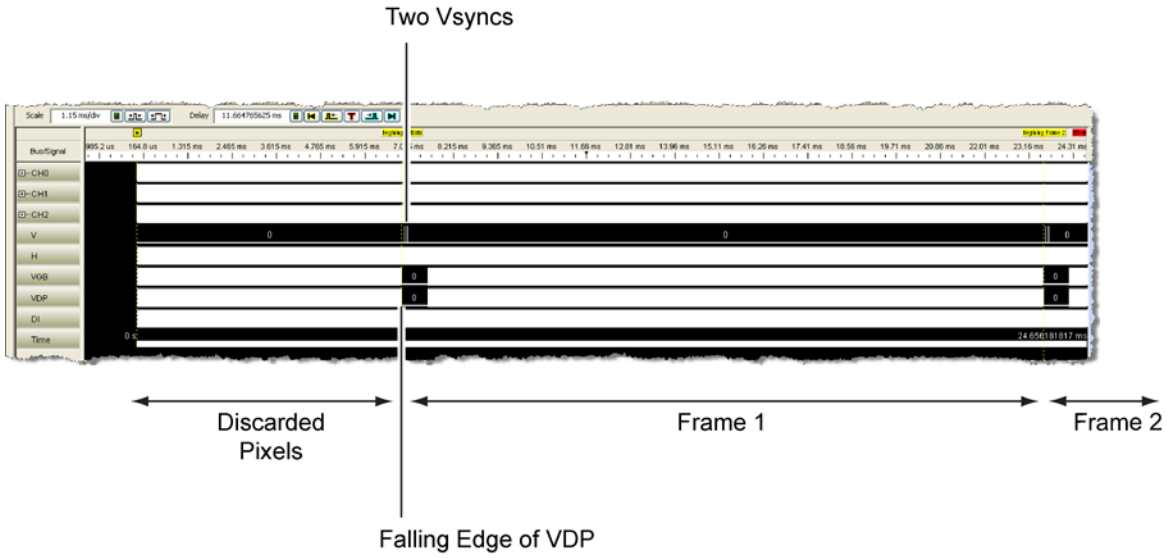


Figure 45 First Frame Displayed on Logic Analyzer

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 N5998A), the last frame ends with the last falling edge of the VDP as shown in Figure 46 on page 114.

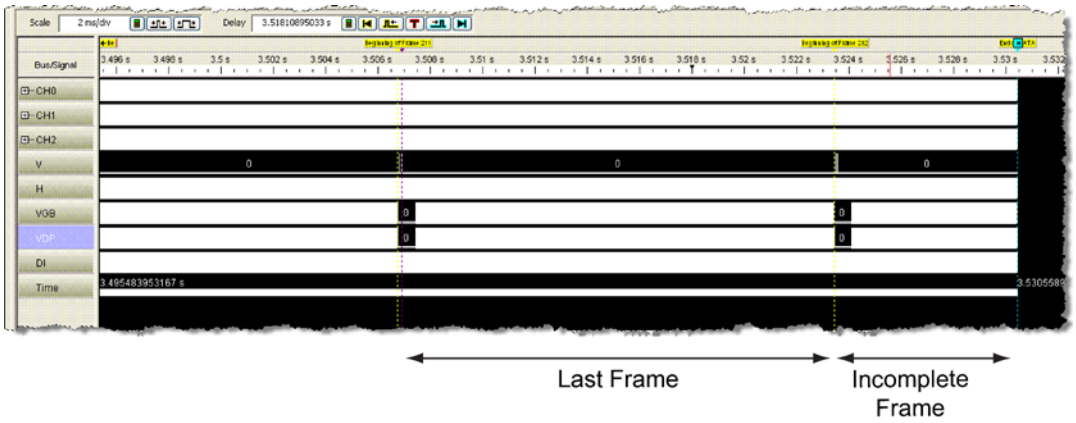


Figure 46 Last Frame Displayed on Logic Analyzer

The first line starts at a frame's first pixel and continues for the numbers of pixels in a line. See Figure 47. The pixels-per-line is unique to the format as listed in Table 18 on page 111. 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 48 and Figure 49.

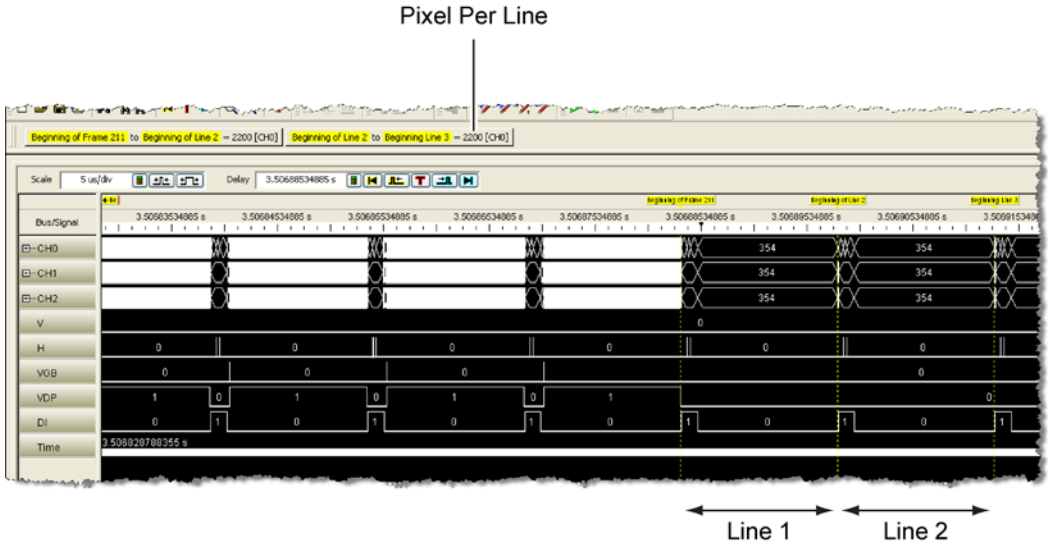


Figure 47 The Beginning of Line

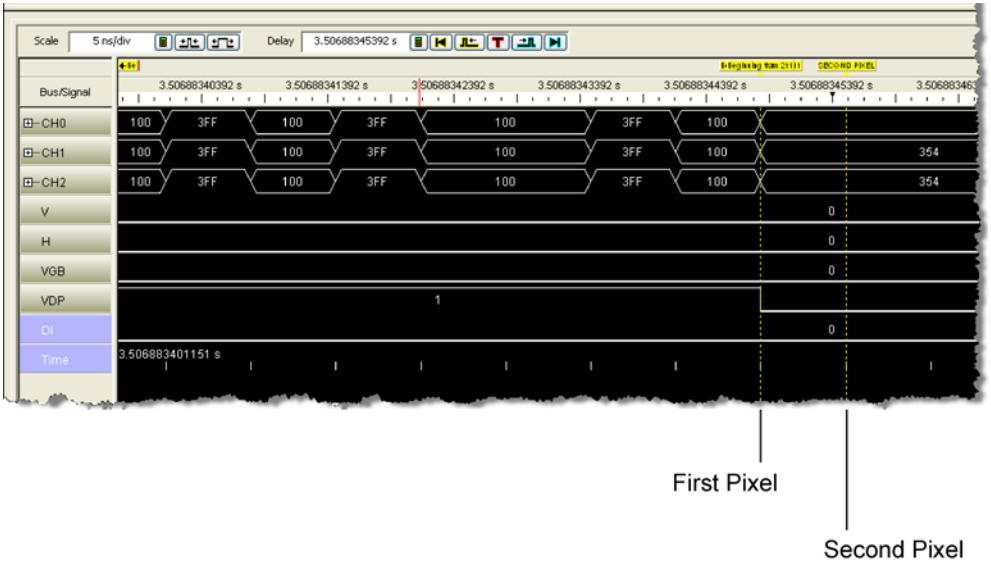


Figure 48 Pixels in Waveform View

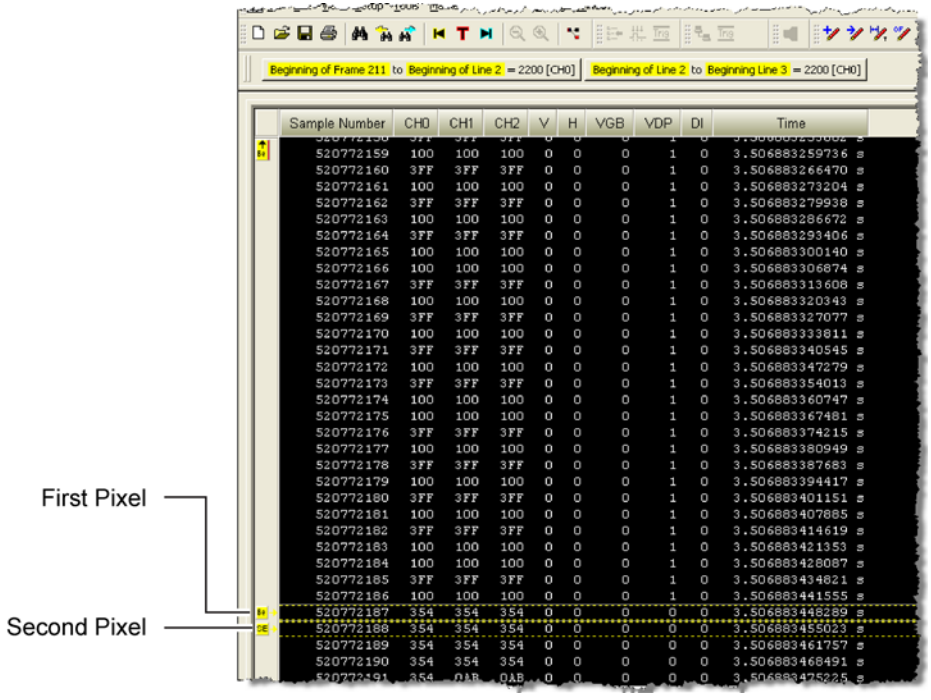


Figure 49 Pixels in Listing View

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 50.

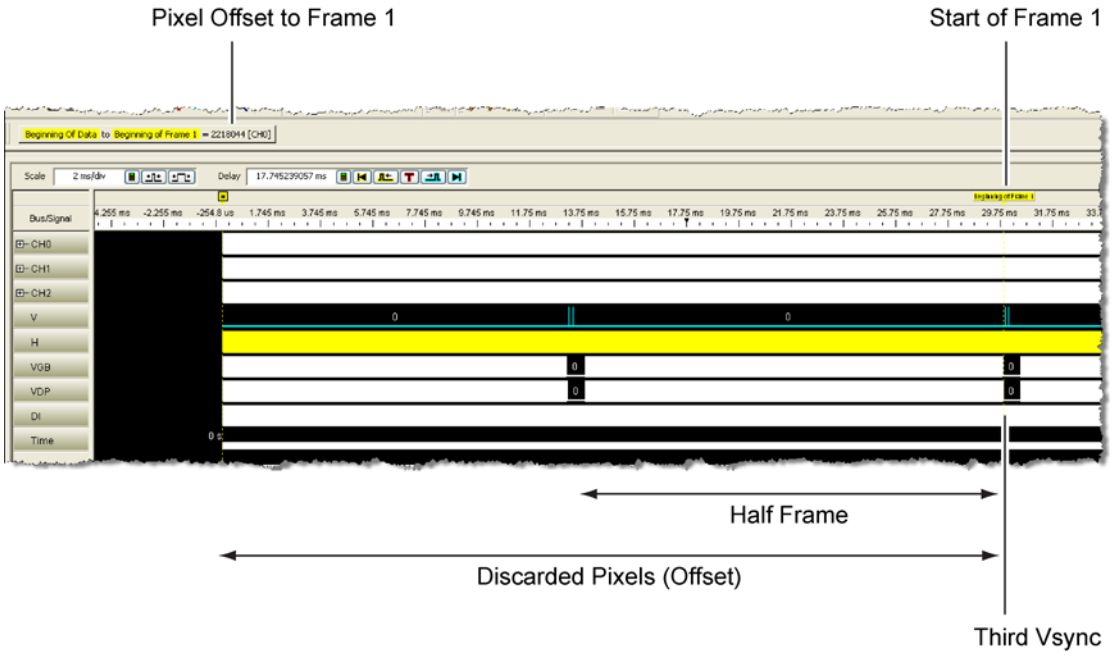


Figure 50 Pixel Offset is Greater than 50% of Frame Width

In interlaced formatted files, the 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 51.

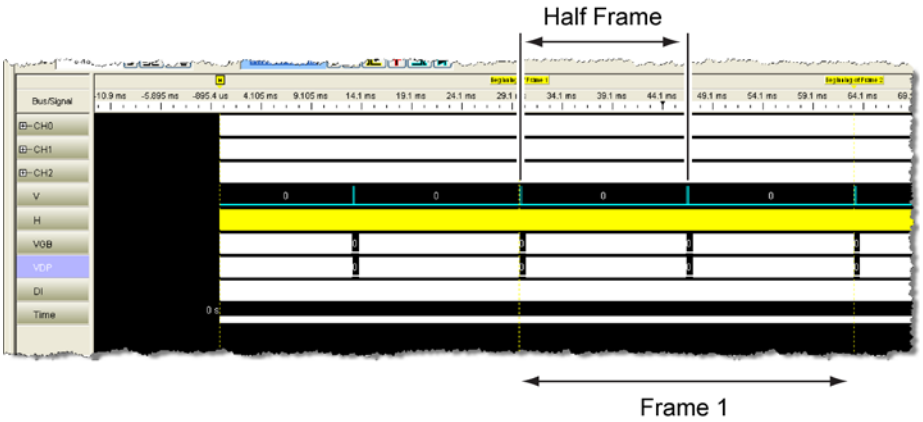


Figure 51 Interlaced Frame

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 52. The pixels-per-line is unique to the format as listed in Table 18 on page 111. 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 53 and Figure 54.

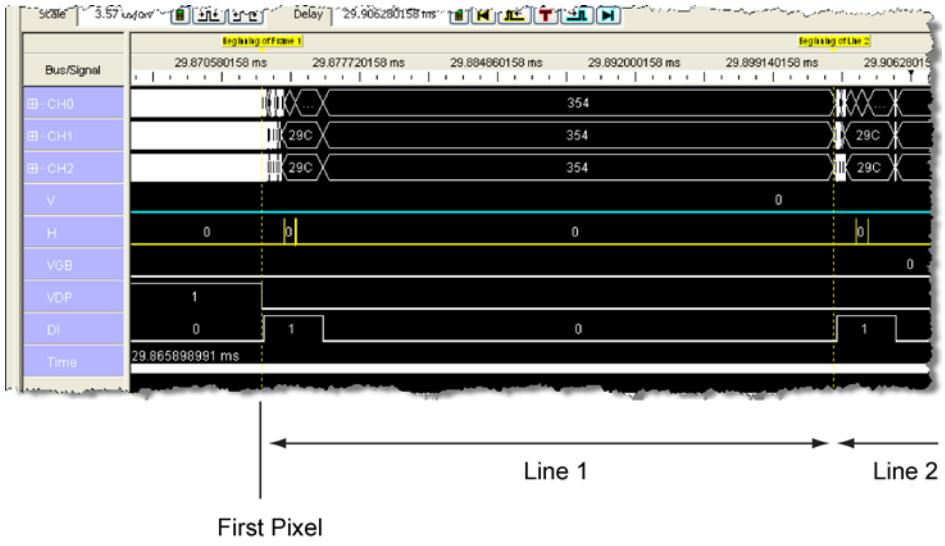


Figure 52 Displayed Lines

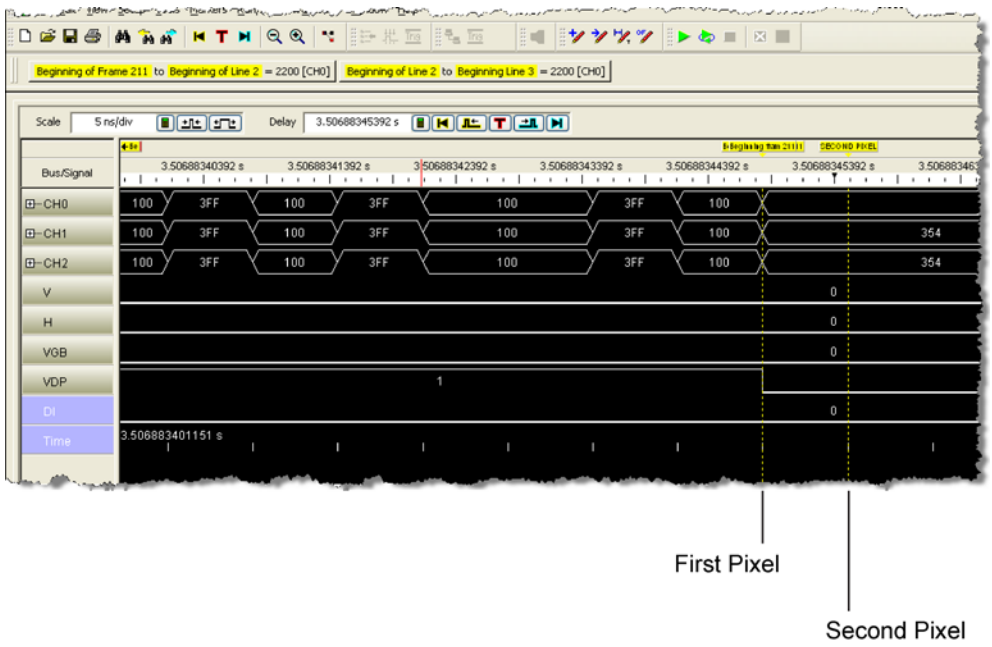


Figure 53 Start of First and Second Pixels of Frame 211 Shown in Waveform View

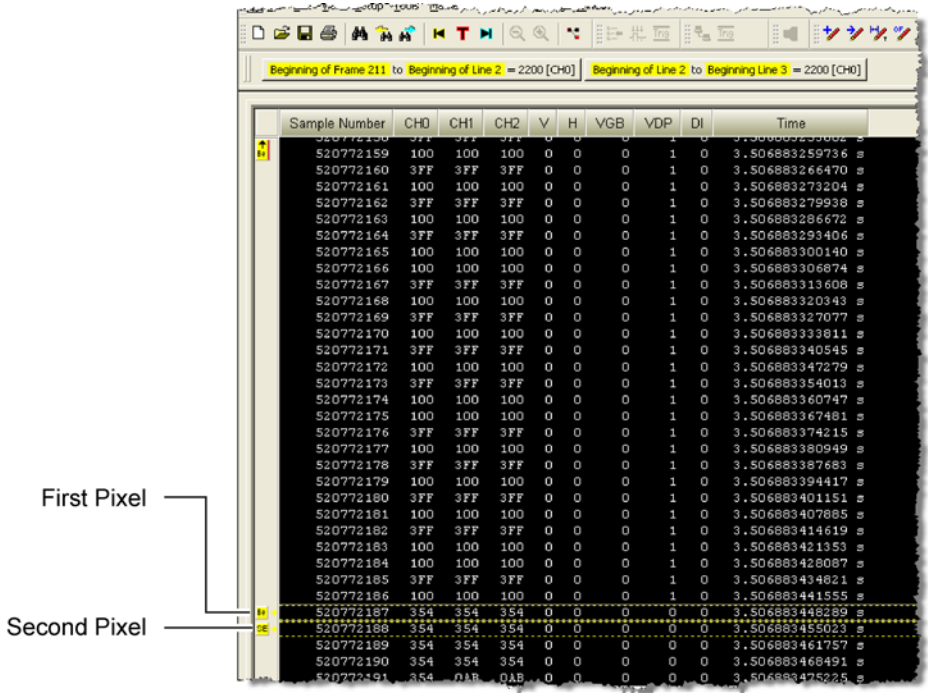


Figure 54 First and Second Pixels of Frame 211 Shown in List View

Navigating Through Frames, Lines, and Pixels

This section demonstrates how to mark and find frames, lines, and pixels.

1 Open the software by double clicking the Agilent Logic Analyzer icon.

2 Click Import when the following screen appears.

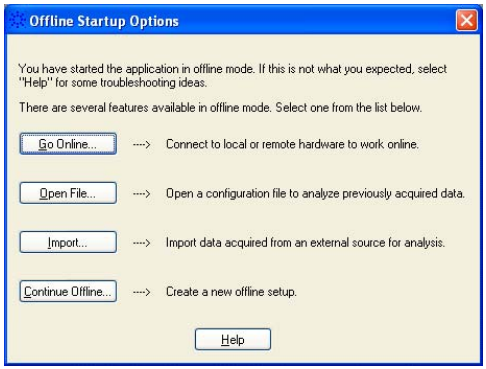


Figure 55 Click Import

3 Select an import file type of Module CSV Test File.

4 Open the converted data file.

5 When the data is displayed, click the zoom out button located at the top of the screen. Click the move right button to center the data. See Figure 57.

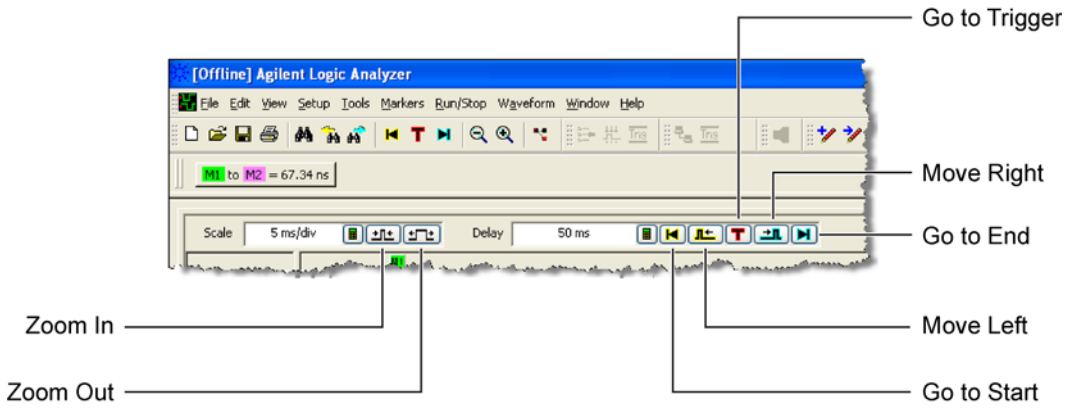


Figure 56 Navigation Icons

6 Locate a frame.

7 Click Markers > New to mark the frame.

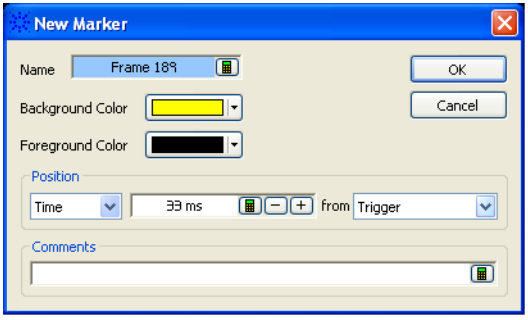


Figure 57 New Marker Dialog Box

8 Enter a name for the marker, in this example Frame 189. Click OK.

9 Drag the marker to the beginning of the frame as shown in Figure 58. 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.

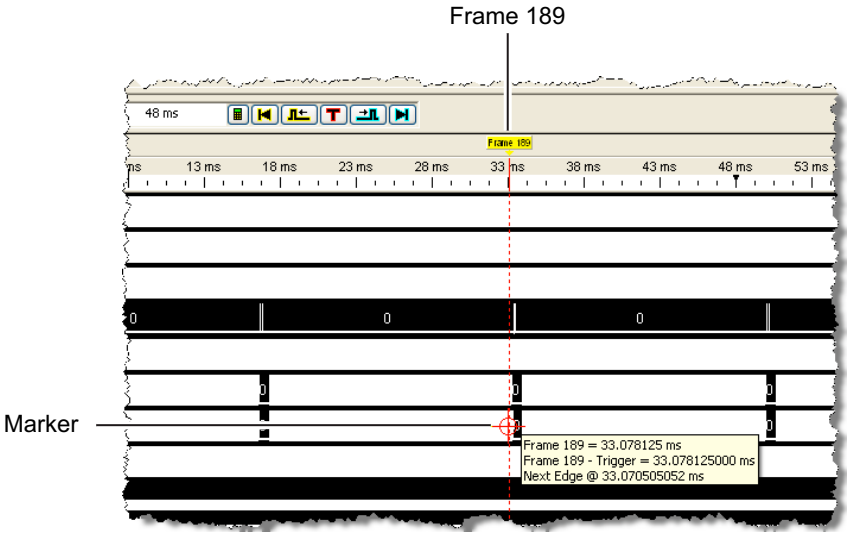


Figure 58 Dragging a Marker Onto a Frame

10 Click Window > New Listing to change to List View.

11 Click on the new listing tab at the bottom of screen.

12 Right click anywhere on the screen. In the shortcut menu, select the frame you wish view.

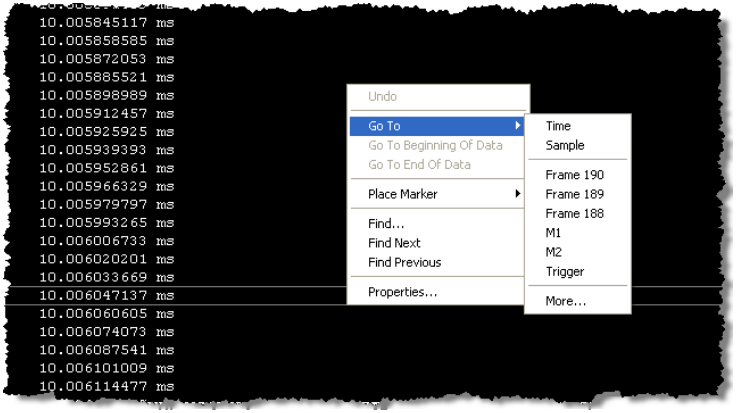


Figure 59 Shortcut Menu with Markers

13 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.

14 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.

6 Remote Operation

The remote commands documented in this chapter allow you to write programs to automate HDMI testing. Your program can directly control the N5998A via the USB COM interface without requiring the HDMI Protocol Analyzer application's user interface.

The COM Server is embedded in the HDMI Protocol Analyzer 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 the COM Server:

- Only one N5998A can be connected to the PC
- Only one instance of HDMIProtocolAnalyzer.exe can be running
- Attempts to create an HDMI Evaluator COM object and run the HDMI Protocol Analyzer application simultaneously will fail

- The HDMI COM Server (and HDMI Protocol Analyzer application) does not support generating and capturing at the same time.

For examples on using the HDMI COM Server, look in the following folder:

```
C:\Program Files\HDMI Evaluator\Examples
```

Methods

DoCommands

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

This method configures the HDMI Protocol Analyzer Generator application's capture, evaluator, and generator settings. The DoCommands method requires an XMLCommand argument that is formed from XML elements. XML elements are explained in "XML Elements and the DoCommands Method" on page 133.

ExportCapture

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

For full HDMI 1.4 testing, the ExportCapture method requires that the N5998A have upgrade N5998U-R14 installed. Refer to "Step 2. Check the Capability of the N5998A" on page 23.

Export the capture to a file. The size of the file to export is set with DoCommands. 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
- N5998A is not connected to the PC
- No data has been captured

GetBitmapFiles

```
BSTR GetBitmapFiles();
```

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>
```

StartCapture

```
VARIANT_BOOL StartCapture();
```

For full HDMI 1.4 testing, the StartCapture method requires that the N5998A have upgrade N5998U-R14 installed. Refer to "Step 2. Check the Capability of the N5998A" on page 23.

Start a capture of HDMI data from the source. This method returns when the capture is complete. Failures can occur with the following causes:

- Not licensed
- Capture not ready (wrong HDMI Pixel Clock selected or HDMI signal not present)
- No PAG connected

NOTE You cannot simultaneously generate and capture data.

StartEvaluate

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

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

The `[in] BSTR EvaluatorFileName` argument is the file (including path) where the evaluation results will be saved.

The `[in] BSTR PacketLogFileName` argument is the file (including path) where the packet log results will be saved. The packet log is produced only for test 7-19.

Set the `[in] VARIANT_BOOL ImageDialog` 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 window. ImageDialog applies to tests 7-23, 7-24, 7-27, 7-34, 7-38, and 7-40. Because the video Image window requires user input, if ImageDialog is true, this method will not return until the user completes input to the ideo Image window. This method returns when the evaluation completes. The method fails if no tests were set up using the DoCommands method. Refer to "Video Image Window" on page 63 to learn about the Image window.

NOTE An N5998A is not required to evaluate a captured data file. Neither is a license required.

StartGenerator

```
VARIANT_BOOL StartGenerator();
```

For full HDMI 1.4 testing, the StartGenerator method requires that the N5998A have upgrade N5998U-R14 installed. Refer to "Step 2. Check the Capability of the N5998A" on page 23.

Start the HDMI Video Timing Generator. Use the DoCommands method to specify the video and audio generator files. Failures can occur with the following causes:

- Not licensed
- Video Generator File not found or not valid
- Audio Generator File not found or not valid (if With == 1)
- No PAG connected

NOTE You cannot simultaneously generate and capture data.

Status

```
BSTR Status();
```

Returns a status string from the N5998A. The string may contain the substrings shown in the following table.

Substring	Description
CaptureBoardReady	There is activity at the HDMI INPUT that the N5998A can capture.
CaptureDone	There is data from a previous capture in N5998A memory.
Generating	The N5998A is currently generating signals on the HDMI OUTPUT.

StopGenerator

```
VARIANT_BOOL StopGenerator();
```

Stop the HDMI Video Timing Generator.

WaitReady

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

Wait until the N5998A is ready to capture data. Seconds is the maximum number of seconds to wait. A value of –1 indicates to wait without a time limit. WaitReady() immediately returns when the N5998A is ready regardless of the specified wait time. This method fails if the capture is not ready within the given time.

WriteEDID

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

Download an EDID file to the N5998A. This method returns when the write is complete. The `[in] BSTR EDIDFileName` argument is the file name (including path) of the EDID file.

Failures can occur with the following causes:

- EDIDFileName is not valid
- No PAG is connected

XML Elements and the DoCommands Method

The DoCommands method requires an XML-based string as the argument, XMLCommand. The XMLCommand string configures the HDMI Protocol Analyzer Generator application settings. 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 and as well as web sites.

Element Hierarchy

The following list shows the hierarchy of the XML elements. The element <Module> is the root element. The hierarchy allows you to visualize that, for example, <Add/> is a descendant of <Evaluate> but not of <Generate>.

```
<Module>
   <Capture> See "<Capture> Element", page 136
   <Evaluate> See "<Evaluate> Element and its Descendants",
   page 137
      <Protocol/>
      <TestID>
         <Add/>
         <Clear/>
         <Full/>
         <Remove>
         <Set>
      <Color/>
      <Options>
   <Generate> See "<Generate> Element and its Descendants",
   page 148
      <Audio/>
      <Vidio/>
```

Creating XML Command Strings

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

```
<Module Name='HDMI Evaluator'>
   …
<Module>
```

The <Module> element must include the attribute name and value Name='HDMI Evaluator'.

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 is 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.

Three elements are children of the <Module> element: <Capture>, <Evaluate>, and <Generate>. These elements and their descendants configure the settings in the application's HDMI Capture, HDMI Evaluator, and HDMI Video Timing 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='HDMI Evaluator'>
   <Capture Clock='25' Size='100' File='C:\MyFile.cap'/>
  <Generate>
     …
   </Generate>
   <Evaluate>
      <TestID>
         <Clear/>
      </TestID>
      …
   </Evaluate>
</Module>
"
…
DoCommands([in] xml_command_string);
```

<Module> Element

The root element. Contains child elements of <Capture>, <Evaluate>, and <Generate>.

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

Parent Elements none

Attributes

Name	Value	Description
Name	HDMI Evaluator	Required attribute.

Example

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

<Capture> Element

The <Capture> element selects HDMI Capture setting for HDMI Pixel Clock frequency and specifies a file (and file size) for saving the captured data. The <Capture> element does not have any children.

Child Elements none

Parent Element <Module>

Attributes

Name	Value	Description
Clock	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
File	*file name*	File name including path.
Size	*integer*	Size in megabytes (MB).

Example

```
<Module Name='HDMI Evaluator'>
  <Capture Clock='25' Size='100' File='C:\Capture\
   MyFile.cap'/>
</Module>
```

<Evaluate> Element and its Descendants

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 show 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 19 on page 139 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'/>
   </Evaluate>
</Module>
```

Table 19 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	15	15 : 1440x480p @ 60 Hz
	1 : 640x480p @ 60 Hz	16	16 : 1920x1080p @ 59.94 Hz
2	2 : 720x480p @ 59.94 Hz		16 : 1920x1080p @ 60 Hz
	2 : 720x480p @ 60 Hz	17	17 : 720x576p @ 50 Hz
3	3 : 720x480p @ 59.94 Hz	18	18 : 720x576p @ 50 Hz
	3 : 720x480p @ 60 Hz	19	19 : 1280x720p @ 50 Hz
4	4 : 1280x720p @ 59.94 Hz	20	20 : 1920x1080i @ 50 Hz
	4 : 1280x720p @ 60 Hz	21	21 : 720(1440)x576i @ 50 Hz
5	5 : 1920x1080i @ 59.94 Hz	22	22 : 720(1440)x576i @ 50 Hz
	5 : 1920x1080i @ 60 Hz	23	23 : 720(1440)x288p @ 50 Hz
6	6 : 720(1440)x480i @ 59.94 Hz	24	24 : 720(1440)x288p @ 50 Hz
	6 : 720(1440)x480i @ 60 Hz	25	25 : 2880x576i @ 50 Hz
7	7 : 720(1440)x480i @ 59.94 Hz	26	26 : 2880x576i @ 50 Hz
	7 : 720(1440)x480i @ 60 Hz	27	27 : 2880x288p @ 50 Hz
8	8 : 720(1440)x240p @ 59.94 Hz	28	28 : 2880x288p @ 50 Hz
	8 : 720(1440)x240p @ 60 Hz	29	29 : 1440x576p @ 50 Hz
9	9 : 720(1440)x240p @ 59.94 Hz	30	30 : 1440x576p @ 50 Hz
	9 : 720(1440)x240p @ 60 Hz	31	31 : 1920x1080p @ 50 Hz
10	10 : 2880x480i @ 59.94 Hz	32	32 : 1920x1080p @ 23.98 Hz
	10 : 2880x480i @ 60 Hz		32 : 1920x1080p @ 24 Hz
11	11 : 2880x480i @ 59.94 Hz	33	33 : 1920x1080p @ 25 Hz
	11 : 2880x480i @ 60 Hz	34	34 : 1920x1080p @ 29.97 Hz
12	12 : 2880x240p @ 59.94 Hz		34 : 1920x1080p @ 30 Hz
	12 : 2880x240p @ 60 Hz	35	35 : 2880x480p @ 59.94 Hz
13	13 : 2880x240p @ 59.94 Hz		35 : 2880x480p @ 60 Hz
	13 : 2880x240p @ 60 Hz	36	36 : 2880x480p @ 59.94 Hz
14	14 : 1440x480p @ 59.94 Hz		36 : 2880x480p @ 60 Hz
	14 : 1440x480p @ 60 Hz	37	37 : 2880x576p @ 50 Hz
15	15 : 1440x480p @ 59.94 Hz	38	38 : 2880x576p @ 50 Hz

Table 19 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
39	39 : 1920x1080i (1250 total) @ 50 Hz	59	59 : 720(1440)x480i @ 240 Hz
40	40 : 1920x1080i @ 100 Hz	60	60 : 1280x720p @ 23.98 Hz
41	41 : 1280x720p @ 100 Hz		60 : 1280x720p @ 24 Hz
42	42 : 720x576p @ 100 Hz	61	61 : 1280x720p @ 25 Hz
43	43 : 720x576p @ 100 Hz	62	62 : 1280x720p @ 29.97 Hz
44	44 : 720(1440)x576i @ 100 Hz		62 : 1280x720p @ 30 Hz
45	45 : 720(1440)x576i @ 100 Hz		
46	46 : 1920x1080i @ 119.88 Hz		
	46 : 1280x720p @ 120 Hz		
47	47 : 1920x1080i @ 119.88 Hz		
	47 : 1280x720p @ 120 Hz		
48	48 : 720x480p @ 119.88 Hz		
	48 : 720x480p @ 120 Hz		
49	49 : 720x480p @ 119.88 Hz		
	49 : 720x480p @ 120 Hz		
50	50 : 720(1440)x480i @ 119.88H Hz		
	50 : 720(1440)x480i @ 120 Hz		
51	51 : 720(1440)x480i @ 119.88H Hz		
	51 : 720(1440)x480i @ 120 Hz		
52	52 : 720x576p @ 200 Hz		
53	53 : 720x576p @ 200 Hz		
54	54 : 720(1440)x576i @ 200 Hz		
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		

<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 | 7-40	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 or 1	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 | 7-40	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

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

Child Elements The following element hierarchy show all the available elements:

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

Parent Elements <Module>

Attributes none

Example

```
<Module Name='HDMI Evaluator'>
   <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. Audio files have the extension .agf and our located in the following installation 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

Example

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

<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 frequeny to 0%, +0.5%, or –0.5%.

Example

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

7
If You Experience a Problem

This chapter provides solutions to problems that you may encounter while using the N5998A.

If the application will not install

Check that the following conditions are met:

- ❑ Log in to the PC using Administrator permissions.
- ❑ If an older version of the application is installed on the PC, uninstall the older version before installing the new version.
- ❑ Always install the application on a local drive. Do not install the application on a networked drive.

If the HDMIProtocolAnalyzer dialog box appears

- ❑ If you are testing for HDMI 1.4 compliance, check that the N5998A has upgrade N5998U-R14 installed. Refer to "Step 2. Check the Capability of the N5998A" on page 23.

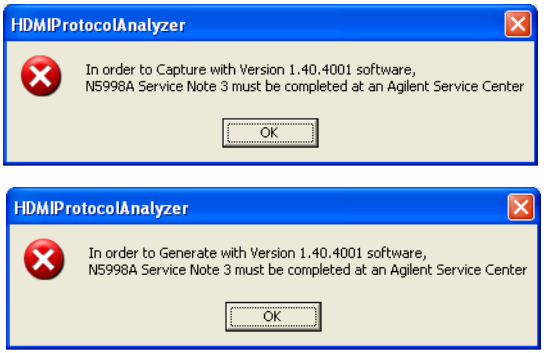


Figure 60 Upgrade Not Installed Notices

If the USB link to the N5998A fails

- ❑ Check that the USB cable is plugged into the same USB port on the PC as was used during the installation procedure. For more information, refer to "If the Device Driver Installation Fails" on page 28.

If video data cannot be captured

- ❑ If you are testing for HDMI 1.4 compliance, check that the N5998A has upgrade N5998U-R14 installed. Refer to "Step 2. Check the Capability of the N5998A" on page 23.
- ❑ Check that the correct HDMI Pixel Clock range has been selected in the application's HDMI Capture window. If not, the front-panel Capture Board Ready indicator will not turn green. Select the correct range.

If a CEA–861D/E Video Format Timing Error occurs

The `CEA-861D Video Format Timing Error` and `CEA-861E Video Format Timing Error` can appear in the test results pane of the application's HDMI Evaluator window.

- ❑ Check that the Video Format Timing selection in the window matches the format in the actual captured video. To determine the format of the video, refer to "To Determine Video Format Timing of Video" on page 44.

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