# 780C Multi-Interface Interoperability Tester for Video and Audio

**User Guide** 

Rev: A2



quantumdata

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# **1** Overview of the 780C Multi-Interface Interoperability Tester

This section provides an overview of the 780C Multi-Interface Interoperability Tester. The 780C provides HDMI Tx port and an HDMI Rx port operating up to 300MHz pixel and TMDS rates for testing devices which support 4K resolutions. The 780C also has analog outputs.

# 1.1 Scope of this User Guide

This User Guide documents the complete operation of the 780C Multi-Interface Interoperability Tester.

Note: Please be sure to check the Quantum Data website for updates to this User Guide.

# 1.2 Changes to this User Guide

The following changes have been made to this User Guide since its last version:

Added descriptions for several commands.

# 1.3 Introducing the 780C Multi-Interface Interoperability Tester

The 780C Multi-Interface Interoperability Tester is a portable multimedia pattern generator that enables you to conduct quick, on-site verification testing of your HDMI, HDBaseT and 3G-SDI systems and analog video displays. The 780C is equipped with both reference source and reference sink HDMI, HDBaseT and 3G-SDI interfaces allowing you to test audio, video and protocols—HDCP, EDID, CEC & infoframes—of any type of HDMI, HDBaseT and 3G-SDI device: sources, repeaters and sinks. Because the 780C has both an digital video outputs and inputs, you can test cables and systems with splitters, extenders and switches as well with the optional pixel error test feature. You can also test hybrid digital video systems comprised of HDMI, HDBaseT and 3G-SDI devices.

A color touch display makes the 780C easy and convenient to use. When testing a digital video source device you can toggle between operating the unit through the touch screen and viewing the incoming video from the source.



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**Note**: 780C Image above shows the front edge with the SD Card slot which is used for storing and loading bitmaps, reports and for recovery in the event of a failed upgrade.

# 1.4 Overview of 780C features

The 780C Multi-Interface Interoperability Tester provides a rich set of features. The following is a list of available options and the key features and benefits of each:

#### 1.4.1 Standard features

The following features are standard with the 780C:

- Pattern testing for HDTVs Enables you to conduct pattern testing for an HDTV through the digital video and analog component outputs. Provides dozens of patterns with variation options on most.
- Custom bitmaps and pattern scrolling The 780C enables you to import bitmaps for use in pattern testing. You can initiate a scroll of these bitmaps with user control over the rate and extent of horizontal movement.
- Create custom formats using the standalone Format Editor.
- 3D bitmap pattern testing The 780C enables you to import 3D bitmaps for use in pattern testing. You can create your own bitmaps from any stereoscopic images you have using the Quantum Data Bitmap Conversion Tool available from the Quantum Data website: <u>http://www.quantumdata.com/apps/3D/BMP\_conv.asp</u>. There are some sample 3D bitmaps on this webpage as well.
- Video confidence test of an HDMI, HDBaseT or 3G-SDI source device The 780C enables you to view the incoming video on the 780C's LCD screen. 780C enables the incoming image to be routed out the digital video output connector if unused. 780C also enables scrolling to view an entire unscaled 4K image received on the HDMI and HDBaseT input ports.
- Audio confidence test of an HDMI, HDBaseT or 3G-SDI source device The 780C enables you to listen to the incoming LPCM audio through the 780C's headphone jack on the front edge or through an embedded speaker. There will be no sound when compressed audio is received on the incoming HDMI stream.
- Audio Return Channel confidence test of an HDMI 1.4 A/V receiver The 780C can emulate an ARC Tx device on its HDMI IN port. Note: The 780C does not support enabling ARC on the AV receiver, therefore you will have to enable ARC through some other means.

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- Audio testing for AVRs and HDTVs The 780C provides multi-channel digital audio test patterns through the HDMI, HDBaseT., 3G-SDI, SPDIF and optical outputs. A variety of audio patterns and formats are provided at sampling rates from 32kHz up to 192kHz and bit depths of 16, 20 and 24. Format supported are Dolby Digital and DTS compressed formats and lossless compressed or high bit rate HDMI formats.
- Installer Utility Provides simplified diagnostics of HDMI and HDBaseT interoperability problems in an installation. The Installer utility enables installers to connect the 780C into an HDMI/HDBaseT network and quickly conduct diagnostics without required detailed knowledge of protocols.
- Command line interface for automated testing.

#### 1.4.2 Network Analyzer features

The following Network Analyzer features are available:

- HDCP test of an HDMI or HDBaseT sink or input to a repeater device The 780C enables you to run an HDCP functional test on an HDMI or HDBaseT sink device directly or through a repeater device.
- EDID test of an HDMI or HDBaseT HDTV, projector or input to a repeater device The 780C enables you to run an EDID functional test on an HDMI or HDBaseT sink device directly or through a repeater device. You can view the entire EDID in human readable text. You can also run a portion of EDID compliance test.
- Video test of an HDMI, HDBaseT or SDI source device The 780C provides an HDMI, HDBaseT or SDI input for testing HDMI, HDBaseT or SDI source devices. You can run a verification test of a video source which includes timing and format information and an indication of whether the video is HDCP content protected.
- Data Island test of an HDMI or HDBaseT source device The 780C provides an HDMI/HDBaseT input for testing HDMI or HDBaseT source devices. You can view the infoframes and other data islands.
- Audio test of an HDMI, HDBaseT or 3G-SDI source device The 780C provides HDMI, HDBaseT and 3G-SDI inputs for testing source devices. You can run a verification test of an audio source which includes decoding of the audio IEC headers, audio infoframes and audio sample packet headers (for HDMI and HDBaseT and parsing out of the channel status bits for 3G-SDI as well.
- EDID test of HDMI or HDBaseT source device or outputs The 780C's HDMI or HDBaseT input ports can be provisioned with any EDID you have access to. You can verify that a source device responds properly to the provisioned EDID. The EDID could be a known-good EDID or an EDID that you have created specifically for testing.
- HDCP test of an HDMI or HDBaseT source device The 780C enables you to run a test to determine how many HDCP devices an HDMI or HDBaseT source can support during HDCP authentication.
- CEC ping test of any HDMI device The 780C enables you to run a CEC ping test on an HDMI device.

#### 1.4.3 Cable and Repeater test features

The following features are available with the Cable and Repeater test option:

Cable & Repeater test – Because the 780C has both digital video inputs and outputs, you can loop a cable or entire distribution networks comprised of splitters, extenders, repeaters, switches, even hybrid networks with HDMI, HDBaseT or 3G-SDI components, from the 780C's output to input and run a pseudo-random noise pattern test to determine pixel errors on the TMDS lines. The feature also runs a continuity test on the HDMI or HDBaseT DDC test pair, CEC bus, the +5V line and the hot plug lead. The Repeater test also shows you the hot plug delay between the downstream side and the upstream side and the pulse width. The Cable & Repeater Test enable you to test a cable, repeater or distribution network if the source and sink ends are not collocated then you need to use the Frame Compare test described below.

#### 1.4.4 Auto EDID Test

The following features are available with the Auto EDID test option:

• Select a series of EDIDs to test a source's handling of them.

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- Emulate the EDIDs on the 780C HDMI or HDBaseT Input port.
- Test runs automatically and flags improper handling. Checks for proper VIC, timing, video type, color depth and sampling mode.

#### 1.4.5 Auxiliary Channel Analyzer for DDC monitoring features

The following features are available with the Auxiliary Channel Analyzer test options:

 DDC monitoring with Auxiliary Channel Analyzer (ACA) – The 780C ACA enables you to monitor HDMI or HDBaseT CEC DDC transactions such as HDCP and EDID as well as hot plug related events while emulating an HDMI or HDBaseT source and/or an HDMI or HDBaseT sink device(s) in a system. You can also monitor passively between two HDMI/HDBaseT devices. When monitoring passively you can also view the +5V status.

#### 1.4.6 What is in the 780C shipping box

The 780C instrument shipping container includes the items listed in Table 1-1 below:

Table 1-1: 780C Shipping Box Contents		
Item Description	Part No.	
780C Multi-Interface Interoperability Tester.	00-00236	
12V DC (40 W) Power Supply / Adapter.	25-00106	
Line cord for 12V Power Supply.	30A00400A03	
Cable: HDMI-to-HDMI Type A.	30-00146	
Cable: VGA to (3) RCA adaptor.	30-00203	
Cable: USB.	30-00163	

# 2 Physical Interfaces of the 780C Multi-Interface Interoperability Tester

This section describes the administration, video and audio interfaces on the 780C test instrument:

# 2.1 Video Interfaces

Table 2-1 below describes the video interfaces on the 780C test instrument, these interfaces are used to render test patterns for testing consumer electronic HDTVs and computer displays.

Video Interface	Description
HDMI (1) Output Type A	<ul> <li>Single HDMI output connector. Supports HDMI 1.4x:</li> <li>Bit Depth: 24/30/36 bit.</li> <li>Colorimetry: RGB, YCbCr.</li> <li>Sampling: 4:4:4, 4:2:2, 4:2:0.</li> <li>Pixel rate: Timings up to 300MHz for 4K x 2K resolutions.</li> <li>DVI support through HDMI to DVI adapter cable (RGB, 4:4:4, 24 bit).</li> <li>Audio: LPCM, Dolby Digital and DTS (more details below).</li> </ul>
HDBaseT (1) Output RJ-45	<ul> <li>Single HDBaseT output connector. Supports HDBaseT 1.x:</li> <li>Bit Depth: 24/30/36 bit.</li> <li>Colorimetry: RGB, YCbCr.</li> <li>Sampling: 4:4:4, 4:2:2, 4:2:0.</li> <li>Pixel rate: Timings up to 300MHz for 4K x 2K resolutions.</li> <li>DVI support through HDMI to DVI adapter cable (RGB, 4:4:4, 24 bit).</li> <li>Audio: LPCM, Dolby Digital and DTS (more details below).</li> </ul>
3G-SDI (1) Output BNC	<ul> <li>3G-SDI output connector.</li> <li>Bit Depth: 24/30/36 bit.</li> <li>Colorimetry: YCbCr.</li> <li>Sampling: 4:4:2.</li> <li>Data rate: Timings up to 2.97Gbps.</li> <li>Audio: LPCM, Dolby Digital and DTS.</li> </ul>
Analog Output – Component and VGA (HD15F)	<ul> <li>Bit Depth: 24 bit color depth.</li> <li>Colorimetry: RGB, YPbPr.</li> <li>Pixel rate: 80MHz.</li> <li>Sync types: separate and composite.</li> </ul>
HDMI (1) Input Type A	<ul> <li>Single link HDMI input connector. Supports HDMI 1.4x:</li> <li>Colorimetry: RGB, YCbCr.</li> <li>Sampling: 4:4:4, 4:2:2, 4:2:0.</li> <li>Pixel rate: Timings up to 300MHz for 4K x 2K resolutions.</li> </ul>
HDBaseT (1) Input RJ-45	<ul> <li>Single link HDBaseT input connector. Supports HDBaseT 1.x:</li> <li>Colorimetry: RGB, YCbCr.</li> <li>Sampling: 4:4:4, 4:2:2, 4:2:0.</li> <li>Pixel rate: Timings up to 300MHz for 4K x 2K resolutions.</li> </ul>
3G-SDI (1) Input BNC 5	<ul> <li>Single link HDMI input connector.</li> <li>Colorimetry: YCbCr.</li> <li>Sampling: 4:2:2.</li> <li>Data rate: Timings up to 2.97Gbps.</li> </ul>

# 2.2 Audio interfaces

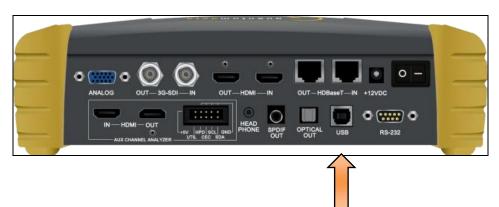
Table 2-2 below describes the audio interfaces supported on the 780C test instrument.

Table 2-2: 780C Audio Interfaces		
Interface	Description	
HDMI (1) Output Type A	<ul> <li>Single HDMI output connector. Supports HDMI 1.4x:</li> <li>Channels: 8.</li> <li>Bits per sample: 16, 20, 24.</li> <li>Sampling rates (kHz): 32.0, 44.1, 48.0, 88.2, 96.0, 176.4, 192.0.</li> <li>Formats: LPCM, Dolby Digital (clips), DTS (clips)</li> </ul>	
HDBaseT (1) RJ-45	<ul> <li>Single HDBaseT output connector. Supports HDBaseT 1.x:</li> <li>Channels: 8.</li> <li>Bits per sample: 16, 20, 24.</li> <li>Sampling rates (kHz): 32.0, 44.1, 48.0, 88.2, 96.0, 176.4, 192.0.</li> <li>Formats: LPCM, Dolby Digital (clips), DTS (clips)</li> </ul>	
SPDIF - RCA	<ul> <li>SPDIF RCA audio connector:</li> <li>Channels: 8 (clips)</li> <li>Bits per sample: 16, 20, 24.</li> <li>Sampling rates (kHz): 32.0, 44.1, 48.0, 96.0</li> <li>Formats: LPCM, Dolby Digital (clips), DTS (clips)</li> </ul>	
Optical – JIS FOS	Optical audio connector: Channels: 8 (clips) Bits per sample: 16, 20, 24. Sampling rates (kHz): 32.0, 44.1, 48.0 Formats: LPCM, Dolby Digital (clips), DTS (clips)	
HDMI (1) Input (Audio Return Channel) Type A	<ul> <li>HDMI ARC SPDIF:</li> <li>Channels: 8 (clips)</li> <li>Bits per sample: 16, 20, 24.</li> <li>Sampling rates (kHz): 32.0, 44.1, 48.0, 96.0</li> <li>Formats: LPCM, Dolby Digital (clips), DTS (clips)</li> </ul>	

# 2.3 Administrative Interface

The 780C is equipped with a USB interface. This interface is used to download custom bitmaps and to upgrade firmware and issue commands. The USB interface is a peripheral device. There are two modes:

- COM Command Mode. Used for sending commands to set the interface, select formats and patterns.
- Disk Mass Storage Mode. Used for downloading bitmaps, audio clips and upgrading firmware or gateware.



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# **3** General Operation

This section describes power up, power usage and general operation.

## **3.1** Power Considerations

The 780C has a rocker style power switch on the back panel. Refer to the photo below.



The 780C is supplied with the Part No 25-00106 12V DC power supply adapter as well as a part number 30A00400A03 line cord.



# 3.2 Tilt Bail

The 780C has support bail for convenience in viewing. This is depicted in the illustration below. (The illustration shows the 780; however, the 780C tilt bail operates in the same manner.)

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# 3.3 Navigating through the 780C User Interface

The 780C user interface is a color touch screen display 800 by 480. A single touch will activate an item on the screen or take you down to a lower level menu. A + indicates that you have to double touch to navigate down to a lower level menu.

### 3.3.1 Home Menu items

The 780C's Home screen is shown below.

ome					Home	Preferences	Help
Source Tests			Sink Tests	Lini	Tests	Installer Tes	its
Format Analyzer	Packet Viewer	Audio Analyzer		Ar	HX Channel halyzer HX Channel HX Channel HX Channel HX Channel HX Channel HX Channel HX Channel HX Channel HX Channel	Sink Test	] <b>^</b>
Video Display	HDCP Test	Audio Monitor Settings		Te	able/Repeater st	Source Te	- 1 11 -
Video Passthrough	CEC Test		CEC Tes	ING	nk Test	Repeater	Fest
HDMI (8 bpc YCbCr 4:4:4)	1920x1080p 60 frames/s	VIC 16: No errors	HDMI 3D disabled	AVMUTE disabled	HDCP disabled	+5V detecte	ed
HDMI (YCbCr 4:4:4)	640x1005 60Hz	Color Bars	3D: Frame Packing	Dolby 5.1 (Sine Wave)	HDCP Disable	AVMUTEOFF	14

Table 3-1 below shows functions available from the Home screen.

Table 3-1: Top Level	Table 3-1: Top Level Menu				
Item	Submenu - Pattern	Third Level Menu	Value		
Top Menu Bar	Home / Back navigation	See Below	Enables you to navigate back to the previous screen.		
	Preferences Page 1 Preferences Page 2	Audible Touch	<ul><li>Off</li><li>On</li></ul>		
F		Screen Brightness	<ul> <li>Min</li> <li>25%</li> <li>50%</li> <li>75%</li> <li>Max</li> </ul>		
		USB Mode	<ul> <li>COM for commands</li> <li>Disk for downloading files and upgrades</li> </ul>		
		Startup Mode	<ul> <li>Set the 780's menu configuration to the default menu (shown throughout this User Guide).</li> <li>Custom Menu – Utilize a configuration that you have created.</li> </ul>		
		Custom Menu	Enter to navigate to custom menu screen.		
		Hot Plug Formats	<ul> <li>On – 780C automatically select the formats in the EDID of the connected HDTV.</li> <li>Off – 780C will not automatically select the formats in the EDID of the connected HDTV.</li> </ul>		
		AVMute on Format Change	<ul> <li>On – AVMute will occur when the resolution is changed on the 780C HDMI output.</li> <li>Off – AVMute will occur when the resolution is changed on the 780C HDMI output.</li> </ul>		

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		RS-232 Baud Rate RS-232 Keypad Mode	<ul> <li>Configure the baud rate of the RS-232 interface on the 780C (N/A to 780).</li> <li>Off – Keypad connected to RS-232 is disabled.</li> <li>On – Keypad connected to RS-232 is enabled.</li> </ul>	
	Help	Upgrades	<ul> <li>USB Storage Flash</li> <li>Application Flash</li> <li>FPGA Flash</li> </ul>	
		Touchscreen	<ul> <li>Calibrate the touch screen display</li> </ul>	
Source Tests Buttons	Format Analyzer	Viewing Source Data Isla	and Packet	
	Video Display	Testing Video from an HDMI Source Device		
	Video Passthrough	Viewing the Incoming 4K Video on a Connected Display using Passthrough		
	Packet Viewer	Viewing Source Data Island Packet		
	HDCP Test	Testing HDCP Max Devices on an HDMI Source Device		
	CEC Test	Viewing the CEC device	s on an HDMI network	
	Audio Analyzer	Testing Audio of an HDM	<u>/Il Source Device</u>	
	Audio Monitor	Procedures for Monitoring LPCM Audio from a Source Device (780C only)		
Sink Tests Buttons	EDID Test	Verifying the EDID on an HDMI HDTV or HDMI Repeater Device		
	HDCP Test	Testing HDCP on an HDMI HDTV or HDMI Repeater Device		
	CEC Test	Viewing the CEC device	s on an HDMI network	
Link Tests Buttons	Aux Channel Analyzer	Procedures for Monitoring Auxiliary Channel events and transactions		
	Cable/Repeater Test	Using the 780C Test Ins	trument to Test HDMI Cable or Repeaters	
	Link Test	Procedures for Installer	Utility	
Installer Tests Buttons	Sink Tests	Using the 780C Test Ins	trument Installer Utility	
	Source Tests	Using the 780C Test Ins	trument Installer Utility	
	Repeater Tests	Using the 780C Test Ins	trument Installer Utility	

### 3.3.2 Back Navigation

When you navigate away from the Home screen a white arrow will appear in the upper left next to the name of the of the screen you are on. You can navigate to the previous screen by touch selecting this arrow. In the example below, touch selecting the upper left area on or near the white, left facing arrow next to **Signal Type** will take you to the previous screen.

VGA(HD15) Analog YPbPr VGA(HD15) Analog RGB VGA(HD15) Analog RGB	HDI DV	/I	HDMI HDBaseT	RGB	YCbCr 4:2:2	YCbCr 4:4:4
3G-SDI	VGA(HD15) A	Analog RGB	)	(	PC (IT)	User-Defined

### 3.3.3 Status Bar

The 780C has a status bar on the bottom of the screen.

-z	HDMI (8 bpc YCbCr 4:4:4)	1920x1080p 60 frames/s	VIC 16: No errors	HDMI 3D disabled	AVMUTE disabled	HDCP disabled	+5V detected	
Ŷ	HDMI (YCbCr 4:4:4)	640x1005 60Hz	Color Bars	3D: Frame Packing	Dolby 5.1 (Sine Wave)	HDCP Disable	AVMUTEOFF	14:32

The items in the status bar are described in the Table 3-2.

Table 3-2: Status Bar		
Туре	Status Item	Function
HDMI/HDBaseT/SDI IN	Video Type Status	<ul> <li>Indicates the status of video on the HDMI/HDBaseT/SDI Rx ports. This includes:</li> <li>Video interface: HDMI or DVI, HDBaseT or SDI</li> <li>Color depth: 8, 10, 12</li> <li>Video type: RGB or YCbCr</li> <li>Sampling mode: 4:4:4, 4:2:2, 4:2:0</li> <li>Note: When SDI is active on the input, the Video Type is always YCbCr and the sampling is always 4:2:2.</li> </ul>
	Video Resolution Status	<ul> <li>Indicates the video resolution on the HDMI Rx port.</li> <li>This includes:</li> <li>Horizontal Active in pixels</li> <li>Vertical Active in pixels</li> <li>Frame rate</li> </ul>

	Video Identification Status 3D Status	Indicates the video resolution on the HDMI Rx port. This includes: Horizontal Active in pixels Vertical Active in pixels Frame rate Indicates the status of 3D video for HDMI or HDBaseT. This includes: 3D enabled or disabled 3D format Indicates the AVmute status, enabled or
	AVMute status HDCP Status	disabled. Applies only to HDMI and HDBaseT. Indicates whether the incoming video is encrypted
	+5V Status	with HDCP. Indicates whether +5V is detected from the HDMI or HDBaseT source.
HDMI/HDBaseT/SDI OUT	Video Type Status/Selection	Indicates the video on the HDMI/HDBaseT/SDI Tx ports. This includes: Video interface: HDMI or DVI Color depth: 8, 10, 12 Video type: RGB or YCbCr Sampling mode: 4:4:4, 4:2:2, 4:2:0 Note: When SDI is active on the output, the Video Type is always YCbCr and the sampling is always 4:2:2. Provides access to the Video Signal Type screen.
	Video Resolution Status/Selection	Indicates the video resolution on the HDMI Tx port. This includes: Horizontal Active in pixels Vertical Active in pixels Frame rate Provides access to the Video Format screen.
	Video Pattern Status/Selection	Indicates the video pattern on the HDMI Tx port. Provides access to the Video Pattern screen.
	3D Format Status/Configuration	Indicates the status of 3D video. This includes: 3D enabled or disabled 3D format
		Provides access to the 3D video configuration screen.
	Audio Status	Indicates the Audio status: Audio format Audio channels Audio sampling rate

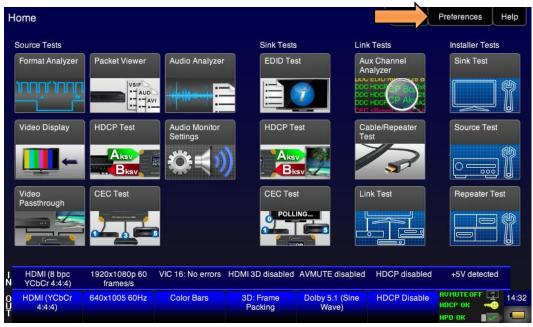
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HDCP Status	Indicates whether the incoming video on the HDMI In port is encrypted with HDCP.
AVMute HDCP Status +5V Status	Indicates the status of the following for HDMI or HDBaseT: AVMute active/inactive status HDCP active/inactive status +5V present/not present status

# **3.4** Calibrating the LCD

It is recommended that you calibrate the LCD display prior to using the 780C Test Instrument. Use the following procedures to perform the calibration.

1. From the **Home** menu, navigate to the Help menu by pressing the **Help** activation button on the upper status bar. The **Home** menu is shown below.



The Help menu appears as shown below:

<	Help					Home	Preferences Help
		U	ISB Storage Flash	Erase			
			Application Flash	Update			
			FPGA Flash	Update			
			Touchscreen	Calibrate			
				SW Ver. 1402275 FPGA Ver. 1308060			
IN	HDMI/DVI: No signal	No TMDS clock	Cannot be analyzed	Not capable of HDMI 3D	No GCP packets received	Not capable of HDCP	No +5V detected
0 U T	Interface: HDMI (8 bpc RGB)	Format: 3840x2160 30Hz	Pattern: Color Bars	3D: Disabled	Audio (HDMI): LPCM 2.0ch 48kHz	Enable HDCP	NO HDCP

2. Touch select the **Calibrate** activation button. A screen appears instructing you to press each of four red squares.



When you finish touch selecting the fourth box, the calibration is completed and you will return to the Home menu.

3. If the calibration fails and you cannot access the menus, establish a command line session and enter the calibration command:

TCAL

This will cause the screen to display the calibration screen again.

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# 4 Using the 780C Test Instrument to Video and Audio Pattern Tests on Sink Devices

This chapter provides procedures for running audio and video pattern tests on high definition sink devices such as HDTVs and projectors. The features and functions described in this chapter are provided with the standard 780C; no options are required. The following signal types are supported.

- HDMI (via the HDMI physical connector)
- DVI (via the HDMI physical connector)
- HDBaseT (via the HDBaseT physical connector)
- 3G-SDI (via the SDI physical connector)
- YPbPr Component analog (via the HD VGA connector)
- RGB Analog (via the HD VGA connector).

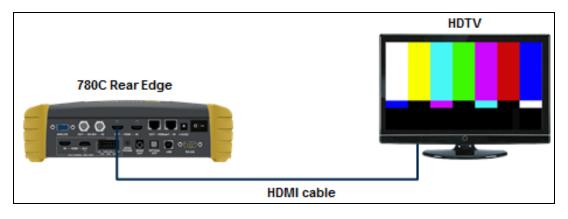
# 4.1 Making Physical Connections - HDMI

The first step in testing a sink device is to make the HDMI physical connections between the 780C and the device(s) under test.

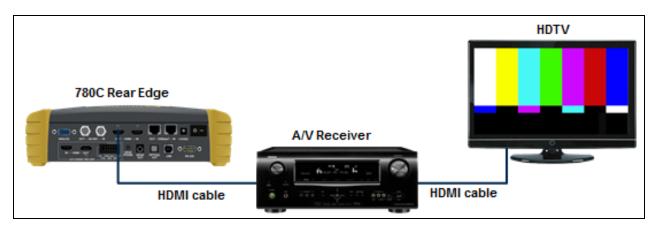
#### 4.1.1 Connecting the 780C to the Display Device - HDMI

Use the following procedures to make the physical connections from the 780C to the display device under test.

- 1. Make the cable connection between the appropriate the 780C video output connector (e.g. **HDMI OUT** or **ANALOG**) connector and the input connector of the HDTV using the cables supplied.
- Alternatively you may connect from the 780C video output connector to an HDTV through an HDMI repeater device such as an A/V receiver. In this case make the HDMI connection between the HDMI OUT connector on the 780C and the HDMI input of the HDMI repeater device using an HDMI-to-HDMI cable. Then connect the HDTV to an active output on the repeater. The following illustrations depict the typical test configurations.



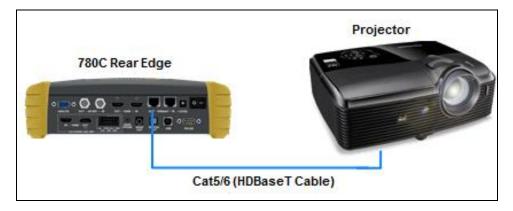
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#### 4.1.2 Connecting the 780C to the Display Device - HDBaseT

Use the following procedures to make the physical connections from the 780C to the display device under test.

1. Make the cable connection between the appropriate the 780C video HDBaseT output connector and the input connector of the HDBaseT device.

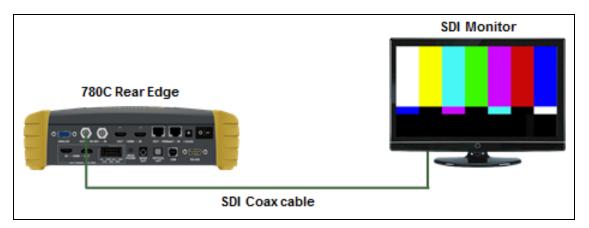


The following illustrations depict the typical test configurations.

#### 4.1.3 Connecting the 780C to the Display Device - SDI

Use the following procedures to make the physical connections from the 780C to the display device under test.

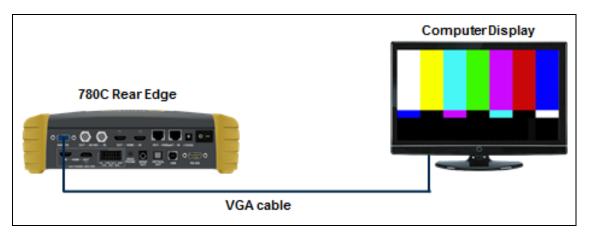
1. Make the cable connection between the appropriate the 780C video SDI output connector and the input connector of the display or monitor using the cables supplied.



#### 4.1.4 Connecting the 780C to the Display Device - Analog

Use the following procedures to make the physical connections from the 780C to the display device under test.

1. Make the cable connection between the appropriate the 780C video VGA output connector and the input connector of the HDTV or computer monitor using the cables supplied.



# 4.2 Selecting a Signal Type and Resolution

After making the physical connections between the 780C and the display device under test you will need to select the signal type, Resolution and Frame Rate for the sink device under test.

#### 4.2.1 Procedures for Selecting a Signal Type

The procedures below describe how to select the active signal type.

- 1. Power up the 780C using the rocker switch on the back panel.
- 2. Touch select the Signal Type activation button on the OUT Status Bar (see screen example below).

ome					Home	Preferences	Help
Source Tests			Sink Tests	s Link	Tests	Installer Te	sts
Format Analyzer	Packet Viewer	Audio Analyzer	EDID Te	An	x Channel alyzer	Sink Test	
		-					] 🎖
Video Display	HDCP Test	Audio Monitor Settings	HDCP Te	est Ca Te	ble/Repeater st	Source Te	est
-→		Q (↓)			3	0	
Video Passthrough	CEC Test		CEC Tes	st Lir	nk Test	Repeater	Test
<b>T</b>		3	POLL				
HDMI (8 bpc YCbCr 4:4:4)	1920x1080p 60 frames/s	VIC 16: No errors	HDMI 3D disabled	AVMUTE disabled	HDCP disabled	+5V detect	ed
HDMI (YCbCr 4:4:4)	640x1005 60Hz	Color Bars	3D: Frame Packing	Dolby 5.1 (Sine Wave)	HDCP Disable	AVMUTEOFF	을 14: 안

The Signal Type menu appears as shown below.

Signal Typ	be				Home	Preferences	Help
Interface/Sign	al Type HDMI DVI	Connector HDMI HDBaseT		Color Space	YCbCr4:	2:2 YCbCr 4:	4:4
	15) Analog YPbP 15) Analog RGB 3G-SDI			Format Type TV (CE)	PC (IT)	User-Defi	ned
HDM//DVI: No signal	No TMDS clock	Cannot be analyzed	Not capable of HDMI 3D	AVMUTE disabled	Not capable o HDCP	f No +5V detec	cted
HDMI (8 bpc RG	Format: B) 3840x2160 30Hz	Pattern: Pseudo Random	3D: Disabled	Audio (HDMI): LPCM 2.0ch 48kHz	Enable HDCP	AVMUTEOFF HDCP OK HPD FAIL	08:00

- 3. Touch select the desired signal type using the associated activation button, example HDMI.
- 4. Touch select the options for the Signal Type. Use the information in Table 4-1 below as a guide:

Table 4-1: Signal Type				
Signal Type Name	Physical Connector	Option	Option Values	
HDMI	HDMI OUT via HDMI to	Color Space	<ul> <li>YCbCr 4:4:4, 4:2:2, 4:2:0</li> <li>RGB</li> </ul>	

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	HDMI cable (provided)		<ul> <li>8</li> <li>10</li> <li>12</li> </ul>
		Format Type	<ul> <li>TV – Uses limited color range</li> <li>PC – Uses full color range</li> <li>User</li> </ul>
DVI	HDMI OUT via HDMI to DVI cable (not provided)	Format Type	<ul> <li>TV – Uses limited color range</li> <li>PC – Uses full color range</li> <li>User</li> </ul>
HDBaseT	HDBaseT OUT via HDBaseT to HDBaseT	Color Space	<ul> <li>YCbCr 4:4:4 4:2:2, 4:2:0</li> <li>RGB</li> </ul>
	cable (not provided)	Bit Depth	• 8 • 10 • 12
		Format Type	<ul> <li>TV – Uses limited color range</li> <li>PC – Uses full color range</li> <li>User</li> </ul>
3G-SDI	SDI OUT via SDI to SDI cable (not provided)	Color Space	<ul> <li>YCbCr 4:2:2</li> </ul>
		Bit Depth	• 8
		Format Type	TV – Uses limited color rang
YPbPr Analog	ANALOG HD-15 (VGA) via HD to 3-RCA cable (provided)	Sync Type	<ul><li>Sep[arate] Sync</li><li>Sync on Green</li></ul>
RGB Analog	ANALOG HD-15 (VGA) via VGA cable (not provided)	Format Type	<ul> <li>TV – Uses limited color range</li> <li>PC – Uses full color range</li> <li>User</li> </ul>
		Sync Type	<ul><li>Sep[arate] Sync</li><li>Sync on Green</li></ul>

### 4.2.2 Procedures for Selecting an Resolution and Frame Rate – HDMI and HDBaseT

The procedures below describe how to select the resolution for HDMI and HDBaseT outputs.

**Note**: You can create your own custom formats using the Quantum Data Format Editor. These procedures are described in <u>Creating and Using Custom Formats, EDIDs and Bitmaps</u>.

When you make a physical connection to an HDTV or monitor, a hot plug event will occur. There are two modes the 780C can be set in when testing HDMI or HDBaseT sink devices that determine how the 780C responds to this hot plug event: 1) Hot plug formats On; 2) Hot plug formats Off.

When hot plug formats are On and a hot plug event occurs, the 780C will read the EDID of the display device connected to its output port. It will then automatically configure the list available signal types (resolutions and frame rates) to only those supported by the HDMI or HDBaseT sink device. The 780C will also be configured to output the signal indicated in the EDID as the "preferred" timing. The preferred timing is highlighted in green following a hot plug event.

When hot plug formats are Off, the 780C will display all viable HDMI or HDBaseT formats for the interface whether they are supported by the display or not.

1. Select the **Preferences** from the 780C top level menu. Navigate to the second page by touch selecting the **More**... key.

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	Preferences					Home	Preferences Help
		Audible	Touch Feedback				
		ŝ	Screen Brightness	25%	50% 75% 1	Max	
			USB Mode	COM Disk			
			Startup Mode	Default	Custom Menu		
			Custom Menu	Enter		More	
1							
l N	HDMI/DVI: No signal	No TMDS clock	Cannot be analyzed	Not capable of HDMI 3D		Not capable of HDCP	
0 U	Interface: HDBaseT (8 bpc BGB)	Format: 720x480 60Hz	Pattern: Color Bars	3D: Disabled	Audio (HDMI): LPCM 2.0ch 48kHz	Enable HDCP	

<	Preferences	s (Page 2)				Home	Preferences Help
			Hot Plug Formats	Off On			
		AV Mute	on Format Change	Off On			
			RS-232 Baud Rate	< 115200			
		RS	-232 Keypad Mode	Off On			
		Bac	<				
I N	HDMI/DVI: No signal	No TMDS clock	Cannot be analyzed	Not capable of HDMI 3D	No GCP packets received	Not capable of HDCP	No +5V detected
0 U T	Interface: HDMI (8 bpc RGB)	Format: 3840x2160 30Hz	Pattern: Color Bars	3D: Disabled	Audio (HDMI): LPCM 2.0ch 48kHz	Enable HDCP	AVMUTEOFF (2) 04:18 NO HDCP 12 (04:18 HPD FAIL (2) (2) (2) (2) (2) (2) (2) (2) (2) (2)

- 2. Select the Hot Plug Formats mode to On or Off as desired. Refer to the screen above.
- 3. Touch select the Formats activation button on the Status bar OUT to access the Formats menu. Refer to the figure below.

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ome					Home	Preferences	Help
Source Tests			Sink Tests	Lini	Tests	Installer Te	sts
Format Analyzer	Packet Viewer	Audio Analyzer	EDID Te		x Channel alyzer	Sink Test	
							] [
Video Display	HDCP Test	Audio Monitor Settings	HDCP Te	est Ca Te	able/Repeater st	Source Te	est
-	Aksv Bksv	Q () ()			3		
Video Passthrough	CEC Test		CEC Tes	t Lir	nk Test	Repeater	Test
		5	o Poll				
HDMI (8 bpc YCbCr 4:4:4)	1920x1080p 60 frames/s	VIC 16: No errors	HDMI 3D disabled	AVMUTE disabled	HDCP disabled	+5V detect	ted
HDMI (YCbCr 4:4:4)	640x1005 60Hz	Color Bars	3D: Frame Packing	Dolby 5.1 (Sine Wave)	HDCP Disable	AVMUTEOFF [ HDCP OK =	<mark>≩</mark> 14: ●

The Formats menu appears as shown below (example HDMI):

TV Format					Home	Preferenc	es Help
16:9 Formats	4:2	B Formats		Frame F	Rate		
480p	480i	720x480p	720x480	li 23.9	76Hz 24	Hz	25Hz
576p	576i	720x576p	720x576	i 29.9	97Hz 30	Hz	50Hz
720p	64	:27 ("21:9") Formats		59.9	94Hz 60	Hz	100Hz
1080p	1080i	1280x720p	1680x720	)p 119.	88Hz	DHz	200Hz
2160p		1920x1080p	2560x108	0p 239.	76Hz 240	DHz	
		3840x2160p					
	25	6:135 Formats					
		4096x2160p					
I HDMI (8 bpc N YCbCr 4:4:4)	1920x1080p 60 frames/s	VIC 16: No errors	HDMI 3D disabled	AVMUTE disabled	HDCP disabled		
O HDMI (YCbCr 4:4:4)	3840x2160 30Hz	Color Bars	3D: Disabled	LPCM 2.0ch 32 kHz	HDCP Enable	NO HDCP	
						HPD FAIL	

4. Touch select the desired format and Frame Rate (example 2160p at 30Hz above).

For the HDMI formats, there are color codes that are applied to the Resolution and Frame Rate selections. The following is a summary of their meaning:

- A Resolution or Frame Rate with **white** lettering but with **no outline** a Resolution or Frame Rate that appears in the EDID and has a short video descriptor associated with it.
- A Frame Rate with **green** lettering and with **white outline** The Frame Rate that is currently selected.
- A Frame Rate with red lettering but with no outline The Frame Rate is not supported by the EDID for that Resolution.
- A Frame Rate(s) with green lettering and with white outline The Frame Rate along with the currently selected Resolution that is the "preferred" timing.

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 A Frame Rate with black lettering but with no outline – The Frame Rate is not supported by the standard for the selected resolution.

**Note**: When you make a physical connection to an HDMI or HDBaseT HDTV or sink device, a hot plug event will occur. If **Hot Plug Formats** is enabled on the **Preference** menu, when the hot plug event occurs, the 780C will read the EDID of the display device connected to its output port. The output is automatically set to the preferred timing which is highlighted in green following a hot plug.

#### 4.2.3 Procedures for Enabling AVMute

The procedures below describe how to enable AVMute on the HDMI or HDBaseT output ports. AVMute is an optional feature in HDMI or HDBaseT that enables a source to signal a sink to extinguish its audio and video. The source, in this case the 780C emulating a source sets the AVMute Set flag in the general control packet. The purpose of AVMute is to avoid audio artifacts when switching resolutions.

1. Select the **Preferences** from the 780C top level menu. Navigate to the second page by touch selecting the **More**... key.

<	Preferences					Home	Preferences	elp
		Audible	Touch Feedback	Off				
		s	creen Brightness	Min 25%	50% 75% [	Max		
			USB Mode	COM Disk				
			Startup Mode	Default	Custom Menu			
			Custom Menu	Enter		More		
								_
l N	HDMI/DVI: No signal	No TMDS clock	Cannot be analyzed	Not capable of HDMI 3D		Not capable of HDCP		
0 U T	Interface: HDBaseT (8 bpc RGB)	Format: 720x480 60Hz	Pattern: Color Bars	3D: Disabled	Audio (HDMI): LPCM 2.0ch 48kHz	Enable HDCP	AVMUTEOFF	08:57

2. Touch select the On activation button next to AVMute on the screen below.

<	Preferences	: (Page 2)				Home	Preferences Help
			Hot Plug Formats	Off On			
		AV Mute	on Format Change	Off On <			
			RS-232 Baud Rate	< 115200			
		RS-	-232 Keypad Mode	Off On			
		Back	<				
I N	HDMI/DVI: No signal	No TMDS clock	Cannot be analyzed	Not capable of HDMI 3D	No GCP packets received	Not capable of HDCP	No +5V detected
0 Ų	Interface: HDMI (8 bpc RGB)	Format: 3840x2160 30Hz	Pattern: Color Bars	3D: Disabled	Audio (HDMI): LPCM 2.0ch 48kHz	Enable HDCP	AVMUTEOFF (2) 04:18 NO HDCP 12-0 HPD FAIL

#### 4.2.4 Procedures for Selecting a Resolution and Frame Rate – SDI

The procedures below describe how to select the resolution for the SDI output.

**Note**: You can create your own custom formats using the Quantum Data Format Editor. These procedures are described in <u>Creating and Using Custom Formats, EDIDs and Bitmaps</u>.

1. Touch select the Formats activation button on the Status bar OUT to access the Formats menu. Refer to the figure below.



The Formats menu appears as shown below:

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TV Format					Home	Preferen	ces Help
16:9 Formats	4:	3 Formats		Frame F	Rate		
480p	480i	720x480p	720x480	i 23.9	76Hz 2	24Hz	25Hz
576p	576i	720x576p	720x576	i 29.9	97Hz	30Hz	50Hz
720p	64	:27 ("21:9") Formats		59.9	94Hz	60Hz	100Hz
1080p	1080i	1280x720p	1680x720	p 119.	88Hz 1	20Hz	200Hz
2160p	1080s	1920x1080p	2560x108	0p 239.	76Hz 2	40Hz	
		3840x2160p					
	25	i6:135 Formats					
_		2048x1080p	2048x108	Oi			
		4096x2160p	2048x108	0s			
SDI: 3G-SDI	1920x1080p 60.00 frames/s	No data	Errors: None				
Interface: 3G-SDI	Format: 1920x1080 60Hz	Pattern: Color Bars	3D: Disabled	Audio (SDI): Not configured	Enable HDC	NO HDCP	- 10.02

2. Touch select the desired format and Frame Rate (example 2160p at 30Hz above).

# 4.3 Rendering Test Patterns on an HDTV

This subsection describes how to render test patterns on an HDTV. You will first have to complete the previous procedures:

- <u>Making the physical connections</u>
- Selecting the Signal Type and Resolution

#### 4.3.1 Procedures for Outputting Test Patterns

The procedures below cover cases where there is a direct connection between the 780C and the HDTV and also where the 780C is connected to an HDTV through a repeater device.

1. From the **Home** screen on the 780C display, touch select the **Video Pattern** status and activation button on the Status Bar as shown below.

ome					Home	Preferences	Help
Source Tests			Sink Tests	i Link	Tests	Installer Te	sts
Format Analyzer	Packet Viewer	Audio Analyzer	EDID Te	An	x Channel alyzer	Sink Test	
	VSIF AUD ••••••	-					] {
Video Display	HDCP Test	Audio Monitor Settings	HDCP T	est Ca Te	ble/Repeater st	Source Te	est
<b>—</b>	Aksv Bksv	<b>\$</b> ₹)			3		
Video Passthrough	CEC Test		CEC Tes	st Lin	k Test	Repeater	Test
		3	C POLL				Ĩ
HDMI (8 bpc YCbCr 4:4:4)	1920x1080p 60 frames/s	VIC 16	HDMI 3D disabled	AVMUTE disabled	HDCP disabled	+5V detect	ed
HDMI (YCbCr 4:4:4)	640x1005 60Hz	Color Bars	3D: Frame Packing	Dolby 5.1 (Sine Wave)	HDCP Disable	AVMUTEOFF	2 14: •

2. Touch select the desired test pattern from the menu shown below. You can select patterns that are standard with the 780C or bitmaps that you have imported.

**Note**: A "+" on the lower right portion of the pattern indicates that there are options related to the specific pattern. In these cases you double touch select to access the lower level menu.

Video Patte	ern				Home	Preferences Help
Color Bars R	amp/Stair Geo Res	metry/ olution Raster	w/ Needles	Focus	Multiburst	Sharpness 1
	ecoder djust	verge Pseudo Rando	b LG Color m Bars	UL 3 Bar	Black Pluge	White Pluge
Checker- board	one Plate Bitmap)				3D Color Ramp	3D Crosstalk
	atterns	/ Grill Data	1080p	ChinaRes	Master (882)	Philips1
HDMI (8 bpc YCbCr 4:4:4)	1920x1080p 60 frames/s	VIC 16: No errors	HDMI 3D disabled	AVMUTE disabled	HDCP disabled	+5V detected
HDMI (YCbCr 4:2:0)	3840x2160 60Hz	Color Bars	3D: Disabled	LPCM 2.0ch 32 kHz	HDCP Enable	AVMUTEOFF 13:00 NO HDCP 17

(If applicable) Specify the test pattern options. Use the information in Table 4-3 below as a guide.
 Note: There may be additional patterns not shown in the table.

Table 4-3: Test Patterns						
Variant	Options	Range of Values				
	Variant	Variant Options				

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Pattern Name	Variant	Options	Range of Values
ColorBar patterns Applications:	SMPTE	Orientation - Vertical	Direction: Left to Right Right to Left
SMPTEBars - To adjust color and hue. Colorbars - To test a display's ability to product fully saturated		Orientation - Horizontal	Direction: Top / Bottom Bottom / Top From left to right, top to bottom:
primary and secondary color.		<ul> <li>Pixel values in RGB, 8bit with TV (limited range) mode.</li> <li>Note 1: Deep color values for 10-bit or 12-bit are different from those shown.</li> <li>Note 2: When using PC Format type the range will go from 0 to 255 for 8-bit color mode.</li> </ul>	From left to right; top to bottom: Top bars: R=180 G=180 B=180 R=180 G=180 B=16 R=16 G=180 B=16 R=16 G=180 B=16 R=180 G=16 B=180 R=180 G=16 B=180 Middle short bars: R=16 G=16 B=16 R=180 G=16 B=16 R=180 G=180 B=180 R=16 G=180 B=180 R=16 G=180 B=180 Lower bars: R=18 G=70 B=107 R=235 G=235 B=235 R=86 G=31 B=134 R=16 G=16 B=16 R=9 G=9 B=9 R=16 G=16 B=16 R=23 G=23 B=23
	Full	Orientation - Vertical	Direction: Left to Right Right to Left
		Orientation - Horizontal	Direction: Top / Bottom Bottom / Top
	Split	Orientation - Vertical	Direction: Left to Right Right to Left
		Orientation - Horizontal	Direction: Top / Bottom Bottom / Top

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Table 4-3: Test Patterns			
Pattern Name	Variant	Options	Range of Values
Ramp/Stair Patterns     Stair - Full       Applications:     Image: Comparison of the second	Stair - Full	Orientation - Vertical	Direction: Left to Right Right to Left Direction: Top / Bottom Bottom / Top 5 11 21
Stair - To visually check grayscale tracking performance of a rear projection display.		Orientation - Horizontal	
Ramp – To check the digitizing linearity of video signal processors.		Bars	
		Color	<ul> <li>R</li> <li>G</li> <li>B</li> <li>C</li> <li>M</li> <li>Y</li> <li>W</li> </ul>
	Stair – Split	Orientation - Vertical	Direction: <ul> <li>Left to Right</li> <li>Right to Left</li> </ul>
		Orientation - Horizontal	Direction: Top / Bottom Bottom / Top
		Bars	<ul> <li>5</li> <li>11</li> <li>21</li> </ul>
		Color	<ul> <li>R</li> <li>G</li> <li>B</li> <li>C</li> <li>M</li> <li>Y</li> <li>W</li> </ul>
	Ramp	Color	<ul> <li>R</li> <li>G</li> <li>B</li> <li>C</li> <li>M</li> <li>Y</li> <li>W</li> </ul>

Table 4-3: Test Patterns			
Pattern Name	Variant	Options	Range of Values
		Pixel values in RGB, 8bit with TV (limited range) mode. <b>Note 1:</b> When using PC Format type the range will go from 0 to 255 for 8-bit color mode.	In 8-bit color mode (24) the ramp displays all 256 shades of gray. In 10-bit color mode (30) the ramp displays 256 shades of gray throughout a range of 64 – 940 skipping interim shades at each increment. In 12-bit color mode (36) the ramp displays 256 shades of gray throughout a range of 256 – 3760 skipping interim shades at each increment.
3D Box Pattern	No variants	Box 1 Offset	-64 to +64
Application: This is a 3D pattern used to test 3D displays. The pattern enables		Box 2 Offset	-64 to +64
you to set the offset between the left and right image components.		Background Brightness	0 to 63
<b>3D Color Ramp</b> Application: This is a 3D pattern used to test 3D color uniformity and crosstalk or extinction ratio.	No variants	<ul> <li>Description: There are 4 pairs of horizontal color bars. Each bar depicts a color gradation from red to purple; two from left to right and one from right to left.</li> <li>Method – Color uniformity: <ol> <li>Close left eye to view image from right eye.</li> <li>Assess the color gradation on each bar.</li> <li>Close right eye to view image from left eye.</li> <li>Subjectively compare the images to assess color uniformity.</li> </ol> </li> </ul>	
		2. Verify that the bot	iew image from right eye. tom bar is extinguished. The extent to ot extinguished represents the amount

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Table 4-3: Test Patterns			
Pattern Name	Variant	Options	Range of Values
<b>3D Cross Talk</b> Application: This is a 3D pattern used to measure the crosstalk (extinction ratio) for frame packing, top and bottom and side by side 3D format structures.	No variants	<ul> <li>Description: This image is divided in two sections with four rows of 16 white boxes each. The top section is for testing with the left eye open. The bottom section is for testing with the right eye open. The bottom section is for testing with the right eye open. The background area surrounding the boxes is a series of grayscale ramps. The ramps begin at 100 IRE and transitions to 50 IRE at the left end of the fourth row of each series.</li> <li>Method – Calculating percent crosstalk: <ol> <li>Close right eye to test the left eye using the top section.</li> <li>Check the visibility of the boxes. Any deviation from black indicates crosstalk.</li> </ol> </li> <li>Assess where the box and its background blend such that they are not distinguishable.</li> <li>Calculate the degree of crosstalk as a percent by counting the number of boxes (from the beginning of the series to the box identified in step 3) and divide that by 127. Example if the 20<sup>th</sup> box blends with its background, the crosstalk would be 20/127 * 100 = 15.7%</li> <li>Repeat with the left eye closed to test the right eye.</li> </ul>	
<b>PGCWRGB Pattern</b> Application: This is a scrolling pattern used to test for noise on analog displays and motion artifacts.	No variants	Show Text Show Center Cross Show Video Show Overscan Grid Type	On / Off           • 10x50           • 5% H/V
Geometry/Resolution Patterns Applications: Grid – To check and adjust convergence of red, green and blue pictures. Linearity – for testing deflection linearity testing and alignment. Overscan – To check and adjust for the proper geometry of display including picture centering, size, pincushion and linearity.	Grid Linearity	Color Mode	<ul> <li>White on Black</li> <li>Black on White</li> <li>White on Black</li> <li>Black on White</li> </ul>

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Table 4-3: Test Patterns			
Pattern Name	Variant	Options	Range of Values
	Overscan	N/A	
EMI/Grill Applications: EMI – Show grid of "H" characters to check for EMI effects on image. Each "H" character should be clear and distinct.	EMI	Н Туре	
		Grill On/Off	
		Scroll – Scrolls the "H" chara	acters vertically.
Grill – for verifying monitor resolution.	EMI - Grill	Grill On/Off	
		Grill Mode	
Color Bars – To test a display's ability to produce fully saturated primary and secondary color.	EMI - ColorBars	Scroll – color bars scroll horizontally.	

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Table 4-3: Test Patterns			
Pattern Name	Variant	Options	Range of Values
Needles Pattern	No variants	I	
Application: To detect whether scan velocity modulation is enabled on display.			
Window/Raster Pattern	Window	IRE Level	■ -5 ■ -1
Applications:			■ 100 ■ +1
Window1 - To calibrate display drive chromaticity.			■ +5
Window2 - To calibrate display cutoff chromaticity.		IRE Label	Off     On
Raster – To check color purity and display chrominance uniformity.		Color	<ul> <li>R</li> <li>G</li> <li>B</li> <li>C</li> <li>M</li> <li>Y</li> <li>W</li> </ul>
	Raster	IRE Level	<ul> <li>-5</li> <li>-1</li> <li>100</li> <li>+1</li> <li>+5</li> </ul>
		IRE Label	Off     On
		Color	<ul> <li>R</li> <li>G</li> <li>B</li> <li>C</li> <li>M</li> <li>Y</li> <li>W</li> </ul>
Needles Pattern	N/A		
Application: To detect whether scan velocity modulation is enabled on display.			

Table 4-3: Test Patterns			
Pattern Name	Variant	Options	Range of Values
Focus Pattern	N/A		I
Application: To detect whether scan velocity modulation is enabled on display.			
Multi-burst Pattern	N/A		
Application: To check a display's ability to produce sharply defined stripes at equal brightness up to full resolution.			
Sharpness	No Variants		
Application: To align display sharpness, picture, aperture and scan velocity modulation adjustments.			
Decoder Check	No Variants		
Application: To check the color decoder performance to determine if the decoder over- emphasizes red or green colors.			
Decoder Adjust Pattern	No Variants		
Application: To adjust a display's color decoder/matrix circuit for most accurate color reproduction.			
Converge Pattern	No Variants		
Application: To color converge a display throughout the entire picture area.			

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Table 4-3: Test Patterns			
Pattern Name	Variant	Options	Range of Values
Pseudo Random Pattern	No Variants	·	·
Application: To test for pixel errors on an HDMI cable.			
LG Color Pattern	No Variants	Horizontal	
Application: To test a display's ability to product fully saturated primary and secondary color.		Vertical	
White is 100 IRE Yellow is 100 IRE Cyan is 100 IRE Gray is 35 IRE Red is 100 IRE Blue is 100 IRE Black is 0 IRE			
UL 3 Bar Pattern	No Variants	'	
Black Pluge Pattern	No Variants	Pixel values in RGB, 8bit with limited range (TV)	Outer background: R=16 G=16 B=16
Application: To set the picture black level and check the DC restoration performance of a display. Note: Outer boxes blink once per second.		mode.	Outer blinking box: R=20/16 G=20/16 B=20/16 Inner blinking box: R=9/16 G=9/16 B=9/16 Top most stair value: R=235 G=235 B=235 Second stair value: R=180 G=180 B=180 Third stair value: R=140 G=140 B=140 Fourth stair value: R=112 G=112 B=112 Bottom stair value: R=90 G=90 B=90

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Pattern Name	Variant	Options	Range of Values
		Pixel values in RGB, 10bit with limited range (TV) mode.	Outer background: R=64 G=64 B=64 Outer blinking box: R=80/64 G=80/64 B=80/64 Inner blinking box: R=36/64 G=36/64 B=36/64 Top most stair value: R=940 G=940 B=940 Second stair value: R=720 G=720 B=720 Third stair value: R=560 G=560 B=560 Fourth stair value: R=448 G=448 B=448 Bottom stair value: R=360 G=360 B=360
		Pixel values in RGB, 12bit with limited range (TV) mode.	Outer background: R=256 G=256 B=256 Outer blinking box: R=320/256 G=320/256 B=320/256 Inner blinking box: R=144/256 G=144/256 B=144/256 Top most stair value: R=3760 G=3760 B=3760 Second stair value: R=2880 G=2880 B=2880 Third stair value: R=2240 G=2240 B=2240 Fourth stair value: R=1792 G=1792 B=1792 Bottom stair value: R=1440 G=1440 B=1440
White Pluge Pattern Application: To set the contras and brightness controls on fixed pixel displays.	t No Variants	Pixel values in RGB, 8bit with limited range (TV) mode.	Top background: R=16 G=16 B=16 Top dark vertical line: R=8 G=8 B=8 Top larger (outer) box: R=18 G=18 B=18 Top smaller (inner) box: R=20 G=20 B=20 Bottom background: R=235 G=235 B=235 Bottom larger (outer) box: R=232 G=232 B=232 Bottom smaller (inner) box:

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Pattern Name	Variant	Options	Range of Values
		Pixel values in RGB, 10bit with limited range (TV) mode.	Top background: R=64 G=64 B=64 Top dark vertical line: R=32 G=32 B=32 Top larger (outer) box: R=72 G=72 B=72 Top smaller (inner) box: R=80 G=80 B=80 Bottom background: R=940 G=940 B=940 Bottom larger (outer) box: R=928 G=928 B=928 Bottom smaller (inner) box: R=920 G=920 B=920
		Pixel values in RGB, 12bit with limited range (TV) mode.	Top background: R=256 G=256 B=256 Top dark vertical line: R=128 G=128 B=128 Top larger (outer) box: R=288 G=288 B=288 Top smaller (inner) box: R=320 G=320 B=320 Bottom background: R=3760 G=3760 B=3760 Bottom larger (outer) box: R=3712 G=3712 B=3712 Bottom smaller (inner) box: R=3680 G=3680 B=3680
Checkboard Pattern	No Variants	Rows	• 2 • 3 • 4
regulation of CRT video drive power supply circuits.		0	■ 5 ■ 6
	8888	Columns	<ul> <li>2</li> <li>3</li> <li>4</li> <li>5</li> <li>6</li> </ul>
Zone Plate Pattern	Vertical	Vertical Movement	<ul><li>Stop</li><li>Slow</li></ul>
This is a bitmap that can be scrolled to test motion artifacts. You can replace particular bitmap with any other bitmap mage to allow scrolling. You ust need to ensure that you			<ul><li>Medium</li><li>Fast</li></ul>

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Table 4-3: Test Patterns			
Pattern Name	Variant	Options	Range of Values
assign it the same name.		Horizontal Movement	<ul><li>Stop</li><li>Slow</li><li>Medium</li><li>Fast</li></ul>

## 4.4 Using Custom Test Image Packs

The 780C provides licensed image packs for certain sets of test images. You need to have a license key to use these custom test image packs. You can arrange to get access to them by contacting Quantum Data customer support at: <u>http://www.quantumdata.com/support</u>.

**Note**: The custom test image packs are bitmap images. Bitmap images are RGB and will not display properly on the 3G-SDI output.

When you purchase an image pack it appears as an icon at the end of the list of Test Patterns. A sample screen is shown below (Philips1, ChinaRes, Master). You simply select one of the test patterns (e.g. ChinaRes in the screen example below). They will take a few seconds to load. They will load at the resolution of the format that you have selected.

Video Pattern				Home	Preferences Help
Color Bars Ramp/Stair	Geometry/ Resolution Resolution Raster	w/ Needles		Multiburst	Sharpness 1
Decoder Adjust	Converge Pseudo Randor	m Bars	UL 3 Bar	Black Pluge	White Pluge
	Halation & PGCwr Loading		Contrast	3D Color Ramp	3D Crosstalk
Test Patterns	EMI / Grill Quantu Data	1080p	ChinaRes	Master (882)	Philips1
HDMI (8 bpc 1920x1080p N YCbCr 4:4:4) frames/s	60 VIC 16: No errors	HDMI 3D disabled	AVMUTE disabled	HDCP disabled	+5V detected
0 HDMI (YCbCr 3840x2160 60 4:2:0)	0Hz Color Bars	3D: Disabled	LPCM 2.0ch 32 kHz	HDCP Enable	AVMUTEOFF 2 13:06 NO HDCP 1

Refer to the tables below for a description and depiction of the Image Packs currently offered.

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#### Table 4-4: Custom Test Image Packs – ChinaRes Pattern

#### ChinaRes Pattern Pack

This is a bitmap that is available through the Image Packs option. The ChinaRes test pattern is specified by the National Testing and Inspection Center for Radio and TV Products of China.

The image pack includes both a standard definition aspect ratio (shown right) and a high definition aspect ratio. This test pattern is supported at: 1920x1080, 1280x720, 720x576 and 720x480 resolutions.

The following is a description of the elements in this test image

- 1. Overscan gauges to determine percentage of overscan.
- 2. Centered cross, centered circles, and centered grid to test centering and concentricity.
- 3. White grid to test convergence.
- 4. Central resolution wedge gauges for vertical, horizontal, and diagonal resolutions.
- 5. Corner resolution wedge gauges for vertical and horizontal resolutions.
- 6. 4-quadrant horizontal and vertical test areas to judge resolution and display artifacts.
- 7. Color bar for testing color purity and chroma delay.
- 8. 10-step grayscale to test brightness, contrast, and luminance.
- 9. Split (left and right) grayscales for testing darkfield and bright-field gray levels.
- Average picture level is approximately 50%.

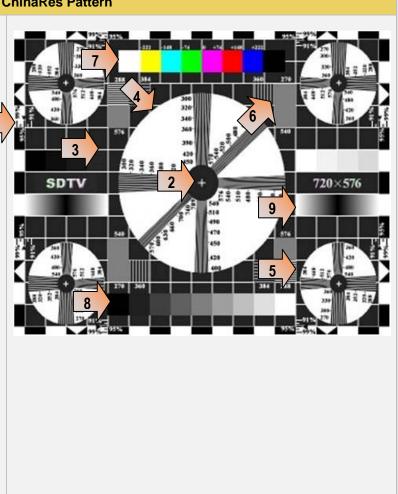


Table 4-5: Custom Test Image Packs – THX Test Patterns

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## Table 4-5: Custom Test Image Packs – THX Test Patterns

#### **THX Test Patterns**

The THX Pattern Pack offers a variety of test patterns for calibrating the luminance and chrominance of high end 3D-capable HDTVs. The following is a list of test patterns provided in this optional test pattern package. 3D Convergence - test patterns to align pixels for proper convergence.

3D Crosstalk - test patterns to determine level of 3D crosstalk.



Color Gamut – 2D/3D primary and secondary color patterns to fine-tune colors and gamma.



Picture performance - pattern within THX Optimizer to verify accuracy of skin tones.

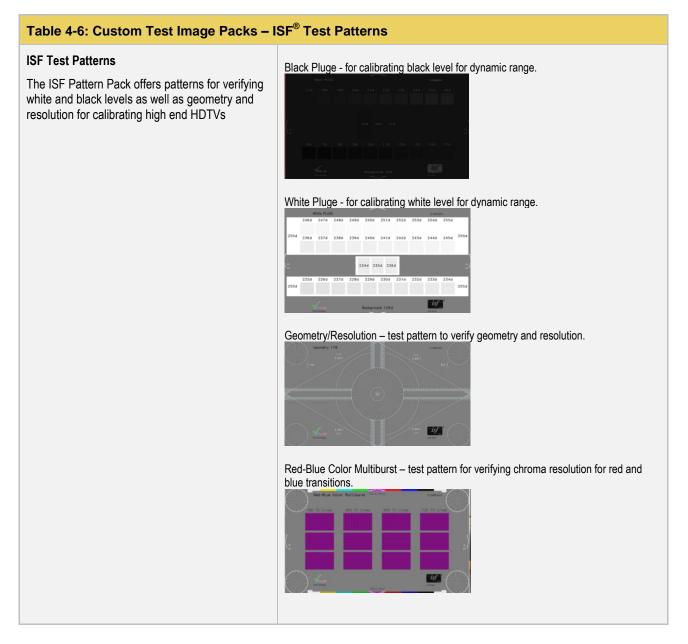


THX Optimizer - test patterns to easily adjust brightness, contrast, color, tint, etc.



Table 4-5: Custom Test Image Packs – THX Test Patterns					
THX box - 2D/3D grayscale test patterns to accurately adjust white point and gamma.					

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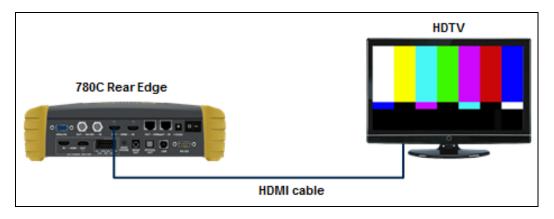
### 4.5 Outputting 3D Test Patterns through HDMI or HDBaseT

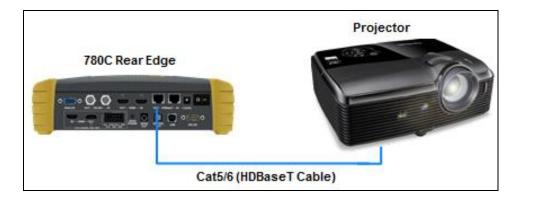
This subsection describes how to render 3D test patterns on an HDTV. The 780C supports Side-by-Side, Topand-Bottom and Frame Packing (for both interlaced and progressive timings) 3D format structures.

#### 4.5.1 Configurations for Rendering 3D Bitmaps on an HDMI or HDBaseT Sink Device

Typically you will render 3D bitmap images with the 780C directly connected to an HDTV or projector. This configuration is shown below:

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#### 4.5.2 Procedures for Obtaining 3D Bitmaps on HDMI or HDBaseT Sink Device

Use the procedures below to render 3D bitmap images on an HDMI sink.

- 1. Follow the procedures provided above to enable the HDMI output as the Signal Type.
- 2. Obtain 3D bitmaps. You can obtain 3D bitmaps in three ways:
  - Develop your own 3D bitmaps.
  - Sample 3D bitmaps from the Quantum Data website (<u>www.quantumdata.com/downloads</u>).
  - Generate 3D bitmaps from your own stereoscopic image pairs using the Quantum Data 3D Bitmap Conversion Tool available from the Quantum Data website (<u>www.quantumdata.com/downloads</u>).
- 3. Transfer your 3D bitmaps over to the 780C using the procedures described in Importing Custom Bitmaps.

#### 4.5.3 Procedures for Rendering 3D Bitmaps or 3D Test Patterns on HDMI or HDBaseT Sink Device

1. Select a format that is suitable for rendering 3D images such as 720p60 and 1080. Use the procedures above <u>Procedures for Selecting an HDMI Resolution and Frame Rate</u>.

If you have used the Quantum Data 3D Bitmap Conversion Tool, there is a naming convention for the 3D bitmaps which also provides the required format for each specific bitmap.

2. Enable the HDMI or HDBaseT as the active digital interface input.

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Interface/Signa	I Type HDMI	Connector HDMI		Color Space	YCbCr 4:2	:2 YCbCr 4:4:4
	DVI	HDBaseT	]			
VGA(HD15	5) Analog YPbP	r		Format Type		
VGA(HD1	5) Analog RGB			TV (CE)	PC (IT)	User-Defined
	3G-SDI					
3						
3						
HDMI/DVI: No	No TMDS clock	Cannot be	Not capable of	AVMUTE disabled	Not capable of	No +5V detected

3. Touch select **3D Output** option from the top level menu shown below.



The following screen will appear:

	3D Test Optio	ans 3D Mode				Home	Preferences	Неір
		Side-by- Side (Half)	Side-by- Side (Full)	Top-and- Bottom Pa LEFT RIGHT	ame ocking L R 2[			
L N	HDMI (8 bpc YCbCr 4:4:4)	1920x1080p 60 frames/s	VIC 16: No errors	HDMI 3D disabled	AVMUTE disabled	HDCP disabled	+5V detected	
Ŷ	HDMI (YCbCr 4:4:4)	1280x720 30Hz	Color Bars	3D: Disabled	Dolby 5.1 (Sine Wave)	HDCP Disable	AVMUTEOFF 🛃 HDCP OK 🚭 HPD OK ा	14:36

4. Select the 3D mode (Side-by-Side, Top-and-Bottom or Frame Packing) and then select the subtype and Left/Right options (if applicable).

K	3D Test Optio	ons				Home	Preferences Help
		3D Mode Side-by- Side (Half) L R	Side-by- Side (Full)	Top-and- Bottom Pa	ame cking L R 2	)	
ч Ч	HDMI (8 bpc YCbCr 4:4:4)	1920x1080p 60 frames/s	VIC 16: No errors	HDMI 3D disabled	AVMUTE disabled	HDCP enabled	+5V detected
Ŷ	HDMI (YCbCr 4:4:4)	640x1005 60Hz	Color Bars	3D: Frame Packing	Dolby 5.1 (Sine Wave)	HDCP Enable	AVMUTEOFF (2) 14:24 NO HDCP 1

5. Select the 3D bitmap or image image from the Test Pattern list.

Video Patter	'n				Home	Preferences Help
Color Bars Ra	amp/Stair Geor Resc	metry/ Plution Raster	w/ Needles	Focus	Multiburst	Sharpness 1
	ecoder Conv ijust	Verge Pseudo Randol		UL 3 Bar	Blaceuge	White Pluge
Checker- board (B	ne Plate Itmap) Hala Load		gb 3D Boxes		3D Color Ramp	3D Crosstalk
Test Pa	EMI / EMI /	Grill Quantu Data	1080p	Master (882)	Philips1	ChinaRes
HDMI (8 bpc RGB) N	1920x2205p 60 frames/s	VIC 16: No errors	HDMI 3D: Frame packing	AVMUTE disabled	HDCP disabled	+5V detected
0 Interface: U HDMI (RGB)	Format: 1920x2205 60Hz	Pattern: 3D Color Ramp	3D: Frame Packing	Audio: LPCM 7.1ch 48kHz	Enable HDCP	NO HDCP 13:12 NO HDCP 1

**Note**: If you are using one of the 3D bitmaps (as opposed to a standard 3D test pattern) you will have to make sure that the 3D bitmap you use matches your selection of 3D formats and timing (resolution). In the example above, a 3D Frame Packing bitmap is selected for 1280 x 720. Therefore you have to make sure that you select that specific timing (i.e. 1280 x 720) and that specific 3D format structure (Frame Packing).

# 4.6 How to Scroll or Pan a Bitmap Pattern

This subsection describes how to scroll bitmaps on your 780C.

Note: The bitmap images are RGB and will not display properly on the 3G-SDI output.

#### 4.6.1 Guidelines for Scrolling Bitmaps

There are two ways you can animate (move) a bitmap image: 1) image shifting (scrolling); 2) panning. You can shift or scroll a bitmap image that you have imported into the 780C by modifying the X and Y parameters or by dragging and panning. When you use the X and Y parameters, you are limited to linear scrolling. With panning you can move the image in non-linear motions.

You can only scroll bitmaps whose overall pixel resolution is smaller than the resolution of the active format and you can only scroll them within the bounds of the resolution of the active format. You cannot scroll the standard test patterns in the 780C.

In order to scroll a bitmap the name of the *bitmap has to be "zp.bmp."* But you can scroll any bitmap. You just have to make sure that you have named it "zp.bmp" (without the quotes). The zone plate bitmap is the only bitmap that comes standard with the 780C.

#### 4.6.2 Procedures for Scrolling Bitmaps

Use the following procedure to scroll your bitmaps.

1. Touch select the desired bitmap image, e.g. Zone Plate image from the list of video patterns.

Video Patter	'n				Home	Preferences Help
Color Bars Ra	Reso	metry/ plution Raster	V/ Needles		Multiburst	Sharpness 1
		verge Pseudo Randor		UL 3 Bar	Black Pluge	White Pluge
	ne Plate timap) Hala Load		gb 3D Boxes	3D Contrast	3D Color Ramp	3D Crosstalk
	EMI / EMI /	/ Grill Quantu Data	1080p	•		<b></b>
HDMI (8 bpc RGB) N	720x480p 60 frames/s	VIC 2: No errors	HDMI 3D disabled	AVMUTE disabled	HDCP disabled	+5V detected
0 Interface: U HDMI (8 bpc RGB) T	Format: 720x480 60Hz	Pattern: Color Bars	3D: Disabled	Audio (Optical): LPCM 2.0ch 48kHz	Enable HDCP	NO HDCP 12 00:33 NO HDCP 12 00:33 HPD OK

2. Double touch select on the Zone Plate bitmap to access its options.

The **Zone Plate Options** menu appears:

<	Image Shifti	ng Options				Home	Preferences	Help
		Horizontal	Movement					
		Stop	Slow	Medium	Fast			
		Vertical Mo	ovement					
		Stop	Slow	Medium	Fast			
		Manua	l Panning					
I N	HDMI/DVI: No signal	No TMDS clock	Cannot be analyzed	Not capable of HDMI 3D	No GCP packets received	Not capable of HDCP	No +5V detecte	d
0 U	Interface: HDMI (8 bpc RGB)	Format: 3840x2160 30Hz	Pattern: Zone Plate	3D: Disabled	Audio (HDMI): LPCM 2.0ch	Enable HDCP		00
-		Format:	analyzed Pattern:	HDMI 3D	received Audio (HDMI):	HDCP	AVMUTEOFF 👮	04:1

- 3. Specify the Horizontal Movement by touch selecting the appropriate setting Slow, Medium, Fast.
- 4. Specify the Vertical Movement by touch selecting the appropriate setting Slow, Medium, Fast.

The pattern will begin to move around the raster of the display in accordance with the horizontal and vertical settings. To halt the motion, touch **Stop** for either or both of the **Horizontal Movement** and **Vertical Movement**.

#### 4.6.3 **Procedures for Panning Bitmaps**

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Use the following procedure to pan your custom bitmaps.

1. Select by double touching, the desired bitmap image, e.g. Master 1920x1080 image from the list of video patterns (shown below).



2. Double touch select on a bitmap to access its options. The screen below appears.

<	Image Shifti	ng Options				Home	Preferences Help	
		Horizontal	Movement					
		Stop	Slow	Medium	Fast			
	Vertical Movement							
		Stop	Slow	Medium	Fast			
		Manua	I Panning					
I N	HDMI/DVI: No signal	No TMDS clock	Cannot be analyzed	Not capable of HDMI 3D	No GCP packets received	Not capable of HDCP	No +5V detected	
0 U T	Interface: HDMI (8 bpc RGB)	Format: 3840x2160 30Hz	Pattern: Zone Plate	3D: Disabled	Audio (HDMI): LPCM 2.0ch 48kHz	Enable HDCP	NO HDCP 12 04: NO HDCP 12 04:	

3. Select Manual Panning to initiate the panning operation.

The message shown on the screen below will appear.

4. Simply move your finger or stylus around the screen to pan the image.

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# 4.7 Testing Digital Audio on an HDTV or A/V Receiver

This section provides procedures for testing digital audio on an HDTV or A/V Receiver.

Note: It is recommended not to select bitmap images when outputting compressed audio clips.

Table 4-5 below summarizes the 780C support for digital audio.

Table 4-5: Summary of	Table 4-5: Summary of Audio Signal Types						
Audio Signal Type	Interfaces	Description					
Dolby 5.1	<ul> <li>HDMI</li> <li>HDBaseT</li> <li>SDI</li> <li>Optical</li> <li>SPDIF</li> <li>HDMI ARC (780C only)</li> </ul>	<ul> <li>Provides a set of Dolby Digital 5.1 noise patterns:</li> <li>500-2kHz Pink</li> <li>20-20kHz Pink</li> <li>Sine Wave</li> <li>Impulse</li> <li>Polarity</li> <li>Auto Time Delay</li> </ul>					
Dolby Digital Plus 7.1       • HDMI       Provides a set of Dolby Digital Plus 7.1 sine wave         • HDBaseT       • 2.0 192kHz – 2 channel @ 192kHz sampling         • SDI       • 5.1 192kHz – 6 channel @ 192kHz sampling         • 7.1 192kHz – 8 channel @ 192kHz sampling		<ul> <li>5.1 192kHz – 6 channel @ 192kHz sampling rate</li> </ul>					
DTS-ES 6.1	<ul> <li>HDMI</li> <li>HDBaseT</li> <li>SDI</li> <li>Optical</li> <li>SPDIF</li> <li>HDMI ARC (780C only)</li> </ul>	<ul> <li>Provides a set of DTS ES 6.1 noise pattern clips:</li> <li>500-2kHz Pink</li> <li>20-20kHz Pink</li> <li>Sine Wave</li> <li>Impulse</li> <li>Polarity</li> <li>Auto Time Delay</li> </ul>					
Dolby TrueHD	<ul><li>HDMI</li><li>HDBaseT</li></ul>	<ul> <li>Provides a set of Dolby TrueHD Hi Bit Rate sine wave clips:</li> <li>192kHz 7.1 1kHz TrueHD – 8 channel @ 192kHz sampling rate</li> <li>192kHz 7.1 2kHz TrueHD – 2 channel @ 192kHz sampling rate</li> </ul>					
DTS HD Master Audio	<ul><li>HDMI</li><li>HDBaseT</li></ul>	<ul> <li>Provides a set of DTS-HD Hi Bit Rate sine wave clips:</li> <li>192kHz 7.1 HDMA – 8 channel @ 192kHz sampling rate</li> <li>192kHz 5.1 HDMA – 6 channel @ 192kHz sampling rate</li> </ul>					
PCM Sine Wave (programmable)	<ul> <li>HDMI</li> <li>HDBaseT</li> <li>SDI</li> <li>Optical</li> <li>SPDIF</li> <li>HDMI ARC</li> </ul>	<ul> <li>Provides programmable sine waves:</li> <li>Bits per sample – 16, 20, 24</li> <li>Sampling rate (kHz) – 32, 44.2, 48, 88.2, 96, 176.4, 192</li> <li>Channels – 2.0, 2.1, 5.1, 6.1, 7.1</li> <li>Level – 0dB to -99dB in 1dB or 3dB increments (per channel)</li> <li>Frequency – 0.01kHz to 20kHz in 1Hz, 10Hz, 100Hz or 1000Hz increments (per channel)</li> <li>Mute – On/Off (per channel)</li> </ul>					

#### 4.7.1 Connecting the 780C to an Audio Rendering Device

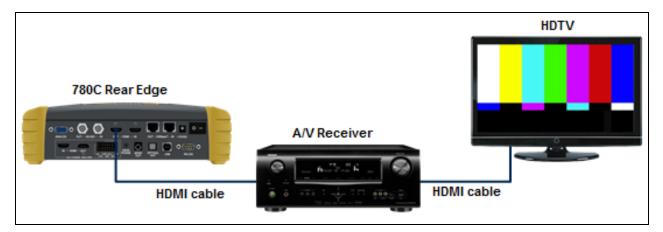
Use the following procedures to make the physical connections from the 780C to the audio rendering device under test.

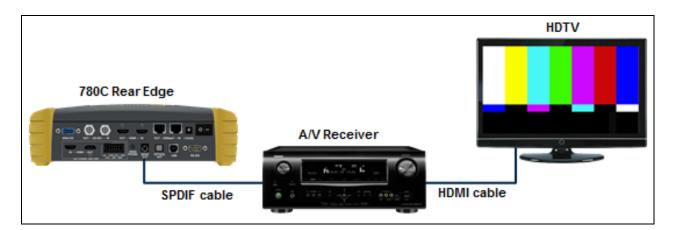
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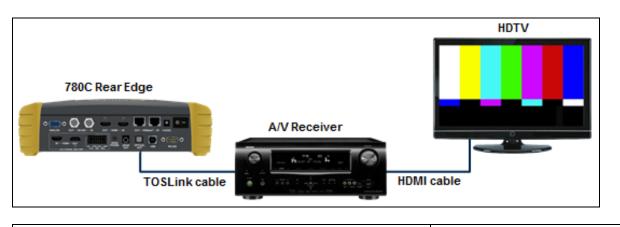
1. Make the cable connection between the appropriate the 780C video output connector (e.g. HDMI OUT, SPDIF or OPTICAL) and the input connector of the audio rendering device using the cables supplied.

Alternatively you may connect from the 780C video output connector to an HDTV through an HDMI repeater device such as an A/V receiver. In this case make the HDMI connection between the HDMI OUT connector on the 780C and the HDMI input of the HDMI repeater device using an HDMI-to-HDMI cable. Then connect the HDTV to an active output on the repeater. The following illustrations depict the typical test configurations.

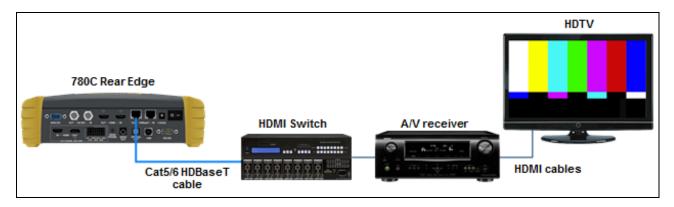
The following illustrations depict the test setups for the HDMI audio, SPDIF audio and optical (TOSLink). Note also that you can test directly into an HDTV without going through an A/V receiver.







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#### 4.7.2 Procedures for Testing a Display with Dolby Digital or DTS Audio Test Patterns

Use the following procedures to run audio tests using Dolby Digital and or DTS audio test patterns. These test patterns are useful for calibrating the room acoustics in a home theatre system.

- 1. Make the physical connections between the 780C and the audio rendering device as described in the procedures above.
- 2. Select the digital interfaces—HDMI, HDBaseT or SDI—output as shown below.

Note for testing SPDIF of TOSLink this is not necessary.

Signal Type					Home	Preferences	Hel
Interface/Signal	Type	Connector HDMI	)	Color Space	YCbCr 4:2	2:2 YCbCr 4	:4:4
VGA(HD15	DVI ) Analog YPbP	HDBaseT					
VGA(HD15) Analog RGB				Format Type TV (CE)	PC (IT)	User-Defi	ned
3	G-SDI						
HDMI/DVI: No signal	No TMDS clock	Cannot be analyzed	Not capable of HDMI 3D	AVMUTE disabled	Not capable of HDCP	No +5V deter	cted
Interface: IDMI (8 bpc RGB)	Format: 3840x2160 30Hz	Pattern: Pseudo Random	3D: Disabled	Audio (HDMI): LPCM 2.0ch 48kHz	Enable HDCP	AVMUTEOFF	00

3. From the **Home** menu (shown in the figure below), select the Audio status/activation button on the Status Bar as indicated below.

ome					Home	Preferences	Help
Source Tests			Sink Tests	s l	Link Tests	Installer Tes	ts
Format Analyzer	Packet Viewer	Audio Analyzer	EDID Te	st	Aux Channel Analyzer	Sink Test	
, , , , , , , , , , , , , , , , , , ,							
Video Display	HDCP Test	Audio Monitor Settings	HDCP T	est	Cable/Repeater Test	Source Tes	st
<b></b> ←		<b>\$</b>			3		Î
Video Passthrough	CEC Test		CEC Tes	st	Link Test	Repeater T	est
		5	O POLL				Ĩ
HDMI (8 bpc YCbCr 4:4:4)	1920x1080p 60 frames/s	VIC 16: No errors	HDMI 3D disabled	AVMUT	ed HDCP disabled	+5V detecte	d
HDMI (YCbCr 4:4:4)	640x1005 60Hz	Color Bars	3D: Frame Packing	Dolby 5.1 (Sine Wave)	HDCP Disable	AVMUTEOFF	14:

4. Enable the digital audio interface (HDMI, HDBaseT, SDI, TOSLInk, SPDIF). Refer to the screen examples below.

<	Audio Test T	Tone				Home	Preferences	Help
	Interface	Signal Type						
	Off	PCM Sine	Wave					
	Optical	Dolby 5	5.1					
	SPDIF	DD+/True	eHD					
	HDMI	DTS-ES	6.1					
	ARC	DTS-H	D					
	SDI							
	NOTE: For non-PC		a bitmap for video					
Ň	HDMI/DVI: No signal	No TMDS clock	Cannot be analyzed	Not capable of HDMI 3D		Not capable of HDCP		and a second s
0 U T	Interface: HDBaseT (8 bpc RGB)	Format: 720x480 60Hz	Pattern: Color Bars	3D: Disabled	Audio (HDMI): LPCM 2.0ch 48kHz	Enable HDCP	NO HDCP	

Please note that not all of the audio formats are available on all of the Interface types.

- 5. Touch select the desired **Interface** from the **Audio Pattern** menu (refer to the screen shot above which shows HDMI). The options are Optical, SPDIF or HDMI.
- 6. Double touch select the **Dolby Digital 5.1** or **DTS-ES 6.1** item on the **Audio Pattern** menu (refer to the screen shot above).

The following screen appears (DTS-ES shown):

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DTS-ES 6.1 Samples				Home	Preferences Help
	500-2kHz Pink	A	uto Time Delay		
	20-20kHz Pink	Channel	Selection		
	Sine Wave				
	Impulse	Cycle	LFE	All	
	Polarity	Ls	Cs	Rs	
HDMI (8 bpc RGB) 3840x2160p 30 N frames/s	HDMI_VIC 1: No errors	HDMI 3D disabled	AVMUTE disabled	HDCP disabled	+5V detected
0 Interface: Format: HDMI (8 bpc RGB) 3840x2160 30Hz	Pattern: Zone Plate	3D: Disabled	Audio (HDMI): DTS-ES 6.1 (Narrow Pink	Enable HDCP	NO HDCP 1 04:23

 Touch select the desired audio test pattern. (500-2kHz Pink is shown selected in the sample screen shot above and Sine Wave shown in the screen shot below.) Use the information in Table 4-6 below to understand the application of each audio test pattern.

K	Dolby 5.1 Sa	amples				Home	Preferences He	lp
		5	00-2kHz Pink		uto Time Delay			
			0-20kHz Pink	63Hz	Cycle All			
			Sine Wave	125Hz				
			Impulse	1kHz	Cycle	Ĵ		
			Polarity	4kHz	Cycle All			
	HDMI (8 bpc RGB)	1920x1080p		HDMI 3D disabled		HDCP disabled	+5V detected	
		60.00 frames/s						
0 U T	Interface: HDMI (8 bpc RGB)	Format: 1920x1080 60Hz	Pattern: Color Bars	3D: Disabled	Audio (HDMI): Dolby 5.1 (Sine Wave)	Enable HDCP	NO HDCP 🔥 🛁	9:02

**Note**: When selecting Sine Wave at 1kHz or 4kHz the 780 will output 5.0 audio. This is because the subwoofer frequency response is 20Hz to 200Hz.

Table 4-6: Audio Pattern Tests					
Pattern	Format	Interfaces	Range of Values		

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Table 4-6: Audio Pattern Tes	ts		
Pattern	Format	Interfaces	Range of Values
<ul> <li>Pink Noise Patterns:</li> <li>500-2kHz Pink noise</li> <li>20-20kHz Pink noise</li> <li>Application:</li> <li>Tests sound pressure level</li> <li>Main speaker frequency</li> </ul>	Dolby Digital 5.1	HDMI HDBASET SDI SPDIF Optical HDMI ARC (780C only)	<ul> <li>Individually selectable channels</li> <li>Cycle – cycling through each channel; 8 seconds per channel</li> </ul>
response	DTS-ES 6.1	HDMI HDBASET SDI SPDIF Optical HDMI ARC (780C only)	
<ul> <li>125Hz</li> <li>125Hz</li> <li>1kHz (5.0 only - no subwoofer)</li> <li>4kHz (5.0 only - no subwoofer)</li> <li>Optical</li> </ul>		HDBASET SDI SPDIF	<ul> <li>Channel selection:</li> <li>Select All channels or</li> <li>Cycle – cycling through each channel; 8 seconds per channel</li> </ul>
<ul> <li>Speaker distortion</li> </ul>	DTS-ES 6.1	HDMI HDBASET SPDIF SDI Optical HDMI ARC (780C only)	
Impulse Pattern Application: Early reflections	Dolby Digital 5.1	HDMI HDBASET SPDIF SDI Optical HDMI ARC (780C only)	<ul> <li>Individually selectable channels</li> <li>Cycle – cycling through each channel; 8 seconds per channel</li> </ul>
	DTS-ES 6.1	HDMI HDBASET SPDIF Optical HDMI ARC (780C only)	
<ul><li>Polarity Pattern</li><li>Application:</li><li>Polarity of the speaker wires</li></ul>	Dolby Digital 5.1	HDMI HDBASET SPDIF Optical HDMI ARC (780C only)	<ul> <li>Individually selectable channels</li> <li>Cycle – cycling through each channel; 8 seconds per channel</li> </ul>
	DTS-ES 6.1	HDMI HDBASET SPDIF Optical HDMI ARC (780C only)	

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Table 4-6: Audio Pattern Tests						
Pattern	Format	Interfaces	Range of Values			
Auto Time Delay Application: Fine tunes sound convergence using the distance setting in an AVR	Dolby Digital 5.1	HDMI HDBASET SPDIF Optical HDMI ARC (780C only)	<ul> <li>Individually selectable channels</li> <li>Cycle – cycling through each channel; 8 seconds per channel</li> </ul>			
	DTS-ES 6.1	HDMI HDBASET SPDIF Optical HDMI ARC (780C only)				

#### 4.7.3 **Procedures for Testing a Display with Dolby Digital or DTS Sine Wave Clips**

Table 4-7 below summarizes the 780C support for digital audio.

Table 4-7: Summary of Audio Sine Wave Clips					
Sine Wave Audio Clips	Interfaces	Description			
Dolby Digital Plus 7.1	HDMI HDBASET SDI	<ul> <li>Provides a set of Dolby Digital Plus 7.1 sine wave clips:</li> <li>2.0 192kHz – 2 channel @ 192kHz sampling rate</li> <li>5.1 192kHz – 6 channel @ 192kHz sampling rate</li> <li>7.1 192kHz – 8 channel @ 192kHz sampling rate</li> </ul>			
Dolby TrueHD	HDMI HDBASET	<ul> <li>Provides a set of Dolby TrueHD Hi Bit Rate sine wave clips:</li> <li>192kHz 7.1 1kHz TrueHD – 8 channel @ 192kHz sampling rate</li> <li>192kHz 7.1 2kHz TrueHD – 2 channel @ 192kHz sampling rate</li> </ul>			
DTS HD HRA	HDMI HDBASET	<ul> <li>Provides a set of DTS-HD Hi Bit Rate sine wave clips:</li> <li>192kHz 7.1 5376kb HDHRA – 8 channel @ 192kHz sampling rate</li> <li>192kHz 5.1 3840kb HDHRA – 6 channel @ 192kHz sampling rate</li> <li>192kHz 7.1 5760kb HDHRA – 8 channel @ 192kHz sampling rate</li> </ul>			
DTS HD Master Audio	HDMI HDBASET	<ul> <li>Provides a set of DTS-HD Hi Bit Rate sine wave clips:</li> <li>192kHz 7.1 HDMA – 8 channel @ 192kHz sampling rate</li> <li>192kHz 5.1 HDMA – 6 channel @ 192kHz sampling rate</li> </ul>			

Use the procedures below for testing multi-channel Dolby or DTS sine wave using clips.

- Make the cable connection between the appropriate the 780C video output connector (e.g. HDMI, HDBaseT OUT, SPDIF or OPTICAL) and the input connector of the audio rendering device using the cables supplied.
- 2. From the top level menu (shown in the figure below), select **Audio Test Tone**.



The Audio Pattern (Test Tone) menu appears as shown below:

<	Audio Test To	one				Home	Preferences	Help
		Interface						
		Off Signal Ty	Optical	SPDIF	HDMI	ARC		
		Č.	olby 5.1	DTS-ES 6.1	PCM Sir	ne Wave		
		NOTE: F		DTS-HD				
			eousiy may cause u					
	HDMI (8 bpc RGB)	3840x2160p 30 frames/s	HDMI_VIC 1: No errors	HDMI 3D disabled	AVMUTE disabled	HDCP disabled	+5V detected	
0 Ų	Interface: HDMI (8 bpc RGB) 3	Format: 3840x2160 30Hz	Pattern: Zone Plate	3D: Disabled	Audio (HDMI): Not configured	Enable HDCP	AVMUTEOFF	04:24
- 1							HPD OK 👘 🗾 🧹 🕅	*

- 3. Touch select the desired **Interface** from the **Audio Pattern (Test Tone)** menu (refer to the screen shot above which shows HDMI). The options are Optical, SPDIF or HDMI.
- 4. Double touch select the **Dolby Digital Plus 7.1/TrueHD** or **DTS-HD** item on the **Audio Pattern (Test Tone)** menu (refer to the screen shot above).

One of the following screens will appear:

<	DTS-HD Sam	ples				Home	Preferences	Help
		DTS HD-H	IRA RA 192k 7.1 57	60kb H	DHRA 192k 7.1	5376kb		
		DTS HD N	RA 192k 5.1 38 laster Audio DMA 7.1 192kH		HDMA 5.1 19	2kHz		
Z-	HDMI (8 bpc RGB)	3840x2160p 30 frames/s	HDMI_VIC 1: No errors	HDMI 3D disabled	AVMUTE disabled	HDCP disabled	+5V detected	
0 U T	Interface: HDMI (8 bpc RGB) 3	Format: 840x2160 30Hz	Pattern: Zone Plate	3D: Disabled	Audio (HDMI): Not configured	Enable HDCP	AVMUTEOFF	04:25

K	DD+/TrueHI	D Samples				Home	Preferences	Help
		Dolby Dig	ital Plus D+ 7.1 192kHz		DD+ 5.1 192	kHz		
		Dolby Tru						
		IrueH	D 1kHz 7.1 19		rueHD 2kHz 2.0			
N	HDMI (8 bpc RGB)	3840x2160p 30 frames/s	HDMI_VIC 1: No errors	HDMI 3D disabled	AVMUTE disabled	HDCP disabled	+5V detected	
0 U T	Interface: HDMI (8 bpc RGB)	Format: 3840x2160 30Hz	Pattern: Zone Plate	3D: Disabled	Audio (HDMI): Not configured	Enable HDCP	AVMUTEOFF	04:25

5. Touch select the desired clip.

#### 4.7.4 Procedures for Testing with Programmable Sine Waves

Use the procedures below for testing with programmable sine waves. Table 4-8 below describes the audio sine wave parameters that can be configured.

Table 4-8: Sine Wave Audio Pattern						
Pattern	Interface	Description				
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Table 4-8: Sine Wave Audio Pattern							
Pattern Interface		Description					
PCM Sine Wave (programmable)	<ul> <li>HDMI</li> <li>HDBaseT</li> <li>Optical</li> <li>SPDIF</li> <li>HDMI ARC</li> <li>SDI</li> </ul>	<ul> <li>Provides programmable sine waves:</li> <li>Bits per sample – 16, 20, 24</li> <li>Sampling rate (kHz) – 32, 44.2, 48, 88.2, 96, 176.4, 192</li> <li>Channels – 2.0, 2.1, 5.1, 6.1, 7.1</li> <li>Level – 0dB to -99dB in 1dB and 3dB increments (per channel)</li> <li>Frequency – 0.01kHz to 20kHz (per channel) in 1Hz, 10Hz, 10Hz and 1000Hz increments</li> <li>Mute – On/Off (per channel)</li> </ul>					

- Make the cable connection between the appropriate the 780C video output connector (e.g. HDMI OUT, HDBaseT OUT, SPDIF or OPTICAL) and the input connector of the audio rendering device using the cables supplied.
- 2. Select the digital interfaces—HDMI, HDBaseT or SDI—output as shown below.

Note for testing SPDIF of TOSLink this is not necessary.

<	Signal Type					Home	Preferences Help
	Interface/Signal	Type HDMI	Connector HDMI	)	Color Space	YCbCr 4:2:	2 YCbCr 4:4:4
		DVI ) Analog YPbP 5) Analog RGB	HDBaseT	J	Format Type	PC (IT)	User-Defined
	3	G-SDI	Ĵ				
N-	HDMI/DVI: No signal	No TMDS clock	Cannot be analyzed	Not capable of HDMI 3D	AVMUTE disabled	Not capable of HDCP	No +5V detected
	Interface: HDMI (8 bpc RGB)	Format: 3840x2160 30Hz	Pattern: Pseudo Random	3D: Disabled	Audio (HDMI): LPCM 2.0ch 48kHz	Enable HDCP	АУМИТЕОГГ 😨 08:00 НОСР ОК 🔫 🖸

3. From the **Home** menu (shown in the figure below), select the Audio status/activation button on the Status Bar as indicated below.



The Audio Pattern (Test Tone) menu appears as shown below:

<	Audio Test Tone					Home	Preferences	Help
		Interface Off Signal Ty	Optical	SPDIF	HDMI	ARC		
		DD-	blby 5.1 F/TrueHD	DTS-ES 6.1 DTS-HD	PCM Sin	e Wave		
			or non-PCM audio ty eously may cause u					
IN		0x1080p 60 frames/s	VIC 16: No errors	HDMI 3D disabled	AVMUTE disabled	HDCP enabled	+5V detecte	ed
0 Y	HDMI (YCbCr 640 4:4:4)	x480 60Hz	Color Bars	3D: Disabled	LPCM 2.0ch 32 kHz	HDCP Disable	AVMUTEOFF	14:22

- 4. Touch select the desired **Interface** (shown in the screen above) to select the active digital audio output. (Optical selected in the example screen shot above.)
- 5. Double touch select the PCM Sine Wave item (shown in the screen above).

The PCM Sine Wave Options menu appears as shown below:

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PCM Sine V	Vave Options				Home	Preferences Help
	Bits Per Sa	mple S 20 24	ample Rate	Channe	ls 2.0 >	
	Channel Selection Level	FL FR	LFE FC	RL RR RL		
	-3dB - -1dB	12dBFS +3dB Mute +1dB	-1k -100 -10 -1		100 +1k +1 +10	
I HDMI (8 bpc RGB) N	1920x1080p 60.00 frames/s	VIC 16: No errors	HDMI 3D disabled	AVMUTE disabled	HDCP disabled	+5V detected
O Interface: U HDMI (8 bpc RGB)	Format: 1920x1080 60Hz	Pattern: Color Bars	3D: Disabled	Audio (HDMI): LPCM 2.0ch 48kHz	Enable HDCP	AVMUTEOFF 🔄 09:03 NO HDCP ∩ →

- 6. Touch select the values for the **Bits per Sample** using the three buttons provided. (24 bits is selected in the example above.)
- 7. Touch select the **Sampling Rate** by incrementing the associated arrows adjacent to the current value. (Refer to the screen shot above which shows 96 kHz selected.)
- 8. Touch select the **Channels** by incrementing the associated arrows adjacent to the current value. (Refer to the screen shot above which shows 7.1 selected.)
- Specify the Level by touch selecting the associated increment or decrement buttons showing +3dB and -3dB. (Refer to the screen shot above which shows the level at 0dB.) Repeat for each channel. You can specify the level for each channel individually.
- 10. Specify the **Frequency** of the sine wave by touch selecting the associated increment or decrement buttons. There are four buttons on the left of the current value. (1.00 kHz is shown selected in the screen shot above) The four buttons provide a variety of increment and decrement values for convenience. Repeat for each channel. You can specify the frequency for each channel individually in 1 Hz increments
- 11. Specify which channels you want to mute by touch selecting a channel and then touch selecting the Mute activation button. You can only select one channel at a time. Note that only the active channels (the ones specified in **Channels** will be selectable. (Refer to the screen shot above.)

#### 4.7.5 Testing HDMI Audio Return Channel (ARC) 780C only

You can test the HDMI 1.4 Audio Return Channel using the 780C. The selected audio is output from the 780C's HDMI IN connector in this case. The HDMI IN connector emulates an ARC Tx device to test the ARC Rx function on an A/V Receiver that supports the Audio Return Channel.

**Note**: The 780C does not support the CEC commands necessary to activate the ARC Rx function in the connected A/V receiver. Therefore you will have to have some other method of activating this ARC function in the A/V receiver under test.

1. Make the cable connection between the 780C HDMI or HDBaseT IN connector and the A/V receiver's HDMI 1.4 capable output connector.

The following illustration depicts the test setups for the HDMI audio return channel. In the first diagram, the 780C is emulating an ARC Tx at its HDMI Input port.

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1. From the top level menu (shown in the screen sample below), select Audio Test Tone.

Home				Home	Preferences	Help
Source Tests		Sink Tests	Link	Tests	Installer Tes	ts
Format Analyzer Packet Viewer	Audio Analyzer	EDID Tes		x Channel alyzer	Sink Test	
						1
Video Display HDCP Test	Audio Monitor Settings	HDCP Te	est Ca Te:	ble/Repeater st	Source Tes	st
	<b>\$</b> {)		sv 🔛	3		
Video CEC Test Passthrough		CEC Tes	t Lin	k Test	Repeater 1	est
	3	POLL				
HDMI (8 bpc 1920x1080p 60	VIC 16: No errors HI	DMI 2D disabled		HDCP disabled	+5V detecte	d
HDMI (8 bpc 1920x1080p 60 N YCbCr 4:4:4) frames/s		Divil 3D disabled	AVINOTE disabled	HDCF disabled	TOV UBICCIE	ч
0 HDMI (YCbCr 640x1005 60Hz U 4:4:4)	Color Bars	3D: Frame Packing	Dolby 5.1 (Sine Wave)	HDCP Disable	AVMUTEOFF	14:32

The Audio Test Tone menu appears as shown below:

	Audio Test Tor	ne				Home	Preferences	leip
		Interface Off	Optical	SPDIF	HDMI	ARC		
		Signal Ty	<sup>pe</sup> Iby 5.1	DTS-ES 6.1	PCM Sir	ne W e		
		NOTE: Fa	/TrueHD rr non-PCM audio ty ously may cause u	DTS-HD vpes, using a bitmap ndesirable behavior	for video pattern			
-Z		No TMDS clock	Cannot be analyzed	Not capable of HDMI 3D	AVMUTE disabled	Not capable of HDCP	No +5V detected	_
0 U T	Interface: HDMI (RGB) 1	Format: 280x720 60Hz	Pattern: Color Bars	3D: Disabled	Audio: DTS-ES 6.1 (Narrow Pink Noise)	Enable HDCP	AVMUTEOFF	13:20

#### 2. Select ARC.

#### 3. Select the desired audio **Signal Type**.

Table 4-9 below describes the audio format available for testing the HDMI Audio Return Channel.

Table 4-9: HDMI Audio Return Channel (ARC) Testing			
Audio Interface	Audio Formats		
HDMI ARC	<ul> <li>Dolby 5.1</li> <li>DTS-ES 6.1</li> <li>PCM Sine Wave</li> </ul>		

# 5 Using the 780C Test Instrument to Test HDMI and HDBaseT Protocols on Sink Devices

This section provides procedures for testing HDMI or HDBaseT sink devices such as HDTVs, projectors and inputs on repeater devices.

# 5.1 Testing HDCP on an HDMI, HDBaseT HDTV, Projector or Repeater Device

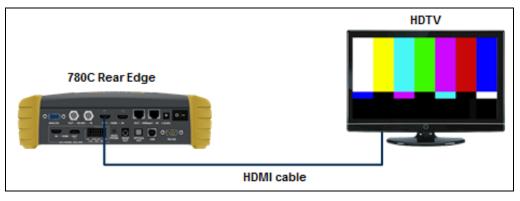
This section provides procedures for testing HDCP on an HDMI or HDBaseT equipped HDTVs, projectors or inputs on repeaters or distribution devices. The HDCP authentication test initiates and HDCP authentication with the sink device (with or without a repeater) and displays the AKSV and BKSV values, the An value, the Ro values and the Ri values. A pass/fail indication is provided as well.

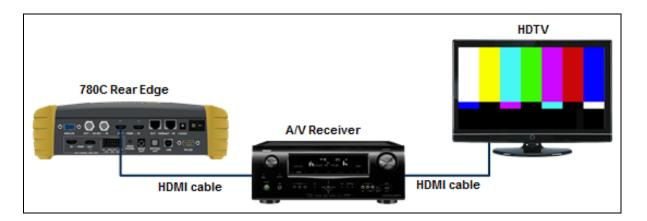
#### 5.1.1 Configurations for Testing HDCP on an HDMI Sink Device

You can run this test in two configurations.

- 780C HDMI OUT port connected directly to an HDTV input
- 780C HDMI OUT port connected to a repeater device which is then connected to a downstream HDTV.

These configurations are shown below:





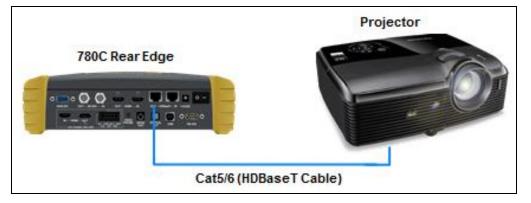
#### 5.1.2 Configurations for Testing HDCP on an HDBaseT Sink Device

You can run this test in two configurations.

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• 780C HDBaseT OUT port connected directly to a projector's input

These configurations are shown below:



#### 5.1.3 Procedures for Testing HDCP on an HDMI or HDBaseT Sink Device

Use the procedures below to run an HDCP test on an HDMI or HDBaseT sink.

- 1. Make the physical connections between the 780C HDMI/HDBaseT OUT connector and the sink device under test.
- 2. Enable the HDMI or HDBaseT interface. Refer to the screen below.

	Signal Type					Home	Preferences	Help
	Interface/Signal	IDMI	Connector HDMI		Color Space	YCbCr 4:	2:2 YCbCr 4:	4:4
	VGA(HD1	DVI ) Analog YPbP 5) Analog RGB	HDBaseT	J	Format Type TV (CE)	PC (IT)	User-Defi	ned
	3	G-SDI	].					
1 N	HDMI/DVI: No signal	No TMDS clock	Cannot be analyzed	Not capable of HDMI 3D	AVMUTE disabled	Not capable o HDCP	f No +5V detec	ned
Û	Interface: HDMI (8 bpc RGB)	Format: 3840x2160 30Hz	Pattern: Pseudo Random	3D: Disabled	Audio (HDMI): LPCM 2.0ch 48kHz	Enable HDCP	AVMUTEOFF	08:00

3. Touch select HDCP Test from the Home menu shown below.

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ome					Home	Preferences	Help
Source Tests			Sink Tests	i Link	Tests	Installer Tes	ts
Format Analyzer	Packet Viewer	Audio Analyzer	E Te		x Channel alyzer	Sink Test	
້ມມາ, ມົມມາ		-		PDC DOC			
Video Display	HDCP Test	Audio Monitor Settings	HDCP T	est Ca Te	ble/Repeater st	Source Tes	st
-		Ø.		sv 🔛	3		
Video Passthrough	CEC Test		CEC Tes	unter retain a maria	k Test	Repeater 1	lest.
		3	Poll				
HDMI (8 bpc YCbCr 4:4:4)	1920x1080p 60 frames/s	VIC 16: No errors	HDMI 3D disabled	AVMUTE disabled	HDCP disabled	+5V detecte	d
HDMI (YCbCr 4:4:4)	640x1005 60Hz	Color Bars	3D: Frame Packing	Dolby 5.1 (Sine Wave)	HDCP Disable	AVMUTEOFF	14:

4. Touch select **Enable** from the **HDCP Output Tests** menu shown below.

HDCP Output Test						Home	Preferences	Help	
			nable						
		Auto	-Restart						
		3840x2160p	Unknown		AVMUTE disabled	HDCP disabled	+5V detected		
	HDMI (8 bpc RGB)	30.00 frames/s	UNKIIUWII	HDIWII 3D disabled	AVINOTE disabled	HDCF disabled			
0 U T	Interface: HDMI (8 bpc RGB)	Format: 3840x2160 30Hz	Pattern: Color Bars	3D: Disabled	Audio (HDMI): LPCM 2.0ch 48kHz	Enable HDCP	AVMUTEOFF	07:45	

The Pass/Fail results and the key values exchanged during the authentication are presented on the display as shown below:

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HDCP Outp	ut Test				Home	Home Preferences		
		sable	Bksv = 0x87A6AB8B62 Bcaps = 0x83 ( HDMI 1 Generated An = 0x5BA Aksv = 0x292CFC5D0I R0 (0x1244) matched I	.1_FEAT FAST_REA 89B218F05E69F D	JUTH )			
	Result: F	PASS	Check #2: Ri = 0x302 Ri' = 0x302					
I HDMI (8 bpc RGB) N	3840x2160p 30.00 frames/s	Unknown	HDMI 3D disabled	AVMUTE disabled	HDCP disabled	+5V detected		
O Interface: HDMI (8 bpc RGB)	Format: 3840x2160 30Hz	Pattern: Color Bars	3D: Disabled	Audio (HDMI): LPCM 2.0ch 48kHz	Disable HDCP	АУМИТЕОГГ 😭 НDCP ОК 🛁 НPD ОК ा 🏹	07:44	

5. Touch select Auto-Restart to restart HDCP authentication.

Alternatively you can run this test from the command line as follows:

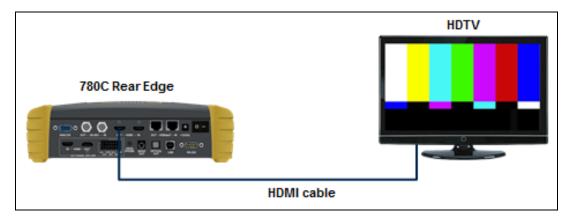
```
HDCP?
0 // indicates pass (1 indicates a failure)
```

## 5.2 Verifying the EDID on an HDMI, HDTV, HDBaseT Projector or HDMI Repeater Device

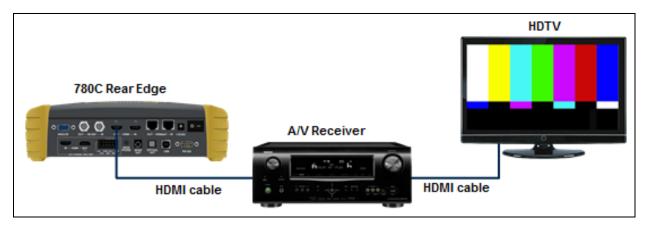
This section provides procedures for verifying and viewing the EDID of an HDMI/HDBaseT HDTV, projector or an HDMI repeater device such as an A/V receiver. You can also compare two EDIDs.

#### 5.2.1 Configurations for Verifying and Viewing the EDID on an HDMI Sink Device

The following illustrations depict the typical test setups. You can either connect directly to an HDTV or to a repeater device connected to an HDTV.

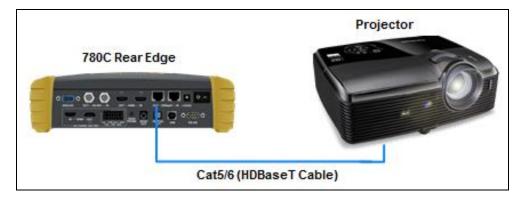


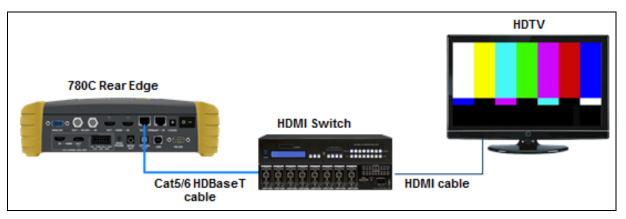
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## 5.2.2 Configurations for Verifying and Viewing the EDID on an HDBaseT Sink Device or Input of an HDBaseT Distribution Device

The following illustrations depict the typical test setups. You can either connect directly to an HDBaseT projector or input of an HDBaseT distribution device.





### 5.2.3 Procedures for Testing and Viewing the EDID on an HDMI/HDBaseT Sink Device

Use the procedures below to run an EDID test on an HDMI sink.

- 1. Make the physical connections between the 780C HDMI OUT connector and the display device under test.
- 2. Enable the HDMI or HDBaseT interface as shown below.

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Note for testing SPDIF of TOSLink this is not necessary.

Signal Type						Preferences
Interface/Signal	Туре	Connector	201	Color Space		
ŀ	IDMI	HDMI		RGB	YCbCr 4:2:	2 YCbCr 4:4:4
ĺ	DVI	HDBaseT	)			
VGA(HD15	) Analog YPbP	r		Format Type		
VGA(HD1	5) Analog RGB			TV (CE)	PC (IT)	User-Defined
30	G-SDI	Ĵ				
HDMI/DVI: No signal	No TMDS clock	Cannot be analyzed	Not capable of HDMI 3D	AVMUTE disabled	Not capable of HDCP	No +5V detected
				The second second		AVMUTEOFF
Interface: DMI (8 bpc RGB)	Format: 3840x2160 30Hz	Pattern: Pseudo Random	3D: Disabled	Audio (HDMI): LPCM 2.0ch	Enable HDCP	

3. Touch select **EDID** from the **Home** menu shown below.

Н	lome					Home	Preferences	Help
	Source Tests			Sink Tests		Tests	Installer Tes	ts
	Format Analyzer	Packet Viewer	Audio Analyzer	EDID Te		ix Channel halyzer	Sink Test	
	, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,							] [
	Video Display	HDCP Test	Audio Monitor Settings	HDCP T	est Ca Te	able/Repeater	Source Te:	st
						R		Î
	Video Passthrough	CEC Test		CEC Tes		nk Test	Repeater 1	Test
			3					
-N	HDMI (8 bpc YCbCr 4:4:4)	1920x1080p 60 frames/s	VIC 16: No errors	HDMI 3D disabled	AVMUTE disabled	HDCP disabled	+5V detecte	d
0 U T	HDMI (YCbCr 4:4:4)	640x1005 60Hz	Color Bars	3D: Frame Packing	Dolby 5.1 (Sine Wave)	HDCP Disable	AVMUTEOFF	14:32

4. Touch select the Read activation button from the EDID Test menu shown below.

The EDID information is presented on multiple pages on the display. An example of a few of the pages of an EDID listing is shown below. You scroll through all the pages using the scroll bar at the right side of the listing. In addition, the EDID test runs a check on the EDID header and checksum to determine if the EDID is valid and runs a portion of the EDID compliance test of the HDMI Compliance Test Specification.

EDID Test					Home	Preferences	Help
Read EDID		All checksums OK					
Load EDID	Manufacturer	PA 1.0.0.0, 36, 30 bi Product: QDI 30730 iming: 3840x2160 3		)			1
Save EDID	SVDs: 480i 48 Speakers: [ R	30p 576i 576p 720p LC/RRC RL/RR FC	1080i 1080p 1080p LFE FL/FR ]				
Compare	AC-3 8 ch., [3	2 44.1 48 88.2 96 1 2 44.1 48] kHz, max 4.1 48] kHz, max rai		20 24] bits			
Use on Rx	Dolby DD+ 8 DTS-HD 8 ch	ch., [ 44.1 48] kHz ., [ 44.1 48 88.2 96 ch., [ 44.1 48 88.2 9	176.4 192] kHz				
Auto-EDID Te		01., [ 44.1 40 00.2 3	1921 112				
							$\nabla$
HDMI (8 bpc RGB) N	3840x2160p 30.00 frames/s	Unknown	HDMI 3D disabled	AVMUTE disabled	HDCP disabled	+5V detected	
0 Interface: U HDMI (8 bpc RGB)	Format: Passthrough Mode	Pattern: Pseudo Random	3D: Disabled	Audio (SDI): LPCM 2.0ch 48kHz	Enable HDCP	AVMUTEOFF 😭 HDCP FAIL 🛁 HPD OK	07:14

EDID Test					Home	Preferences	Help
Read EDID	Pixel clock: 2		ng)				
Load EDID	Active video: Total video: 4 HSYNC: Dela						
Save EDID	VSYNC: Dela Image size: 8	y 8, Width 10 00mm x 450mm					7
Compare	Border: 0 pixe Scan type: Pr Stereo mode		stereo				
Use on Rx	Sync: Digital	Separate, VSYNC+,	HSYNC+,				
Auto-EDID Te	st						
7							
HDMI (8 bpc RGB) N	3840x2160p 15 frames/s	HDMI_VIC 1: Bad VRAT	HDMI 3D disabled	AVMUTE disabled	HDCP disabled	+5V detected	
0 Interface: U HDMI (12 bpc T RGB)	Format: 3840x2160 30Hz	Pattern: Color Bars	3D: Disabled	Audio (HDMI): LPCM 2.0ch 48kHz	Enable HDCP	AVMUTEOFF	06:36

EDID Test					Home	Preferences He
Read EDID	Audio Details Speakers: [ F	s: RLC/RRC RL/RR FC	LFE FL/FR ]			
Load EDID	AC-3 8 ch., [3	32 44.1 48] kHz, max		20 24] bits		
Save EDID	Dolby DD+ 8	4.1 48] kHz, max ra ch., [44.1 48] kHz n., [44.1 48 88.2 96				
Compare		ch., [44.1 48 88.2 9				-
Use on Rx						1
Auto-EDID Te	est					
DMI (8 bpc RGB)	3840x2160p 30.00 frames/s	Unknown	HDMI 3D disabled	AVMUTE disabled	HDCP disabled	+5V detected

EDID Test					Home	Preferences	Help
Read EDID	[1080p60 (Na			080i25] [720p60] [72			
Load EDID	[480p2x60(16	5:9)] [480p2x60(4:3)	] [576p2x50(16:9)] [5	:3)] [576i25(16:9)] [5 576p2x50(4:3)] [240p 25(16:9)] [288p4x50(-	4x60(16:9)] [240p	4x60(4:3)]	
Save EDID	[480i4x30(4:3	3)] [480i4x30(16:9)]	[240p60(16:9)]				
Compare							
Use on Rx							15
Auto-EDID Te	st						
							$\checkmark$
HDMI (8 bpc RGB)	3840x2160p 30.00 frames/s	Unknown	HDMI 3D disabled	AVMUTE disabled	HDCP disabled	+5V detected	
0 Interface: U HDMI (8 bpc RGB)	Format: 3840x2160 60Hz	Pattern: Pseudo Random	3D: Disabled	Audio (SDI): LPCM 2.0ch	Disable HDCP	AVMUTEOFF	07:19
				48kHz		нро ок 🛛 🛛 🔽	-

The EDID sink test will also run certain sections of the EDID compliance test. The sections that are run are those sections that do not require Capabilities Declaration Form (CDF) information to be entered for example Test ID 8-2 shown in the following screen example below.

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	EDID Test					Home	Preferences	Help
	Read EDID	Test ID 8-2: E - PASS	DID VESA Structure	, <b>(</b>				
	Load EDID							
	Save EDID							
	Compare							
	Use on Rx							
	Auto-EDID Tes	it						
								25
								_
								$\checkmark$
N	HDMI (8 bpc RGB)	3840x2160p 30.00 frames/s	Unknown	HDMI 3D disabled	AVMUTE disabled	HDCP disabled		500) 1112
0 Ų	Interface: HDMI (8 bpc RGB)	Format: 3840x2160 60Hz	Pattern: Pseudo Random	3D: Disabled	Audio (SDI): LPCM 2.0ch	Disable HDCP	AVMUTEOFF	9
1					48kHz		нро ок 📲	

### 5.2.4 Workflow for Comparing EDIDs

Use the following procedures to compare two EDIDs. The following is the workflow for comparing two EDIDs.

- Load a reference EDID either from an EDID file stored on the 780C or an EDID you have obtained from an HDTV and subsequently stored.
- Load the reference EDID.
- Connect the 780C HDMI OUT or HDBaseT OUT port to the sink device whose EDID you wish to compare with your reference EDID.
- Compare the two EDIDs.

**Note**: To load an EDID use the procedures described in <u>Adding Reference EDIDs for Use in Testing HDMI</u> <u>Devices</u>.

### 5.2.5 Procedures for Comparing EDIDs

Use the following procedures to compare two EDIDs.

- 1. Follow the procedures above for <u>Selecting a Signal Type and Resolution</u> to enable the HDMI output.
- 2. Touch select **EDID** from the **Home** menu shown below.



3. Touch select Load from the EDID Tests menu. The following screen results.

EDID Test					Home	Preferences Help	
Read EDID							
Load EDID	L	.oad File					
Save EDID	Load	TV Default					
Compare	Load	AVR Default					
Use on Rx							
Auto-EDID Te	st						
HDMI (8 bpc RGB) N	3840x2160p 30 frames/s	HDMI_VIC 1: No errors	HDMI 3D disabled	AVMUTE disabled	HDCP disabled	+5V detected	
O Interface: U HDMI (8 bpc RGB)	Format: 3840x2160 30Hz	Pattern: Zone Plate	3D: Disabled	Audio (HDMI): Not configured	Enable HDCP		
						нро ок 🛛 🔹 🔽 🖻	

- 4. Touch select the **Load** option from the **EDID Test** menu shown above that you want to use as a reference EDID. The options:
- Load File Loads from an EDID file stored on the 780C file system
- Load TV Default Loads the standard reference EDID for a TV from the 780C file system
- Load AVR Default Loads the standard reference EDID for a AVR from the 780C file system
- 5. If you have selected the **Load File** option, the following screen results. Select the file that you wish to use as the reference EDID. In the example below there is only one file.

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Interface: HDMI (12 bpc	Format: 3840x2160 30Hz	Pattern: Color Bars	3D: Disabled	Audio (HDMI): LPCM 2.0ch	Enable HDCP	
HDMI (8 bpc RGB)	3840x2160p 15 frames/s	HDMI_VIC 1: Ba VRAT	d HDMI 3D disabled	AVMUTE disabled	HDCP disabled	
TESTCMP.XM	IL TEZT	F.XML				
H8P3L00C.XM	ML HPC2L	D1S.XML	HPC2L01X.XML	PPC2L00Q	.XML SE	50UY04.XML
H8P2M01X.XI	ML H8P2N	D1S.XML	H8P2O01S.XML	H8P3D06C	.XML H8	P3H01S.XML
H8P2D00C.XI	ML H8P2D	DOX.XML	H8P2D01C.XML	H8P2H00X	.XML H8	P2L00X.XML
H7P2M00X.XI	ML H7P2O	D1S.XML	H7P2T01X.XML	H8I2D00C.	XML Ha	BI2D01S.XML
H7P2D00T.XM	ML H7P2D	D1S.XML	H7P2L00Q.XML	H7P2L02X	XML H7	P2M00C.XML
DPC2N00Q.X	ML H4I2DC	OT.XML	H4P2M00C.XML	H4P2M01S	.XML H4	P2T01S.XML

The EDID is loaded and displayed on the screen.

EDID Test					Home	Preferences	Help
Read EDID	EDID Summa Header is OK	ry: . All checksums OK.	. EDID Ver. 1.3				
Load EDID	Manufacturer	PA 1.0.0.0, 36, 30 bit Product: QDI 30730 iming: 3840x2160 3		1)			1
Save EDID	SVDs: 480i 4 Speakers: [ R	30p 576i 576p 720p LC/RRC RL/RR FC	1080i 1080p 1080p LFE FL/FR ]				
Compare	AC-3 8 ch., [3	2 44.1 48 88.2 96 1 2 44.1 48] kHz, max 4.1 48] kHz, max rat		20 24] bits			
Use on Rx	DTS-HD 8 ch	ch., [ 44.1 48] kHz ., [ 44.1 48 88.2 96 1 ch., [ 44.1 48 88.2 9					
Auto-EDID Te		01., [ 44.1 40 00.2 9	192] KHZ				
							$\nabla$
HDMI (8 bpc RGB) N	3840x2160p 30.00 frames/s	Unknown	HDMI 3D disabled	AVMUTE disabled	HDCP disabled	+5V detected	
0 Interface: U HDMI (8 bpc RGB)	Format: Passthrough Mode	Pattern: Pseudo Random	3D: Disabled	Audio (SDI): LPCM 2.0ch	Enable HDCP	AVMUTEOFF	07:14
				48kHz		HPD OK	

6. Connect the 780C **HDMI OUT** or **HDBaseT OUT** port to a sink device (e.g. HDTV, projector or A/V receiver) and touch select **Compare**. The results will show PASS or FAIL with an explanation as in the following two screen examples.

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	EDID Test					Home	Preferences	Help
	Read EDID	PASS - EDID	of the device conne	cted to Tx port match	nes the currently load	led reference EDI	<b>)</b> .	
	Load EDID							1
	Save EDID							
	Compare							
	Use on Rx							
	Auto-EDID Te	st						
IN	HDMI (8 bpc RGB)	3840x2160p 30.00 frames/s	Unknown	HDMI 3D disabled	AVMUTE disabled	HDCP disabled	+5V detect	ed
0 Ц	Interface: HDMI (8 bpc RGB)	Format: 3840x2160 60Hz	Pattern: Pseudo Random	3D: Disabled	Audio (SDI): LPCM 2.0ch 48kHz	Disable HDCP	AVMUTEOFF	07:22

When a failure occurs the following message is displayed.

EDID Test					Home	Preferences	Help
Read EDID	FAIL - EDID o	of the device connec	ted to Tx port does n	ot match the currentl	y loaded reference	e EDID.	
Load EDID							1
Save EDID							
Compare							
Use on Rx							
Auto-EDID Te	st						
							$\mathbf{\nabla}$
HDMI (8 bpc RGB) N	3840x2160p 30 frames/s	HDMI_VIC 1: No errors	HDMI 3D disabled	AVMUTE disabled	HDCP disabled	+5V detected	
O Interface: HDMI (8 bpc RGB)	Format: 3840x2160 30Hz	Pattern: Zone Plate	3D: Disabled	Audio (HDMI): Not configured	Enable HDCP	AVMUTEOFF	04:38

### 5.3 Viewing the CEC devices on an HDMI/HDBaseT network

This section describes how to view the CEC devices on an HDMI/HDBaseT network.

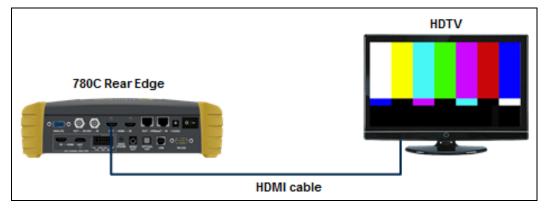
### 5.3.1 Configurations for Testing CEC on an HDMI/HDBaseT Sink Device

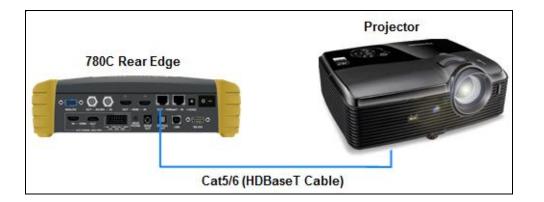
You can run this test in two configurations.

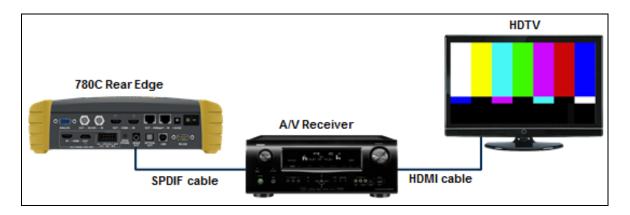
- 780C HDMI/HDBaseT OUT port connected directly to an HDTV or projector input
- 780C HDMI/HDBaseT OUT port connected to a repeater device which is then connected to a downstream HDTV.

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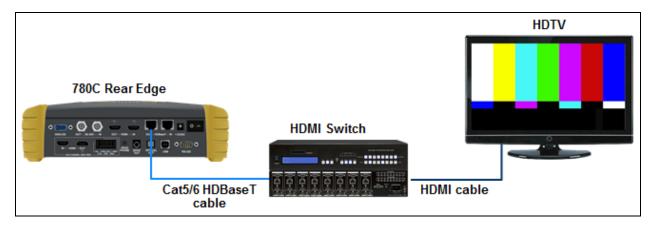
These configurations are shown below:







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### 5.3.2 Procedures for Testing CEC on an HDMI/HDBaseT Sink Device

Use the following procedures to test CEC on an HDMI/HDBaseT sink device.

- 1. Connect the 780C **HDMI/HDBaseT OUT** port to an HDMI/HDBaseT sink device (e.g. HDTV or A/V receiver) using the configuration guidelines provided above.
- 2. Follow the procedures above for <u>Selecting a Signal Type and Resolution</u> to enable the HDMI/HDBaseT output.
- 3. Touch select **CEC Test** from the **Home** menu shown below.

Н	lome					Home	Preferences	Help
	Source Tests			Sink Tests	s Lin	k Tests	Installer Tes	ts
	Format Analyzer	Packet Viewer	Audio Analyzer	EDID Te		ux Channel nalyzer	Sink Test	
	, , , , , , , , , , , , , , , , , , ,							] ]
	Video Display	HDCP Test	Audio Monitor Settings	HDCP Te	est Ca	able/Repeater est	Source Tes	st
	-					3		Ĩ
	Video Passthrough	CEC Test		CEC Tes	st Li	nk Test	Repeater 1	fest
			3	POLL				ł
N	HDMI (8 bpc YCbCr 4:4:4)	1920x1080p 60 frames/s	VIC 16: No errors	HDMI 3D disabled	AVMUTE disabled	HDCP disabled	+5V detecte	d
0 U T	HDMI (YCbCr 4:4:4)	640x1005 60Hz	Color Bars	3D: Frame Packing	Dolby 5.1 (Sine Wave)	HDCP Disable	AVMUTEOFF	14:32

The CEC devices on the HDMI network are presented on the display as shown below:

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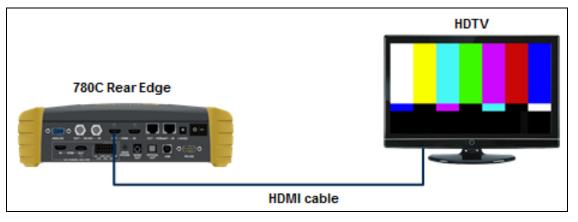
### 5.4 Multi-protocol (HDCP, EDID and CEC) testing on an HDMI or HDBaseT HDTV or Projector

This section provides procedures for testing HDCP, EDID and CEC using the Aux Combo Test image. The Aux Combo Test image runs tests similar to the individual HDCP, EDID and CEC tests except that the results are displayed on the HDTV or projector that the 780C HDMI or HDBaseT output is connected to.

### 5.4.1 Configurations for running multi-protocol tests on an HDMI Sink Device

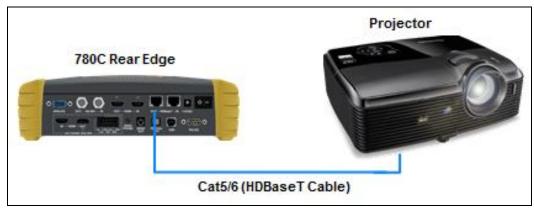
You run this test with the 780C HDMI OUT port connected directly to an HDTV input

This configuration is shown below:



### 5.4.2 Configurations for running multi-protocol tests on an HDBaseT Sink Device

You run this test with the 780C HDBaseT OUT port connected directly to a projector or HDBaseT input on a distribution device.



This configuration is shown below:

### 5.4.3 Procedures for running multi-protocol tests on an HDMI or HDBaseT Sink Device

Use the procedures below to run a multi-protocol test on an HDMI or HDBaseT sink.

- 1. Make the physical connections between the 780C HDMI or HDBaseT OUT connector and the display device under test.
- 2. Enable the HDMI or HDBaseT interface as shown below.

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Note for testing SPDIF of TOSLink this is not necessary.

Signal Type					Home	Preferences
Interface/Signal		Connector	)	Color Space	YCbCr 4:2:	2 YCbCr 4:4:4
	DVI	HDBaseT	)			
VGA(HD15	) Analog YPbP	]		Format Type		
	5) Analog RGB	Ì		TV (CE)	PC (IT)	User-Defined
3	G-SDI	ļ				
HDMI/DVI: No signal	No TMDS clock	Cannot be analyzed	Not capable of HDMI 3D	AVMUTE disabled	Not capable of HDCP	No +5V detected
Interface: MI (8 bpc RGB)	Format: 3840x2160 30Hz	Pattern: Pseudo Random	3D: Disabled	Audio (HDMI): LPCM 2.0ch	Enable HDCP	

3. Touch select video pattern status and activation button on the lower right of the LCD interface.



4. Touch select the Aux Combo Test pattern from the second page of the Video Pattern menu shown below.

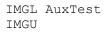
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Video Patte	rn				Home	Preferences Help
Color Bars R		metry/ olution Raster	w/ Needles	Focus	Multiburst	Sharpness
	ecoder djust	verge Pseudo Randoi		UL 3 Bar	Black Pluge	White Pluge
Chec board	one Plate Bitmap)	tion & PGCwr ding • •	gb 3D Boxes		Ramp	3D Crosstalk
	atterns	/ Grill Quantu Data	1080p	ChinaRes	Master (882)	Philips1
HDMI (12 bpc RGB)	1280x720p 30 frames/s	VIC 62: No errors	HDMI 3D disabled	AVMUTE disabled	HDCP disabled	+5V detected
) HDMI (RGB)	1280x720 30Hz	Color Bars	3D: Disabled	LPCM 2.0ch 32 kHz	HDCP Enable	AVMUTEOFF 😭 14:01 HDCP OK 🛁

The results will appear on the connected display. An example of the results is shown below:

EDID	Raw	Dat															HDCP Test:
EDID 0000 010 020 030 040 050 060 070 080 080 080 080 080 000 000 000 00	00 00 12 01 45 10 53 00 02 09 E3 C4 43 10 16	01 FF 11 48 01 00 3E 42 17 03 07 05 8E 00 3E 00 3E	02 FF 01 4C 01 C4 96 2D 4C 24 07 03 21 C4 96 26	FF 03 2D 01 8E 00 54 0F 77 6C 01 00 8E 00 7C	FF 80 CE 01 21 C4 56 44 4A 03 01 00 21 13 43	FF 69 00 01 00 8E 0A 0F 90 0C 1D 1E 00 8E 00	FF 3B 8B 02 00 21 20 00 05 00 05 00 8C 00 21 13	00 78 C0 3A 1E 00 20 0A 04 10 72 0A 98 00 8E	52 0A 81 80 8C 00 20 20 03 00 51 A0 8C 00 21	62 0D 80 18 0A 18 20 20 07 00 D0 14 0A 18 00	05 C9 01 71 D0 20 20 02 1E 1E 51 D0 8C 00	02 A0 01 38 8A 00 20 06 20 06 C0 20 F0 8A 0A 98	20 00 20 01 22 6E	00 47 01 40 E0 FC 00 20 20 22 28 00 E0 14	00 98 01 58 2D 00 01 22 28 55 26 2D 51 80	00 27 01 2C 10 54 FD 23 2B 00 7C 10 F0 18	NCCF Test:           Bksv = 0xC8638899397           Bcaps = 0x80 ( HOM )           Generated An = 0x125F28FC0F041CDA           Aksv = 0x84770317DE           R0 (0x8D36) matched R0' (0x8D36)           Ri match results:           Third part of authentication OK:           Ri = 0x8E28           Ri' = 0x8E28           CEC Test:           CEC TV (LA=0) found
EDID											sum						

4. Alternatively you can run the AuxComboTest from the command line as follows:



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# 6 Using the 780C Test Instrument to Test HDMI or HDBaseT Source Devices

This section provides procedures for testing HDMI source devices such as DVD players, set top boxes and HDMI and HDBaseT outputs on repeater and distribution devices.

### 6.1 Testing Video from an HDMI Source Device

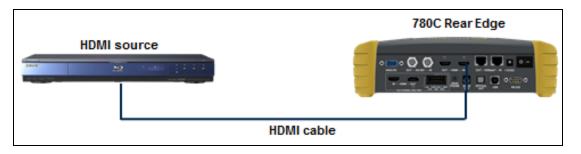
This subsection describes how to test the video on HDMI source devices.

### 6.1.1 Connection Configurations for Testing HDMI Source Devices

The 780C's HDMI input port acts as a "reference" HDMI sink device. Therefore it enables you to emulate a known good HDMI sink device to conduct a basic confidence test of an HDMI source device or output of an HDMI distribution or repeater device. This test ensures that you are receiving a valid HDMI video signal by displaying the timing of the incoming signal and informing you whether it is HDCP encrypted or not. You can run this test in three configurations:

- Source device connected directly to the 780C HDMI IN connector.
- Source device connected to the 780C HDMI IN connector through a repeater device.
- 780C HDMI OUT and HDMI IN ports acting as both as a known good source and a known good sink connect to both the input and output of the repeater device.

In all cases the 780C is emulating a sink to test an upstream source. In the third configuration, the 780C is emulating both an HDMI source and sink. These test configurations are shown below.





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### 6.1.2 Connection Configurations for Testing HDBaseT Outputs on Repeater and Distribution Devices

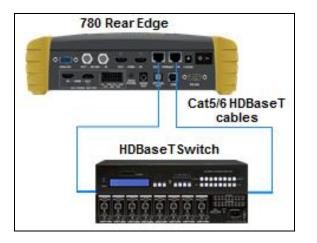
The 780C's HDMI input port acts as a "reference" HDBaseT sink device. Therefore it enables you to emulate a known good HDBaseT sink device to conduct a basic confidence test of an HDBaseT output of an HDBaseT distribution or repeater device. This test ensures that you are receiving a valid HDBaseT video signal by displaying the timing of the incoming signal and informing you whether it is HDCP encrypted or not. You can run this test in three configurations:

- Source device connected to the 780C HDBaseT IN connector through a repeater device.
- 780C HDBaseT OUT and HDBaseT IN ports acting as both as a known good source and a known good sink connect to both the input and output of the repeater device.

In all cases the 780C is emulating a sink to test an upstream source. These test configurations are shown below.



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### 6.1.3 Procedures for Viewing Video on an HDMI/HDBaseT Source Device

Use the following procedures to test the video from an HDMI/HDBaseT source device. You can view the incoming video and check the video and timing parameters of the incoming video.

- 1. Make the physical connection between the 780C HDMI/HDBaseT IN port and the source device under test using the configuration instructions above.
- 2. Enable the HDMI or HDBaseT Input port.

Signal Type					Home	Preferences Help
Interface/Signal	Type HDMI DVI	Connector HDMI HDBaseT		Color Space	YCbCr 4:2:	2 YCbCr 4:4:4
VGA(HD1	) Analog YPbP 5) Analog RGB G-SDI	]		Format Type TV (CE)	PC (IT)	User-Defined
HDMI/DVI: No signal	No TMDS clock	Cannot be analyzed	Not capable of HDMI 3D	AVMUTE disabled	Not capable of HDCP	
Interface: HDMI (8 bpc RGB)	Format: 3840x2160 30Hz	Pattern: Pseudo Random	3D: Disabled	Audio (HDMI): LPCM 2.0ch 48kHz	Enable HDCP	AVMUTEOFF 208:00 HDCP OK 200

3. Touch select Video Display from the Home menu shown below.

### VIC 16: No errors HDMI 3D disabled AVMUTE disabled HDCP disabled HDMI (8 bpc YCbCr 4:4:4) 1920x1080p 60 frames/s +5V detected AVMUTEOFF Dolby 5.1 (Sine Wave) HDMI (YCbCr 4:4:4) 3D: Frame Packing 640x1005 60Hz HDCP Disable Color Bars 14:32 HPD OK

4. Touch select the Start Fullscreen activation button on the Video Display menu to view only the incoming video (no metadata) from the source device under test.

<	Video Displa	ay				Home	Preferences	Help
				4				
			Start Fullscreer					
			Start Detailed					
			view Full Frame	e				
I N	HDMI (8 bpc YCbCr 4:4:4)	1920x1080p 60 frames/s	VIC 16: No errors	HDMI 3D disabled	AVMUTE disabled	HDCP enabled	+5V detecte	d
0 U T	HDMI (YCbCr 4:4:4)	640x480 60Hz	Color Bars	3D: Disabled	Dolby 5.1 (Sine Wave)	HDCP Disable	AVMUTEOFF	14:23
1							нро ок 🛛 🔳 🖉	

The video from the source is shown on the 780C LCD as depicted below.

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Source Tests			Sink Tests	Link Tests	Installer Tests
Formationalyzer	Packet Viewer	Audio Analyzer	EDID Test	Aux Channel Analyzer	Sink Test
	VSIF AUD • AUD				
Video Display	HDCP Test	Audio Monitor Settings	HDCP Test	Cable/Repeater Test	Source Test
-		<b>\$</b>		3	
Video Passthrough	CEC Test		CEC Test	Link Test	Repeater Test
			POLLING		





5. Return to the Source Test menu by touching the LCD. The **Source Test** menu reappears as shown below. Note that you can also view 3D video bitmaps as well. The following screen is a sample of what a 3D

Note that you can also view 3D video bitmaps as well. The following screen is a sample of what bitmap would look like. The example below is a Top-and-Bottom format.



6. Touch select the screen to return to Video Display menu.

	Video Displa	ay				Home	Preferences	Help
			Start Fullscreer		_			
			Start Detailed	*				
I N	HDMI (8 bpc YCbCr 4:4:4)	1920x1080p 60 frames/s	VIC 16: No errors	HDMI 3D disabled	AVMUTE disabled	HDCP enabled	+5V detected	
0 U	HDMI (YCbCr 4:4:4)	640x480 60Hz	Color Bars	3D: Disabled	Dolby 5.1 (Sine Wave)	HDCP Disable	AVMUTEOFF	14:23

7. Touch select the **Start Detailed** activation button on the **Video Display** menu to view the incoming video along with the metadata from the source device under test. In this example a test pattern is shown.

Note that the HDCP end	cryption status and AVmute	status are also shown.
------------------------	----------------------------	------------------------

<	Video Displa	ay				Home	Preferences	Help
					Timing: 1920 x 1080 60 frames/sec, Progre Video type: HDMI Bits per color: 8 Color space: YCbCr 4 Colorimetry: ITU-709 Range: Limited VIC code: 16 AV Mute: Disabled HDCP: Enabled			
N	HDMI (8 bpc YCbCr 4:4:4)	1920x1080p 60 frames/s	VIC 16: No errors	HDMI 3D disabled	AVMUTE disabled	HDCP enabled	+5V detecte	d
0 U T	HDMI (YCbCr 4:4:4)	640x480 60Hz	Color Bars	3D: Disabled	Dolby 5.1 (Sine Wave)	HDCP Disable	AVMUTEOFF	14:23

1. For the 780C you have the additional option of capturing and viewing a captured bitmap of the entire resolution of the incoming video **View Full Frame**.

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K	Video Displa	ау				Home	Preferences	Help
			Start Fullscreen					
			Start Detailed					
			/iew Full Frame	•				
I N	HDMI (8 bpc YCbCr 4:4:4)	1920x1080p 60 frames/s	VIC 16: No errors	HDMI 3D disabled	AVMUTE disabled	HDCP enabled	+5V detected	
0 U	HDMI (YCbCr 4:4:4)	640x480 60Hz	Color Bars	3D: Disabled	Dolby 5.1 (Sine Wave)	HDCP Disable	AVMUTEOFF	14:23

Use the arrows to move about the video frame. Note that in the example below the 780 is receiving a test pattern; typically this screen would show video from a source device.

<	Frame View	er				Home	Preferences	Help
					[			
I N	HDMI (8 bpc YCbCr 4:4:4)	1920x1080p 60 frames/s	VIC 16: No errors	HDMI 3D disabled	AVMUTE disabled	HDCP enabled		
0 U T	HDMI (YCbCr 4:4:4)	640x480 60Hz	Color Bars	3D: Disabled	Dolby 5.1 (Sine Wave)	HDCP Disable	AVMUTEOFF	14:24

8. Return to the **Home** menu by touching the LCD then the **Home** menu.



### 6.1.4 Viewing the Incoming 4K HDMI/HDBaseT Video on a Connected Display using Passthrough

You can also view 4K incoming video on a connected display using the Video Passthrough feature. Use the following procedures.

1. Touch select Video Passthrough from the Source Tests menu shown below.



The video passthrough screen is shown below.

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	Video Pass	through Setup				Home	Preferences	Help
		Passthroug Off	gh Enable On					
				(to 1920x1080)	No Downsca	ale		
Z-	HDMI (8 bpc YCbCr 4:2:0)	3840x2160p 30 frames/s	VIC 97: Bad VRAT	HDMI 3D disabled	AVMUTE disabled	HDCP disabled	+5V detected	
U U T	Interface: HDMI (YCbCr 4:2:0)	Format: 3840x2160 60Hz	Pattern: Color Bars	3D: Disabled	Audio: LPCM 7.1ch 48kHz	Enable HDCP	AVMUTEOFF	11:45

2. Specify how you want to view the video on the connected display.

You can either view it unscaled on a 4K display, or scaled to 1080p or scaled to 1920 by 1080 resolution. Refer to Table 6-1 below:

Table 6-1: Passthrough options					
Option	Passthrough Enable Mode	4K Passthrough Mode	Application		
Passthrough Enable	Off	Not Applicable	HDMI/HDBaseT OUT port uses 780C generator selection		
	On 4K to 1080p 4K to 1920x1080p No Downscale	4K to 1080p	4K input horizontal resolution is scaled by 2:1 and the vertical resolution is scaled to 1080 lines. Used for SMPTE 4K inputs.		
		4K to 1920x1080p	4K input horizontal resolution is scaled 1920 and the vertical resolution is scaled to 1080 lines. Used for CEA 4K inputs.		
		No Downscale	4K input is unscaled as it is passed through the 780C.		

### 6.1.5 Viewing Video Metadata from an HDMI/HDBaseT Source Device

Use the following procedures to verify the video metadata and video timing data from an HDMI/HDBaseT source device.

1. Enable the HDMI or HDBaseT as the active digital interface input as shown below.

signal		analyzeu	HDIVII 3D		HDCP	
HDMI/DVI: No signal	No TMDS clock	Cannot be analyzed	Not capable of HDMI 3D	AVMUTE disabled	Not capable of HDCP	No +5V detected
	G-SDI			TV (CE)	PC (IT)	User-Defined
	DVI i) Analog YPbP 5) Analog RGB	HDBaseT		Format Type		
Interface/Signal	HDMI	Connector HDMI		Color Space	YCbCr 4:2	2 YCbCr 4:4:4

2. Touch select Format Analyzer from the Source Tests menu shown below.

	Format Analy	zer				Home	Preferences	Help	ļ
		Rea Errors: None	ad Total Activ Fram Scar HSY HSY VSYI VSYI HSY	o type: HDMI I: 2200 x 1125 re: 1920 x 1080 nes/sec: 660.0 n type: Progressive NC delay: 88 NC width: 44 NC delay: 4 NC width: 5 NC polarity: + NC polarity: +	Bits per comp.: Color space: Y Colorimetry: IT Pixels repeate Video ID code (1920 x 1080 p @59.94/60Hz AV Mute Status HDCP: Encryp	'CbCr 4:4:4 'U-709 d 0 times (VIC): 16 0 16:9) s: Not muted			
I N	HDMI (8 bpc YCbCr 4:4:4)	1920x1080p 60 frames/s	VIC 16: No errors	HDMI 3D disabled	AVMUTE disabled	HDCP enabled	+5V dete	cted	
Ŷ	HDMI (YCbCr 4:4:4)	640x480 60Hz	Color Bars	3D: Disabled	Dolby 5.1 (Sine Wave)	HDCP Disable	AVMUTEOFF HDCP OK HPD OK	14:22	2

3. Touch select the **Read** activation button (shown on the screen below) to initiate the test. The results are shown in the screen shots below. The first screen shows a typical pass results, the second screen shows a failure condition and the third screen shows a case where the incoming format was unknown.

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If one of the timing parameters does not match the value of the parameters in the associated standard timing in the 780C format library, an indication of the error is shown as can be seen below.

<	Format Ana	lyzer				Home	Preferences	Н	elp
		Read Errors: (Expected - Hsync width (44	val): Scan ty HSYNC VSYNC HSYNC HSYNC HSYNC	ype: HDMI 200 x 1125 1920 x 1080 /ysec: 60 pe: Progressive 2 delay: 88 2 width: 45 2 delay: 4 2 polarity: + 2 polarity: +	Pixels repeat Video ID cod (1920 x 1080 @59.94/60H	YCbCr 4:4:4 hetry: ITU-709 ted 0 times e (VIC): 16 0 p z 16:9) us: Not muted			
I N	HDMI (8 bpc YCbCr 4:4:4)	1920x1080p 60 frames/s	VIC 16: No errors	s HDMI 3D disabled	AVMUTE disabled	HDCP enabled	+5V dete	cted	
0 U	HDMI (YCbCr 4:4:4)	640x480 60Hz	Color Bars	3D: Disabled	Dolby 5.1 (Sine Wave)	HDCP Disable	AVMUTEOFF HDCP OK	-	14:22
1							HPD OK	× 1	

If the timing does not match a standard timing in the 780C format library, a message is shown: "Unknown format" as can be seen below.



Table 6-2 below describes each field in the Format Analyzer on-screen report. The basic timing information is shown on the left of the resulting screen and the AVI infoframes received are displayed on the right. Also displayed on the right side is an indication of the status of HDCP encryption.

Table 6-2: Format Analyzer					
Timing Parameters (left side)	Description				
Video Type	Indicates whether the source is HDMI or DVI.				
Total	Total horizontal and vertical resolution including blanking.				
Active	Total active horizontal and vertical resolution excluding blanking.				
Frames/sec	The frame rate of the HDMI/DVI input source.				
Scan Type	Indicates whether the HDMI/DVI input source is progressive or interlaced.				
HSYNC delay	The horizontal sync pulse delay in pixels.				
HSYNC width	The horizontal sync pulse width in pixels.				
VSYNC delay	The vertical sync pulse delay in lines.				
VSYNC delay	The vertical sync pulse width in lines.				
HSYNC polarity	The polarity of the horizontal sync pulse; either positive (+) or negative (-).				
VSYNC polarity	The polarity of the vertical sync pulse; either positive (+) or negative (-).				
AVI Infoframe Parameters (right side)	Description				
Bits per comp	The number of bits per component color. Can be 6, 8, 10, 12, 16.				

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Table 6-2: Format Analyzer	
Color space	Color space and sampling Color space: • YCbCr • RGB • xvColor Sampling: • 4:4:4 • 4:2:2 • 4:2:0
Basic colorimetry	The ITU colorimetry standard.
Pixels repeated	Indicates whether pixel repetition is active.
Video ID code (VIC)	The CEA video identification code number.
Resolution	Shows the horizontal and vertical resolution as well as the frame rate and the aspect ratio.
AVmute status	The current setting of the AVmute parameter in the General Control Packet.
HDCP	Indicates the HDCP encryption status either: 1) Encrypted or 2) Unencrypted.

#### 6.1.6 Procedures for Viewing Video on an SDI Source Device

Use the following procedures to test the video from an SDI source device. You can view the incoming video and check the video and timing parameters of the incoming video.

- 1. Make the physical connection between the 780C SDI IN port and the source device under test using the configuration instructions above.
- 2. Enable the SDI Input port.



3. Touch select Video Display from the Home menu shown below.

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#### Home Home Preferences Help Link Tests Source Tests Sink Tests Installer Tests Aux Channel Analyzer Format Analyzer Packet Viewer Audio Analyzer EDID Test Sink Test VSIF Ь AUD HDCP Test Audio Monitor Settings HDCP Test Video Display Cable/Repeater Source Test Test ()Aksv 2 22 Bksv Bksv 000 b Video Passthrough CEC Test CEC Test Link Test Repeater Test O POLLING... 5 1920x1080p 60.00 frames/s 3G A 1080p 60 YCC 4:2:2 1920px SDI: 3G-SDI Audio (HDMI): LPCM 2.0ch 48kHz 3D: Disabled Enable HDCP Interface 3G-SDI Pattern: Format: 1920x1080 60Hz Pseudo Random

4. Touch select the **Start Fullscreen** activation button on the **Video Display** menu to view only the incoming video (no metadata) from the source device under test.

	Video Displa	ay				Home	Preferences	Help
			Start Fullscreen					
			Start Detailed					
			Start Detaileu					
			View Full Frame					
N N	SDI: HD-SDI	1280x720p 60.00 frames/s	HD 720p 60 YCC 4:2:2 10bpc	Errors: None				
0 U	Interface: HD-SDI	Format: 1280x720 60Hz	Pattern: THX Pic	3D: Disabled	Audio (SDI): DTS- ES 6.1 (Sine	Enable HDCP	NO HDCP	17:36
Ŧ	110 001	1200x120 00112	Performance		Wave)		HPD FAIL	à:

The video from the source is shown on the 780C LCD as depicted below.

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5. Return to the Source Test menu by touching the LCD. The **Source Test** menu reappears as shown below.

K	Video Displa	ay				Home	Preferences	Help
			Start Fullscreen					
			Start Detailed					
			/iew Full Frame	•				
_								
N	SDI: HD-SDI	1280x720p 60.00 frames/s	HD 720p 60 YCC 4:2:2 10bpc	Errors: None				
0 U	Interface: HD-SDI	Format: 1280x720 60Hz	Pattern: THX Pic	3D: Disabled	Audio (SDI): DTS- ES 6.1 (Sine	Enable HDCP		
1			Performance		Wave)		HPD FAIL 🔹 🕽	C

6. Touch select the screen to return to Video Display menu.

7. Touch select the **Start Detailed** activation button on the **Video Display** menu to view the incoming video along with the metadata from the source device under test. In this example a test pattern is shown.

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For the 780C you have the additional option of capturing and viewing a captured bitmap of the entire resolution of the incoming video **View Full Frame**.

<	Video Displ	ay				Home	Preferences	Help
			Start Fullscreen					
			Start Detailed					
			/iew Full Frame					
I N	SDI: HD-SDI	1280x720p 60.00 frames/s	HD 720p 60 YCC 4:2:2 10bpc	Errors: None				
Ŷ	Interface: HD-SDI	Format: 1280x720 60Hz	Pattern: THX Pic Performance	3D: Disabled	Audio (SDI): DTS- ES 6.1 (Sine Wave)	Enable HDCP	AVMUTEOFF	17:36

Use the arrows to move about the video frame. Note that in the example below the 780 is receiving a test pattern; typically this screen would show video from a source device.



8. Return to the Home menu by touching the LCD then the Home menu.

Home					Home	Preferences	Help
Source Tests			Sink Tests	Lin	k Tests	Installer Test	s
Format Analyzer	Packet Viewer	Audio Analyzer	EDID Te	A	ux Channel nalyzer	Sink Test	
	VSIF AUD ••••••						1
Video Display	HDCP Test	Audio Monitor Settings	HDCP Te		able/Repeater est	Source Tes	:
-	Aksv Bksv	¢∢»)			3		Ĩ
Video Passthrough	CEC Test		CEC Tes	t Li	nk Test	Repeater T	est
		3	Poll				1
I SDI: 3G-SDI	1920x1080p 60.00 frames/s	3G A 1080p 60 YCC 4:2:2 1920px	Errors: None				
0 Interface: U 3G-SDI T	Format: 1920x1080 60Hz	Pattern: Pseudo Random	3D: Disabled	Audio (HDMI): LPCM 2.0ch 48kHz	Enable HDCP	AVMUTEOFF	- 00.02

### 6.1.7 Viewing Video Metadata from an SDI Source Device

Use the following procedures to verify the video metadata and video timing data from an SDI source device.

1. Enable the SDI as the active digital interface input as shown below.

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Signal Type	e				Home	Preferences	leip
Interface/Signa	Type						
C	HDMI	1					
	DVI	Ĩ					
VGA(HD1	5) Analog YPbP	Ĩ					
VGA(HD1	5) Analog RGB	Ĩ					
	IG-SDI	ī —					
SDI: HD-SDI	1280x720p 60.00 frames/s	No data	Errors: EAV1, SAV1, LNUM1,				
Interface: HD-SDI	Format: 1280x720 60Hz	Pattern: Pseudo Random	3D: Disabled	Audio (HDMI): LPCM 2.0ch 48kHz	Enable HDCP		0

2. Touch select Format Analyzer from the Source Tests.

Table 6-2: Format Analyzer - SDI

3. Touch select the **Read** activation button (shown on the screen below) to initiate the test. The results are shown in the screen shots below. The first screen shows a typical pass results, the second screen shows a failure condition and the third screen shows a case where the incoming format was unknown.

Format Ana	alyzer				Home	Preferences Help
Read		Total: 2200 x 112 Active: 1920 x 10 Frames/sec: 60.0 Scan type: Progr	080 00	Raw Des Pictu Sam	PTE 352M embedd data: 0x89 0xCB 0 cription: 1080-line ure rate: 0xB (60) pling structure: 0x0 isport: Progressive	on Level A 3G-SDI ) (4:2:2 Y/Cb/Cr)
Errors: None				Pictu Aspe Hori	Isport: Progressive ure: Progressive ect ratio: Unknown zontal samples: 19 lepth: 10 bit	
				Raw Des Pictu Sam	data: 0x89 0xCB ( cription: 1080-line ( ure rate: 0xB (60) upling structure: 0x0	on Level A 3G-SDI ) (4:2:2 Y/Cb/Cr)
				Pictu Aspe Hori	Isport: Progressive ure: Progressive ect ratio: Unknown zontal samples: 19 lepth: 10 bit	
SDI: 3G-SDI	1920x1080p 60.00 frames/s	3G A 1080p 60 YCC 4:2:2 1920px	Errors: None			
0 Interface: U 3G-SDI	Format: 1920x1080 60Hz	Pattern: Pseudo Random	3D: Disabled	Audio (HDMI): LPCM 2.0ch 48kHz	Enable HDCP	

If one of the timing parameters does not match the value of the parameters in the associated standard timing, an indication of the error will be shown.

Table 6-2 below describes each field in the Format Analyzer on-screen report for SDI. The basic timing information is shown on the left of the resulting screen and the metadata data from the far end chip is displayed on the right.

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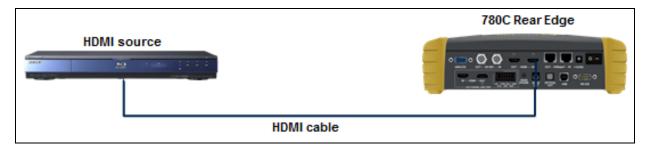
Table 6-2: Format Analyzer - SDI				
Timing Parameters (left side)	Description			
Total	Total horizontal and vertical resolution including blanking.			
Active	Total active horizontal and vertical resolution excluding blanking.			
Frames/sec	The frame rate of the HDMI/DVI input source.			
Scan Type	Indicates whether the HDMI/DVI input source is progressive or interlaced.			
Video Parameters (right side)	Description			
SMPTE embedded Stream 1 Description	Total active lines. E.g. 720.			
Picture Rate	Frames per second: E.g. 60			
Sampling Structure	Video Type and Sampling: YCbCr 4:2:2			
Picture	Scan: Progressive or Interlaced			
Bit Depth	Color depth plus overhead: 10 bits			
SMPTE embedded packet Stream 2	Alignment level			

### 6.2 Viewing Source Data Island Packets on HDMI and HDBaseT

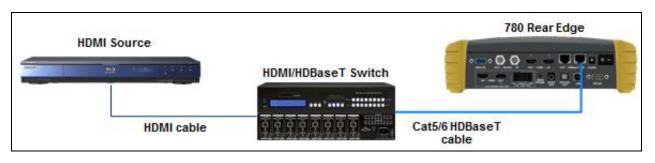
This subsection describes how to view the HDMI/HDBaseT data island packets from an HDMI source device or HDBaseT output of a repeater or distribution device.

### 6.2.1 Configurations for Viewing the Data Island Packets from an HDMI or HDBaseT Source Device

The 780C's HDMI/HDBaseT input ports acts as "reference" HDMI sink devices. Therefore they enable you to emulate a known good HDMI sink device to conduct a test on a source device. You can view the data island packets with the source device connected directly to the 780C. This test configuration is shown below for HDMI and HDBaseT (second illustration).



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#### 6.2.2 Procedures for Viewing the HDMI/HDBaseT Data Island Packets from a Source Device

Use the following procedures to view the data islands packets from an HDMI source device or output of an HDBaseT distribution device.

- 1. Connect the HDMI/HDBaseT system devices to the 780C as shown in the diagram above. The HDMI source device output is connected the 780C HDMI IN or HDBaseT IN connector.
- Preferences Help Signal Type Home Interface/Signal Type Color Spa YCbCr 4:2:2 HDBaseT VGA(HD15) Analog YPbPr Format Type VGA(HD15) Analog RGB User-Defined 3G-SDI HDMI/DVI: No No TMDS clock Cannot be Not capable of HDMI 3D AVMUTE disabled Not capable of HDCP signal analyzed AVMUTEOFF 🔄 08:00 Audio (HDMI): 3D: Disabled Enable HDCP Interface: Format: HDMI (8 bpc RGB) 3840x2160 30Hz Pattern: Pseudo Random LPCM 2.0ch HUCD UK 48kHz
- 2. Enable the HDMI or HDBaseT as the active digital interface input.

3. Touch select **Packet Viewer** from the **Home** menu shown below.



4. Touch select the **Refresh** activation button on the **Packet Viewer** menu (shown below) to view the data island packet information (AVI Infoframe shown).

<	Packet View	/er				Home	Preferences	Help
		Refr Sa	Video ID: Coded Fr Non-unifo Pixels rep Checksur	ce: YCbCr 4:4:4 Lin 16 (1920 x 1080 p ( ame AR: 16:9 orm Scaling: None k beated 0 times. m OK. Version: 2, Le	nown	1 04 00		
I N	HDMI (8 bpc YCbCr 4:4:4)	1920x1080p 60 frames/s	VIC 16: No errors	HDMI 3D disabled	AVMUTE disabled	HDCP enabled	+5V detecte	d
0 U T	HDMI (YCbCr 4:4:4)	640x480 60Hz	Color Bars	3D: Disabled	Dolby 5.1 (Sine Wave)	HDCP Disable	AVMUTEOFF	14:23

Touch select the Save activation button on the Packet Viewer menu to save the data to a file.
 A keyboard appears enabling you to select a name.

<	Virtual Keyb	oard				Home	Preferences	Help
		DA	TA.txt		< Back	kspace		
			1 2 3 W E R S D 2 X C	4 5 T Y F G H		89 OP L Enter		
- N	HDMI (8 bpc RGB)	3840x2160p 30 frames/s	HDMI_VIC 1: No errors	HDMI 3D disabled	AVMUTE disabled	HDCP disabled	+5V detected	
0 U T	Interface: HDMI (8 bpc RGB)	Format: 3840x2160 30Hz	Pattern: Zone Plate	3D: Disabled	Audio (HDMI): Not configured	Enable HDCP	AVMUTEOFF	04:51

### 6.3 Testing HDCP Max Devices on an HDMI Source Devices and Outputs of HDBaseT distribution Devices

This subsection describes how to run a test of the number of HDCP devices an HDMI or HDBaseT source device supports. The Max HDCP devices test runs a test on the source device (such as a DVD or STB) to determine how many downstream devices are supported during an HDCP authentication with a repeater device.

### 6.3.1 Configurations for Testing Max Devices an HDMI Source Device Supports

The 780C's HDMI input port acts as a "reference" HDMI sink device. Therefore it enables you to emulate a known good HDMI sink device to conduct a test on a source device. You can run this source device connected directly to the 780C. This test configuration is shown below.

### 6.3.2 Procedures for Testing Max Devices a Source Device Supports

Use the following procedures to test the maximum number of HDCP devices a source device supports.

- 1. Connect the HDMI system devices to the 780C as shown in the diagram above. The HDMI source device or HDBaseT device output is connected the 780C HDMI IN or HDBaseT IN connector.
- 2. Enable the HDMI as the active digital interface input as shown below.

Signal Type					Home	Preferences
Interface/Signal	Type HDMI	Connector HDMI		Color Space	YCbCr 4:2:	2 YCbCr 4:4:4
	DVI ) Analog YPbP	HDBaseT	)			
	5) Analog RGB			Format Type TV (CE)	PC (IT)	User-Defined
3	G-SDI					
HDMI/DVI: No	No TMDS clock	Cannot be		AVMUTE disabled		
signal	NO TMDS CIOCK	analyzed	Not capable of HDMI 3D	AVMUTE disabled	Not capable of HDCP	No +5V detected
Interface: DMI (8 bpc RGB)	Format: 3840x2160 30Hz	Pattern: Pseudo Random	3D: Disabled	Audio (HDMI): LPCM 2.0ch 48kHz	Enable HDCP	AVMUTEOFF 🔮 0 HDCP OK 🛁

3. Touch select HDCP Test from the Home menu shown below.



K	HDCP Outp	ut Test				Home	Preferences	Help
		E	nable					
		Auto	-Restart					
I N	HDMI (8 bpc RGB)	3840x2160p 30 frames/s	HDMI_VIC 1: No errors	HDMI 3D disabled	AVMUTE disabled	HDCP disabled	+5V detected	
0 U T	Interface: HDMI (12 bpc RGB)	Format: 3840x2160 30Hz	Pattern: Color Bars	3D: Disabled	Audio (HDMI): LPCM 2.0ch 48kHz	Enable HDCP	AVMUTEOFF 🔄 NO HDCP 🔓 🛁 HPD OK	06:43

4. Touch select the **Find Max Devs** activation button on the **HDCP Input Tests** menu (shown below) to test the number of HDCP device the source device supports.

The results of the test are shown on the screen.

Note: You can also disable HDCP on the HDMI/HDBaseT Out port using the Allow Rx HDCP toggle button.

<	HDCP Input	Tests				Home	Preferences	Help
		Find	Max Devs					
		Allow	RXHDCP					
I N	HDMI (8 bpc RGB)	3840x2160p 30 frames/s	HDMI_VIC 1: No errors	HDMI 3D disabled	AVMUTE disabled	HDCP disabled	+5V detected	ł
0 U T	Interface: HDMI (12 bpc	Format: 3840x2160 30Hz	Pattern: Color Bars	3D: Disabled	Audio (HDMI): LPCM 2.0ch	Enable HDCP	NO HDCP	
T	RGB)	CONTRACTION CONTE	eeler Balo		48kHz		нро ок 🛛 💽 🧹	ja 🚾 i

The results of the test are shown on the screen.

<	HDCP Input	Tests				Home	Preferences	lelp
		Find		Your 780B supports ( devices.	up to 16 downstream	HDCP		
		Allow	Rx HDCP					
		0040-0400-00					. EM data at a	_
N	HDMI (8 bpc RGB)	3840x2160p 30 frames/s	HDMI_VIC 1: No errors	HDMI 3D disabled	AVMUTE disabled	HDCP disabled	+5V detected	
0 U T	Interface: HDMI (12 bpc RGB)	Format: 3840x2160 30Hz	Pattern: Color Bars	3D: Disabled	Audio (HDMI): LPCM 2.0ch 48kHz	Enable HDCP	AVMUTEOFF	06:32

#### 6.3.3 Procedures for disabling HDCP on the 780C HDMI/HDBaseT Out port - GUI

You can disable the HDCP registers of the 780C's Rx port to test how your source device responds to HDCP being disabled. You can disable the HDCP port either through the GUI or through the command line.

1. Touch select the **Allow Rx HDCP** activation button to enable / disable HDCP. When the button is green HDCP is enabled.

**Note**: You can also disable HDCP on the HDMI Rx port using the Allow Rx HDCP toggle button. See procedures below.

<	HDCP Input	Tests				Home	Preferences	Help
		Find	Max Devs					
		Allow	Rx HDCP					
		3840x2160p 30	HDMI_VIC 1: No	HDMI 3D disabled		HDCP disabled	+5V detected	
Ň	HDMI (8 bpc RGB)	frames/s	errors	HDWI 3D disabled	AVMOTE disabled	HDCP disabled		
0 U T	Interface: HDMI (12 bpc	Format: 3840x2160 30Hz	Pattern: Color Bars	3D: Disabled	Audio (HDMI): LPCM 2.0ch	Enable HDCP	AVMUTEOFF	06:32
Т	RGB)				48kHz		нро ок 🛛 💽 📈	-

#### 6.3.4 Procedures for disabling HDCP on the 780C out port

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You can disable the HDCP registers of the 780C's Rx port to test how your source device responds to HDCP being disabled. Currently you can only disable the HDCP port through the command line. For instructions on establishing a command line session with the 780C from your PC refer to the section: <u>Command Interface</u>. Use the commands in the following procedures enable and disable HDCP on the HDMI or HDBaseT In port.

1. To disable HDCP on the HDMI In port enter the following command:

```
CPAG 0
ALLU
```

2. To re-enable HDCP on the HDMI In port enter the following command:

```
CPAG 1
ALLU
```

## 6.4 Testing Audio of an HDMI Source Device or at the Output of an HDBaseT Distribution Device

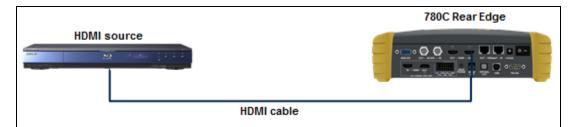
This subsection describes how to test the audio from an HDMI source device.

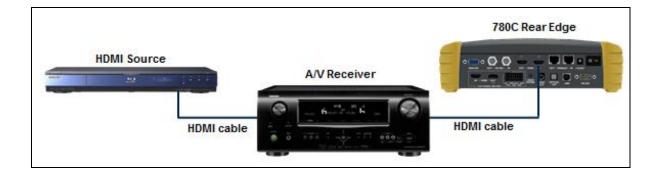
## 6.4.1 Configurations for Testing Audio on an HDMI Source Device

With the 780C you can run a test on the HDMI audio from a source device. This test shows you the decoded audio IEC header information, the audio infoframes and the audio sample packet header information transmitted from the connected source device which could be a DVD, set top box or the output of an A/V Receiver. You can run this test in three configurations:

- Source device connected directly to the 780C.
- Source device connected to the 780C through a repeater device such as an A/V receiver.
- 780C HDMI OUT and HDMI IN ports acting as both as a known good source and a known good sink connect to both the input and output of the repeater device.

In all cases the 780C is emulating a sink to test an upstream source. In the third configuration, the 780C is emulating both an HDMI source and sink. These test configurations are shown below.





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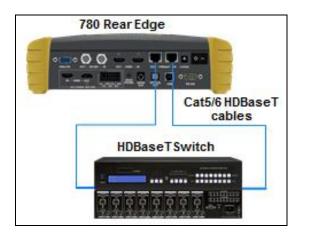
### 6.4.2 Configurations for Testing Audio on the Output of an HDBaseT Distribution Device

With the 780C you can run a test on the HDMI audio from a source device. This test shows you the decoded audio IEC header information, the audio infoframes and the audio sample packet header information transmitted from the connected source device which could be a DVD, set top box or the output of an A/V Receiver. You can run this test in three configurations:

- Source device connected to the 780C through an HDBaseT distribution device.
- 780C HDBaseT OUT and HDBaseT IN ports acting as both as a known good source and a known good sink connect to both the input and output of the repeater device.

In all cases the 780C is emulating a sink to test an upstream source. In the third configuration, the 780C is emulating both an HDBaseT source and sink. These test configurations are shown below.





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### 6.4.3 Procedures for Testing Audio from an HDMI/HDBaseT Source Device

Use the following procedures to test the audio from an HDMI source device.

- 1. Make the physical connection between the 780C **HDMI** or **HDBaseT IN** port and the source device under test using the configuration instructions above.
- 2. Enable the HDMI or HDBaseT as the active digital interface input.

<	Signal Type					Home	Preferences	Help
		HDMI	Connector HDMI		Color Space	YCbCr 4:	2.2 YCbCr 4:	4:4
	VGA(HD15 VGA(HD15	DVI ) Analog YPbPi 5) Analog RGB G-SDI	HDBaseT		Format Type TV (CE)	PC (IT)	User-Defi	ned
đ	HDM//DVI: No	No TMDS clock	Cannot be	Not capable of	AVMUTE disabled	Not capable of	No +5V deter	med.
N	signal	NO TWID'S CIOCK	analyzed	HDMI 3D	AVINOTE disabled	HDCP		-
Чн	Interface: IDMI (8 bpc RGB)	Format: 3840x2160 30Hz	Pattern: Pseudo Random	3D: Disabled	Audio (HDMI): LPCM 2.0ch 48kHz	Enable HDCP	AVMUTEOFF	08:00

3. Select Audio Analyzer from the Home menu shown below.

Η	lome					Home	Preferences	Help
	Source Tests			Sink Tests	Lini	k Tests	Installer Te	sts
	Format Analyzer	Packet Viewer	Audio Analyzer	EDID Te	An	ux Channel nalyzer	Sink Test	
	Video Display	HDCP Test	Audio Monitor Settings	HDCP T	est Ca Te	able/Repeater est	Source Te	st
	-	Aksv Bksv	Q ₹)			3		Ĩ
	Video Passthrough	CEC Test		CEC Tes		nk Test	Repeater	Test
			5					
I N	HDMI (8 bpc YCbCr 4:4:4)	1920x1080p 60 frames/s	VIC 16: No errors	HDMI 3D disabled	AVMUTE disabled	HDCP disabled	+5V detecte	ed
0 U T	HDMI (YCbCr 4:4:4)	640x1005 60Hz	Color Bars	3D: Frame Packing	Dolby 5.1 (Sine Wave)	HDCP Disable	AVMUTEOFF	14:32

The Audio Analysis screen appears as shown below:

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Audio Analys	is				Home	Preferences	Help
	Rea	ad Cha Coo stre Wor hea San stre Cha  FR ACF	npling freq.: Refer to am header Innel allocation: RC RR RL FC LF	Sample wo Copyright a eam Format info emph. Mode: 0 Category or Source num E Channel nu Sampling fr	: Consumer rds: Other isserted: Yes : 2 ch., no pre- ode: 00 nber: 0 imber: 0 req.: 48 KHz		
HDMI (8 bpc RGB)	3840x2160p 30 frames/s	HDMI_VIC 1: No errors	HDMI 3D disabled	AVMUTE disable	d HDCP disabled	+5V detected	
Interface: HDMI (8 bpc RGB) 3	Format: 3840x2160 30Hz	Pattern: Zone Plate	3D: Disabled	Audio (HDMI): No configured	ot Enable HDCP	AVMUTEOFF	04:52

- 4. Touch select the Read activation button to initiate the test.
- 5. Alternatively you can run this test from the command line as follows:

AUDA:RPTP?

An example of the results are shown below:

Audio InfoFrame data: Channel count: 2 channels Coding type: 0 (Refer to stream header) Word length: Refer to stream header Sampling freq.: Refer to stream header Channel allocation: --- --- FR FL Channel status bits: Application: Consumer Sample words: LPCM Copyright asserted: Yes Format info: Default Mode: 0 Category code: 00 Source number: 0 Channel number: 0 Sampling freq.: 48 KHz Word length: 24 bits)

Table 6-2 below describes each field in the Audio Analyzer on-screen report. The audio infoframe information is shown on the left of the resulting screen and the channel status data from the audio sample packets received are displayed on the right.

Table 6-2: Audio Analyzer	
Audio IEC Header decoded data (left side)	Description
Audio Format	Indicates the audio format type. Typically one of: <ul> <li>LPCM</li> <li>Dolby</li> <li>DTS</li> </ul>
Sampling rate	The sampling frequency. One of: <ul> <li>Refer to Stream Header</li> <li>32kHz</li> <li>44.1kHz</li> <li>48kHz</li> <li>88.2kHz</li> <li>96kHz</li> <li>176.4kHz</li> <li>192kHz</li> </ul>
Target bitrate	
Audio Infoframe Data (middle)	Description
Channel count	Indicates the number of active channels. One of:  Refer to Stream Header  2ch  3ch  4ch  5ch  6ch  7ch  8ch
Coding type	Indicates the audio format. One of: Refer to stream header LPCM (IEC 60958) AC-3 MPEG1 MPEG2 AAC DTS ATRAC One Bit Audio Dolby Digital Plus DTS-HD MAT DST WMA Pro
Sample Size	The sample size or bit depth. One of: <ul> <li>Refer to Stream Header</li> <li>16 bit</li> <li>20 bit</li> <li>24 bit</li> </ul>

|--|

Table 6-2: Audio Analyzer	
Audio IEC Header decoded data (left side)	Description
Sampling Frequency	The sampling frequency. One of: Refer to Stream Header 32kHz 44.1kHz 48kHz 88.2kHz 96kHz 176.4kHz 192kHz
Channel Allocation	The speaker mapping and allocation. One or more of the following: FL FC FR RLC FRC RL RC RR RR RRC LFE
Audio Clock Regeneration N/ CTS values	<ul> <li>N</li> <li>CTS</li> </ul>
Channel Status Bit Data (right side)	Description
Application	Application format. One of: Consumer or Professional.
Sample words	Sample word encoding. One of: LPCM or Encoded (non linear compressed).
Copyright asserted	Copyright assertion. One of: Yes or No.
Format info	Format. Typically Default.
Mode	Channel mode. Typically 0 for Mode 0.
Category code	Category code. Typically 00 for general.
Source number	Source number. Typically 0 for Unspecified.
Channel number	Channel number. Typically 0 for Unspecified
Sampling freq	Sampling rate. One of: 32kHz 44.1kHz 48kHz 88.2kHz 96kHz 176.4kHz 192kHz

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Table 6-2: Audio Analyzer	
Audio IEC Header decoded data (left side)	Description
Word length	Audio word length. One of: 16 bit 20 bit 24 bit

#### 6.4.4 Procedures for Testing Audio from an HDMI/HDBaseT Source Device

Use the following procedures to test the audio from an HDMI source device.

- 6. Make the physical connection between the 780C **HDMI** or **HDBaseT IN** port and the source device under test using the configuration instructions above.
- 7. Enable the HDMI or HDBaseT as the active digital interface input.

<	Signal Type					Home	Preferences	Help
		Type HDMI DVI	Connector HDMI HDBaseT		Color Space	YCbCr 4:	2:2 YCbCr 4	4:4
	VGA(HD1	) Analog YPbP 5) Analog RGB G-SDI			Format Type	PC (IT)	User-Defi	ned
Z-	HDMI/DVI: No signal	No TMDS clock	Cannot be analyzed	Not capable of HDMI 3D	AVMUTE disabled	Not capable o HDCP	No +5V deter	cted
Ŷн	Interface: IDMI (8 bpc RGB)	Format: 3840x2160 30Hz	Pattern: Pseudo Random	3D: Disabled	Audio (HDMI): LPCM 2.0ch 48kHz	Enable HDCP	AVMUTEOFF	08:00

8. Select Audio Analyzer from the Home menu shown below.



The Audio Analysis screen appears as shown below:

<ul> <li>Audio Analy</li> </ul>	sis				Home	Preferences	Help
	Rea	ad Ch Co Stre Sai Stre Ch 	dio InfoFrame data: annel count: 7 channi ding type: 0 (Refer to sam header) ird length: Refer to str ader mpling freq.: Refer to sam header annel allocation: RC RR RL FC LF FL R N: 6144, CTS: 2970 kHz)	Sample word Copyright as: eam Format info: 2 emph. Mode: 0 Category cod Source numb E Channel num Sampling free	Consumer is: Other serted: Yes 2 ch., no pre- le: 00 her: 0 her: 0 q.: 48 KHz		
1 HDMI (8 bpc RGB) N	3840x2160p 30 frames/s	HDMI_VIC 1: No errors	HDMI 3D disabled	AVMUTE disabled	HDCP disabled	+5V detected	
0 Interface: U HDMI (8 bpc RGB)	Format: 3840x2160 30Hz	Pattern: Zone Plate	3D: Disabled	Audio (HDMI): Not configured	Enable HDCP	AVMUTEOFF	04:52

- 9. Touch select the Read activation button to initiate the test.
- 10. Alternatively you can run this test from the command line as follows:

AUDA:RPTP?

An example of the results are shown below:

```
Audio InfoFrame data:
Channel count: 2 channels
Coding type: 0 (Refer to stream header)
```

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Word length: Refer to stream header Sampling freq.: Refer to stream header Channel allocation: --- --- ------ --- FR FL Channel status bits: Application: Consumer Sample words: LPCM Copyright asserted: Yes Format info: Default Mode: 0 Category code: 00 Source number: 0 Channel number: 0 Sampling freq.: 48 KHz Word length: 24 bits)

Table 6-2 below describes each field in the Audio Analyzer on-screen report. The audio infoframe information is shown on the left of the resulting screen and the channel status data from the audio sample packets received are displayed on the right.

Table 6-2: Audio Analyzer				
Audio IEC Header decoded data (left side)	Description			
Audio Format	Indicates the audio format type. Typically one of: LPCM Dolby DTS			
Sampling rate	The sampling frequency. One of: Refer to Stream Header 32kHz 44.1kHz 48kHz 88.2kHz 96kHz 176.4kHz 192kHz			
Target bitrate				
Audio Infoframe Data (middle)	Description			
Channel count	Indicates the number of active channels. One of: • Refer to Stream Header • 2ch • 3ch • 4ch • 5ch • 6ch • 7ch • 8ch			
Coding type	Indicates the audio format. One of: Refer to stream header LPCM (IEC 60958) AC-3 MPEG1 MPEG2 AAC DTS ATRAC One Bit Audio Dolby Digital Plus DTS-HD MAT DST WMA Pro			
Sample Size	The sample size or bit depth. One of: <ul> <li>Refer to Stream Header</li> <li>16 bit</li> <li>20 bit</li> <li>24 bit</li> </ul>			

|--|

Table 6-2: Audio Analyzer	
Audio IEC Header decoded data (left side)	Description
Sampling Frequency	The sampling frequency. One of: Refer to Stream Header 32kHz 44.1kHz 48kHz 88.2kHz 96kHz 176.4kHz 192kHz
Channel Allocation	The speaker mapping and allocation. One or more of the following: FL FC FR RLC FRC RL RC RR RR RRC LFE
Audio Clock Regeneration N/ CTS values	<ul> <li>N</li> <li>CTS</li> </ul>
Channel Status Bit Data (right side)	Description
Application	Application format. One of: Consumer or Professional.
Sample words	Sample word encoding. One of: LPCM or Encoded (non linear compressed).
Copyright asserted	Copyright assertion. One of: Yes or No.
Format info	Format. Typically Default.
Mode	Channel mode. Typically 0 for Mode 0.
Category code	Category code. Typically 00 for general.
Source number	Source number. Typically 0 for Unspecified.
Channel number	Channel number. Typically 0 for Unspecified
Sampling freq	Sampling rate. One of: 32kHz 44.1kHz 48kHz 88.2kHz 96kHz 176.4kHz 192kHz

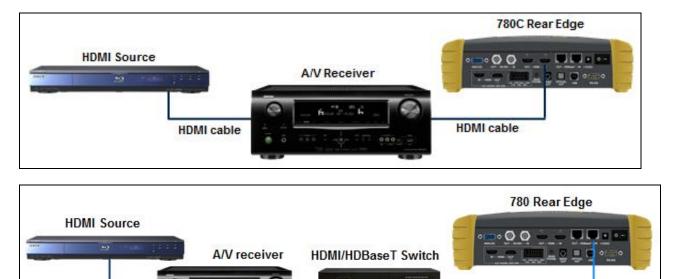
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Table 6-2: Audio Analyzer			
Audio IEC Header decoded data (left side)	Description		
Word length	Audio word length. One of: 16 bit 20 bit 24 bit		

#### 6.4.5 Procedures for Audible Monitoring of LPCM Audio from an Digital Video Source Device

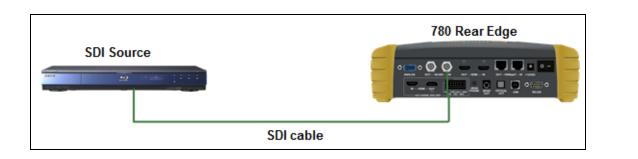
You can monitor the incoming stereo LPCM audio on the HDMI, HDBaseT or SDI IN port at the headphone jack on the front edge of the 780C. You can also monitor a single channel of LPCM audio through the embedded speaker. You can select what channels of a multi-channel LPCM to monitor on the stereo headphone jack or which single channel on the speaker using the screens provided. Use the following procedures to configure the audio monitoring of the incoming LPCM audio through the headphone jack and embedded speaker.

 Connect the HDMI system devices to the 780C as shown in the diagrams below. The HDMI source device output is connected the 780C HDMI, HDBaseT or SDI IN connector is the audio is routed through an HDBaseT distribution device. Refer to the diagrams below:



Cat5/6 HDBaseT

cables



#### 2. Touch select Audio Monitor Settings from the Home menu shown below.

HDMI cable

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ome					Home	Preferences	Help
Source Tests			Sink Tests	s Link	Tests	Installer Tes	sts
Format Analyzer	Packet Viewer	Audio Analyzer	EDID Te		x Channel alyzer	Sink Test	
<u> </u>							] {
Video Display	HDCP Test	Audio Monitor Settings	HDCP T	est Ca Te	ble/Repeater st	Source Te	st
<b>□</b> ←					3	0	
Video Passthrough	CEC Test	1	CEC Tes	st Lir	nk Test	Repeater	Test
		5	POLL				
HDMI (8 bpc YCbCr 4:4:4)	1920x1080p 60 frames/s	VIC 16: No errors	HDMI 3D disabled	AVMUTE disabled	HDCP disabled	+5V detecte	əd
HDMI (YCbCr 4:4:4)	640x1005 60Hz	Color Bars	3D: Frame Packing	Dolby 5.1 (Sine Wave)	HDCP Disable	AVMUTEOFF	14:

The following screen appears:

<	Audio Monitor Setup				Home	Preferences	Help
		Channel Select	3+4 5	+6 7+	8		
		Output Select	) –	olume Level 3dB 0dBFS	+3dB		
		Headphones	)	1dB Mute	+1dB		
I N	HDMI (8 bpc RGB) 3840x2160p frames/s	30 HDMI_VIC 1: No errors	HDMI 3D disabled	AVMUTE disabled	HDCP disabled	+5V detected	
O U T	Interface: Format: HDMI (12 bpc 3840x2160 3 RGB)	Pattern: 0Hz Color Bars	3D: Disabled	Audio (HDMI): LPCM 2.0ch 48kHz	Enable HDCP	AVMUTEOFF	06:33

3. Select the pair of channels to monitor through the headphone jack using the **Headphone Channels** set of selection buttons.

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Audio Monitor Setu	p				Home	Preferences Help
	Cha			+6 7+		-
	Out	23 out Select Speaker		Iume Level	8 +3dB	
		Headphones	) -	1dB Mute	+1dB	
	2160p 30 nes/s	HDMI_VIC 1: No errors	HDMI 3D disabled	AVMUTE disabled	HDCP disabled	+5V detected
	mat: 160 30Hz	Pattern: Zone Plate	3D: Disabled	Audio (HDMI): Not configured	Enable HDCP	

4. Specify the Headphone amplitude in increments of +/-3dB or =/-1dB using the buttons under **Headphone** Level. Select **Mute** to extinguish the audio.

<	Audio Monitor Setup				Home	Preferences	Help
		Channel Select	3 + 4 5	+ 6 7 +	. 8		
		1 2 3	4 5	6 7	8		
		Output Select	Vo	lume Level			
		Speaker		3dB 0dBFS	+3dB		
		Headphones	) -	1dB Mute	+1dB		
N	HDMI (8 bpc RGB) 3840x2160p frames/s	30 HDMI_VIC 1: No errors	HDMI 3D disabled	AVMUTE disabled	HDCP disabled	+5V detected	
0 U	Interface: Format: HDMI (8 bpc RGB) 3840x2160 3	Pattern: 0Hz Zone Plate	3D: Disabled	Audio (HDMI): Not configured	Enable HDCP	AVMUTEOFF	04:58
T	( service) service ( service)			Junganoa		нро ок	-

5. Select the single channel to monitor through the embedded speaker using the **Speaker Channel** set of selection buttons.

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Audio Monitor	Setup				Home	Preferences Help
	Char	nnel Select	3 + 4 5	+ 6 7 +	8	
	Outp	23 out Select	4 5 Vo	6 7	8	
		Speaker Headphones		BdB -15dBFS	+3dB +1dB	
	840x2160p 30	HDMI_VIC 1: No	HDMI 3D disabled	AVMUTE disabled	HDCP disabled	+5V detected
N O Interface: U HDMI (8 bpc RGB) 38	frames/s Format: 340x2160 30Hz	errors Pattern: Zone Plate	3D: Disabled	Audio (HDMI): Not configured	Enable HDCP	AVMUTEOFF 🔄 04:5 NO HDCP 🔓 🥌 HPD OK

6. Specify the speaker amplitude in increments of +/-3dB or =/-1dB using the buttons under **Speaker Level**. Select **Mute** to extinguish the audio.

<	Audio Monitor Setup				Home	Preferences	Help
		Channel Select					
		1+2	3 + 4 5	+6 7+	8		
		1 2 3	4 5	6 7	8		
		Output Select	Va	olume Level	(		
		Speaker	J	3dB -15dBFS +	+3dB		
		Headphones		1dB Mute H	⊦1dB		
I N	HDMI (8 bpc RGB) 3840x2160p frames/s		HDMI 3D disabled	AVMUTE disabled	HDCP disabled	+5V detected	
0 U	Interface: Format: HDMI (8 bpc RGB) 3840x2160 3	Pattern: 0Hz Zone Plate	3D: Disabled	Audio (HDMI): Not configured	Enable HDCP	AVMUTEOFF	04:58
Т						нро ок 🛛 🛛 📈	-

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## 6.5 Testing an HDMI or HDBaseT Source's Response to EDIDs

The 780C HDMI and HDBaseT IN ports emulate an HDMI or HDBaseT sink device. Part of that emulation function is presenting an EDID to a source when a sink device is powered and hot plug is asserted. The 780C is provisioned with a default EDID from the factory. There are two standard EDIDs available with the 780C as provided: 1) Standard HDTV EDID, 2) Standard A/V Receiver EDID.

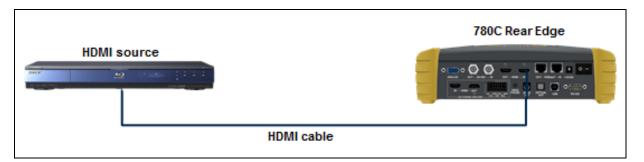
However you can reprovision the EDID by connecting it to a sink device whose EDID you would like to use for testing. The 780C can store multiple EDIDs. These EDIDs can be obtained either by extracting them from an HDMI or HDBaseT sink device (e.g. HDTV, Projector, AVR, repeater or distribution device input) or by importing EDID .xml files created using Quantum Data EDID Editor tools. For procedures on importing EDIDs refer to Adding Reference EDIDs for Use in Testing HDMI Devices.

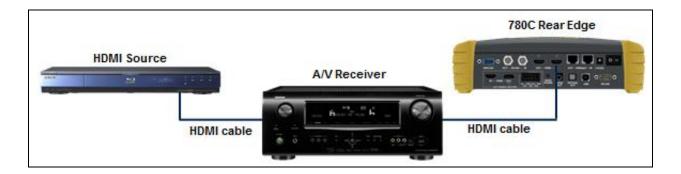
Note: Quantum Data has an EDID Library available for free at: http://www.quantumdata.com/edid/.

The EDID test of an HDMI or HDBaseT source device enables you to see how a source device responds to a specific EDID or a series of EDIDs. The EDID could be a known good EDID or an EDID you have chosen specifically for testing purposes.

### 6.5.1 Configurations for Testing an HDMI Source Devices Response to an EDID

You can run this test in two configurations: 1) with your source device connected directly to the 780C, 2) with your source device connected to the 780C through a repeater device. In both cases the 780C is emulating an HDMI sink to test an upstream source. These configurations are shown below.





## 6.5.2 Configurations for Testing an HDBaseT Device's Output Response to an EDID

Typically you run this test with the 780C connected to an HDMI source through an HDBaseT distribution device. This configurations is shown below.

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### 6.5.3 Procedures for Testing an HDMI Source Devices Response to an EDID

Use the following procedures to test the EDID response from an HDMI source device.

1. Touch select EDID Test from the Home menu (shown below).

H	lome					Home	Preferences He	lp
	Source Tests			Sink Tests	Link	Tests	Installer Tests	
	Format Analyzer	Packet Viewer	Audio Analyzer	EDID Te:	An	x Channel alyzer	Sink Test	
	 	VSIF AUD AUD AVI						
	Video Display	HDCP Test	Audio Monitor Settings	HDCP Te	est Ca Te	ble/Repeater st	Source Test	
						3		
	Video Passthrough	CEC Test		CEC Tes		nk Test	Repeater Test	
				Poll				
I N	HDMI (8 bpc YCbCr 4:4:4)	1920x1080p 60 frames/s	VIC 16: No errors	HDMI 3D disabled	AVMUTE disabled	HDCP disabled	+5V detected	
0 U T	HDMI (YCbCr 4:4:4)	640x1005 60Hz	Color Bars	3D: Frame Packing	Dolby 5.1 (Sine Wave)	HDCP Disable	AVMUTEOFF 2 14 HDCP OK -0 14 HPD OK -0 1	4:32

2. Enable the HDMI or HDBaseT as the active digital interface input.

				0.10		
Interface/Signal	Type HDMI	Connector HDMI		Color Space	YCbCr 4:2:	2 YCbCr 4:4:4
	DVI 5) Analog YPbP	HDBaseT				
	5) Analog RGB	]		Format Type	PC (IT)	User-Defined
3	G-SDI			<u>,</u>		
IDMI/DVI: No signal	No TMDS clock	Cannot be analyzed	Not capable of HDMI 3D	AVMUTE disabled	Not capable of HDCP	No +5V detected
Interface: MI (8 bpc RGB)	Format: 3840x2160 30Hz	Pattern: Pseudo Random	3D: Disabled	Audio (HDMI): LPCM 2.0ch	Enable HDCP	AVMUTEOFF

The following menu appears.

	EDID Test					Home	Preferences	Help
1	Read EDID							
	Load EDID	ī <del>(</del>						1
	Save EDID							
	Compare							
	Use on Rx							
	Auto-EDID Te	st						
								$\nabla$
IN	HDMI (8 bpc RGB)	3840x2160p 15 frames/s	HDMI_VIC 1: Bad VRAT	HDMI 3D disabled	AVMUTE disabled	HDCP disabled	+5V detected	d
0 U T	Interface: HDMI (12 bpc RGB)	Format: 3840x2160 30Hz	Pattern: Color Bars	3D: Disabled	Audio (HDMI): LPCM 2.0ch 48kHz	Enable HDCP	AVMUTEOFF	

3. Touch select Load from the EDID Tests menu. The following screen results.

EDID Test					Home	Preferences Help
Read EDID						
Load EDID	L	oad File				
Save EDID	Load	TV Default				
Compare	Load	AVR Default				
Use on Rx						
Auto-EDID Te	st					
HDMI (8 bpc RGB) N	3840x2160p 30 frames/s	HDMI_VIC 1: No errors	HDMI 3D disabled	AVMUTE disabled	HDCP disabled	+5V detected
0 Interface: U HDMI (8 bpc RGB)	Format: 3840x2160 30Hz	Pattern: Zone Plate	3D: Disabled	Audio (HDMI): Not configured	Enable HDCP	

The options:

- Load File Loads from an EDID file stored on the 780C file system
- Load TV Default Loads the standard reference EDID for a TV from the 780C file system
- Load AVR Default Loads the standard reference EDID for a AVR from the 780C file system
- 4. If you have selected the Load File option, the following screen results. Select the file that you wish to use as the reference EDID. In the example below there is only one file.

	EDID Files					Home	Preferences	Help
	DPC2N00Q.XI	ML H4I2D0	OT.XML	4P2M00C.XML	H4P2M01S.	XML H4I	P2T01S.XML	1
	H7P2D00T.XM	ML H7P2D	D1S.XML	17P2L00Q.XML	H7P2L02X.	XML H7F	P2M00C.XML	
	H7P2M00X.XM	ML H7P2O	D1S.XML	17P2T01X.XML	H8I2D00C.	XML H8	12D01S.XML	
	H8P2D00C.XM	ML H8P2D	DOX.XML	8P2D01C.XML	H8P2H00X.	XML H8I	P2L00X.XML	
	H8P2M01X.XM	ML H8P2N	01S.XML	18P2O01S.XML	H8P3D06C.	XML H8F	P3H01S.XML	
	H8P3L00C.XM	ML HPC2LO	D1S.XML	IPC2L01X.XML	PPC2L00Q.	XML SE	50UY04.XML	
	TESTCMP.XN	IL TEZT	r.xml					
								•
N	HDMI (8 bpc RGB)	3840x2160p 15 frames/s	HDMI_VIC 1: Bad VRAT	HDMI 3D disabled	AVMUTE disabled	HDCP disabled	+5V detected	
0 U T	Interface: HDMI (12 bpc RGB)	Format: 3840x2160 30Hz	Pattern: Color Bars	3D: Disabled	Audio (HDMI): LPCM 2.0ch 48kHz	Enable HDCP	AVMUTEOFF	06:41

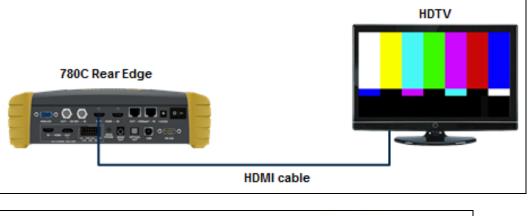
The EDID is loaded and displayed on the screen.

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Read EDID Summary: Header is OK. All checksums OK. EDID Ver. 1.3	
그는 그는 것은 것을 하는 것을 수 없는 것을 수 없는 것을 하는 것을 것을 수 있다. 것은 것을 것을 것을 수 있는 것을 하는 것을 수 있는 것을 수 있는 것을 하는 것을 수 있는 것을 수 있다. 것을 것 같이 것 같이 것 같이 것 같이 같이 같이 것 같이 없다. 것 같이 것 같이 것 같이 것 같이 않는 것 같이 않는 것 같이 없다. 것 같이 것 같이 같이 않는 것 같이 않 않는 것 같이 않는 것 같이 않는 것 같이 않는 것 않는 것 같이 않는 것 같이 않는 것 같이 않는 것 않는	
Load EDID HDMI: Yes (PA 1.0.0.0, 36, 30 bit color, 3D supported ) Manufacturer/Product: QDI 30730 Pref. Native Timing: 3840x2160 30.00Hz	1
SVDs: 480i 480p 576i 576p 720p 1080i 1080p 1080p24 Speakers: [ RLC/RRC RL/RR FC LFE FL/FR ] PCM 8 ch., [32 44,1 48 88,2 96 176,4 192] kHz @ [16 20 24] bits	
Compare AC-3 8 ch., [32 44.1 48] kHz, max rate 640 kHz DTS 8 ch., [44.1 48] kHz, max rate 1536 kHz	
Use on Rx Dolby DD+ 8 ch., [ 44.1 48] kHz DTS-HD 8 ch., [ 44.1 48 88.2 96 176.4 192] kHz MAT (MLP) 8 ch., [ 44.1 48 88.2 96 192] kHz	
Auto-EDID Test	
I HDMI (8 bpc RGB) 3840x2160p Unknown HDMI 3D disabled AVMUTE disabled HDCP disabled +5V dete N 30.00 frames/s	cted
O Interface: Format: Pattern: 3D: Disabled Audio (SDI): Enable HDCP AUDIC FRIL HDMI (8 bpc RGB) Passthrough Mode Pseudo Random 48kHz HPD 0K	07:14

5. If you wish to obtain an EDID from an HDMI or HDBaseT sink device that you have on hand, connect the 780C HDMI or HDBaseT OUT port to the HDMI/HDBaseT input of that sink device. This configuration is depicted below.

Skip to Step 8 if you do not want to use an EDID from an HDMI/HDBaseT sink device you have on hand.





6. Navigate to the EDID Test from the Sink Tests menu shown below.

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	EDID Test					Home	Preferences	Help
	Read EDID							
	Load EDID							1
	Save EDID							
	Compare							
	Use on Rx							
	Auto-EDID Te	st						
IN	HDMI (8 bpc RGB)	3840x2160p 15 frames/s	HDMI_VIC 1: Bad VRAT	HDMI 3D disabled	AVMUTE disabled	HDCP disabled	+5V detected	
		Format: 3840x2160 30Hz	Pattern: Color Bars	3D: Disabled	Audio (HDMI): LPCM 2.0ch 48kHz	Enable HDCP	AVMUTEOFF	06:36

7. Touch select the Read activation button from the EDID Test menu shown above.

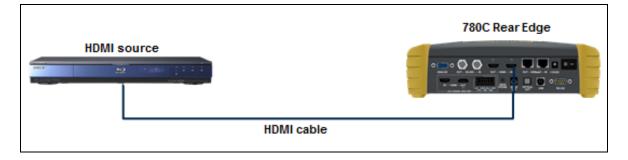
The EDID is listed as shown below.

EDID Test					Home	Preferences	Help
Read EDID	EDID Summa Header is OK	ry: All checksums OK	. EDID Ver. 1.3				
Load EDID	Manufacturer/	A 1.0.0.0, 36, 30 bi Product: QDI 30730 ming: 3840x2160 3		)			1
Save EDID	SVDs: 480i 48 Speakers: [ RI	80p 576i 576p 720p LC/RRC RL/RR FC	1080i 1080p 1080p LFE FL/FR ]				
Compare	AC , [3:	2 44.1 48 88.2 96 1 2 44.1 48] kHz, max 4.1 48] kHz, max rai		20 24] bits			
Use on Rx	DTS-HD 8 ch.	ch., [ 44.1 48] kHz , [ 44.1 48 88.2 96 ch., [ 44.1 48 88.2 9	176.4 192] kHz				
Auto-EDID Tes		cn., [ 44. 1 48 88.2 9	192] KHZ				
							$\nabla$
HDMI (8 bpc RGB) N	3840x2160p 30.00 frames/s	Unknown	HDMI 3D disabled	AVMUTE disabled	HDCP disabled	+5V detected	
0 Interface: U HDMI (8 bpc RGB) P	Format: assthrough Mode	Pattern: Pseudo Random	3D: Disabled	Audio (SDI): LPCM 2.0ch 48kHz	Enable HDCP	AVMUTEOFF	07:14

- 8. Touch select the Use on Rx activation button to apply the EDID, you have either loaded from a file or read from an HDMI/HDBaseT sink device, to the 780C HDMI or HDBaseT IN port.
- 9. Connect the 780C HDMI IN or HDBaseT IN port to the HDMI output of a source device or HDBaseT output you wish to test as shown in the illustration below.

This will cause a hot plug event and the source device under test should read the EDID of the 780C **HDMI IN** or **HDBaseT IN** port. Run the Format Analyzer test and other diagnostic tests on the source to determine how it responded to the EDID.

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# 7 Using the 780C Test Instrument Installer Test Utility

This section provides procedures for diagnosing HDMI and HDBaseT networks using the automated Installer Test. *The features and functions described in this section are included as a standard feature.* The Installer Test enables you to quickly and simply identify common interoperability problems. The Installer Test enables you to conduct step by step diagnostics toward the source—upstream (**Source Test**), toward the sink—downstream (**Sink Test**), or in a looped configuration around a repeater device (**Repeater Test**). You can also conduct both and upstream and a downstream diagnostic test at the same time using the Link Test.

Table 7-1 below describes what items are tested with each test in the Installer Test.

Table 7-1: Installer Test	
Sink Test	Description
	<ul> <li>Verifies hot plug detect is high</li> <li>Verifies EDID (bad header, bad checksum, pass/fail on compliance)</li> <li>Runs an HDCP test</li> <li>Runs a video test at EDID preferred timing, with HDCP enabled</li> <li>Test EDID video at 1080p(24/50/60), 1080i(25/30), 720p(50/60)</li> <li>YCbCr 4:2:0 4:2:2 and 4:4:4 video tests</li> <li>Tests deep color parameters</li> <li>Test port switch on HDTV with HDCP re-authentication</li> </ul>
Source Test	Description
	<ul> <li>Tests the maximum number of HDCP keys supported by the source device during HDCP authentication.</li> <li>Verifies the incoming video at various timings</li> <li>Verifies video timing parameters.</li> </ul>

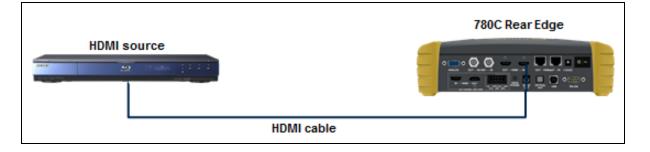
Repeater Test	Description
	<ul> <li>Verifies hot plug detect is asserted.</li> </ul>
	<ul> <li>Verifies EDID (bad header, bad checksum, pass/fail on compliance)</li> </ul>
	<ul> <li>Indicates if the EDID was modified.</li> </ul>
	<ul> <li>Verifies timing pass-through.</li> </ul>
	<ul> <li>Checks if video was passed through unchanged or not.</li> </ul>
	<ul> <li>If timing is passed through, test will also verify if the video is passed through without color manipulation.</li> </ul>
	<ul> <li>Verifies HDCP authentication and if repeater acts as an HDCP repeater or not and verifies that it acts properly as an HDCP repeater.</li> </ul>
	<ul> <li>Test port switch on HDTV with HDCP re-authentication</li> </ul>
Link Test	Description
	<ul> <li>Tests the maximum number of HDCP keys (max dev count) supported by the source device during HDCP authentication.</li> </ul>
	<ul> <li>Verifies hot plug detect is asserted.</li> </ul>
	<ul> <li>Verifies EDID (bad header, bad checksum, pass/fail on compliance).</li> </ul>
	<ul> <li>Runs an HDCP authentication test on both source and sink.</li> </ul>
	<ul> <li>Runs a video test at EDID preferred timing, with HDCP enabled.</li> </ul>
	<ul> <li>Test port switch on HDTV with HDCP re-authentication</li> </ul>
	<ul> <li>Verifies the incoming video at various timings</li> </ul>
	<ul> <li>Verifies video timing parameters.</li> </ul>

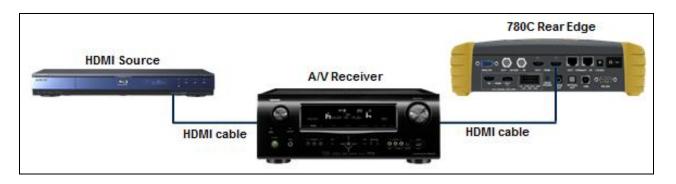
## 7.1 Diagnosing HDMI and HDBaseT Interoperability Problems toward the Source - Upstream

This subsection describes how to diagnose HDMI and HDBaseT interoperability problems on HDMI/HDBaseT source device—upstream (Source Test).

## 7.1.1 Connection Configurations for Testing HDMI Source Devices

The 780C's HDMI input port acts as a "reference" HDMI sink device. Therefore it enables you to emulate a known good HDMI sink device to conduct diagnostics upstream toward the source device. The following illustrations show the typical configurations.





## 7.1.2 Connection Configurations for Testing HDBaseT Source Devices

The 780C's HDBaseT input port acts as a "reference" HDBaseT sink device. Therefore it enables you to emulate a known good HDBaseT sink device to conduct diagnostics upstream toward the source device. The following illustrations show the typical configurations.



## 7.1.3 Procedures for Testing Upstream (Source Test) with the Installer Utility

Use the following procedures to test the video from an HDMI source device directly at the HDMI source or through an HDMI repeater device or HDBaseT distribution device. You can view the incoming video and check the video and timing parameters of the incoming video.

- 1. Make the physical connection between the 780C **HDMI IN** or HDBaseT IN port and the upstream device under test using the configuration instructions above or by following the instructions on the screen.
- 2. Enable the HDMI or HDBaseT as the active digital interface input.

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Signal Type					Home	Preferences Help
Interface/Signal	HDMI	Connector HDMI		Color Space	YCbCr 4:2:	2 YCbCr 4:4:4
	DVI ) Analog YPbP 5) Analog RGB	HDBaseT	J	Format Type	PC (IT)	User-Defined
3	G-SDI	J				
HDMI/DVI: No signal	No TMDS clock	Cannot be analyzed	Not capable of HDMI 3D	AVMUTE disabled	Not capable of HDCP	No +5V detected
Interface: HDMI (8 bpc RGB)	Format: 3840x2160 30Hz	Pattern: Pseudo Random	3D: Disabled	Audio (HDMI): LPCM 2.0ch 48kHz	Enable HDCP	AVMUTEOFF 208:0 HDCP OK -

3. Touch select **Source Test** under **Installer Tests** from the **Home** menu shown below.



4. Touch select the **OK** activation button to initiate the test.

Installer Tes	t				Home	Preferences Help
Source Devic Player, S <sup>-</sup>		a i i i i i i i i i i i i i i i i i i i	10 T 6 TH			
	Conne	ct your 780 as show	n.			
HDMI/DVI: No signal	No TMDS clock	Cannot be analyzed	Not capable of HDMI 3D	AVMUTE disabled	Not capable of HDCP	No +5V detected
0 Interface: U HDMI (8 bpc RGB)	Format: 1920x1080 60Hz	Pattern: Pseudo Random	3D: Disabled	Audio (HDMI): LPCM 2.0ch 48kHz	Enable HDCP	AVMUTEOFF (2) 07:51 NO HDCP 1 → 07:51

The test will run for up to about a minute. A status screen is provided as shown below.

	Installer Tes	ŧ				Home	Preferences	Help
		Testing	source please w	ait.				
IN	HDMI (8 bpc RGB)	3840x2160p 30.00 frames/s	Unknown	HDMI 3D disabled	AVMUTE disabled	HDCP disabled	+5V detected	
0 U T	Interface: HDMI (8 bpc RGB)	Format: 1920x1080 60Hz	Pattern: Pseudo Random	3D: Disabled	Audio (HDMI): LPCM 2.0ch 48kHz	Enable HDCP	AVMUTEOFF	

You will be asked to verify the video and video parameters presented on the 780C display. Touch select the appropriate activation button **Yes** or **No**.

A sample of a results screen is shown below.



<	Installer Tes	t				Home	Preferences	Help
		Testinç	g complete.					
	HDMI (8 boc BGB)	3840x2160p	Unknown	HDMI 3D disabled	AVMUTE disabled	HDCP disabled	+5V detected	
n	HDMI (8 bpc RGB) Interface: HDMI (8 bpc RGB)	3840x2160p 30.00 frames/s Format: 1920x1080 60Hz	Pattern: Pseudo Random	3D: Disabled	Audio (HDMI): LPCM 2.0ch 48kHz	Enable HDCP	+5V detected	07:52

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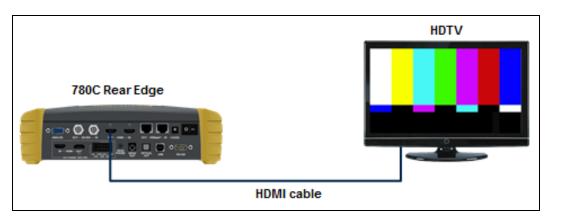
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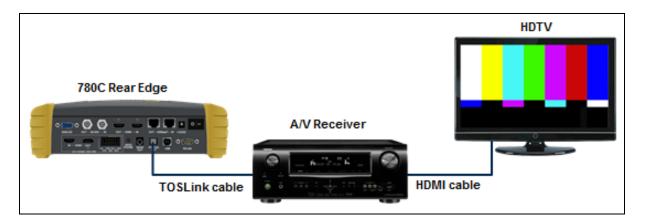
## 7.2 Diagnosing HDMI and HDBaseT Interoperability Problems at the Sink -Downstream

This subsection describes how to diagnose HDMI and HDBaseT interoperability problems on HDMI or HDBaseT sink device—downstream (**Sink Test**).

## 7.2.1 Connection Configurations for Testing HDMI Sink Devices

The 780C's HDMI input port acts as a "reference" HDMI source device. Therefore it enables you to emulate a known good HDMI source device to conduct diagnostics downstream toward the sink device. The following illustrations show the typical configurations.

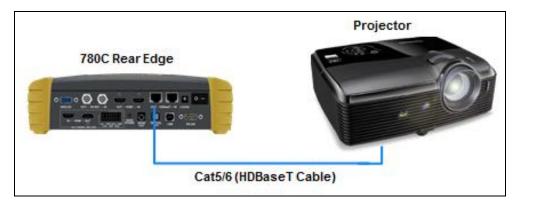


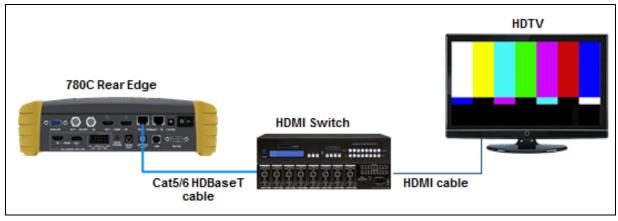


## 7.2.2 Connection Configurations for Testing HDBaseT Sink Devices

The 780C's HDBaseT output port acts as a "reference" HDBaseT source device. Therefore it enables you to emulate a known good HDBaseT source device to conduct diagnostics downstream toward the sink device. The following illustrations show the typical configurations.

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#### 7.2.3 Procedures for Testing Downstream (Sink Test) with the Installer Utility

Use the following procedures to test the video from an HDMI sink device.

- 1. Make the physical connection between the 780C **HDMI/HDBaseT OUT** port and the sink device under test using the configuration instructions above or by following the instructions on the screen.
- 2. Enable the HDMI or HDBaseT as the active digital interface input.

Signal Type					Home	Preferences
Interface/Signal	Type HDMI	Connector		Color Space	YCbCr 4:2	2 YCbCr 4:4:4
	DVI ) Analog YPbP	HDBaseT		Format Type		
	5) Analog RGB G-SDI			TV (CE)	PC (IT)	User-Defined
HDMI/DVI: No signal	No TMDS clock	Cannot be analyzed	Not capable of HDMI 3D	AVMUTE disabled	Not capable of HDCP	No +5V detected
Interface: DMI (8 bpc RGB)	Format: 3840x2160 30Hz	Pattern: Pseudo Random	3D: Disabled	Audio (HDMI): LPCM 2.0ch 48kHz	Enable HDCP	AVMUTEOFF 20 HDCP OK -0 HPD FAIL

3. Touch select Sink Test under the Installer Tests from the Home menu shown below.



4. Touch select the **OK** activation button to initiate the test.

	Installer Tes		s	ink Device (TV Projector)		Home	Preferences Help	
		Conne	ct your 780 as show	n.				
I N	HDMI (8 bpc RGB)	3840x2160p 30 frames/s	HDMI_VIC 1: No errors	HDMI 3D disabled	AVMUTE disabled	HDCP disabled	+5V detected	
0 U T	Interface: HDMI (8 bpc RGB)	Format: 3840x2160 30Hz	Pattern: Ramp/Stair	3D: Disabled	Audio (HDMI): Not configured	Enable HDCP		

The test will run for up to about a minute. You will be asked to verify the video and video parameters presented on the display device under test. Touch select the appropriate activation button **Yes** or **No**.

<	Installer Tes	t				Home	Preferences	lelp
		HPD: Asse EDID: HDM HDCP: Aut HDCP: Vid						
	HDCP Video/Audio (preferred): OK							
Switch inputs on the sink device. Does video always come back?								
I N	HDMI (8 bpc RGB)	3840x2160p 30 frames/s	HDMI_VIC 1: No errors	HDMI 3D disabled	AVMUTE disabled	HDCP disabled	+5V detected	
0 U T	Interface: HDMI (8 bpc RGB)	Format: 3840x2160 30Hz	Pattern: Color Bars	3D: Disabled	Audio (HDMI): LPCM 2.0ch	Enable HDCP	AVMUTEOFF	05:03

The results are presented for each timing (video resolution) tested. The following two screens are samples of these results screens.

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## 7.3 Diagnosing HDMI/HDBaseT Interoperability Problems with a Repeater

This subsection describes how to diagnose HDMI/HDBaseT interoperability problems related to an HDMI/HDBaseT repeater device (**Repeater Test**).

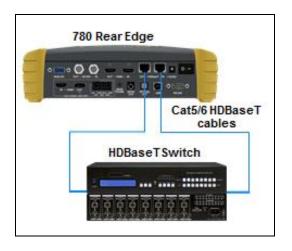
### 7.3.1 Connection Configurations for Testing HDMI Repeater Devices

The 780C's HDMI input port acts as a "reference" HDMI source and sink device simultaneously. Therefore it enables you to emulate both a known good HDMI source and sink device to conduct diagnostics on a repeater device. The following illustration shows the typical configuration.



#### 7.3.2 Connection Configurations for Testing HDBaseT Repeater Devices

The 780C's HDBaseT input port acts as a "reference" HDBaseT source and sink device simultaneously. Therefore it enables you to emulate both a known good HDBaseT source and sink device to conduct diagnostics on a repeater device. The following illustration shows the typical configuration.



#### 7.3.3 Procedures for Testing Repeaters (Repeater Test) with the Installer Utility

Use the following procedures to test the video from an HDMI/HDBaseT repeater device with the Installer Utility.

- 1. Make the physical connections between the 780C HDMI/HDBaseT IN and OUT ports and the sink device under test using the configuration instructions above or by following the instructions on the screen.
- 2. Enable the HDMI or HDBaseT as the active digital interface input as shown below.

Interface/Signal	Туре	Connector	an 🖌	Color Space		
	HDMI	HDMI		RGB.	YCbCr 4:2:	2 YCbCr 4:4:4
	DVI	HDBaseT	]			
VGA(HD15	) Analog YPbP			Format Type		
VGA(HD1	5) Analog RGB			TV (CE)	PC (IT)	User-Defined
3	G-SDI					
HDMI/DVI: No signal	No TMDS clock	Cannot be analyzed	Not capable of HDMI3D	AVMUTE disabled	Not capable of HDCP	No +5V detected

3. Touch select Repeater Test from Installer Tests from the Home menu shown below.

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#### 780C Multi-Interface Interoperability Tester - User Guide

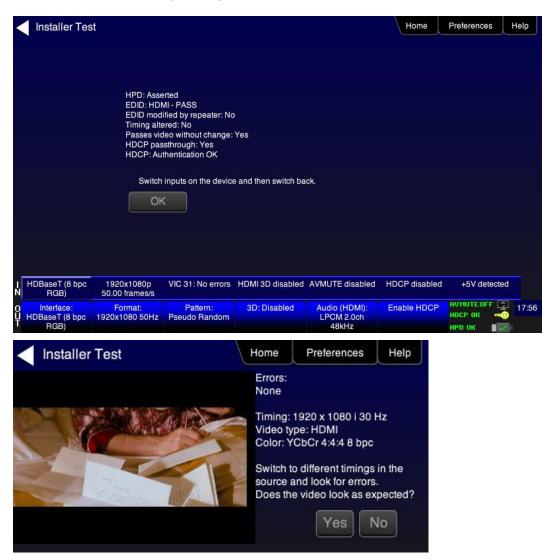
ome					Home	Preferences	Help
Source Tests			Sink Tests	i Link	Tests	Installer Test	S
Format Analyzer	Packet Viewer	Audio Analyzer	EDID Te	An	x Channel alyzer	Sink Test	
		-					1
Video Display	HDCP Test	Audio Monitor Settings	HDCP T	est Ca Te	ble/Repeater st	Source Test	t
<b></b> ←	Aksv Bksv	Q ₹)		1973 C	3		1
Video Passthrough	CEC Test		CEC Tes		nk Test	Repeater Te	est
		3					7
HDMI (8 bpc YCbCr 4:4:4)	1920x1080p 60 frames/s	VIC 16: No errors	HDMI 3D disabled	AVMUTE disabled	HDCP disabled	+5V detected	ł
HDMI (YCbCr 4:4:4)	640x1005 60Hz	Color Bars	3D: Frame Packing	Dolby 5.1 (Sine Wave)	HDCP Disable	AVMUTEOFF	14:

The Repeater Test screen will appear as shown below.

<	Installer Tes	st				Home	Preferences	Help
	Repeater Output Port		<b></b>	Repeat Input P				
		Conne	ct your 780 as show	n.				
I N	HDBaseT (8 bpc RGB)	3840x2160p 30.00 frames/s	Unknown	HDMI 3D disabled	AVMUTE disabled	HDCP enabled	+5V detected	
O U T	Interface: HDBaseT (8 bpc RGB)	Format: 3840x2160 30Hz	Pattern: Color Bars	3D: Disabled	Audio (HDMI): LPCM 2.0ch 48kHz	Enable HDCP	AVMUTEOFF 🙀 HDCP OK 🔫 HPD OK ा	17:55

4. Touch select the **OK** activation button to initiate the test.

The test will run for up to about a minute. You will be instructed to switch to different timings and verify that the video displayed on the 780C screen looks correct.



The results are presented for each timing (video resolution) tested. The following screen is a sample of these results.



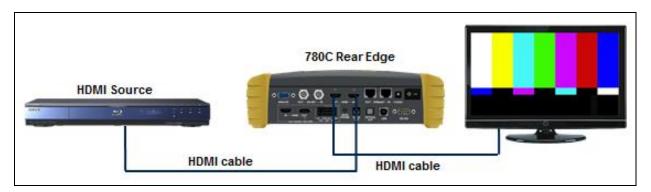
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# 7.4 Diagnosing HDMI/HDBaseT Interoperability Problems in an HDMI/HDBaseT Network

This subsection describes how to diagnose HDMI interoperability problems in an HDMI network (Link Test).

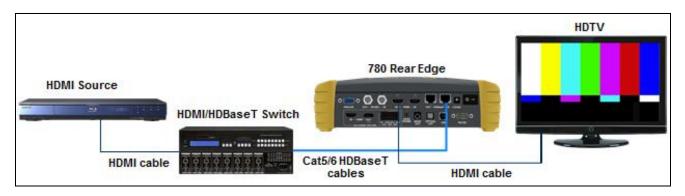
#### 7.4.1 Connection Configurations for Testing HDMI Links

The 780C's HDMI input port acts as a "reference" HDMI source and sink device simultaneously. Therefore it enables you to emulate both a known good HDMI source and sink device to conduct diagnostics on a source devices upstream and sink devices downstream simultaneously. The following illustration shows the typical configuration.



#### 7.4.2 Connection Configurations for Testing HDBaseT Links

The 780C's HDBaseT input port acts as a "reference" HDBaseT source and sink device simultaneously. Therefore it enables you to emulate both a known good HDBaseT source and sink device to conduct diagnostics on a source devices upstream and sink devices downstream simultaneously. The following illustration shows the typical configuration.



#### 7.4.3 Procedures for Testing HDMI Networks (Links) with the Installer Utility

Use the following procedures to test the video on an HDMI link with the Installer Utility.

- 1. Make the physical connection between the 780C HDMI IN and OUT ports and the HDMI source and sink devices under test using the configuration instructions above or by following the instructions on the screen.
- 2. Enable the HDMI as the active digital interface input as shown below.

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Interface/Signal Type       Connector       Color Space         HDMI       HDMI       RGB       YCbCr 4:2:2       YCbCr 4:4:4         DVI       HDBaseT       Format Type       Format Type         VGA(HD15) Analog RGB       TV (CF)       PC (IT)       User-Defined         3G-SDI       No TMPS clock       Conceptor       Moderated       Admitted disclock       No vitil disclock	HDMI HDMI RGB DVI HDBaseT VGA(HD15) Analog YPbPr VGA(HD15) Analog RGB 3G-SDI	Home	Preferences				
VGA(HD15) Analog YPbPr VGA(HD15) Analog RGB 3G-SDI		HDMI	HDMI			YCbCr 4:2:	2 YCbCr 4:4:4
UDWUWINE No THDS deals Corporate Not creately at AVWUTE dischlard Nationable of No (59 detected)	VGA(HD1	) Analog YPbP 5) Analog RGB		J		PC (IT)	User-Defined
	HDM//DVI: No	No TMDS clock	Cannot be	Not capable of	AVMUTE disabled	Not capable of	No +5V detected
	Interface: DMI (8 bpc RGB)	3840x2160 30Hz	Pseudo Random		LPCM 2.0ch		НОСР ОК 🛁 💭 💻

3. Touch select Link Test from Installer Tests from the Home menu shown below.



A diagram will appear on the 780C display depicting the proper setup for the Link Test.

4. Touch select the OK activation button to initiate the test.

<	Installer Tes	st				Home	Preferences	elp
C	Device Output Port		<b>**</b> 0 ** * * **	Adjace Device In Port				
		Conne	ct your 780 as show	n.				
I N	HDMI (8 bpc RGB)	3840x2160p 30.00 frames/s	Unknown	HDMI 3D disabled	AVMUTE disabled	HDCP disabled	+5V detected	
0 U T	Interface: HDMI (8 bpc RGB)	Format: 3840x2160 30Hz	Pattern: Pseudo Random	3D: Disabled	Audio (HDMI): LPCM 2.0ch 48kHz	Enable HDCP	носр ок 🛛 🛁 👘	07:58

The test will run for up to about a minute. A status screen is provided as shown below.

Installer Test	Home	Preferences	Help
Tasia lisk slassouit			
Testing link please wait.			

You will be instructed to switch interfaces on the HDTV during the test. Touch select the appropriate the **OK** activation button.



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# 8 Using the 780C to Monitor the HDMI/HDBaseT CEC and DDC channel

This section provides procedures for using the *optional* Auxiliary Channel Analyzer (ACA) feature. This option enables you to monitor the following:

- HDMI/HDBaseT DDC and CEC emulation monitoring with Auxiliary Channel Analyzer (ACA) The 780C ACA enables you to monitor DDC transactions such as HDCP and EDID as well as hot plug related events while emulating an HDMI/HDBaseT source and/or sink device(s) in an HDMI/HDBaseT system.
- DDC and CEC passive monitoring with Auxiliary Channel Analyzer (ACA) The 780C ACA enables you to
  passively monitor HDMI CEC and DDC transactions between an HDMI source and sink. You can monitor
  +5V, hot plug events as well as the HDCP and EDID transactions and CEC messages.

These ACA features require a license key and can be enabled remotely. *The features and functions described in this section are included only if you have purchased the Auxiliary Channel Analyzer option.* 

## 8.1 Auxiliary Channel Analyzer (ACA) Transactions

This subsection describes the ACA transaction screens. The screen shot and tables below describes the Auxiliary Channel Analyzer control buttons and on-screen transactions.

Aux Channe	el Analyzer				Home	Preferences	Help
Start	Save	Clear	Details	3	Auto Scr	oll	
Timestamp	Туре	Data					
0:04:37.6282	DDC	U HDCP MASTER -	> SLAVE I2C Request	RI			
0:04:37.6284 DDC U HDCP_SLAVE -> MASTER I2C HDCP_Response							
0:04:39.6950 DDC U HDCP MASTER -> SLAVE I2C Request [RI']							
0:04:39.6952 DDC U HDCP SLAVE -> MASTER 12C HDCP Response							
0:04:39.7283	DDC	U HDCP MASTER -	SLAVE I2C Request				
0:04:39.7286	DDC	U HDCP_SLAVE ->	MASTER I2C HDCP Re	sponse			
0:04:41.8951	DDC	U HDCP MASTER -	SLAVE I2C Request				
0:04:41.8954	DDC	U HDCP_SLAVE ->	MASTER I2C HDCP Re	sponse			
0:04:43.2121	HPD	U Tx/U Port Falling E	dge				
0:04:44.6678	HPD	U Tx/U Port Rising E	dge				
0:04:44.8017	DDC	U EDID MASTER ->	SLAVE I2C E-EDID Se	gment 0			
0:04:44.8021	DDC	U EDID MASTER ->	SLAVE I2C Request C	lffset 0			
0:04:44.8024	DDC	U EDID SLAVE -> N	ASTER I2C Response				
HDMI (8 bpc RGB)	3840x2160p 30 frames/s	HDMI_VIC 1: No errors	HDMI 3D disabled	AVMUTE disabled	HDCP disabled		
Interface: HDMI (8 bpc RGB)	Format: 3840x2160 30Hz	Pattern: Pseudo Random	3D: Disabled	Audio (HDMI): LPCM 2.0ch	Enable HDCP	AVMUTEOFF	00.0
				48kHz		нро ок 👘 📳	/ 🖃

**Note**: You can scroll through the transactions up or down (older to more recent) by sliding your finger or stylus up or down on the touch screen.

The following table describes the control buttons on the top of the ACA screen.

Table 8-2: Auxiliary Channel Analyzer activation button description					
Button Description					
Start/Stop	A toggle button to initiate and then halt the collection of ACA transactions. You must stop the collection if you want to save the transactions or view the details. Once stopped you can scroll through the transactions by moving your finger or stylus up or down.				

|--|

Table 8-2: Auxiliary Channel Analyzer activation button description					
Button	Description				
Save	Enables you to name and save an ACA trace for later examination and exporting to other colleagues. Once exported the saved traces can be viewed either through another 780 or through the ACA viewer application available from the Quantum Data website.				
Clear	Clears out the trace transactions shown on the 780 display.				
Details	Enables you to view the details of the transaction that is highlighted. Also enable you to return to the main screen with the transactions.				
Auto Scroll	Automatically moves the viewer to the most recently collected transactions.				

Data type	Description	Color coding
Hot Plug indication	An indication from the HDMI/HDBaseT sink to the HDMI/HDBaseT source that there is a device connected. The Hot Plug voltage is a steady. In the case of a repeater, it is a 100ms pulse.	Blue
+5V	A voltage from an HDMI/HDBaseT source to the HDMI/HDBaseT sink to power the hot plug voltage. The +5V is a steady voltage nominally 5 volts.	Cyan
EDID Exchange	A data set in the HDMI/HDBaseT sink that describes its capabilities to a connected source device. This data is transmitted over the DDC channel.	Yellow
HDCP Transactions	Content protection authentication and encryption transactions. The source initiates HDCP for protected content. Various values and registers are exchanged over the DDC.	Green
CEC messages	CEC messages are transmitted over a one wire CEC bus. These messages are monitored through the ACA	Magenta
Errors	The DDC channel uses the I2C protocol. Errors in the I2C protocol are shown in the ACA transactions.	Red

1. For each transaction there is a timestamp. The timestamps are: HH:MM:SS:MSEC format. They are best used for comparing between transactions.

- 2. Each transaction has a type indicate which can be: DDC, Hot Plug, CEC or 5V.
- Each transaction there is a directional indicator, U Upstream, D Downstream. This pertains to the location of the 780 relative to the network it is exchanging information with. Upstream means that the 780 is upstream and communicating downstream and Downstream means that the 780 is downstream and communicating upstream.

You can save these transactions and then view them on the Quantum Data external ACA viewer which is available for free on the Quantum Data website.

## 8.2 Auxiliary Channel Analyzer – Emulation Monitoring of DDC on Sink

The Aux Channel Analyzer test monitors the DDC channel transactions and hot plug events while emulating HDMI devices. *The features and functions described in this section are included only if you have purchased the Auxiliary Channel Analyzer option.* 

You can view the details of each transaction and save the traces for viewing on the external ACA application available from the Quantum Data website.

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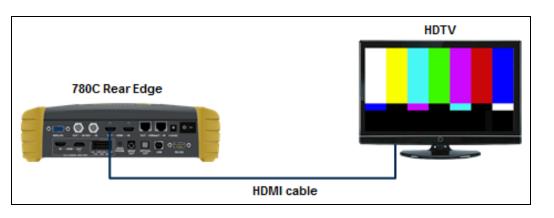
#### 8.2.1 Configurations for Monitoring DDC Transactions with ACA on HDMI Sink Devices

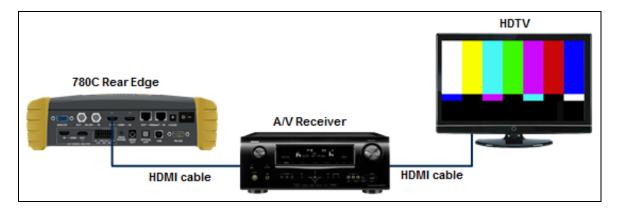
This subsection provides configuration diagrams that depict ACA monitoring of HDMI sink devices, with or without a repeater while the 780C is emulating an HDMI source device.

- 1. Connect the HDMI or HDBaseT sink devices to the 780C in either of the ways shown in the diagrams below and described as follows:
  - a. The HDMI sink device input is connected the 780C HDMI OUT connector.

OR

b. The HDMI repeater device input is connected to the 780C HDMI OUT connector.





#### 8.2.2 Configurations for Monitoring DDC Transactions with ACA on HDBaseT Sink Devices

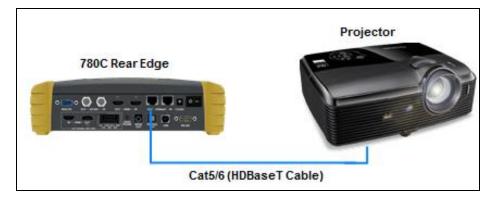
This subsection provides configuration diagrams that depict ACA monitoring on HDBaseT sink devices, with or without a repeater while the 780C is emulating an HDBaseT source device.

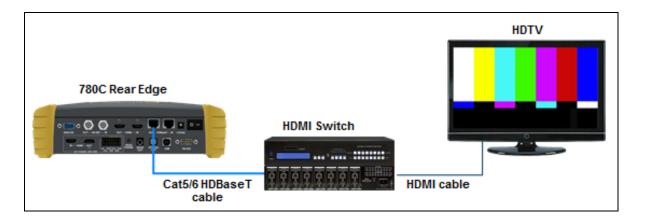
- 1. Connect the HDBaseT system devices to the 780C in either of the ways shown in the diagrams above and described as follows:
  - a. The HDBaseT sink device input is connected the 780C HDBaseT OUT connector.

OR

b. The HDBaseT repeater device input is connected to the 780C HDBaseT OUT connector.

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#### 8.2.3 Monitoring DDC Transactions with ACA on HDMI or HDBaseT Sink Devices

This subsection provides configuration diagrams that depict ACA monitoring of HDMI or HDBaseT sink devices, with or without a repeater while the 780C is emulating an HDMI or HDBaseT source device.

1. Enable the HDMI or HDBaseT as the active digital interface input as shown below.

< Si	gnal Type					Home	Preferences	Help
		Type HDMI DVI	Connector HDMI HDBaseT		Color Space	YCbCr 4:	2:2 YCbCr 4	:4:4
	/GA(HD1	) Analog YPbPi 5) Analog RGB G-SDI			Format Type	PC (IT)	User-Defi	ined
	MI/DVI: No signal	No TMDS clock	Cannot be analyzed	Not capable of HDMI3D	AVMUTE disabled	Not capable of HDCP	No +5V dete	cted
	terface: (8 bpc RGB)	Format: 3840x2160 30Hz	Pattern: Pseudo Random	3D: Disabled	Audio (HDMI): LPCM 2.0ch 48kHz	Enable HDCP	AVMUTEOFF	08:00

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- 2. From the Home screen (shown below) touch select the Aux Channel Analyzer activation button.

F	lome					Home	Preferences Help
	Source Tests			Sink Tests	s Link	Tests	Installer Tests
	Format Analyzer	Packet Viewer	Audio Analyzer	EDID Te	An	ix Channel alyzer	Sink Test
		VSIF - AUD - AUD - AVI - AVI					
	Video Display	HDCP Test	Audio Monitor Settings	HDCP T	est Ca Te	able/Repeater st	Source Test
	÷		$\dot{\mathbf{x}}$			3	
	Video Passthrough	CEC Test		CEC Tes		nk Test	Repeater Test
				POLL			
I N	HDMI (8 bpc YCbCr 4:4:4)	1920x1080p 60 frames/s	VIC 16: No errors	HDMI 3D disabled	AVMUTE disabled	HDCP disabled	+5V detected
0 U T	HDMI (YCbCr 4:4:4)	640x1005 60Hz	Color Bars	3D: Frame Packing	Dolby 5.1 (Sine Wave)	HDCP Disable	АУМИТЕОГГ (2) 14:32 НDCP ОК -00 НPD ОК -00

The ACA Setup Options screen appears:

Tx Monitor Rx Monitor	
Tx Monitor Rx Monitor	
780 Tx Port 780 Rx Port	
Passive Upstream Passive Downstream	
DDC CEC HPD +5V DDC CEC HPD +5V	
Capture Data Table	
HDMI (8 bpc RGB) 3840x2160p 30 HDMI_VIC 1: No HDMI 3D disabled AVMUTE disabled HDCP enable frames/s errors	
0 Interface: Format: Pattern: 3D: Disabled Audio (HDMI): Disable HDC HDMI (8 bpc RGB) 3840x2160 30Hz Pseudo Random 48kHz	AVMUTEOFF HDCP OK HDCP OK HPD OK ■ T T HPD OK ■ T T T T T T T T T T T T T

- 5. Select the data types that you wish to monitor. In this application you would select data types from the **Tx Port side**.
- 6. Determine what data types you wish to monitor. Typically you will want to monitor the DDC and hot plug (+5V only available with passive monitoring option).

**Note**: By default the two activation buttons labeled **780C Tx Port** and **780C Rx port** are enabled. You cannot disable them. Transactions will be shown based on which ports (HDMI/HDBaseT OUT and/or

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HDMI/HDBaseT IN) are connected to HDMI/HDBaseT devices and which set of transactions you have enabled (i.e. DDC, HPD on Tx or Rx side).

ACA Setup C	Options				Home	Preferences	Help
	Tx Mo	onitor 780 Tx Po		onitor 780 Rx Por	t		
		Passive Upstr	ream	Passive Downs			
			Capture Data Ta	able			
HDMI (8 bpc RGB) N	3840x2160p 30 frames/s	HDMI_VIC 1: No errors	HDMI 3D disabled	AVMUTE disabled	HDCP enabled	+5V detected	
O Interface: U HDMI (8 bpc RGB)	Format: 3840x2160 30Hz	Pattern: Pseudo Random	3D: Disabled	Audio (HDMI): LPCM 2.0ch 48kHz	Disable HDCP	AVMUTEOFF 📑 HDCP OK 🛁 HPD OK 📲	00:07

- 7. Enable HDCP on the 780C HDMI or HDBaseT OUT port. Use the procedures in the section entitled: Testing HDCP on an HDMI HDTV or HDMI Repeater Device.
- 8. Take whatever action necessary to initiate a new HDCP authentication. Typically this would be a hot plug event at the sink device you are testing. Alternatively you can simply disable and re-enable HDCP on the 780C.
- 9. Touch select the **Capture Data Table** activation button to initiate the capturing of the data. A screen similar to the one shown below will appear.

Aux Channe	el Analyzer				Home	Preferences Help
Start	Save	Clear	Details	;	Auto Scro	
Timestamp	Туре	Data				
0:04:37.6282	DDC	U HDCP MASTER -	> SLAVE I2C Request	Ri']		
0:04:37.6284	DDC	U HDCP_SLAVE ->	MASTER I2C HDCP Re	sponse		
0:04:39.6950	DDC	U HDCP MASTER -	> SLAVE I2C Request			
0:04:39.6952	DDC	U HDCP_SLAVE ->	MASTER I2C HDCP Re	sponse		
0:04:39.7283	DDC	U HDCP MASTER -	> SLAVE I2C Request			
0:04:39.7286	DDC	U HDCP_SLAVE ->	MASTER I2C HDCP Re	sponse		
0:04:41.8951	DDC	U HDCP MASTER -	> SLAVE I2C Request			
0:04:41.8954	DDC	U HDCP_SLAVE ->	MASTER I2C HDCP Re	sponse		
0:04:43.2121	HPD	U Tx/U Port Falling E	idge			
0:04:44.6678	HPD	U Tx/U Port Rising E	dge			
0:04:44.8017	DDC	U EDID MASTER ->	SLAVE I2C E-EDID Se	gment 0		
0:04:44.8021	DDC	U EDID MASTER ->	SLAVE I2C Request C	lfset 0		
0:04:44.8024	DDC	U EDID SLAVE -> N	ASTER I2C Response			
HDMI (8 bpc RGB)	3840x2160p 30 frames/s	HDMI_VIC 1: No errors	HDMI 3D disabled	AVMUTE disabled	HDCP disabled	+5V detected
Interface: HDMI (8 bpc RGB)	Format: 3840x2160 30Hz	Pattern: Pseudo Random	3D: Disabled	Audio (HDMI): LPCM 2.0ch	Enable HDCP	
				48kHz		нро ок 🛛 🔽 🗖

10. Touch select the **Details** activation button (top center) to view the details of any specific transaction that you have selected. The following screen is an example of the details screen for the BCAPS register.

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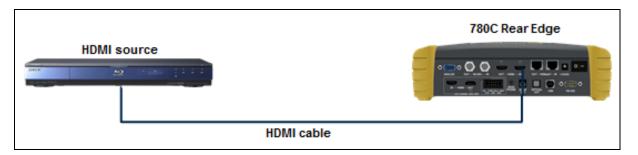
<	Aux Chann	nel Analyzer				Home	Preferences	Help
	Start	Save	Clear	Details		Auto Scro	oll	
ļ	START * ACK * 0000: 75 83 STOP *	ſu.					<b>A</b>	j .
	Register 0x40 (Br HDMI: 1 REPEATER: 0 READY: 0 FAST: 0 I.1_FEATURES: FAST_REAUTHE		lity Bits)) = 0X83					
		2) 2840-2460-20		HDMI 3D disabled		HDCP disabled		, _
	HDMI (8 bpc RGE		HDMI_VIC 1: No errors	HDMI 3D disabled	AVMUTE disabled	HDCP disabled	+5V detected	
Ŭ T	Interface: IDMI (8 bpc RGE	Format: 3) 3840x2160 30Hz	Pattern: Pseudo Random	3D: Disabled	Audio (HDMI): LPCM 2.0ch 48kHz	Enable HDCP	AVMUTEOFF	00:09

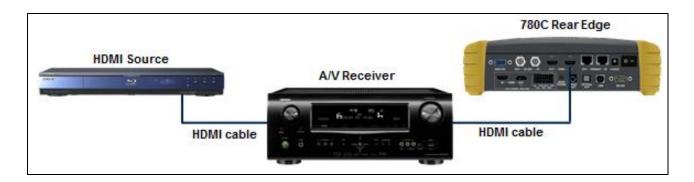
11. Touch select Stop activation button (top left) to halt the collection of messages.

12. Touch select **Clear** activation button (top center) to clear the collected of messages.

#### 8.2.4 Configurations for Monitoring DDC Transactions with ACA on HDMI Source Devices

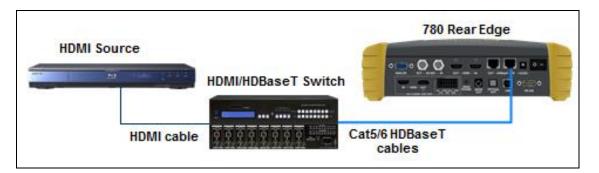
This subsection provides configuration diagrams that depict ACA monitoring of HDMI source devices, with or without a repeater, while the 780C is emulating an HDMI sink device.





#### 8.2.5 Configurations for Monitoring DDC Transactions with ACA on HDBaseT Source Devices

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#### 8.2.6 Procedures for Monitoring the DDC Transactions using the Auxiliary Channel Analyzer on HDMI or HDBaseT Source Devices

This subsection provides procedures for ACA monitoring of HDMI and HDBaseT source devices, with or without a repeater while the 780C is emulating an HDMI or HDBaseT sink device with HDCP capabilities.

Note: You will have to obtain a license key for the ACA option to use the feature.

- 1. Connect the HDMI or HDBaseT source devices to the 780C in either of the ways shown in the diagrams above and described as follows:
  - a. The HDMI source device output is connected the 780C HDMI IN connector.

OR

- b. The HDMI/HDBaseT repeater device output is connected to the 780C HDMI/HDBaseT IN connector.
- c. The HDMI source device output is connected to the HDMI/HDBaseT repeater device input.
- 2. Enable the HDMI or HDBaseT interface as the active digital interface input as shown below.

	Signal Type					Home	Preferences	Help
		Type IDMI DVI	Connector HDMI HDBaseT		Color Space	YCbCr 4:	2:2 YCbCr 4:	4:4
	VGA(HD1	) Analog YPbP 5) Analog RGB G-SDI			Format Type TV (CE)	PC (IT)	User-Defi	ned
-N 0	HDMI/DVI: No signal	No TMDS clock	Cannot be analyzed Pattern:	Not capable of HDMI 3D 3D: Disabled	AVMUTE disabled	Not capable o HDCP Enable HDCP		
Ŭн	Interface: DMI (8 bpc RGB)	3840x2160 30Hz	Pattern: Pseudo Random	5D. Disabled	LPCM 2.0ch 48kHz	Enable FIDCP	HDCP OK 🛁	08:00

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- 3. From the Home screen (shown below) touch select the Aux Channel Analyzer activation button.

Н	ome					Home	Preferences Help
	Source Tests			Sink Tests	s Lini	Tests	Installer Tests
	Format Analyzer	Packet Viewer	Audio Analyzer	EDID Te	An	ix Channel alyzer	Sink Test
		AUD AUD AUD AUD AUD					
	Video Display	HDCP Test	Audio Monitor Settings	HDCP T	est Ca Te	able/Repeater st	Source Test
	<b>-</b>	Aksv Bksv				3	
	Video Passthrough	CEC Test		CEC Tes	st Lir	nk Test	Repeater Test
			3	POLL			
I N	HDMI (8 bpc YCbCr 4:4:4)	1920x1080p 60 frames/s	VIC 16: No errors	HDMI 3D disabled	AVMUTE disabled	HDCP disabled	+5V detected
0 U	HDMI (YCbCr 4:4:4)	640x1005 60Hz	Color Bars	3D: Frame Packing	Dolby 5.1 (Sine Wave)	HDCP Disable	AVMUTEOFF 2 14:32 HDCP OK 2 14:32 HPD OK 2 14:32

The ACA Setup Options screen appears:

<	ACA Setup C	Options				Home	Preferences	Help
		Tx Mo	onitor	Rx M	fonitor			
			780 Tx Po	rt	780 Rx Por	t		
Passive Upstream			ream	Passive Downs	tream			
		DD	C CEC HP			D +5V		
				Capture Data T	able			
IN	HDMI (8 bpc RGB)	3840x2160p 30 frames/s	HDMI_VIC 1: No errors	HDMI 3D disabled	AVMUTE disabled	HDCP enabled	+5V detecte	ed
0	Interface: HDMI (8 bpc RGB)	Format:	Pattern:	3D: Disabled	Audio (HDMI):	Disable HDCP	AVMUTEOFF	00:07
f	HDMI (8 bpc RGB)	3840x2160 30Hz	Pseudo Random		LPCM 2.0ch 48kHz		нро ок	- 

- 4. Select the data types that you wish to monitor on the **Rx Port** side.
- 5. Determine what data types you wish to monitor. Typically you will want to monitor the DDC, hot plug (shown in the example above).

**Note**: By default the two activation buttons labeled **780C Tx Port** and **780C Rx port** are enabled. You cannot disable them. Transactions will be shown based on which ports (HDMI/HDBaseT OUT and/or HDMI/HDBaseT IN) are connected to HDMI/HDBaseT devices and which set of transactions you have enabled (i.e. DDC, HPD on Tx or Rx side).

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ACA Setup Options	i				Home	Preferences Help			
	Tx Mo			Ionitor					
780 Tx Port     780 Rx Port       Passive Upstream     Passive Downstream									
	DDC     CEC     HPD     +5V     DDC     CEC     HPD     +5V       Capture Data Table								
I HDMI/DVI: No No TMI N signal	OS clock	Cannot be analyzed	Not capable of HDMI 3D	AVMUTE disabled	Not capable of HDCP	No +5V detected			
	mat: 60 30Hz	Pattern: Color Bars	3D: Disabled	Audio (HDMI): LPCM 2.0ch 48kHz	Enable HDCP	AVMUTEOFF 💽 05:24 HDCP OK 🔫 🔽			

- 6. Take whatever action necessary to initiate a new HDCP authentication. Typically this would be a hot plug event, for example a disconnection and reconnection on the 780C HDMI/HDBaseT IN port.
- Touch select the Capture Data Table activation button to access the Auxiliary Channel Analyzer screen. Then touch select Start to initiate the capturing of the data. A screen similar to the one shown below will appear.

Aux Channe	el Analyzer				Home	Preferences Hel
Start	Save	Clear	Details	:	Auto Scro	bll
Timestamp	Туре	Data				
0:07:59.3071	DDC	D HDCP MASTER -	SLAVE I2C Request [	Bksv]		
0:07:59.3074	DDC	D HDCP_SLAVE ->	MASTER I2C HDCP Re	sponse		
0:07:59.3082	DDC	D HDCP MASTER -	SLAVE I2C Request [	Bcaps]		
0:07:59.3084	DDC	D HDCP_SLAVE ->	MASTER I2C HDCP Re	sponse		
0:07:59.4267	DDC	D HDCP MASTER -	SLAVE I2C Write [An]			
0:07:59.4280	DDC	D HDCP MASTER -	SLAVE I2C Write [Aks			
0:08:09.9118	DDC	D HDCP MASTER -	SLAVE I2C Request [	Bksv]		
0:08:09.9121	DDC	D HDCP_SLAVE ->	MASTER I2C HDCP Re	sponse		
0:08:09.9129	DDC	D HDCP MASTER -	SLAVE I2C Request [	Bcaps]		
0:08:09.9131	DDC	D HDCP_SLAVE ->	MASTER I2C HDCP Re	sponse		
0:08:10.0314	DDC	D HDCP MASTER -	SLAVE I2C Write [An]			
	DDC	D HDCP MASTER -	SLAVE I2C Write [Aks			
0:08:10.2400	DDC	D HDCP MASTER -	SLAVE I2C Request [	Ri']		
HDMI (8 bpc RGB)	3840x2160p 30 frames/s	HDMI_VIC 1: No errors	HDMI 3D disabled	AVMUTE disabled	HDCP enabled	+5V detected
Interface: HDMI (8 bpc RGB)	Format: 3840x2160 30Hz	Pattern: Pseudo Random	3D: Disabled	Audio (HDMI): LPCM 2.0ch	Disable HDCP	АУМИТЕОFF 🚉 00 НДСР ОК 🛁
				48kHz		нро ок 🛛 🔽 👘

8. Touch select the **Details** activation button (top center) to view the details of any specific transaction that you have selected. The following screen is an example of the details screen. The screen below shows a detailed view of the BCAPS register.

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Aux Chan	nel Analyzer				Home	Preferences	Help
Start	Save	Clear	Details		Auto Scro		
* START *							
* ACK * 0000: 75 83 * STOP *	Ιu.					1	
Register 0x40 (E HDMI: 1 REPEATER: 0	Bcaps (HDCP B Capab	ility Bits)) = 0X83					
READY: 0							
FAST: 0 1.1_FEATURES FAST_REAUTH							
iner_neren							
							7
HDMI (8 bpc RG N	B) 3840x2160p 30 frames/s	HDMI_VIC 1: No errors	HDMI 3D disabled	AVMUTE disabled	HDCP disabled	+5V detected	
0 Interface:	Format: B) 3840x2160 30Hz	Pattern: Pseudo Random	3D: Disabled	Audio (HDMI): LPCM 2.0ch	Enable HDCP	NO HDCP	00:09
T	B) 00402100 30112	1 30000 Handom		48kHz		нро ок 🛛 📝	-

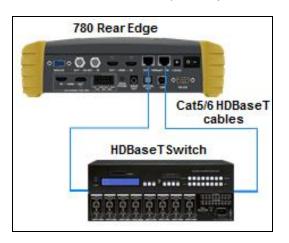
9. Touch select **Stop** activation button (top left) to halt the collection of messages.

10. Touch select Clear activation button (top center) to clear the collected of messages.

# 8.3 Configuration for Monitoring DDC Transactions with the ACA on an HDMI or HDBaseT Repeater or distribution device

This subsection provide a configuration diagram that depicts ACA monitoring of HDMI/HDBaseT repeater devices while emulating both an HDMI/HDBaseT source device and an HDMI/HDBaseT sink device.





#### 8.3.1 Procedures for Running an Auxiliary Channel Analyzer Test on HDMI/HDBaseT Repeater or Distribution Devices

This subsection provides procedures for ACA monitoring of HDMI/HDBaseT repeater devices while the 780C is emulating both an HDMI/HDBaseT sink device and an HDMI/HDBaseT source device.

- 1. Connect the HDMI system devices to the 780C as shown in the diagrams above and described as follows:
  - a. The HDMI/HDBaseT repeater device input is connected the 780C HDMI/HDBaseT OUT connector.
  - b. The HDMI/HDBaseT repeater device output is connected to the 780C HDMI/HDBaseT IN connector.

Interface/Signal	Type HDMI	Connector HDMI		Color Space	YCbCr 4:2:	2 YCbCr 4:4:4
	DVI	HDBaseT		<u></u>		
VGA(HD15	i) Analog YPbP					
VGA(HD1	5) Analog RGB	Ì		Format Type	PC (IT)	User-Defined
3G-SDI						
3	6-501					
3	G-SDI					
3	G-5D1-					
3	<u></u>					
HDMI/DVI: No signal	No TMDS clock	Cannot be analyzed	Not capable of HDMI3D	AVMUTE disabled	Not capable of HDCP	No +5V detected

2. Enable the HDMI or HDBaseT interface as the active digital interface input as shown below.

3. From the Home screen (shown below) touch select the Aux Channel Analyzer activation button.

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The ACA Setup Options screen appears:

ACA Setup Options				Home	Preferences	Help		
τ	Tx Monitor			Rx Monitor				
	780 Tx Port			t				
	ream	Passive Downs	tream					
		D +5V DD		D +5V				
		Capture Data Ta	able					
						_		
HDMI (8 bpc RGB) 3840x2160p 3 N frames/s	0 HDMI_VIC 1: No errors	HDMI 3D disabled	AVMUTE disabled	HDCP enabled	+5V detected			
U Interface: Format: HDMI (8 bpc RGB) 3840x2160 30H	Pattern: Hz Pseudo Random	3D: Disabled	Audio (HDMI): LPCM 2.0ch 48kHz	Disable HDCP	AVMUTEOFF 😭 HDCP OK 🔫 HPD OK	00:07		

 Determine what data types you wish to monitor. Typically you will want to monitor the DDC and hot plug (+5V is only available for monitoring with the passive monitoring option). Select the data types that you wish to monitor.

**Note**: By default the two activation buttons labeled 780C **Tx Port** and 780C **Rx Port** are enabled. You cannot disable them. Transactions will be shown based on which ports (**HDMI OUT** and/or **HDMI IN**) are connected to HDMI devices and which transaction types (i.e. DDC and HPD) you have enabled.

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<	ACA Setup	Options				Home	Preferences	Help
		Tx M	onitor 780 Tx Pol		lonitor 780 Rx Pol	rt		
			Passive Upstream     Passive Downstream       DDC     CEC     HPD     +5V					
				Capture Data Ta	able			
I N	HDMI/DVI: No signal	No TMDS clock	Cannot be analyzed	Not capable of HDMI 3D	AVMUTE disabled	Not capable of HDCP	No +5V detect	ed
0 U T	Interface: HDMI (8 bpc RGB)	Format: 3840x2160 30Hz	Pattern: Color Bars	3D: Disabled	Audio (HDMI): LPCM 2.0ch 48kHz	Enable HDCP	АУМИТЕОГГ 🔄 НDCP ОК 🛁 HPD ОК 📲	

- 5. Enable HDCP on the 780C **HDMI OUT** port. Use the procedures in the section entitled: <u>Configurations for</u> <u>Testing HDCP on an HDMI Sink Device</u>.
- 6. Take whatever action necessary to initiate a new HDCP authentication. Typically this would be a hot plug event at the sink device you are testing. Alternatively you can simply disable and re-enable HDCP on the 780C.
- 7. Touch select the **Capture Data Table** activation button to initiate the capturing of the data. A screen similar to the one shown below will appear.

Aux Channe	l Analyzer				Home	Preferences Help
Start	Save	Clear	Details	:	Auto Scro	bll
Timestamp	Туре	Data				
0:45:08.1012	DDC	D EDID SLAVE -> N	ASTER I2C Response			
0:45:08.1357	DDC	D EDID MASTER ->	SLAVE I2C E-EDID Se	gment 0		
0:45:08.1359	DDC	D EDID MASTER ->	SLAVE I2C Request O	ffset 128		
0:45:08.1361	DDC	UEDID SLAVE -> N	ASTER I2C Response			
0:45:09.3197	DDC	U HDCP MASTER -	> SLAVE I2C Request [	Bstatus]		
0:45:09.3199	DDC	U HDCP_SLAVE ->	MASTER I2C HDCP Re	sponse		
0:45:09.3206	DDC	U HDCP MASTER -	SLAVE I2C Request [	Bcaps]		
0:45:09.3209	DDC	U HDCP_SLAVE ->	MASTER I2C HDCP Re:			
0:45:09.3215	DDC	U HDCP MASTER -	SLAVE I2C Request [	Bksv]		
0:45:08.1361	DDC	DEDID SLAVE -> M	ASTER I2C Response			
0:45:09.3197	DDC	D HDCP MASTER -	SLAVE I2C Request [	Bstatus]		
0:45:09.3217		U HDCP_SLAVE ->	MASTER I2C HDCP Re	sponse		
0:45:09.3199	DDC	D HDCP SLAVE ->	MASTER I2C HDCP Re	sponse		
HDMI (8 bpc RGB)	720x480p 59.94 frames/s	VIC 3: No errors	HDMI 3D disabled	AVMUTE disabled	HDCP enabled	+5V detected
0 Interface: HDMI (8 bpc RGB) T	Format: 1920x1080 50Hz	Pattern: Color Bars	3D: Disabled	Audio (HDMI): LPCM 2.0ch 48kHz	Enable HDCP	AVMUTEOFF 20:21 NO HDCP 1 20:21 HPD FAIL

Note: There are both upstream and downstream transactions mixed in the screen example above.

8. Touch select the **Details** activation button (top center) to view the details of any specific transaction that you have touch selected. The following screen is an example of the details screen. A detailed view of the BCAPS register is shown. Touch Details again to return to the ACA transaction screen.

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<	Aux Channe	el Analyzer				Home	Preferences He	lp
	Start	Save	Clear	Details		Auto Scro		
	* START * * ACK * 0000: 75 83 * STOP *	lu.					1	
	Register 0x40 (Bca HDMI: 1 REPEATER: 0 READY: 0	ps (HDCP B Capab	ility Bits)) = 0X83					
	FAST: 0 1.1_FEATURES: 1 FAST_REAUTHEN	TICATION: 1						
N	HDMI (8 bpc RGB)	3840x2160p 30 frames/s	HDMI_VIC 1: No errors	HDMI 3D disabled	AVMUTE disabled	HDCP disabled	+5V detected	
0 U T	Interface: HDMI (8 bpc RGB)	Format: 3840x2160 30Hz	Pattern: Pseudo Random	3D: Disabled	Audio (HDMI): LPCM 2.0ch 48kHz	Enable HDCP	NO HDCP 🔓 🛁 🚽	0:09

9. Touch select **Stop** activation button (top left) to halt the collection of messages.

10. Touch select Clear activation button (top center) to clear the collected of messages.

## 8.4 Auxiliary Channel Analyzer – Passive Monitoring

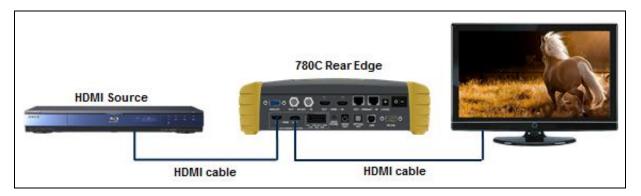
The Aux Channel Analyzer test monitors the CEC and DDC channel transactions and hot plug events. You can monitor the events while emulating either an HDMI source or sink device or you can passively monitor the transactions. This subsection provides procedures on passive monitoring. *The features and functions described in this section are included only if you have purchased the Auxiliary Channel Analyzer – Passive Monitoring option.* 

You can view the details of each transaction and save the traces for viewing on the external ACA application available from the Quantum Data website.

# 8.4.1 Configurations for Passively Monitoring CEC and or DDC Transactions with ACA on an HDMI System

This subsection provides configuration diagrams that depict ACA passive monitoring of an HDMI system.

- 1. Connect the HDMI system devices to the 780C as shown in the diagram below and described as follows:
  - a. The HDMI source is connected to the 780C ACA IN connector.
  - b. The HDMI sink device (e.g. HDTV) is connected to the 780C ACA OUT connector.



# 8.4.2 Procedures for Passive Monitoring DDC transactions and hot plug events with the Auxiliary Channel Analyzer on HDMI Devices

This subsection provides procedures for ACA passive monitoring of HDMI devices.

1. Enable the HDMI interface as the active digital interface input as shown below.

Signal Type					Home	Preferences He
Interface/Signal	Type HDMI	Connector		Color Space	YCbCr 4:2:	2 YCbCr 4:4:4
	DVI	HDBaseT				
	) Analog YPbP			Format Type		
VGA(HD15) Analog RGB 3G-SDI				TV (CE)	PC (IT)	User-Defined
HDMI/DVI: No signal	No TMDS clock	Cannot be analyzed	Not capable of HDMI 3D	AVMUTE disabled	Not capable of HDCP	No +5V detected
Interface: DMI (8 bpc RGB)	Format: 3840x2160 30Hz	Pattern: Pseudo Random	3D: Disabled	Audio (HDMI): LPCM 2.0ch 48kHz	Enable HDCP	

2. From the Home screen (shown below) touch select the Aux Channel Analyzer activation button.



The ACA Setup Options screen appears:

ACA Setup Options						Home	Preferences	Help
	Tx Monitor				Ionitor 780 Rx Pot	t		
			Passive Upstr		Passive Downs			
				Capture Data Ta	able			
I N		0x2160p 30 frames/s	HDMI_VIC 1: No errors	HDMI 3D disabled	AVMUTE disabled	HDCP enabled	+5V detected	
0 U T		Format: 0x2160 30Hz	Pattern: Pseudo Random	3D: Disabled	Audio (HDMI): LPCM 2.0ch 48kHz	Disable HDCP	AVMUTEOFF	00:07

- 3. Select the data types that you wish to monitor. In this application you would select either **Passive Upstream** or **Passive Downstream**.
- 4. Determine what data types you wish to monitor. Typically you will want to monitor the DDC and hot plug and +5V. Refer to the screen example below.

<	ACA Setup Op	otions				Home	Preferences	Help
	Tx Monitor			Rx M	onitor			
	Selected Tx (HDMI/HDBaseT)			DBaseT) S	elected Rx (HDMI/HI	DBaseT)		
			ACA Passive I		ACA Passive HDMI			
				D +5V DD Capture Data Ta		D +5V		
	HDMI (8 bpc RGB)	1920x1080p	VIC 31: No errors	HDMI 3D disabled	AVMUTE disabled	HDCP disabled	+5V detected	
	Interface:	50.00 frames/s Format: 920x1080 50Hz	Pattern: Color Bars	3D: Disabled	Audio (HDMI): LPCM 2.0ch	Enable HDCP	AVMUTEOFF	18:09
Ť		320X1060 50HZ	Color Bars		48kHz		нрр ок 🛛 🗖	

- 5. Enable HDCP on the HDMI source device under test. Use the procedures in the section entitled: <u>Testing</u> <u>HDCP on an HDMI HDTV or HDMI Repeater Device</u>.
- 6. Take whatever action necessary to initiate a new HDCP authentication. Typically this would be a hot plug event at the sink device you are testing.
- 7. Touch select the **Capture Data Table** activation button to initiate the capturing of the data. A screen similar to the one shown below will appear.

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Aux Channe	l Analyzer					Preferences	Help
Start	Save	Clear	Details	;	Auto Scro	bll	
Timestamp	Туре	Data					
0:44:31.3901	DDC	U HDCP_SLAVE ->	MASTER I2C HDCP Re	sponse			
0:44:31.4098	DDC	U HDCP MASTER -	> SLAVE I2C Request [				
0:44:31.4101	DDC	U HDCP_SLAVE ->	MASTER I2C HDCP Re	sponse			
0:44:32.4360	HPD	U Tx/U Port Failing E	dge				
0:44:33.1348	HPD	U Tx/U Port Rising E	dge				
0:44:33.3348	DDC	U EDID MASTER ->	SLAVE I2C E-EDID Se	gment 0			
0:44:33.3352	DDC	U EDID MASTER ->	SLAVE I2C Request O	lfset 0			
0:44:33.3355	DDC	U EDID SLAVE -> N	ASTER I2C Response				
0:44:33.3568	DDC	U EDID MASTER ->	SLAVE I2C E-EDID Se	gment 0			
0:44:33.3572	DDC	U EDID MASTER ->	SLAVE I2C Request C	Iffset 128			
0:44:33.3575	DDC	U EDID SLAVE -> N	ASTER I2C Response				
0:44:33.7793	DDC	U HDCP MASTER -	SLAVE I2C Request [	Bcaps]			
0:44:33.7796	DDC	U HDCP SLAVE ->	MASTER I2C HDCP Re	sponse			
IDMI (8 bpc RGB)	1920x1080p 50.00 frames/s	VIC 31: No errors	HDMI 3D disabled	AVMUTE disabled	HDCP enabled	+5V detected	
Interface: IDMI (8 bpc RGB)	Format: 1920x1080 50Hz	Pattern: Color Bars	3D: Disabled	Audio (HDMI): LPCM 2.0ch 48kHz	Disable HDCP	AVMUTEOFF	18:1

8. Touch select the **Details** activation button (top center) to view the details of any specific transaction that you have selected. The following screen is an example of the details screen. This example shows the BCAPS register details. Touch select the **Details** activation button again to return to the trace view.

<	Aux Channe	el Analyzer				Home	Preferences	Help
	Start	Save	Clear	Details		Auto Scro		
	* START * * ACK * 0000: 75 83 * STOP *	lu.						) ]
	Register 0x40 (Bca HDMI: 1 REPEATER: 0 READY: 0 FAST: 0 1.1_FEATURES: 1 FAST_REAUTHEN	ps (HDCP B Capabi TICATION: 1	ility Bits)) = 0X83					
								,
I N	HDMI (8 bpc RGB)	3840x2160p 30 frames/s	HDMI_VIC 1: No errors	HDMI 3D disabled	AVMUTE disabled	HDCP disabled	+5V detected	
0 U T	Interface: HDMI (8 bpc RGB)	Format: 3840x2160 30Hz	Pattern: Pseudo Random	3D: Disabled	Audio (HDMI): LPCM 2.0ch 48kHz	Enable HDCP	AVMUTEOFF	00:09

10. Touch select Stop activation button (top left) to halt the collection of messages.

11. Touch select Clear activation button (top center) to clear the collected of messages.

### 8.5 Auxiliary Channel Analyzer – Monitoring of CEC Messages

The Aux Channel Analyzer test monitors the CEC channel message while emulating HDMI/HDBaseT devices. *The features and functions described in this section are included only if you have purchased the Auxiliary Channel Analyzer option.* 

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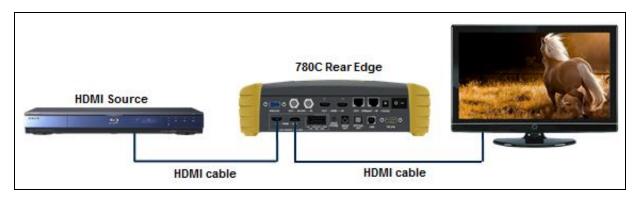
You can view the details of each transaction and save the traces for viewing on the external ACA application available from the Quantum Data website.

#### 8.5.1 Procedures for Passive Monitoring HDMI CEC messages with the Auxiliary Channel Analyzer

This subsection provides procedures for ACA passive monitoring of CEC messages on HDMI devices.

Note: You will have to obtain a license key for the ACA passive monitoring option to use the feature.

- 1. Connect the HDMI system devices to the 780C as shown in the diagram above and described as follows:
  - a. The HDMI source is connected to the 780C ACA IN connector.
  - b. The HDMI sink device (e.g. HDTV) is connected to the 780C ACA OUT connector.



2. From the Home screen (shown below) touch select the Aux Channel Analyzer activation button.



The ACA Setup Options screen appears:

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<	ACA Setup C	Options				Home	Preferences	Help
		Tx Me	onitor elected Tx (HDMI/H		onitor elected Rx (HDMVHI	DBaseT)		
			ACA Passive I		ACA Passive H			
				Capture Data Ta				
Ţ	HDMI (8 bpc RGB)	1920x1080p	VIC 31: No errors	HDMI 3D disabled	AVMUTE disabled	HDCP disabled	+5V detected	
	Interface:	50.00 frames/s Format: 1920x1080 50Hz	Pattern: Color Bars	3D: Disabled	Audio (HDMI): LPCM 2.0ch 48kHz	Enable HDCP	AVMUTEOFF	18:09

3. Select the CEC to monitor. In this application you would select **Passive Upstream**. Note that you need only set either the **Passive Upstream** or **Passive Downstream**.

<	ACA Setup	Options				Home	Preferences	Help
			onitor 780 Tx Po		fonitor 780 Rx Por	t		
			Passive Upstr	ream	Passive Downs	tream		
		DD		D +5V DD Capture Data T		) +5V		
I N	HDMI/DVI: No signal	No TMDS clock	Cannot be analyzed	Not capable of HDMI 3D	AVMUTE disabled	Not capable of HDCP	No +5V de	tected
0	Interface: HDMI (8 bpc RGB)	Format: 3840x2160 30Hz	Pattern: Color Bars	3D: Disabled	Audio (HDMI): LPCM 2.0ch 48kHz	Enable HDCP	AVMUTEOFF HDCP OK HPD OK	05:24

- 4. Enable HDCP on the HDMI source device under test. Use the procedures in the section entitled: <u>Testing</u> <u>HDCP on an HDMI HDTV or HDMI Repeater Device</u>.
- 5. Take whatever action necessary to initiate CEC messages.
- 6. Touch select the **Capture Data Table** activation button to initiate the capturing of the data. A screen similar to the one shown below will appear.

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Aux Cha	annel	Analyzer	Home	Preferences	Service
Start	Sa	ave Clear	Details	Auto Sc	roll
Timestamp	Туре	Data			
0:37:40.0059	CEC	U Tuner 1 -> T	uner 1 - <polling> o</polling>	or UnAcked Head	ler
0:37:40.0426	CEC	U Tuner 1 -> T	uner 1 - <polling> o</polling>	or UnAcked Head	ler
0:37:40.1042	CEC	U Player 1 -> F	Player 1 - <polling></polling>	or UnAcked Hea	der
0:37:40.1776	CEC	U Player 1 -> F	Player 1 - <polling></polling>	or UnAcked Hea	der
0:37:40.2392	CEC	U Audio -> Au	dio - <polling> or U</polling>	nAcked Header	
0:37:40.2759	CEC	U Audio -> Au	dio - <polling> or U</polling>	nAcked Header	
0:37:40.3126	CEC	U Audio -> Au	dio - <polling> or U</polling>	nAcked Header	

Touch select the **Details** activation button (top center) to view the details of any specific transaction that you have selected. The following screen is an example of the details screen. These screen examples show polling example.





- 7. Touch select Stop activation button (top left) to halt the collection of messages.
- 8. Touch select **Clear** activation button (top center) to clear the collected of messages.

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# 9 Using the 780C Test Instrument to Test HDMI Cable or Repeaters

This section provides procedures for testing HDMI cables, cable extenders, splitters, repeaters, etc. The HDMI/DVI Cable Test runs a pixel error test on the TMDS leads and a continuity check on the 5V & hot plug leads and the DDC leads. The Repeater test runs a pixel error test on the TMDS leads and a continuity check on the 5V & hot plug leads and the DDC leads but additionally tests the hot plug delay and the hot plug width.

The cable test and repeater test can be used when the source and sink ends are collocated, in other words can be connected to the 780C Tx and Rx ports. For a cable or distribution system that is installed and where the source and sink ends cannot be connected to the 780C, you can use the Frame Compare feature. The Frame Compare feature captures a reference frame and then compares a series of captured frames pixel by pixel to the reference frame.

The features and functions described in this section are included only if you have purchased the HDMI Cable and Link Test option.

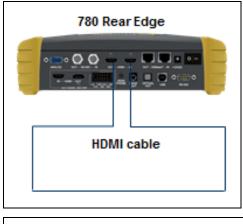
### 9.1 HDMI/HDBaseT Cable or Repeater Test

The HDMI/DVI/HDBaseT Cable Test runs a test on all the leads in the HDMI/HDBaseT (CAT) cable and HDMI or HDBaseT networks (when extenders, splitters, switchers and repeaters are used) except the power bus as follows:

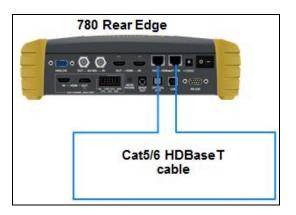
- Pixel error test using a pseudo-noise pattern on the TMDS lines using three separate timings:
  - o 480p60 using 8 bit/component color
  - o 720p60 using 8 bit/component color
  - o 1080p60 using 8 bit/component color
  - 1080p60 using 12 bit/component (deep color)
  - o 2160p30 using 8 bit/component color
- Read/write test on the DDC leads and the CEC bus. It reads an EDID at the output from the input.
- Continuity test on the 5V/Hot plug leads.
- Hot plug delay and hot plug pulse width. The hot plug delay is the time that elapses between the falling
  edge of the hot plug line on the on the sink side of a repeater and the falling edge of the hot plug line on the
  source side. The hot plug pulse width is the time that the hot plug pulse goes low as detected on the HDMI
  Tx side.

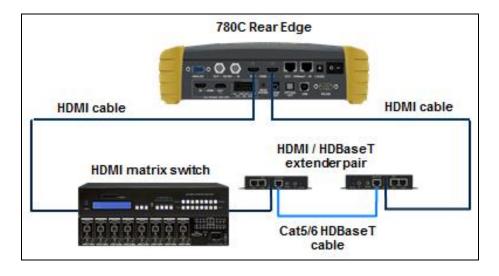
#### 9.1.1 Configurations for Running an HDMI/HDBaseT Cable or Repeater Test

This subsection provides configurations supported when performing an HDMI/HDBaseT cable test or a test of an HDMI network comprised of repeaters, splitters, extenders, switches, etc.



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#### 9.1.2 Procedures for Running an HDMI/HDBaseT Cable or Network ("Repeater") Test

This subsection provides procedures for performing an HDMI cable test or a test of an HDMI network comprised of repeaters, splitters, extenders, switches, etc.

1. For testing an HDMI cable, connect one end of the HDMI cable to the 780C HDMI OUT connect and the other end to the 780C HDMI IN connector.

For testing an HDBaseT cable, connect one end of the HDBaseT CAT cable to the 780C **HDBaseT OUT** connect and the other end to the 780C **HDBaseT IN** connector.

For testing an HDMI repeater device such as a repeater, video or audio processor, extender, switch, etc, connect the 780C **HDMI OUT** connector to the repeater device input and connect the 780C **HDMI IN** connector to the repeater device output.

2. Touch select **Cable/Repeater Test** from the **Home** menu shown below.

lome					Home	Preferences	Help
Source Tests			Sink Tests	s Link	Tests	Installer Te	sts
Format Analyzer	Packet Viewer	Audio Analyzer	EDID Te		x Channel alyzer	Sink Test	
ູ້ນາເນັ່ນນາເ 					HCCE HCCE HCCE HCCE HCCE HCCE HCCE HCCE		] 🖞
Video Display	HDCP Test	Audio Monitor Settings	HDCP Te	est Ca	ble/Repeater st	Source Te	est
-					3		
Video Passthrough	CEC Test		CEC Tes	st Lir	nk Test	Repeater	Test
		5	POLL				
HDMI (8 bpc YCbCr 4:4:4)	1920x1080p 60 frames/s	VIC 16: No errors	HDMI 3D disabled	AVMUTE disabled	HDCP disabled	+5V detec	ted
HDMI (YCbCr 4:4:4)	640x1005 60Hz	Color Bars	3D: Frame Packing	Dolby 5.1 (Sine Wave)	HDCP Disable	AVMUTEOFF	14:3

3. For testing an HDMI cable touch select **Test Wire** to initiate the test.

The pixel errors are displayed for each timing on the screen as shown below. The +5V, Hot Plug and DDC test results are shown as Pass/Fail.

<	Cable Test					Home	Preferences Help	J
		Τε	est Wire					
		Test	Repeater					
		Test R	emote PRN					
		Fram	e Capture					
		Frame	e Compare					
N	HDMI (8 bpc RGB)	3840x2160p 30 frames/s	HDMI_VIC 1: No errors	HDMI 3D disabled	AVMUTE disabled	HDCP disabled	+5V detected	
0 U T	Interface: HDMI (12 bpc	Format: 3840x2160 30Hz	Pattern: Color Bars	3D: Disabled	Audio (HDMI): LPCM 2.0ch	Enable HDCP	AVMUTEOFF 2 06:4	
	RGB)				48kHz		нро ок 🛛 🔽 🗠 🗠	

For testing an HDMI repeater device touch select Test Repeater to initiate the test.

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	Cable Test					Home	Preferences	lelp
			est Wire	·				
		Test R	Repeater					
			e Capture					
IN	HDMI (8 bpc RGB)	3840x2160p 30 frames/s	HDMI_VIC 1: No errors	HDMI 3D disabled	AVMUTE disabled	HDCP disabled	+5V detected	
0 U T	Interface: HDMI (12 bpc RGB)	Format: 3840x2160 30Hz	Pattern: Color Bars	3D: Disabled	Audio (HDMI): LPCM 2.0ch 48kHz	Enable HDCP	AVMUTEOFF	06:44

When a repeater device is tested using the **Test Repeater** function, the hot plug pulse delay and the hot plug pulse with are shown in addition to the information and results displayed for the Cable Test. In the Test Repeater function, the 780C initiates a hot plug event on its sink (HDMI IN) port. The hot plug delay is the time that elapses between the falling edge of the hot plug line on the on the sink side of a repeater and the falling edge of the hot plug pulse width is the time that the hot plug pulse goes low as detected on the HDMI OUT side.

<	Cable Test					Home	Preferences	Help
		Test Test R Fram	est Wire Repeater emote PRN ne Capture	+5v: PASS 2160p30 (8 bit 1080p60 (12 b 1080p60 (8 bits) 480p60 (8 bits) 480p60 (8 bits) Hot Plug: PASS (1 ms delay, 10 DDC: PASS	its): 0 errors s): 0 errors ): 0 errors ): 0 errors S			
-N	HDMI (8 bpc RGB)	720x480p 60 frames/s	VIC 2: No errors	HDMI 3D disabled		HDCP disabled	+5V detected	
0 U T	Interface: HDMI (8 bpc RGB)	Format: 720x480 60Hz	Pattern: Color Bars	3D: Disabled	Audio (HDMI): LPCM 2.0ch 48kHz	Enable HDCP		06:45

The following is an example of test on an HDBaseT CAT cable.

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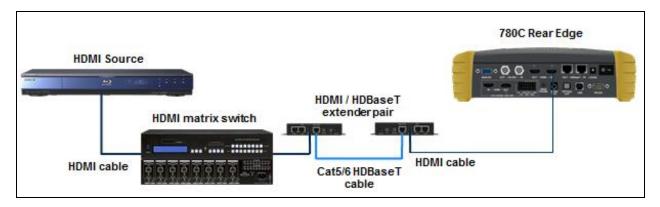
Cable Test		499		HDBaseT Tx I	Home	Preferences	Help
Test Wire		30 (8 bits): 0 en	rors		sion: 13072110 (2	013/11/21)	
	Ercop	60 (12 bits): 0 e		Operation Mo			
Test Repea	19.001			HDBaseT Tx I	estimated to be < 2	20 meters	
тезспереа	, acep	60 (8 bits): 0 er			connected to Tx: V	(S100BX	
<b>_</b>		0 (8 bits): 0 erro	ors		sion: 13072100 (2		
Test Remote I	<sup>2</sup> RN 480p6	0 (8 bits): 0 erro	ors		: -22db, -21db, -22		
	Hot PI	ug: PASS		Operation Mo	de: HDBaseT		
Frame Capt	ALC: NOT THE REPORT OF THE REP	Rx PASS, Tx P	ASS	Cable length	estimated to be < 2	20 meters	
	DDC:	PASS		HDBaseT Rx	Local Info:		
Frame Comp	are			Firmware Ver	sion: 13072100 (2	013/11/21)	
					: -22db, -21db, -22	2db, -22db	
				Operation Mo			
					estimated to be < 2	20 meters	
				HDBaseT Rx			
				and the second se	connected to Rx: \		
					sion: 13072110 (2	013/11/21)	
				Operation Mo			
				Cable length	estimated to be < 2		
HDBaseT (8 bpc RGB)	720x480p 60.00 frames/s	VIC 2: No errors	HDMI 3D disabled	AVMUTE disabled	HDCP disabled	+5V detected	
Interface:	Format:	Pattern:	3D: Disabled	Audio (HDMI):	Enable HDCP	AVMUTEOFF	17:2
HDBaseT (8 bpc	720x480 60Hz	Pseudo Random		LPCM 2.0ch		NO HDCP 🔓 🛁 🛁	
RGB)				48kHz			

### 9.2 HDMI Frame Compare Test

The cable test and repeater test can be used when the source and sink ends are collocated, in other words can be connected to the 780C Tx and Rx ports. For a cable or distribution system that is installed and where the source and sink ends cannot be connected to the 780C, you can use the Frame Compare feature. The Frame Compare feature captures a reference frame and then compares a series of captured frames pixel by pixel to the reference frame.

#### 9.2.1 Configuration for Running an HDMI Frame Compare Test

This subsection shows a typical configuration when performing an HDMI Frame Compare test for an HDMI cable or network comprised of repeaters, splitters, extenders, switches, etc.



#### 9.2.2 Procedures for Running the Frame Compare Test

This subsection provides procedures for performing an HDMI Frame Compare test on an HDMI network comprised of repeaters, splitters, extenders, switches, etc.

- 1. Connect the far end of the HDMI cable (at the display or HDTV) to the 780C HDMI IN connect as shown in the diagram above.
- 2. Touch select **Cable/Repeater Test** from the **Home** menu shown below.

|--|

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ome					Home	Fielefences
Source Tests			Sink Tests	Link	Tests	Installer Tests
Format Analyzer	Packet Viewer	Audio Analyzer	EDID Tes	An	x Channel alyzer	Sink Test
Video Display	HDCP Test	Audio Monitor Settings	HDCP Te	est Ca Te	able/Repeater st	Source Test
-		⋭⋞⋑			3	
Video Passthrough	CEC Test		CEC Tes		nk Test	Repeater Test
		3				
HDMI (8 bpc YCbCr 4:4:4)	1920x1080p 60 frames/s	VIC 16: No errors H	IDMI 3D disabled	AVMUTE disabled	HDCP disabled	+5V detected
HDMI (YCbCr 4:4:4)	640x1005 60Hz	Color Bars	3D: Frame Packing	Dolby 5.1 (Sine Wave)	HDCP Disable	AVMUTEOFF
						нро ок

The following screen appears:

<	Cable Test					Home	Preferences	Help
		Τe	est Wire					
		Test	Repeater					
		Test R	emote PRN	4				
			e Capture					
		Frame	e Compare					
I I	IDMI (8 bpc RGB)	3840x2160p 30 frames/s	HDMI_VIC 1: No errors	HDMI 3D disabled	AVMUTE disabled	HDCP disabled	+5V detected	-
0 U	Interface: HDMI (12 bpc RGB)	Format: 3840x2160 30Hz	Pattern: Color Bars	3D: Disabled	Audio (HDMI): LPCM 2.0ch 48kHz	Enable HDCP	AVMUTEOFF	06:44

3. Select Frame Capture to capture a reference frame.

The 780C will capture a frame and indicate that the +5V was detected properly or not. The screen below shows these results.

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	2000	

<	Cable Test					Home	Preferences Help
			est Wire	+5v: PASS Capture succe	eded.		
			t Repeater				
			ne Capture				
		Fram	e Compare				
		720x480p 60	VIC 2: No errors	HDMI 3D disabled		HDCP disabled	+5V detected
-	HDMI (8 bpc RGB)	frames/s	VIO 2. NO ENUIS	Howirod disabled	ANNOTE disabled	HECT disabled	
0 Ų	Interface: HDMI (8 bpc RGB)	Format: 720x480 60Hz	Pattern: Color Bars	3D: Disabled	Audio (HDMI): LPCM 2.0ch 48kHz	Enable HDCP	NO HDCP

4. Select Frame Compare to compare a series of frames to the reference frame.

The following screen example shows the results of the **Frame Compare** test. Note that the incoming resolution is shown with the number of pixel errors detected.

<	Cable Test					Home	Preferences	Help
			est Wire	+5v: PASS 1920 x 2160p: 10 frames com				
		Test R Fram	lemote PRN ne Capture e Compare					
Z-	HDMI (8 bpc YCbCr 4-2:0)	3840x2160p 60 frames/s	VIC 97: No errors	HDMI 3D disabled	AVMUTE disabled	HDCP disabled	+5V detected	-
	Interface: HDMI (8 bpc RGB)	Format: 3840x2160 30Hz	Pattern: Color Bars	3D: Disabled	Audio (HDMI): LPCM 2.0ch 48kHz	Enable HDCP	AVMUTEOFF	05:31

#### 9.2.3 Procedures for Running the Remote PRN Test

This subsection provides procedures for performing an HDMI Remote PRN test on an HDMI network comprised of repeaters, splitters, extenders, switches, etc. This test differs in that there is a 780 at both ends of the network—source and sink ends.

1. Follow the procedures above for rendering a Test Pattern on an HDMI HDTV Rendering Test Patterns on an HDMI HDTV.

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- 2. Disconnect the source device at the near end of an HDMI distribution network and connect the HDMI cable to the first 780's HDMI output connector.
- 3. Disconnect the sink device at the far end of an HDMI distribution network and connect the HDMI cable to the second 780's HDMI input connector.
- 4. Touch select **Cable/Repeater Test** from the **Home** menu shown below.



The following screen appears:

<	Cable Test					Home	Preferences	lelp
		Γte	est Wire					
		Test	Repeater					
		Test R	emote PRN					
		Fram	ne Capture					
		Fram	e Compare					
								_
N	HDMI (8 bpc RGB)	3840x2160p 30 frames/s	HDMI_VIC 1: No errors	HDMI 3D disabled	AVMUTE disabled	HDCP disabled	+5V detected	
0 U T	Interface: HDMI (12 bpc RGB)	Format: 3840x2160 30Hz	Pattern: Color Bars	3D: Disabled	Audio (HDMI): LPCM 2.0ch 48kHz	Enable HDCP	AVMUTEOFF	06:44

5. Select **Test Remote PRN** to capture a reference frame.

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The 780C will run the PRN test at the format resolution set for the 780 at the source end. Repeat the test at other resolutions and bit depths.

	Cable Test					Home	Preferences	Help
	Test Wire Test Repea Test Remote I Frame Capte	ter PRN ure	ASS :0 errors					
Z-	HDMI (8 bpc RGB)		VIC 16: No errors	HDMI 3D disabled		HDCP disabled	+5V detected	
0 U T	Interface: HDMI (8 bpc RGB)	Format: 1920x1080 60Hz	Pattern: Pseudo Random	3D: Disabled	Audio (HDMI): DTS-ES 6.1 (Sine Wave)	Enable HDCP	AVMUTEOFF	18:11

# 10 Running the Automated EDID Tests on HDMI Source Devices

This section provides procedures for running the optional Auto EDID test on HDMI source devices.

#### The HDMI Auto-EDID Test is included only if you have purchased the Auto EDID Test option.

# 10.1 HDMI Auto EDID Test

The Auto EDID Test enables you to verify that an HDMI source (or upstream HDMI network) properly handles a series of EDIDs. The test checks the incoming timing against what is expected based on the contents of the EDID such as the preferred timing. The test also verifies that the video parameters are consistent with the capabilities of the EDID that is emulated. The 780C is configured with a set of EDIDs that it will emulate on its HDMI Rx port. The EDIDs can be commercial EDIDs, test EDIDs or even known-bad EDIDs. The HDMI source is connected to the HDMI Rx port and the test is initiated. The results are presented on the embedded screen. As an option you can define a report for later viewing and dissemination to other colleagues and subject matter experts.

#### 10.1.1 Procedures for Configuring a Set of EDIDs for the Auto EDID Test

This subsection provides procedures for configuring the 780C with the desired set of EDIDs for testing. Note that the test comes with a default set of EDIDs for running the test. However, typically you will want to create your own set of test EDIDs. You will have to create a text file with the names (and descriptions) of the EDIDs that you wish to use for testing.

Quantum Data offers an <u>EDID Library</u> free of charge which has a variety of EDIDs for use in testing. The EDID Library provides details procedures on how to download and install EDIDs on a PC. The procedures below assume that you have a set of EDIDs on your PC that you wish to use for the Auto EDID test. This procedure also assumes that you have transferred those EDIDs into the EDID directory of the 780C. Refer to the section in this manual <u>Adding Reference EDIDs for Use in Testing HDMI Devices</u> for instructions on transferring EDIDs into the proper directory of the 780C.

1. Open up your favorite text editor program (example Notepad). Create a text file listing the EDIDs. Each EDID listing in the file is structured as follows:

<name> <description>

Where name is the name of the EDID as it appears in the 780C file system and description is the name you assign and appears in the Name field on the Auto EDID test results screen. The following is an example of the text file:

TSTLIST2 - Notepad	- • <b>x</b>
File Edit Format View Help	
H8P2D01C Librar H8P2D01C H7P2M001 Library H7P2M001 H4I2D00T Library H4I2D00T H8P3D06C Library H8P3D06C H8P2L00X Library H8P2L00X H4I2D00T Library H4I2D00T H7P2D00T Library H7P2D00T H8P3H01S Library H8P3H01S H7P2M00X Bad H7P2M00X TESTCMP Commercial TESTCMP	
	Ŧ

**Note**: In the example above the first white space separates the name of the EDID which matches the EDID file in the 780C for testing and the description that appears on the AutoEDID test screen. The second white space is part of the description.

 Transfer this text file to the AutoEDID directory of the 780C. Use the procedures in <u>Procedures for</u> <u>Importing EDIDs into the 780C</u> to transfer the this text file to the 780C. Refer to the figure below for reference on the AutoEDID directory.

Com	1 ▶ Rem ▶ 🔫	Search Rer	novable Disk (E:)	×
Organize 👻 🛛 🔭	Open Share with 🔻	Burn »		(?)
Name	Date modified	Туре	Size	•
VBR_71.PCM	9/29/2013 4:00 PM	PCM File	1,440 KB	
VERSION	9/29/2013 4:00 PM	TXT File	1 KB	
ZP ZP	9/29/2013 4:00 PM	Bitmap image	508 KB	
📄 fpga780a.bin	8/7/2013 10:16 AM	BIN File	3,241 KB	
bootstrp.bin	6/6/2013 10:56 AM	BIN File	32 KB	
🌗 AUTOEDID	1/2/2014 2:00 PM	File folder		
🐌 EDID 🔶	9/29/2013 4:00 PM	File folder		
J FMT	9/29/2013 4:00 PM	File folder		
퉬 РАСКS	9/29/2013 4:00 PM	File folder		
퉬 REPORTS	9/29/2013 4:00 PM	File folder		=
)) RESOURCE	9/29/2013 4:00 PM	File folder		-

The AutoEDID directory should now include your EDID list file:

😋 🗢 📕 « Removable Disk (E:) 🕨		← Search AUTOE	DID		<u>×</u>
Organize 🔻 Share with 👻 Burn	n New folder			•== •	0
Name	Date modified	Туре	Size		
TSTLIST1	1/21/2014 1:35 PM	TXT File		1 KB	
TSTLIST2	1/22/2014 8:39 AM	TXT File		1 KB	

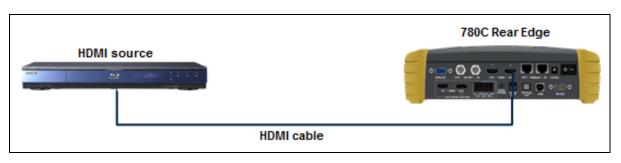
The EDID directory would look similar to the following:

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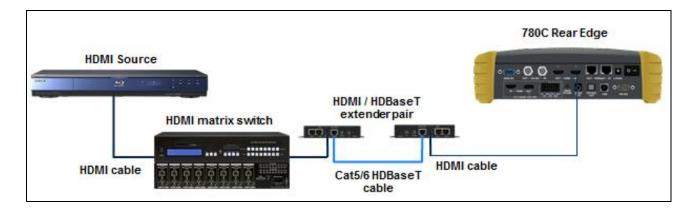
		Search EDID		, • •
Organize	able Disk (E:) ► EDID			
Name	Date modified	Type Siz	-	
DPC2N00Q	5/7/2013 3:00 PM	XML Document	1 KB	
H4I2D00T	5/7/2013 2:59 PM	XML Document	1 KB	
H4P2M00C	5/7/2013 2:59 PM	XML Document	1 KB	
H4P2M01S	5/7/2013 2:57 PM	XML Document	1 KB	
H4P2T01S	5/7/2013 2:57 PM	XML Document	1 KB	
H7P2D00T	5/7/2013 2:59 PM	XML Document	1 KB	
H7P2D01S	5/7/2013 2:59 PM	XML Document	1 KB	
P7P2L00Q	5/7/2013 2:59 PM	XML Document	1 KB	
📄 H7P2L02X	5/7/2013 2:59 PM	XML Document	1 KB	
P7P2M00C	5/7/2013 2:59 PM	XML Document	1 KB	
H7P2M00X	5/7/2013 2:59 PM	XML Document	1 KB	
H7P2O01S	5/7/2013 2:57 PM	XML Document	1 KB	
P7P2T01X	5/7/2013 2:57 PM	XML Document	1 KB	
H8I2D00C	5/7/2013 2:59 PM	XML Document	1 KB	
H8I2D01S	5/7/2013 2:57 PM	XML Document	1 KB	
H8P2D00C	5/7/2013 2:59 PM	XML Document	1 KB	
🖹 H8P2D00X	5/7/2013 2:59 PM	XML Document	1 KB	

## 10.1.2 Configurations for Running an Auto EDID Test

This subsection provides configurations supported when performing an HDMI Auto EDID test on a source device which could be an entire upstream HDMI network.







#### **10.1.3** Procedures for Running the Auto EDID Test

This subsection provides procedures for running the optional Auto EDID Test on an HDMI source or upstream network. The procedure assumes that you have the EDIDs saved on the 780C and also the AutoEDID test list file using the procedures above. The procedures also assume that you have the source device connected to the 780C's HDMI Rx port.

**Important Note**: If you wish to run the optional text report, you will have to have installed a suitable SDCard into the 780C at the SDCard input on the front edge. You will have to **install the SDCard before you boot up the 780C** and run the test.

1. From the Home screen touch select the EDID Test application on the Sink Test region.

Home					Home	Preferences Help
Source Tests			Sink Tests	Link	Tests	Installer Tests
Format Analyzer	Packet Viewer	Audio Analyzer	EDID Te	st Au	x Channel	Sink Test
		- <del>(                                    </del>				
Video Display	HDCP Test	Audio Monitor Settings	HDCP Te	est Ca Te	ble/Repeater st	Source Test
-					3	
Video Passthrough	CEC Test		CEC Tes		nk Test	Repeater Test
		3				
I HDMI (8 bpc N YCbCr 4:4:4)	1920x1080p 60 frames/s	VIC 16: No errors	HDMI 3D disabled	AVMUTE disabled	HDCP disabled	+5V detected
O HDMI (YCbCr 4:4:4)	1280x720 60Hz	Color Bars	3D: Disabled	Dolby 5.1 (Sine Wave)	HDCP Disable	АУМИТЕОГГ 😭 15:57 НОСР ОК 🛁 —

The EDID Test screen appears.

2. From the EDID Test screen, touch select Auto-EDID Test as shown below.

<	EDID Test					Home	Preferences	Help
	Read EDID							
	Load EDID							1
	Save EDID							
ſ	Compare							
	Use on Rx							
	Auto-EDID Te	st	]					
00								
I N	HDMI/DVI: No signal	No TMDS clock	Cannot be analyzed	Not capable of HDMI 3D	No GCP packets received	Not capable of HDCP	No +5V detec	cted
0	Interface: HDMI (8 bpc RGB)	Format: 720x480 60Hz	Pattern: Color Bars	3D: Disabled	Audio (HDMI): LPCM 2.0ch	Enable HDCP	NO HDCP	

The Auto-EDID Test screen appears.

3. From the Auto-EDID Test screen optionally select Set Report Name as shown below.

Auto EDID T	est				Home	Preferences	Help
Set Report Na	me Set Te	est List	Start	Show ED	ID A	uto Scroll	
EDID	+5V Type	Video Format	VIC Code	Color Sp	ace/Bit Depth	3D Mode	
HDMI (8 bpc RGB) N	1920x1080p 59 frames/s	VIC 16: Bad VRAT	HDMI 3D disabled	AVMUTE disabled	HDCP enabled	+5V detected	
0 Interface: HDMI (8 bpc RGB)	Format: 1920x1080 60Hz	Pattern: Color Bars	3D: Disabled	Audio (HDMI): LPCM 2.0ch	Enable HDCP	AVMUTEOFF	23:21
				48kHz		HPD FAIL 🛛 🗙	~

A Virtual Keyboard screen appears enabling you enter a name for the report. This screen is shown in the next step in this procedure.

**Important Note**: You will have to have installed a suitable SDCard into the 780C at the SDCard input on the front edge. Refer to the image below. You will have to *install the SDCard before you boot up the* **780C** and run the test. If you have not installed the SDCard. Install the SDCard now, power cycle the 780C and repeat the previous steps.



4. (Optional) If you wish to create a report, enter a name for the report using 8.3 naming convention. Touch select the **Enter** key when you are finished entering the name. An example is shown below:

Virtual Keybo	pard				Home	Preferences Help
	TS'	TRPT2.txt		< Back	space	
	0	1 2 3	4 5	6 7	89	
	Q	WER	ΤΥ	UII	0 P	
	A	SD	FGH	H J K		
	Z	Z X C	VB	NM	Enter	
					Î	
HDMI (8 bpc RGB) N	1920x1080p 59 frames/s	VIC 16: Bad VRAT	HDMI 3D disabled	AVMUTE disabled	HDCP enabled	+5V detected
Interface: HDMI (8 bpc RGB)	Format: 1920x1080 60Hz	Pattern: Color Bars	3D: Disabled	Audio (HDMI): LPCM 2.0ch 48kHz	Enable HDCP	AVMUTEOFF (23:3) NO HDCP ∩1 → 23:3 HPD FAIL

5. (Optionally) Touch select the **Set Test List** activation button if you wish to use your specific list of EDIDs for testing.

Auto EDID T	est				Home	Preferences Help
Set Report Nar	ne Set Te	est List	Start	Show ED	ID /	Auto Scroll
EDID	+5V Type	Video Format	VIC Code	Color Sp	ace/Bit Depth	3D Mode
HDMI/DVI: No signal	No TMDS clock	Cannot be analyzed	Not capable of HDMI 3D	No GCP packets received	Not capable of HDCP	No +5V detected
Interface: HDMI (8 bpc RGB)	Format: 720x480 60Hz	Pattern: Color Bars	3D: Disabled	Audio (HDMI): LPCM 2.0ch	Enable HDCP	
				48kHz		HPD FAIL 🛛 🗙 🕓

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The **Auto Test Lists** screen will appear enabling you to select your previously defined test list. Refer to the screen below.

EDID Auto T	est Lists				Home	Preferences	Help
Full Library	TSTLIS	ST1.TXT	STLIST2.TXT	)			1
I HDMI (12 bpc N RGB)	720x480p 59 frames/s	VIC 3: Bad VRAT	HDMI 3D disabled	AVMUTE disabled	HDCP enabled	+5V detected	
0 Interface: U HDMI (8 bpc RGB) T	Format: 720x480 60Hz	Pattern: Color Bars	3D: Disabled	Audio (HDMI): LPCM 2.0ch 48kHz	Enable HDCP	AVMUTEOFF	

- 6. Select the desired EDID test list as shown in the screen above.
- 7. Initiate the test with the **Start** button as shown below.

K	Auto EDID T	est					Home	Preferences	Help
	Set Report Na	me	Set Te	est List	Start	Show ED	ID A	uto Scroll	
	EDID	+5V	Туре	Video Format	-"IC Code	Color S	pace/Bit Depth	3D Mode	
I N	HDMI (8 bpc RGB)	1920x frai	1080p 59 mes/s	VIC 16: Bad VRAT	HDMI 3D disabled	AVMUTE disabled	HDCP enabled	+5V detected	
0 U T	Interface: HDMI (8 bpc RGB)		rmat: 080 60Hz	Pattern: Color Bars	3D: Disabled	Audio (HDMI): LPCM 2.0ch 48kHz	Enable HDCP	AVMUTEOFF	23:21

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Auto EDID T	est						Hom	ne	Preferences	Help
Set Report Nar	ne	Set Te	est List		Stop	Show ED		Au	to Scroll	
EDID	+5V	Туре	Video Format	t	VIC Code	Color S	pace/Bit De	pth	3D Mode	
Library H8P2D01C	OK		1920x1080p	60 Hz	CEA 16	RGB 24	i bpp		Disabled	
HDMI (8 bpc RGB)		080p 59 nes/s	VIC 16: Bad VF	RAT HI	DMI 3D disabled	AVMUTE disabled	HDCP en	abled	+5V detected	I
Interface: HDMI (8 bpc RGB)	For	mat: 080 60Hz	Pattern: Color Bars		3D: Disabled	Audio (HDMI): LPCM 2.0ch 48kHz	Enable H	IDUF	AVMUTEOFF 📑 NO HDCP 👍 📢	

The test will begin executing and you will see the results one by one as each EDID it tested. The following screen shows another example. Note that you can stop the test anytime by touch selecting the **Stop** activation/toggle button (indicated above).

Auto EDID Te	est					Home	Preferences Help
Set Report Nam	ie	Set Te	est List	Start	Show EDI	DA	Auto Scroll
EDID	+5V	Туре	Video Format	VIC Code	Color Sp	ace/Bit Depth	3D Mode
Library H8P3D06C	OK	HDMI	1920x1080p 60 H	z CEA 16	RGB 24	Брр	Disabled
Library H8P2L00X	ОК	HDMI	1920x1080p 60 H	z CEA 16	RGB 24	рр	Disabled
Library H4I2D00T	OK	HDMI	1920x1080p 60 HzNot found	CEA 16	RGB 24	Брр	Disabled
Library H7P2D00T	ОК	HDMI	1920x1080p 60 HzNot found	CEA 16	RGB 24	bpp	Disabled
Library H8P3H01S		HDMI	1920x1080p 60 H	CEA 16			
Bad H7P2M00X	OK		080p 60 H	z			
Commercial TESTCM	POK	HDMI	1920x1080p 60 H	z CEA 16	RGB 24	рр	Disabled
HDMI (8 bpc RGB)		1080p 59 mes/s	VIC 16: Bad VRAT	HDMI 3D disabled	AVMUTE disabled	HDCP enabled	+5V detected
Interface: HDMI (8 bpc RGB) 1		rmat: 080 60Hz	Pattern: Color Bars	3D: Disabled	Audio (HDMI): LPCM 2.0ch 48kHz	Enable HDCP	

The following screen shows an example of a completed report:

Notes on the example above:

Red text in the example above, indicates anomalous conditions in the handling of an EDID. Examples show:

- 1. Incoming video timing resolution is not present in EDID (2 cases).
- 2. EDID with bad checksum where incoming video is interpreted as DVI (since there are no infoframes).

#### **10.1.4** Viewing the Auto-EDID Test report.

This subsection discusses viewing of the AutoEDID test text report. The test report is a text file stored on the SDCard that you inserted in the SDCard slot. You will need an SDCard reader or an SDCard slot on your PC to

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view the text report. You can view the Auto-EDID test report directly from the SDCard or transfer it to your PC. An example of the report is shown below.

TSTRPT2 - Notepad								
File Edit Format View Help								
EDID description: Library	/ H8P2D01C							
EDID raw data:	6       07       08       09       0A       0B       0C       0D       0E       0F         5       00       35       49       0C       00       00       00       00       00         5       78       2A       F7       4E       A3       54       4A       99       26         1       C0       81       80       81       00       01       01       01         2       3A       80       18       71       38       2D       40       58       2C         1       E       01       1D       80       18       71       1C       16       20         2       0       00       9E       00       00       0F       D0       3A         0       20       20       20       20       00       00       FC         20       48       44       4D       49       32       0A       01       50         5       04       02       03       0E       FF       09       7F       07         0       07       F0       4D       02       00       83       4F       0							
+5V: OK Video information: - Current video timing: 1920x1080p 60Hz - Incoming video matches CEA-861 VIC 16 and 76 exactly - HDMI video detected - Received AVI VIC 16 - Color space: RGB 8 bpc #								
EDID description: Library	H7P2M001							
EDID raw data: 00 01 02 03 04 05 06 000 00 FF FF FF FF FF FF 010 00 11 01 03 80 52 2E 020 0F 47 4A A1 08 00 81	00 35 49 0C 00 00 00 00 00 78 2A F7 4E A3 54 4A 99 26							

You can disseminate the test report to subject matter experts or colleagues.

# 11 Creating and Using Custom Formats, EDIDs, Bitmaps and Menus

This chapter provides procedures on creating and using custom formats, EDIDs, bitmaps and Menus.

# **11.1** Creating and Using Custom Formats

You can also create your own formats using the Quantum Data Format Editor available at: <u>www.quantumdata.com/downloads</u>. The Format Editor will create an .xml format file that you can store in the 780C. The instructions for using the Format Editor are included with the 882 User Guide also available on at: <u>www.quantumdata.com/downloads</u>. Once created you can load your custom formats either through the command line or by selecting them through the User buttons on the Signal Type menu.

#### 11.1.1 Workflow for Using Custom Formats

In order to import and use custom formats in the 780C you must take the following high level steps (detailed procedures are provided further below):

- Create custom formats with the Quantum Data Format Editor available from <u>www.quantumdata/com/downloads</u> page. The instructions for using the Format Editor are provided in the 882 User Guide also available from <u>www.quantumdata/com/downloads</u> page.
- Store the .xml format files on your PC.
- Place the 780C's USB interface in the **Disk** mode. This is not the default mode for the USB interface.
- Transfer the .xml format file(s) to the FMT directory of 780C over the USB interface.
- Establish a command line session with the 780C from your PC over the USB port.
- Select the custom format through the User Signal Type menu.
- Apply the custom formats using the FMTL and FMTU commands.

#### 11.1.2 Procedures for Creating and Loading Custom Formats

Use the following procedures to add custom formats to your 780C.

- 1. Create a new custom format or modify an existing formats with the Quantum Data Format Editor. You can use some of the sample formats available from the Quantum Data website as a starting point for creating a new format. Be sure to save the file. The format files will be saved as .xml files by the Format Editor.
- 2. Select the **Preferences** from the 780C top level menu.

The following screen will appear:

	Preferences					Home	Preferences	elp
		Audible	Touch Feedback	Off On				
		s	creen Brightness	Min 25%	50% 75% [	Max		
			USB Mode	COM Disk				
			Startup Mode	Default	Custom Menu			
			Custom Menu	Enter		More		
l N	HDMI/DVI: No signal	No TMDS clock	Cannot be analyzed	Not capable of HDMI 3D		Not capable of HDCP		
0 U T	Interface: HDBaseT (8 bpc RGB)	Format: 720x480 60Hz	Pattern: Color Bars	3D: Disabled	Audio (HDMI): LPCM 2.0ch 48kHz	Enable HDCP		08:57

3. Choose **Disk** mode.

The Disk selection for **USB Mode** in the above screen will be highlighted in green.

4. Power cycle the 780C using the rocker switch on the back panel.

The 780C will appear as a mass storage device on your PC like any other USB drive.

**Note**: If this is the first time you have used the 780C in the **Disk** mode you will have to reformat the disk. The system will prompt you through the format process.

5. Connect the 780C to a PC host via the USB cable provided.

The 780C should appear as a USB storage device.

6. Transfer your custom format .xml files from your PC to the FMT directory of the 780C using standard Windows methods for transferring files to a USB drive, i.e. by dragging and dropping or copying and pasting.

Note: Your formats are limited to 8 characters with an extension (.xml).

7. Touch select the Preferences from the 780C top level menu. Refer to the screen below.

Preferences	1				Home	Preferences Help
	Audible	Touch Faedback	Off On			
		Creen Brig		50% 75% 1	Max	
		USB Mode	COM Disk			
		Startup Mode	Default	Custom Menu		
		Custom Menu	Enter		More	
HDMI/DVI: No	No TMDS clock	Cannot be	Not capable of		Not capable of	No +5V detected
HDMI/DVI: No N signal		analyzed	HDMI 3D		HDCP	
O Interface: HDBaseT (8 bpc RGB)	Format: 720x480 60Hz	Pattern: Color Bars	3D: Disabled	Audio (HDMI): LPCM 2.0ch 48kHz	Enable HDCP	NO HDCP 1 08:57

- 8. Touch select COM for the USB Mode (refer to the screen above).
- 9. Power cycle the 780C.
- 10. Navigate to the **Signal Type** menu of the desired interface and select **User-Defined** for the Format Type as indicated below.

HDM//DVI: No	No TMDS clock	Cannot be	Not capable of	AVMUTE disabled	Not capable of	No +5V detected
VGA(HD1	i) Analog YPbP 5) Analog RGB G-SDI			Format Type TV (CE)	PC (IT)	User-Defined
		HDMI HDBaseT	J J	RGB	YCbCr 4:2:	2 YCbCr 4:4:4
Interface/Signal		Connector	)	Color Space		

The following screen appears which shows the list of custom formats.

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- 11. (Alternatively) Establish a command line session with the 780C from your PC using the procedures described in <u>Procedures for Enabling the Command Line Interface</u>.
- 12. Load a custom format using the following commands:

FMTL <formatName> // where formatName is the name of the custom format
FMTU

# 11.2 Adding Reference EDIDs for Use in Testing HDMI Devices

You can import EDIDs for use in testing HDMI source and sink devices. You can compare a reference EDID stored in the 780C with the EDID of an HDMI sink device the 780C is connected to. You can also test HDMI source devices to test how they will respond to a variety of EDIDs you have stored in the 780C.

#### 11.2.1 Workflow for Importing EDIDs into the 780C

In order to import and use EDIDs in the 780C you must take the following high level steps (detailed procedures are provided further below):

- Place the 780C's USB interface in the **Disk** mode. This is not the default mode for the USB interface.
- Create.xml EDID files using Quantum Data EDID Editor utilities available with the 882 or the 980. You can
  use the EDID Editor utility provided with the 980 Manager application available from the Quantum Data
  website on the downloads page at: <u>www.quantumdata/com/downloads</u>.
- Transfer the .xml EDID file(s) to the EDID directory of 780C over the USB interface.
- Navigate to EDID Test screen to view and use the EDIDs

Alternatively you can load an EDID from an HDMI sink device and store its EDID for use as a reference EDID in the EDID compare test. Procedures for this feature are also provided below.

#### 11.2.2 Procedures for Importing EDIDs into the 780C

Use the following procedures to add custom EDIDs to your 780C.

- 1. Create a new custom EDID or modify an existing EDID with the Quantum Data EDID Editor. Be sure to save the file. These will be saved as .xml files by the EDID Editor.
- 2. Select the **Preferences** from the 780C top level menu.

Preferences Home Preferences Help Off Audible Touch Feedback 25% 50% Screen Brightness COM USB Mode Custom Menu Startup Mode Custom Menu HDMI/DVI Not capable of HDMI 3D No TMDS clock Cannot be Not capable of HDCP No signal analyzed Format: 720x480 60Hz Pattern 3D: Disabled Audio (HDMI) LPCM 2.0ch Enable HDCP 08:57 NO HDCP Color Bars DBaseT (8 bpc 48kHz

The following screen appears:

#### 3. Choose Disk mode.

The Disk selection for **USB Mode** in the above screen will be highlighted in green.

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4. Power cycle the 780C using the rocker switch on the back panel.

The 780C will appear as a mass storage device on your PC like any other USB drive.

**Note**: If this is the first time you have used the 780C in the **Disk** mode you will have to reformat the disk. The system will prompt you through the format process.

5. Connect the 780C to a PC host via the USB cable provided.

The 780C should appear as a USB storage device.

6. Transfer your custom EDID .xml files from your PC to the **EDID** directory of the 780C using standard Windows methods for transferring files to a USB drive, i.e. by dragging and dropping or copying and pasting.

Note: Your EDID names are limited to 8 characters with an extension (.xml).

7. Touch select the **Preferences** from the 780C top level menu. Refer to the screen below.

	Preferences	0				Home	Preferences	Help
		Audible	Touch Feedback	Off				
		s	Screen Brigh	Min 25%	50% <b>75%</b> N	Max		
			USB Mode	COM Disk				
			Startup Mode	Default	Custom Menu			
			Custom Menu	Enter		More		
I N	HDMI/DVI: No signal	No TMDS clock	Cannot be analyzed	Not capable of HDMI 3D		Not capable of HDCP	No +5V detecte	d
0 U	Interface: HDBaseT (8 bpc RGB)	Format: 720x480 60Hz	Pattern: Color Bars	3D: Disabled	Audio (HDMI): LPCM 2.0ch 48kHz	Enable HDCP	AVMUTEOFF	08:57

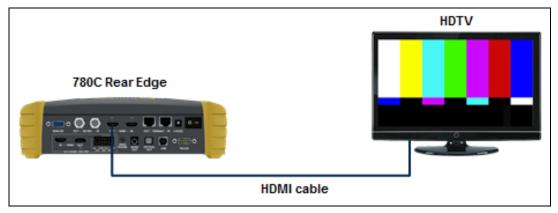
- 8. Touch select COM for the USB Mode (refer to the screen above).
- 9. Power cycle the 780C.
- 10. Navigate to the EDID Test menu.

You should now see the new EDIDs on the list.

#### 11.2.3 Procedures for Saving an EDID into the 780C

Use the following procedures to add an EDID to your 780C from a connected HDMI sink device.

1. Make the physical connections between the 780C **HDMI** or **HDBaseT OUT** connector and the display device whose EDID you wish to store.



- 2. Enable the HDMI output using the procedures at <u>Selecting a Signal Type and Resolution</u>.
- 3. Touch select EDID Test from the Home menu shown below.



4. Touch select the Read activation button from the **EDID Test** menu shown below.

The EDID information is presented on multiple pages on the display. An example of a page of the EDID listing is shown below. You scroll through all the pages using the scroll bar at the right side of the listing.

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EDID Test					Home	Preferences	Help
Read EDID		All checksums OK					
Load EDID		PA 1.0.0.0, 36, 30 bi Product: QDI 30730 iming: 3840x2160 3		1)			1
Save EDID		80p 576i 576p 720p LC/RRC RL/RR FC	o 1080i 1080p 1080p   LFE FL/FR ]				
Compare	AC-3 8 ch., [3	2 44.1 48 88.2 96 1 2 44.1 48] kHz, max 4.1 48] kHz, max rai		20 24] bits			
Use on Rx	Dolby DD+ 8 DTS-HD 8 ch.	ch., [ 44.1 48] kHz ., [ 44.1 48 88.2 96	176.4 192] kHz				
Auto-EDID Te		ch., [44.1 48 88.2 9	36 192] KHZ				
3 <del>.</del>							
I HDMI (8 bpc RGB) N	3840x2160p 30.00 frames/s	Unknown	HDMI 3D disabled	AVMUTE disabled	HDCP disabled	+5V detected	
0 Interface: U HDMI (8 bpc RGB)	Format: Passthrough Mode	Pattern: Pseudo Random	3D: Disabled	Audio (SDI): LPCM 2.0ch 48kHz	Enable HDCP	AVMUTEOFF	07:14

5. Touch select the **Save** activation button from the **EDID Test** menu shown below.

Virtual Keyboa	ard				Home	Preferences Help
		DID.xml 23 7 E R S D	4 5 T Y F G H		kspace 89 OP L	
	Z	XC	VB	NM	Enter	
N signal	No TMDS clock Format: 1840x2160 60Hz	Cannot be analyzed Pattern: Color Bars	Not capable of HDMI 3D 3D: Disabled	No GCP packets received Audio (HDMI): LPCM 2.0ch 48kHz	Not capable of HDCP Enable HDCP	No +5V detected

- 6. Spell out a name for the EDID (limit 8 characters) by touch selecting the virtual keys (e.g. above "MYEDID". Then touch select the **Enter** key.
- 7. Power cycle the 780C.
- 8. Navigate to the EDID Test screen and touch select **Load** from the **EDID Tests** menu. The following screen results.

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<	EDID Test					Home	Preferences	Help
	Read EDID							
	Load EDID	L	oad File.					
	Save EDID	Load	TV Default					
	Compare	Load	AVR Default					
	Use on Rx							
	Auto-EDID Tes	st						
I N	HDMI (8 bpc RGB)	3840x2160p 30 frames/s	HDMI_VIC 1: No errors	HDMI 3D disabled	AVMUTE disabled	HDCP disabled	+5V detected	
0 U T	Interface: HDMI (8 bpc RGB)	Format: 3840x2160 30Hz	Pattern: Zone Plate	3D: Disabled	Audio (HDMI): Not configured	Enable HDCP	AVMUTEOFF	04:26

9. Touch select the Load File option to view your new EDID.

	TMDS clock	Cannot be analyzed	Not capable of HDMI 3D	No GCP packets received	Not capable HDCP	e of No +5V detected	d 04
TESTCMP.XML	TEZT.X	ML	MYEDID.XML				
H8P3L00C.XML	HPC2L01S	.XML F	HPC2L01X.XML	PPC2L00Q	XML	SE50UY04.XML	
H8P2M01X.XML	H8P2N01S	XML H	H8P2O01S.XML	H8P3D06C	.XML	H8P3H01S.XML	
H8P2D00C.XML	H8P2D00X	XML F	18P2D01C.XML	H8P2H00X	.XML	H8P2L00X.XML	
H7P2M00X.XML	H7P2O01S	.XML	H7P2T01X.XML	H8I2D00C	XML	H8I2D01S.XML	
H7P2D00T.XML	H7P2D01S	.XML	H7P2L00Q.XML	H7P2L02X	.XML	H7P2M00C.XML	
DPC2N00Q.XML	H4I2D00T.	XML F	14P2M00C.XML	H4P2M01S	.XML	H4P2T01S.XML	E

# **11.3 Using Custom Bitmaps**

You can import your own bitmaps into the 780C through the USB interface or load them from an SD card. Note that when bitmaps are imported into the 780C, they are **rendered at their native resolution**, *i.e. they do not* **scale** to the resolution of the video format you have selected as the standard test patterns do. Therefore, if you want to test with a specific bitmap pattern for each resolution and you want the bitmap to fill the entire display, you would need to import a separate bitmap of that image for each resolution you wish to test.

Note: Bitmap images are RGB and will not display properly on the 3G-SDI output.

The 780C can accommodate up to 50 custom bitmap images in its internal memory and additional bitmaps stored on the SD card.

**Important Note:** It is highly recommended that you not select bitmap images when outputting compressed audio clips.

#### 11.3.1 Workflow for Importing Bitmaps

In order to import and use bitmaps in the 780C you must take the following high level steps (detailed procedures are provided further below):

- Place the 780C's USB interface in the **Disk** mode. This is not the default mode for the USB interface.
- Create a text file called "UserPats.txt" that lists each bitmap stored for use. The name in the file has to
  match the name of the bitmap. The procedures below provide an example of this text file.
- Transfer the UserPats.txt file to the 780C over the USB interface.
- Transfer the bitmap(s) over to the 780C flash memory through the USB interface.



#### 11.3.2 Workflow for loading bitmaps from the SD card

In order to load bitmaps from the 780C's SD card you must take the following high level steps (detailed procedures are provided further below):

- Create a text file called "UserPats.txt" that lists each bitmap stored for use. The name in the file has to match the name of the bitmap. The procedures below provide an example of this text file.
- Transfer the UserPats.txt file to the 780C to an SC card using a card reader.
- Insert the SD card into the 780C SD slot on the front.

#### Important notes about SD card use and formatting:

- 1. The SD card (not an SDHC and not an SDXC).
- 2. The SD card should be a 1GB or less.
- 3. The SD card should be formatted using an SD format program available from www.sdcard.org.
- 4. The SD card must be formatted FAT16.

#### 11.3.3 Procedures for Importing Bitmaps

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Use the procedures below to import bitmaps.

- 1. Connect the 780C to a PC host via the USB cable provided.
- 2. Select the **Preferences** from the 780C top level menu.

<	Preferences					Home	Preferences	Help
		Audible	Touch Feedback	Off				
		S	creen Brightness	Min 25%	50% 75% 1	Max		
			USB Mode					
			Startup Mode	Default	Custom Menu			
			Custom Menu	Enter		More		
I N	HDMI/DVI: No signal	No TMDS clock	Cannot be analyzed	Not capable of HDMI 3D		Not capable of HDCP	No +5V detecte	d
0 U T	Interface: HDBaseT (8 bpc RGB)	Format: 720x480 60Hz	Pattern: Color Bars	3D: Disabled	Audio (HDMI): LPCM 2.0ch 48kHz	Enable HDCP	AVMUTEOFF	08:57

3. Choose Disk mode.

The Disk selection for USB Mode in the above screen will be highlighted in green.

4. Power cycle the 780C using the rocker switch on the back panel.

The 780C will appear as a mass storage device on your PC like any other USB drive.

- 5. If this is the first time you have used the 780C in the **Disk** mode you will have to reformat the disk. The system will prompt you through the format process.
- 6. Create the **userpats.txt** text file listing your bitmaps. Use the information in Table 11-1 below to construct your text file:

Table 11-1: Importing Bitmaps – UserPats.txt file					
Bitmap Name (use 8.3 naming convention)	Bitmap Resolution	UserPats.txt Text File Structure			
Mast480.bmp Mast720.bmp	720x480 128x720	The structure of the UserPats file is: <bitmap name=""> space <description></description></bitmap>			
Mast1080.bmp	1920x1080	<ul> <li>The contents of the UserPats.txt text file would be:</li> <li>Mast480.bmp Master 720x480</li> <li>Mast720.bmp Master 1280x720</li> <li>Mast1080.bmp Master 1920x1080</li> <li>Note 1: The bitmap name has to match the name of the stored bitmap.</li> <li>Note 2: The description is limited to 20 characters.</li> </ul>			

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**Important Note:** It is very important to ensure that the names in the userpats.txt file match the names of the bitmaps.

**Example:** Given the following bitmap file names:

Mast720.bmp

Mast1080.bmp

MYPLG07.bmp

MYPLG10.bmp

MYGEO07.bmp

MYGEO10.bmp

MYBRTS07.bmp

MYBRTS 10.bmp

Your userpats.txt file would be something like the following:

**Note**: Must use 8.3 naming system. Eight (8) characters. The names in the name field (first field) must match the bitmap names.

Mast720.bmp Master 720 Mast1080.bmp Master 1080 MYPLG07.bmp BlkPlug 720 MYPLG10.bmp BlkPlug 1080 MYGEO07.bmp Geom178 720 MYGEO10.bmp Geom178 1080 MYBRTS07.bmp RGMultBurst 720 MYBRTS10.bmp RGMultBurst 1080

7. Transfer your userpats.txt file from your PC to the 780C using standard Windows methods for transferring files to a USB drive, i.e. by dragging and dropping or copying and pasting.

Note: Your bitmaps are limited to 8 characters with an extension (.bmp).

8. Transfer your bitmap(s) from your PC to the 780C using standard windows procedures for transferring files to a USB drive, i.e. dragging and dropping or copying and pasting.



9. Touch select the **Preferences** from the 780C top level menu. Refer to the screen below.

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<	Preferences					Home	Preferences Help
		Audible	e Touch Feedback	Off			
			Screen Brightness	Min 25%	50% 75% 1	Max	
			USB Mode	COM Disk			
			Startup Mode	Default	Custom Menu		
			Custom Menu	Enter		More	
I N	HDMI/DVI: No signal	No TMDS clock	Cannot be analyzed	Not capable of HDMI 3D		Not capable of HDCP	No +5V detected
0 U T	Interface: HDBaseT (8 bpc RGB)	Format: 720x480 60Hz	Pattern: Color Bars	3D: Disabled	Audio (HDMI): LPCM 2.0ch 48kHz	Enable HDCP	NO HDCP 1 08:57

- 10. Touch select COM for the USB Mode (refer to the screen above).
- 11. Power cycle the 780C.
- 12. Navigate to the Video Pattern menu.

You should now see the new bitmap image(s) on the pattern list (below).

Video P	Pattern		Home	Prefe	erences	Help
Checker- board	Zone Plate	Master 720x480	Master 1280x720		Master 1920x1080	Ð
						2

#### 11.3.4 Procedures for Loading Bitmaps from SD Card

Use the procedures below to load bitmaps from an SD card.

- 1. Load your bitmaps on to the SD card from your PC using a USB SD card reader.
- 2. Create the **UserPats.txt** text file listing your bitmaps. Use the information in Table 10-2 below to construct your text file:

Table 10-2: Importing Bitmaps – UserPats.txt file						
Bitmap Name (use 8.3 naming convention)	Bitmap Resolution	UserPats.txt Text File Structure				

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Table 10-2: Importing Bitmaps – UserPa		
Bitmap Name (use 8.3 naming convention)	Bitmap Resolution	UserPats.txt Text File Structure
Mast480.bmp	720x480	The structure of the UserPats file is:
Mast720.bmp	128x720	<bitmap name=""> space <description></description></bitmap>
Mast1080.bmp	1920x1080	<ul> <li>The contents of the UserPats.txt text file would be: Mast480.bmp Master 720x480 Mast720.bmp Master 1280x720 Mast1080.bmp Master 1920x1080</li> <li>Note 1: The bitmap name has to match the name of the stored bitmap.</li> <li>Note 2: The description is limited to 20 characters.</li> </ul>

3. Transfer your UserPats.txt file from your PC to the SD card using standard Windows methods for transferring files to a USB drive, i.e. by dragging and dropping or copying and pasting.

In this example, you would have created a bitmap called for example 980\_640.bmp and stored it on the SD card. In this example the bitmap is 640 x 480 resolution. You would then create a userpats.txt file as follows:

4. 980\_640.bmp 980 640x480

Note: Your bitmaps are limited to 8 characters with an extension (.bmp).

- 5. Insert the SD card into your 780C.
- 6. Power cycle the 780C.
- 7. Navigate to the Video Pattern menu.

You should now see the new bitmap image(s) (980 640x480) on the pattern list (below).



# **11.4 Creating Custom Menus**

This section describes how to configure custom menus on the 780C. Custom menus enable you to display a menu of commonly used functions on the 780C touch display. This allows you to save time by quickly executing a specific set of resolution and image combinations.

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The custom menus are setup using two text files that you create on your PC and transfer over to the 780C. The two files are: 1) UserKeys.txt and 2) SeqMap.txt. The UserKeys.txt is a set of commands with menu key codes. Each set of commands is a line in the text file.

#### 11.4.1 To create a custom menu:

Use the following procedure to create a custom menu on your 780C.

1. Create a UserKeys.txt file or edit an existing file. An example of a UserKeys.txt file is shown below.

```
#F0 fmtl 720p60;imgl user01;fmtu
#F1 fmtl 1080p60;imgl pgcwrgb;fmtu
#F2 fmtl 480p60;imgl smptebar;fmtu
#F3 fmtl dmt0660;imgl ramp;fmtu
#F4 fmtl 1080i30;imgl focus;fmtu
#FF fmtl dmt0660;imgl smpte;fmtu
```

Note that the commands are separated by a semicolon. In the example above in the first line there is a custom bitmap image "user01" that is used.

2. Create a SeqMap.txt file or edit an existing file. An example of a SeqMap.txt file is shown below.

The SeqMap.txt then maps the commands listed in the UserKeys.txt file to a name and a location on the custom menu. The following is an example of a SeqMap.txt file.

```
#F0 720p Master
#F1 1080p PGCWrgb
#F2 480p SMPTEbar
#F3 DMT0660 Ramp
#F4 1080i Focus
#FF Go Home
```

The result of these two files would be the following custom menu:

	1080p PGCWrgb	480p SMPTEbar
MT0660 Ramp	1080i Focus	Go Home

Touch selecting the key labeled "1080p PGCWrgb" would cause the following command sequence to execute:

#F1 fmtl 1080p60;imgl pgcwrgb;fmtu // loads 1080p60 format, displays pgcwrgb test pattern

#### 11.4.2 To access custom menus:

Use the following procedure access the custom menu on your 780C.

1. Navigate to the **Preference** menu by selecting the **Preferences** tab from the **Home** menu.

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ome						Preferences	Help
Source Tests			Sink Tests	Linl	k Tests	Installer Test	6
Format Analyzer	Packet Viewer	Audio Analyzer		Ar	ux Channel halyzer HDCF HDCF HDCF HDCF HDCF HDCF HDCF HDCF	Sink Test	Ŷ
Video Display	HDCP Test	Audio Monitor Settings	HDCP Te:	Te	able/Repeater est	Source Test	
Video Passthrough	CEC Test		CEC Test		nk Test	Repeater Te	est
		3	POLLIN				
HDMI (8 bpc YCbCr 4:4:4)	1920x1080p 60 frames/s	VIC 16: No errors	HDMI 3D disabled	AVMUTE disabled	HDCP disabled	+5V detected	
HDMI (YCbCr 4:4:4)	640x1005 60Hz	Color Bars	3D: Frame Packing	Dolby 5.1 (Sine Wave)	HDCP Disable	AVMUTEOFF	14

2. Navigate Touch select **Custom Menu** from the Preference screen as shown below.

<	Preferences					Home	Preferences	Help
		Audible	Touch Feedback	Off				
		s	Screen Brightness	Min 25%	50% 75% N	lax		
			USB Mode	COM Disk				
			Startup Mode	Default	Custom Menu			
			Custom Menu	Enter		More		
N	HDMI/DVI: No signal	No TMDS clock	Cannot be analyzed	Not capable of HDMI 3D		Not capable of HDCP	No +5V detecti	
0 U T	Interface: HDBaseT (8 bpc RGB)	Format: 720x480 60Hz	Pattern: Color Bars	3D: Disabled	Audio (HDMI): LPCM 2.0ch 48kHz	Enable HDCP	AVMUTEOFF	

The following screen appears.

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# **12 Command Interface**

This chapter describes how to use the command line to control the 780C. The command line is useful for automated control applications.

## 12.1 Guidelines for Using the Command Line

The command line is available through the 780C USB port and additionally through an RS-232 connector on the 780C. In order to use the command line through the USB port you need to set the 780C USB port in COM mode. You may need to download an .INF file from the Quantum Data website on the downloads page.

# **12.2** Procedures for Enabling the Command Line Interface through USB Port

Use the following procedures for command line control of the 780C via the USB port.

Please note if you experience a different behavior on your PC, refer to the 780C release notes on the Quantum Data website at: <u>http://www.quantumdata.com/downloads/index.asp</u>.

- 1. Download the .INF file from the Quantum Data website <u>http://www.quantumdata.com/downloads/index.asp</u> to your PC and unzip the file. Store it in a convenient location on your PC.
- 2. Power up the 780C and touch select **Preferences** from the 780C top level menu.
- 3. Choose COM for the USB Mode (refer to the screen below).

Preferences					Home	Preferences Help
	Audible	Touch Feedback	Off On			
	s	creen Brightness	Min 25%	50% 75%	Max	
		USB Mode	COM Disk			
		Startup	Default	Custom Menu		
		Custom Menu	Enter		More	
HDMI/DVI: No	No TMDS clock	Cannot be	Not capable of		Not capable of	No +5V detected
HDMI/DVI: No N signal		analyzed	HDMI 3D		HDCP	
0 Interface: U HDBaseT (8 bpc RGB)	Format: 720x480 60Hz	Pattern: Color Bars	3D: Disabled	Audio (HDMI): LPCM 2.0ch 48kHz	Enable HDCP	

4. Connect the 780C to your host PC via the USB cable provided.

The first time you connect 780C to your PC in COM mode, the Found New Hardware Wizard will appear.



5. Follow the instructions provided on the dialog box to browse to the location of the .INF file. Once you locate the .INF file the required software will load as shown below.

Found New Hardware Wizard Please wait while the wizard insta	ills the software	Ð
USB COM Port		
	è 📂	
	K Back Next >	Cancel

6. Power cycle the 780C.

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# 12.3 Procedures for using the Command Line Interface through RS-232 Port (780C only)

Use the following procedures for command line control of the 780C via the RS-232 serial port.

Please note if you experience a different behavior on your PC, refer to the 780C release notes on the Quantum Data website at: <u>http://www.quantumdata.com/downloads/index.asp</u>.

- 1. Power up the 780C and touch select Preferences from the 780C top level menu.
- 2. Select More to view the second Preferences page.

<	Preferences					Home	Preferences	Help
		Audible	Touch Feedback	Off On				
		s	creen Brightness	Min 25%	50% 75% N	/lax		
			USB Mode	COM Disk				
			Startup Mode	Default	Custom Menu			
			Custom Menu	Enter		More		
â								
1 N	HDMI/DVI: No signal	No TMDS clock	Cannot be analyzed	Not capable of HDMI 3D		Not capable of HDCP		ted
0 U T	Interface: HDBaseT (8 bpc BGB)	Format: 720x480 60Hz	Pattern: Color Bars	3D: Disabled	Audio (HDMI): LPCM 2.0ch 48kHz	Enable HDCP		

3. Choose the baud rate for the RS-232 port.

<	Preferences	(Page 2)				Home	Preferences	Help
			Hot Plug Formats	Off				
		AV Mute o	on Format Change	Off On	1			
		F	S-232 Baud Rate	< 230400				
		RS-2	232 Keypad Mode	Off				
		Back						
I N	HDMI/DVI: No signal	No TMDS clock	Cannot be analyzed	Not capable of HDMI 3D		Not capable of HDCP	No +5V detected	
0 U T	Interface: HDBaseT (8 bpc RGB)	Format: 720x480 60Hz	Pattern: Color Bars	3D: Disabled	Audio (HDMI): LPCM 2.0ch 48kHz	Enable HDCP	AVMUTEOFF	08:58

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4. Connect the 780C to your host PC via an RS-232 cable.

You will have to use a standard RS-232 cable.

## **12.4 Procedures for Entering Commands**

Use the following procedure to connect to the 780C through the USB port.

- 1. Open up a terminal program such as Hyperterm on your Windows PC. Configure the terminal session with the following settings:
  - Bits per second = 2400, 4800 or 9600
  - Data bits = 8
  - Parity = none
  - Stop bits = 1
  - Flow control = Hardware
- 2. Press the Return key on your PC and you should receive the R:\> prompt.

Now you are ready to enter commands.

3. Use the following tables as a guideline for enter commands.

**Note:** Changes you make through the command line will not be reflected on the 780C touch panel. For example if you make a selection through the touch panel for the signal type, format and pattern and then override these changes through the command line, the 780C touch screen will still show the selections you made through the touch screen but the interface, format and pattern selections you made through the command line will be active.

Table 12-1 below provides the list of commands supported or testing HDMI sink devices:

Note: The commands are not case sensitive.

Table 12-1: List of Commands (alphabetical) – For Testing HDivit Sink Devices						
Command	Description	Syntax	Parameters	Command Example		
ACRG	Enables or disables ("Gates" on or off) the ACR packets sent to a sink.	ACRG 0, 1 ASSG? <0, 1>	Where <i>1, 0</i> are one of: 0 – disable 1 - enable	To disable ACR packets: ACRG 0 ALLU		
ALLU	Activates a change to the video output.	ALLU	Not applicable	To load and invoke a format load command: FMTL 1080i60 ALLU		
ASSG	Enables or disables adding composite sync to all three analog components.	ASSG R, G, B ASSG? <r, b="" g,=""></r,>	Where <i>R</i> , <i>G</i> , <i>B</i> are one of: 0 – disable 1 - enable	To enable composite sync on green: ASSG 0, 1, 0 FMTU		
ASSS	Sets or queries the analog sync signal swing.	ASSS <swing> ASSS?</swing>	Where <i>swing</i> is between the range of: min = 0.000 volts max = 0.500 volts	To set the analog sync signal swing: ASSS 0.286 ALLU		

Table 12-1: List of Commands	(alphabetical) – Ec	or Testing HDMI Sink Devices
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Command	Description	Syntax	Parameters	Command Example
AUDL	Sets the digital audio format, audio tone and channels	AUDL <type> <subtype_dolby_dts> <subtype_comp> <chan_select> <sine_type></sine_type></chan_select></subtype_comp></subtype_dolby_dts></type>	Where $\langle type \rangle$ is the audio format:0 = LPCM1 = Dolby 5.12 = DTS-ES 6.13 = DD+/TrueHD/DTSHDHRA/DTS-HDMAWhere $\langle subtype_dolby_dts \rangle$ is the audio signal for Dolby and DTS formats:1 = narrow pink noise2 = wide pink noise3 = sine wave4 = impulse5 = polarity6 = auto time delayWhere $\langle subtype_comp \rangle$ is the type of compressed audio format:2 = 7.1 5376kb DTS-HDHRA3 = 5.1 3840kb HDHRA4 = 7.1 5760kb HDHRA5 = 5.1 DTS-HDMA6 = 7.1 HDMA8 = DD + 2.09 = DD + 5.1 10 = DD + 7.111 = TrueHD 7.1 12 = TrueHD 2.0Where $\langle chan_select \rangle$ is the channels used when the audio signal is not sine wave:0 = Left channel 1 = Center channel 2 = Right channel 3 = Cycle4 = LFE 5 = All6 = Left rear 7 = Center rear 8 = Right rearWhere $\langle sine_type \rangle$ is sine wave frequency and channel usage:0 = 63Hz cycle 	To set the digital audio to LPCM using sine wave on all channels at 4kHz: AUDL 0 3 5 7 To set the digital audio to Dolby Digital 5.1 with wide pink noise, using only the center channel: AUDL 1 2 1 To set the digital audio to Dolby TrueHD 7.1 and cycling through all channels: AUDL 3 11 3

Table 12-1: List of Commands (alphabetical) – For Testing HDMI Sink Devi	ces
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Command	Description	Syntax	Parameters	Command Example
AVMG	Sets or clears AVmute on the HDMI output.	AVMG <enable> AVMG?</enable>	Where <i>enable</i> is one of: disable = 0 enable = 1	To set avmute: AVMG 1 ALLU
AVMM	Enables or disables AVmute upon format change on the HDMI output.	AVMM <enable> AVMM?</enable>	Where <i>enable</i> is one of: disable = 0 enable = 1	To enable avmute on an HDMI format change: AVMM 1 ALLU
AVSS	Sets the maximum peak-to-peak swing for all three analog video channels.	AVSS <level> AVSS?</level>	Where <i>level</i> is between the range of: min = 0.000 volts max = 1.000 volts	To set the analog video type: AVSS 0.9 ALLU
AVST	Selects the analog video format type.	AVST <format_type> AVST?</format_type>	Where <i>format_ty</i> pe is one of: 2 – Analog RGB 6 - Analog YPbPr	To set the analog video type: AVST 2 ALLU
BKSV?	Shows value of sink device's BKSV (in hex) when connected to 780C Tx	BKSV?	Not applicable	To read a sink device's BKSV: BKSV? 152BDD2533
BOXG	To enable or disable the moving box on an image.	BOXG <enable></enable>	Where <i>enable</i> is: 0 = disable 1 = enable	To enable the moving box: BOXG 1 ALLU
CECx:PING?	Runs a CEC ping test from: the HDMI Tx (x = 1) or the HDMI Rx (x = 2) port.	CECx:PING <la> <results></results></la>	Where $x = 0$ for the HDMI Rx port and $x = 1$ for the HDMI Tx port. Where <i>LA</i> = the logical address of the device you want to ping.	To ping an HDTV from the 780C HDMI Tx port: CEC1:PING 00 TV (LA=0) found
CSPG	Enable and disable the digital composite sync outputs when digital composite sync is selected via the SSST command.	CSPG <enable> CSPG?</enable>	Where <i>enable</i> is: 0 = disable 1 = enable	To enable digital composite sync: SSST 2 CSPG 1 ALLU
CSPP	Sets or queries the polarity of the composite sync pulse.	CSPP <polarity> CSPP?</polarity>	Where <i>polarity</i> is: 0 = active low (negative going) 1 = active high (positive going)	To set the composite sync pulse to a positive going: CSPP 1 FMTU or ALLU

## Table 12-1: List of Commands (alphabetical) – For Testing HDMI Sink Devices

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			For Testing HDMI Sink Devi	
Command	Description	Syntax	Parameters	Command Example
DACG	Specifies which audio channels are activated (gated on) for LPCM audio.	DACG <mask></mask>	Where <i>mask</i> is an 8 bit value. Each bit corresponds to a channel with the first bit (bit 0) associated with channel 1, bit 1 for channel 2 and so on to bit 7 corresponding to channel 8. The bit position values are:	To enable channel 1 only: DACG 1 ALLU To disable all channels: DACG 0 ALLU
			Bit 0 – Ch 1 = 1 Bit 1 – Ch 2 = 2 Bit 2 – Ch 3 = 4 Bit 3 – Ch 4 = 8	To enable all channels: DACG 255 ALLU
			Bit 4 – Ch 5 = 16 Bit 5 – Ch 6 = 32 Bit 6 – Ch 7 = 64 Bit 7 – Ch 8 = 128	To enable channel 8 only: DACG 128 ALLU
	To enable	To enable channels 1-6: DACG 127 ALLU		
DVSM	Sets or queries the digital video sampling mode. Applies only for HDMI.	DVSM <sampling> DVSM?</sampling>	Where <i>sampling</i> is one of: 0 – RGB (4:4:4) 2 – YCbCr (4:2:2) 4 - YCbCr (4:4:4)	To set the HDMI sampling mode to RGB (4:4:4): DVST 10 DVSM 0 ALLU
DVST	Sets or queries the digital video type. Applies only for HDMI.	DVST <type> DVST?</type>	Where <i>type</i> is one of: 10 – RGB 14 – YCbCr	To set the HDMI sampling mode to YCbCr (4:4:4): DVST 14 DVSM 4 ALLU
DVQM	Sets or queries the digital video quantizing range. Applies only for HDMI.	DVQM <mode> DVQM?</mode>	Where <i>range</i> is one of: 0 – 0-255 (8 bit) 1 – 1-254 (8 bit) 2 – 16-235 (8 bit RGB 16-240 (8 bit YCbCr)	To set the HDMI quantizing range to 0-255: to RGB: DVQM 0 ALLU
EDID?	Shows the EDID (in hex) of the sink device connected to the 780C Tx port.	EDID?	Not applicable	To read a sink device's EDID: EDID? 01FFFFFFF01
FMTL	Loads a format.	FMTL <format></format>	Where <i>format</i> is one of the formats listed in Table 7-2 and Table 7-3	See example below for FMTU
FMTU	Activates a format that has been loaded and queries for the currently active format.	FMTU FMTU?	Not applicable	To load and invoke a format load command: FMTL 1080i60 FMTU

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Command	Description	Syntax	Parameters	Command Example
FRAT?	Queries the frame rate of the outgoing HDMI format.	FRAT?	Not Applicable	To read the frame rate of the outgoing HDMI signal: FRAT? +60.000E+00
HDCP?	Runs an HDCP authentication test on an HDMI sink device	HDCP? <frames></frames>	Number of frames: Where <i>frames</i> is number of frames rounded to the nearest 128 frames. Results: where <i>results</i> are: 0 = pass 1 = fail	To run an HDCP authentication test on an HDMI sink device or repeater device: To run an HDCP test for 128 frames: (pass reported) HDCP? 255 To run an HDCP test for 256 frames: HDCP? 257 0 To run an HDCP test for 512 frames (with a failure reported): HDCP? 1
HPAG?	Query the incoming sink for hot plug pin status.	HPAG? <hotplug></hotplug>	Where <i>hotplug</i> can be 0 (no hot plug detected) or 1 (hot plug detected)	To check for hot plug on the HDMI Out port: HPAG?
HRAT	Sets the horizontal rate of the video timing.	HRAT <rate> HRAT? <rate></rate></rate>	Where <i>rate</i> can be within the range of: 1000Hz to 130000Hz	To set the horizontal rate to 15000Hz: HRAT 15000 ALLU or FMTU
HRES	Sets the horizontal resolution of the video timing.	HRES <pixels> HRES? &lt; pixels &gt;</pixels>	Where <i>pixels</i> can be within the range of: 100 to 4000 pixels	To set the horizontal resolution to 1282 pixels: HRES 1282 ALLU
нтот	Sets the horizontal total number of pixels of the video timing.	HTOT <pixels> HTOT? &lt; pixels &gt;</pixels>	Where <i>pixels</i> can be within the range of: 100 to 4000 pixels	To set the horizontal total to 1376 pixels: HTOT 1376 ALLU or FMTU
HSPP	Sets of the polarity of the horizontal sync pulse.	HSPP <polarity> HSPP? <polarity></polarity></polarity>	Where <i>polarity</i> can be within the range of: 0 = high to low transition 1 = low to high transition	To set the horizontal sync pulse polarity to low to high transition: HSPP 1 ALLU or FMTU
HSPW	Sets the horizontal sync pulse width of the video timing in pixels.	HSPW <pixels> HSPW? &lt; pixels &gt;</pixels>	Where <i>pixels</i> can be within the range of: 1 to HTOT-HRES-HSPD	To set the horizontal sync pulse width to 32 pixels: HSPW 32 ALLU or FMTU

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Table 12-1: List of Commands (alphabetical) – For Testing HDMI Sink Devices				
Command	Description	Syntax	Parameters	Command Example
HSPG	Sets enable gate of the horizontal sync pulse.	HSPG <enable> HSPG? &lt; enable &gt;</enable>	Where <i>enable</i> is: 0 = disable 1 = enable	To enable the horizontal sync pulse: HSPG 1 ALLU or FMTU
IMGL	Loads an image (pattern).	IMGL <image/>	Where <i>image</i> is one of the images listed in Table 7-4	See example below for IMGU
IMGU	Activates an image that has been loaded and queries for the currently active image.	IMGU IMGU?	Not applicable	To load and invoke a image load command: IMGL SMPTEbar IMGU
NBPC	Sets or queries the number of bits per component. Applies only to HDMI	NBPC < <i>bit_depth&gt;</i> NBPC?	Where <i>bit_depth</i> is one of: 8 – 8 bits per component 10 – 10 bit per component 12 – 12 bits per component	To set the HDMI bit depth to 10: NBPC 10 ALLU or FMTU
PRAT?	Queries the pixel rate of the outgoing HDMI format.	PRAT?	Not Applicable	To read the pixel rate of the outgoing HDMI signal: PRAT? +74.2500E+06
RGBW	Sets RGB values on with Raster and Window test patterns	RGBW <pattern> <r> <g> <b> RGBW? <pattern> <r> <g> <b></b></g></r></pattern></b></g></r></pattern>	Where pattern is either 4 for Window pattern or 33 for raster pattern. Where <i>R G B</i> are the respective values for the RGB color components	To set the Window pattern to dark brown: imgl window imgu rgbw 4 115 82 68 or rgbw 4 115 87 74
SCAN	Defines whether the active timing is progressive or interlaced or queries the state of the active timing.	SCAN <scan> SCAN? &lt; scan &gt;</scan>	Where <i>scan</i> is: 1 = progressive 2 = interlaced	To set the scan to interlaced: SCAN 2 ALLU or FMTU
SIRE	Sets IRE levels for certain images: Window1/2, Raster, Flat_Wht/Grn/ Red/Blu/Cyn/Mag/Blk	SIRE <range></range>	Where <i>range</i> is a value from 0 to 100.	To set the IRE range for any of the images listed: SIRE 50 ALLU
SSST	Sets or queries the sync type. Applies only to analog outputs.	SSST <sync_type> SSST?</sync_type>	Where <i>format_ty</i> pe is one of: 1 – separate sync 3 – sync on green	To set the analog sync type to separate sync: SSST 1 ALLU
VRES	Sets or queries the vertical resolution of the active timing. Express in number of lines.	VRES <lines> VRES? &lt; lines &gt;</lines>	Where lines can be within the range of: Min = 1 (if scan = 1) = 2 (if scan = 2) Max = VTOT - 1 (if scan = 1) = VTOT - 3 (if scan = 2)	To set the horizontal resolution: VRES 480 ALLU

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Command	Description	Syntax	Parameters	Command Example
VRAT?	Queries the vertical rate (field rate for interlaced formats) of the outgoing video format.	VRAT?	Not Applicable	To read the vertical rate of the outgoing HDMI signal of 1080i30: VRAT? +60.000E+00
VSPD	Sets or queries the vertical sync pulse delay of the active timing. Express in number of lines.	VSPD <lines> VSPD? &lt; lines &gt;</lines>	Where <i>lines</i> can be within the range of: Min = 1 (if scan = 1) = 2 (if scan = 2) Max = VTOT - 1 (if scan = 1) = VTOT - 3 (if scan = 2)	To set the horizontal sync pulse delay: VSPD 11 ALLU
VSPW	Sets or queries the vertical sync pulse width of the active timing. Express in number of lines.	VSPW <lines> VSPW? &lt; lines &gt;</lines>	Where <i>lines</i> are the number of lines for the vertical pulse width	To set the horizontal sync pulse width: VSPW 3 ALLU
VSPP	Sets the polarity of the vertical sync pulse.	VSPP <polarity> VSPP? <polarity></polarity></polarity>	Where <i>polarity</i> can be one of: 0 = high to low transition 1 = low to high transition	To set the horizontal sync pulse polarity to low to high transition: VSPP 1 ALLU
VSPG	Enables or disables the vertical sync pulse.	VSPG <enable> VSPG? &lt; enable &gt;</enable>	Where <i>enable</i> is: 0 = disable 1 = enable	To enable the vertical sync pulse: VSPG 1 ALLU
VTOT	Sets the vertical total number of lines of the video timing.	VTOT <lines> VTOT? &lt; lines &gt;</lines>	Where <i>lines</i> are the total number of lines.	To set the vertical total to 525 lines: VTOT 525 ALLU
XVSI	Selects the interface.	XVSI <interface> XVSI?</interface>	Where <i>interface</i> is one of: 2 – DVI (Computer) 3 – DVI (TV) 4 - HDMI 9 – Analog YPbPr or RGB)	To set the interface: XVSI 4 ALLU
XVSG	Determines which video components are active when a format is selected.	XVSG <i>R G B</i> FMTU or ALLU XVSG? <i>R G B</i>	Where $R G$ and $B$ are: R = 0 (Off) or 1 (On) G = 0 (Off) or 1 (On) B = 0 (Off) or 1 (On)	To set gate on or off red, green or blue components: XVSG 1 0 1 (Red On; Green Off; Blue On) ALLU

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Command	Description	Syntax	Parameters	Command Example
XAVI	Enables you to send specific parameter values of the AVI infoframes out the HDMI outputs independent of the HDMI video stream parameters.	XAVI:aviparamete Where aviparamete Where aviparamete below and value is CEA-861-E. S – Scan informatio value or retrieves fi B – Bar informatio or retrieves the value A – Active format information value of C – Colorimetry. So retrieves the value Y – Video type. So retrieves the value Q – RGB Quantization range transmitted. YQ – YCC quantiz quantization range R – Active Format aspect ratio value M – Picture Aspect ratio value or retrie EC – Extended Co colorimetry value of SC – Non-uniform uniform picture sca ETB – Line number number start top v transmitted. SBB – Line number number start top v transmitted. SBB – Line number pixel number start value transmitted. SBB – Pixel number pixel number start transmitted. SRB – Pixel number start ter value transmitted. SRB – Pixel number start ter val	er is one of the values identified an associated value provided in on. Sets the scan information the value transmitted. In Sets the bar information value ue transmitted. Information. Sets the active format or retrieves the value transmitted. ets the colorimetry value or transmitted. Its the video type value format or retrieves the value transmitted. Its tatio. Sets the picture aspect eves the value transmitted. Its tatio. Sets the picture aspect eves the value transmitted. Its tatio. Sets the picture aspect eves the value transmitted. Picture Scaling. Sets the non- aling value or retrieves the value. It at start of top bar. Sets the pixel alue or retrieves the value er at start of bottom bar. Sets the pixel alue or retrieves the value er at start of left bar. Sets the pixel alue or retrieves the value fication Code. Retrieves the value fication Code. Retrieves the value on. Sets the pixel repetition value the transmitted. Sets the IT content value or transmitted. In Sets the checksum value or	To set the scan parameter to overscanned: XAVI:S 1 IFGU To set the video type to RGB and aspect ratio to 4.3: XAVI:Y 0; M 1 IFGU To return the value of the video parameter type: XAVI:Y?

#### Table 12-1: List of Commands (alphabetical) – For Testing HDMI Sink Devices

Command	Description	Syntax	Parameters	Command Example
XAUD	Enables you to send specific parameter values of the AUD infoframes out the HDMI output independent of the HDMI audio stream.	XAUD:audparameter <value> Where audparameter is one of the values identified below and value is an allowed value associated with the parameter provided in CEA-861-E. CA – Channel assignment. Sets the channel assignment value or retrieves the value transmitted. CC – Channel count. Sets the channel count value or retrieves the value transmitted. CT – Audio coding type. Sets the audio coding type value or retrieves the value transmitted. SS – Sample size. Sets the sample size value or retrieves the value transmitted. SF – Sampling frequency. Sets the sampling frequency value or retrieves the value transmitted. DMI – Down-mix inhibit. Sets the down-mix inhibit value or retrieves the value transmitted. LSV – Level shift value. Sets the level shift value or retrieves the value transmitted. CSUM – Checksum. Sets or gets the checksum value for the corresponding InfoFrame.</value>		To set the channel count to 3: XAUD:CC 2 IFGU To set the sampling size to 24: XAUD:SS 3 IFGU To return the value of the channel count parameter type: XAUD:CC?
XHVI	Enables you to send specific parameter values of the Vendor Specific infoframe out the HDMI output independent of the HDMI stream.	below and value is a the parameter provi HVF – HDMI Video i.e. 2D; 1 = 4Kx2K; HVIC – HDMI Video VIC for 4Kx2K use. H3DS– HDMI 3D st indication. 3DMG – 3D metada 3DED – 3D Externa LEN – HDMI VSIF I	r is one of the values identified an allowed value associated with ded in CEA-861-E. Format field. Values: 0 = no info, 2 = 3D. b Identification Code (VIC). Sets ructure. Sets the 3D structure at present gate. Indicates ta is present or not present. I data. ength in bytes. Sets or gets the checksum	To enable 3D: XHVI:HVF 2 IFGU To indicate that 3D metadata is present: XHVI:3DMG 2 IFGU To query if 3D metadata is present: XHVI:3DMG?

#### Table 12-1: List of Commands (alphabetical) – For Testing HDMI Sink Devices

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Command	Description	Syntax	Parameters	Command Example
XSPD	Enables you to send specific parameter values of the Source Product Descriptor infoframe out the HDMI output independent of the HDMI stream.	below and <i>value</i> is the parameter prov XSPD [VNS [PDS <i>Where</i> : XSPD – Vendor str PDS – Product des	ter is one of the values identified an allowed value associated with ided in CEA-861-E. [SDI]] ing name.	To assign a vendor string name XSPD QDI HDMI-Analyze: IFGU To query the vendor string name: XSPD?

#### Table 12-1: List of Commands (alphabetical) – For Testing HDMI Sink Devices

Table 12-2 below provides the list of commands supported or testing HDMI sink devices:

Note: The commands are not case sensitive.

Table 12-2: List of Commands (alphabetical) – For Testing HDMI Audio in Sink Devices					
Command	Description	Syntax	Parameters	Command Example	
ARAT	Sets the audio rate on Optical, SPDIF and HDMI LPCM audio.	ARAT rate ARAT? <rate></rate>	Where <i>rate</i> is one of: 32000, 44100, 48000, 88200, 96000, 176400, 192000.	To set the audio sampling rate to 48kHz: ARAT 48000 FMTU	
SAMP	Sets the amplitude on either a specific channel or channels.	SAMP <amp> <ch> SAMP? <amp> <ch></ch></amp></ch></amp>	Where <i>amp</i> is between the range of: min = -99 dB max = 0 dB Where <i>ch</i> is in one of: 0 - 7	To set the amplitude of the audio signal on channel 1 (FR) to -3dB: SAMP -3 1 FMTU To set the amplitude of the audio signal on all channels to -6dB: SAMP -6 FMTU	
SRAT	Sets the sine wave frequency on either a specific channel or all channels.	SRAT <rate> <ch> SRAT? <rate> <ch></ch></rate></ch></rate>	Where <i>rate</i> is between the range of: min = 8Hz max = 20000Hz Where <i>ch</i> is in one of: 0 - 7	To set the sinewave frequency of the audio signal on channel 1 (FL) to 2000 Hz: SRAT 2000 0 FMTU To set the sinewave frequency of the audio signal on all channels to 4000Hz: SRAT 4000 FMTU	

Table 12-2. List of Commands (alphabetical) - For resting fibin Addio in Sink Devices				
Command	Description	Syntax	Parameters	Command Example
NBPA	Sets the number of bits per sample in the SPDIF, Optical and HDMI PCM audio.	NBPA <bits> NBPA? <bits></bits></bits>	Where <i>bits</i> is one of: 16, 20, 24	To set the audio bit depth to 24: NBPA 24 FMTU
NDAC	Sets the number of digital audio channels for an LPCM audio signal.	NDAC <channels> NDAC? <channels></channels></channels>	Where <i>channels</i> is: 2 or 8	To set the number of channels to 8: NDAC 8 FMTU
DASI	Sets the digital audio interface.	DASI <interface> DASI? <interface></interface></interface>	Where <i>interface</i> is one of: 0 = disabled 1 = SPDIF 4 = Optical 6 = HDMI	To set the digital audio interface to HDMI: DASI 6 FMTU

#### Table 12-2: List of Commands (alphabetical) – For Testing HDMI Audio in Sink Devices

Table 12-3 below provides the list of commands supported or testing HDMI source devices:

Table 12-3: List of Commands – For Testing HDMI Source Devices				
Command	Description	Syntax	Command Example	
AKSV?	Shows value of source device's AKSV (in hex) when connected to 780C Rx.	AKSV?	To read a source device's AKSV: AKSV? 152BDD2533	
AUDA	Queries the Audio Clock Regeneration (ACR) N and CTS values received from a source.	AUDA:N? AUDA:CTS?	To view the N value from a source: AUDA:N? 458779	

Command	Description	Syntax	Command Example
AUDA:RPTP?	Queries the audio infoframe and channel status bits and issues a text report.	AUDA:RPTP?	To view the audio infoframe and channel status bits: AUDA:RPTP? Audio InfoFrame data: Channel count: 2 channels Coding type: 0 (Refer to stream header) Word length: Refer to stream header Sampling freq.: Refer to stream header Channel allocation: 
CECx:PING?	Runs a CEC ping test from: the HDMI Tx (x = 1) or the HDMI Rx (x = 2) port.	CECx:PING < <i>LA</i> > < <i>results</i> > Where <i>x</i> = 0 for the HDMI Rx port and <i>x</i> = 1 for the HDMI Tx port. Where <i>LA</i> = the logical address of the device you want to ping.	To ping an HDTV from the 780C HDMI Tx port: CEC1:PING 00 TV (LA=0) found
CPAG	Enables or disables HDCP on the HDMI Rx port.	CPAG < <i>enable</i> > CPAG? Where <i>enable</i> is: 0 = disable 1 = enable	To disable HDCP on the HDMI Rx port: CPAG 0 ALLU
DIDL	Loads an EDID file into memory in preparation to apply it to the Rx port with the DIDU command.	DIDL < <i>file.xml</i> > Where file.xml is an EDID file stored in the 780C memory.	To load an EDID file and apply it to the Rx port: DIDL my720p.xml DIDU

#### Table 12-3: List of Commands – For Testing HDMI Source Devices

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Command	Description	Syntax	Command Example
DIDU	Applies an EDID file loaded with DIDL to the Rx and issues a hot plug pulse. <b>Note</b> : can be used in conjunction with the HPPW command to produce hot plug pulses of varying witdths.	DIDU	To load an EDID file, apply it to the Rx port and issue a hot plug pulse DIDL my720p.xml DIDU
HPPW	Sets the hot plug pulse width.	HPPW <pulse> HPPW? <pulse></pulse></pulse>	Where <i>pulse</i> can be within the range of: 100 to 4000 milliseconds
IFAU	Reads infoframes.	IFAU	Not applicable
IFAD?	Displays the contents of a specific type of infoframe.	IFAU IFAD? <infoframe packet=""></infoframe>	Where <i>infoframe packet</i> is the header number assigned to the infoframe type in the HDMI specification: - VSIF = 81 - AVI = 82 - SPD = 83 - AUD = 84 - MPEG = 85
TMAU	Invokes timing analyzer.	TMAU	To initiate a timing test: TMAU <b>Note</b> : Then use one or more of the TMAX commands below.
TMAX:HTOT?	Reads horizontal total pixels.	TMAX:HTOT?	To read horizontal total pixels: TMAX:HTOT?
TMAX:HRES?	Reads horizontal active pixels.	TMAX:HRES?	To read horizontal active pixels: TMAX:HRES?
TMAX:HSPD?	Reads horizontal sync pulse delay	TMAX:HSPD?	To read horizontal sync pulse delay: TMAX:HSPD?
TMAX:HSPW?	Reads horizontal sync pulse width	TMAX:HSPW?	To read horizontal sync pulse width: TMAX:HSPW?
TMAX:VTOT?	Reads vertical total pixels (lines)	TMAX:VTOT?	read vertical total pixels (lines): TMAX:VTOT?
TMAX:VRES?	Reads vertical active pixels (lines)	TMAX:VRES?	To read vertical active pixels (lines): TMAX:VRES?
TMAX:VSPD?	Reads vertical sync pulse delay	TMAX:VSPD?	To read vertical sync pulse delay: TMAX:VSPD?

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Table 12-4: List of Commands – For Testing HDMI Cables and Distribution Networks				
Command	Description	Syntax	Command Example	
CBLT?	Cable Test. Runs pseudo random noise error test on the TMDS R,G,B channels of an HDMI cable.	CBLT? < <i>x</i> errors> Where <i>x</i> errors is the number of errors detected on R, G and B channels.	To run a pseudo random noise error test on the TMDS R,G,B channels of an HDMI cable: CBLT? 0 errors	
CBL2?	Runs continuity test on +5V, Hot Plug and DDC leads in an HDMI cable.	CBL2? <+5v results> >Hot Plug results> <ddc results=""> Where +5V results, hot plug results and DDC results indicate Pass or Fail for each lead or lead pair.</ddc>	To run a cable test on the +5V, DDC and hot plug leads: CBL2? +5v: PASS Hot Plug: PASS DDC: PASS	

Table 12-4 below provides the list of commands supported for testing HDMI source devices:

Table 11-5 below provides the list of commands supported for running the Frame Compare test:

Command	Description	Syntax	Command Example
PDAX:CAPF	Initiates the capture of a reference frame for the Frame Compare test.	PDAX:CAPF	To capture a reference frame: PDAX:CAPF
PDAX:FRMS	Specifies the number of frames to capture during the Frame Compare test.	PDAX:FRMS <frames> Where frames are the number of frames that you want to capture and compare to the reference frame. Valid values are 0-250. Default value is 10. You can query the current value with: PDAX:FRMS?</frames>	To specify that 100 incoming frames will be used to compare with the reference frame: PDAX:FRMS 100
PDAX:REFG	Enables or disables auto reference capturing for the Frame Compare test. If this parameter is disabled you have to manually capture a reference frame.	PDAX: REFG < <i>enable</i> > Where <i>enable</i> is either 0 to disable or 1 to enable auto reference capturing. Default value is o to disable. You can query the current value with: PDAX: REFG?	To enable auto reference capturing: PDAX: REFG 1

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<b>3</b>				
Command	Description	Syntax	Command Example	
PDAU	Initiates the capture of the number of frames specified by the PDAX:FRMS command and compares those frames with the captured reference frame.	PDAU	To capture a reference frame and compare 100 of incoming frames to the reference frame: PDAX:CAPF PDAX:FRMS 100 PDAU	
PDAX:ERRQ?	Returns the number of pixel errors that occurred during the comparison.	PDAX:ERRQ?	To query for the number of errors following the pixel error comparison (PDAU): PDAX:ERRQ?	

#### Table 12-5: List of Commands – For Testing Distribution Networks with the Frame Compare Test

Table 12-6 below lists the format names, their resolutions and frame rates for television formats. For command line control you would use the format name as the argument for the FMTL command.

## Table 12-6: List of HDTV Format Names for Command Line Applies to: HDMI, DVI (TV), Analog YPbPr Video Signal Types

Syntax for Format Name	Resolution	Frame Rates (Hz)	Command example	
480i[frame rate] e.g.: 480i29	H: 720; V: 480	29.97, 30, 59.94, 60, 119.88, 120	FMTL 480i60 FMTU	
480p[frameRate] e.g.: 480p59	H: 720; V: 480	59.94, 60, 119.88, 120	FMTL 480p60 FMTU	
576i[frame rate] e.g.: 576i25	H: 720; V: 576	25, 50, 100	FMTL 576i25 FMTL	
576p[frameRate] e.g.: 576p50	H: 720; V: 576	50, 100	FMTL 576p50 FMTU	
720p[frameRate] e.g.: 720p25	H: 1280; V: 720	24, 25, 29.97, 30, 59.94, 60, 100, 119.88, 120	FMTL 720p60 FMTU	
1080i[frameRate] e.g.: 1080i25	H: 1920; V: 1080	25, 29.97, 30, 50, 59.94, 60	FMTL 1080i59 FMTU	
1080p[frameRate] e.g.: 1080p30	H: 1920; V: 1080	25, 29.97, 30, 50, 59.94, 60	FMTL 1080p60 FMTU	

Table 12-7 lists some of the format names for computer formats. For command line control you would use the format name as the argument for the FMTL command as shown in the example

**Note:** The following table *only shows a sample of some of the more common formats*. The other names can be obtained from the list on the 780C itself.

Table 12-7: Partial List of Computer Format Names for Command Line         Applies to: DVI (Computer) Analog RGB Video Signal Types		
Format Name	Command example	
640x480_72Hz	FMTL 640x480_72Hz FMTU	
800x600_56Hz	FMTL 800x600_56Hz FMTU	
1024x768_60Hz	FMTL 1024x768_60Hz FMTU	
1280x768_60Hz	FMTL 1280x768_60Hz FMTU	
1280x1024_60Hz	FMTL 1280x1024_60Hz FMTU	
1600x1024_60Hz	FMTL 1600x1024_60Hz FMTU	
1920x1440_60Hz	FMTL 1920x1440_60Hz FMTU	

Table 12-8 below lists the image names. For command line control you would use the image name as the argument for the IMGU command.

Table 12-8: List of Image parameter names for command line					
Image Name	Example	Image Name	Example	Image Name	Example
SMPTEBar	IMGL SMPTEBar IMGU	Regulate	IMGL Regulate IMGU	Flat_Yel	IMGL Flat_Yel IMGU
H_Stair (Horizontal)	IMGL H_Stair IMGU	Checker (6x6)	IMGL Checker IMGU	Flat_Blk	IMGL Flat_Blk IMGU
Pluge	IMGL Pluge IMGU	Focus	IMGL Focus IMGU	Crosshtch (Grid)	IMGL Crosshtch IMGU
Needle	IMGL Needle IMGU	Multibrst	IMGL Multibrst IMGU	Anmorphic	IMGL Anmorphic IMGU
HiLoTrk (White Pluge)	IMGL HiLoTrk IMGU	SplitGray (11 vertical bars)	IMGL SplitGray IMGU	GrayBar	IMGL GrayBar IMGU
Overscan	IMGL Overscan IMGU	LG_V_CBAR (Vertical bars)	IMGL LG_V_CBAR IMGU	Staircase	IMGL Staircase IMGU
Window1 (30 IRE)	IMGL Window1 IMGU	LG_H_CBAR (Horiz bars)	IMGL LG_H_CBAR IMGU	PulseBar	IMGL PulseBar IMGU
Window2 (80 IRE)	IMGL Window2 IMGU	V_3BARS (UL 3 bar pattern)	IMGL V_3BARS IMGU	Rev_Grid	IMGL Rev_Grid IMGU

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Table 12-8: List of Image parameter names for command line					
Image Name	Example	Image Name	Example	Image Name	Example
Raster	IMGL Raster IMGU	Flat_Wht	IMGL Flat_Wht IMGU	Linearity	IMGL Linearity IMGU
DecodAdj (Color Adjust)	IMGL DecodAdj IMGU	Flat_Red	IMGL Flat_Red IMGU	PRN24Bit (pseudo noise)	IMGL PRN24Bit IMGU
DecodChk (Color Decode)	IMGL DecodChk IMGU	Flat_Grn	IMGL Flat_Grn IMGU	ZonePlate (Moving zone plate)	IMGL ZonePlate IMGU
ColorBar (75 IRE)	IMGL ColorBar IMGU	Flat_Blu	IMGL Flat_Blu IMGU	User00/24 (User bitmaps)	IMGL User01 IMGU
Ramp	IMGL Ramp IMGU	Flat_Cyn	IMGL Flat_Cyn IMGU	Aux Combo Test	IMGL AuxTest IMGU
Converge	IMGL Converge IMGU	Flat_Mag	IMGL Flat_Mag IMGU		

# 13 Using the Keypad

This section provides information and procedures for operating the 780C with a keypad. The 780C can support keypad operation to enable efficient production test operation. An RS-232 numeric keypad is used for this application. Supported keypad functions include selection of interface, timing, pattern, and test sequences.

# 13.1 Connecting a Keypad

A serial terminal keypad can be connected to the 780C front edge RS-232 connector.



## 13.2 Enabling and Configuring an RS-232 Keypad

The RS-232 keypad must be enabled and configured from the 780C **Preferences** menu. Use the following procedures to enable a keypad.

1. From the 780C **Home** menu, select the **Preferences** tab. The **Preferences** menu will be displayed as shown below.

Preferences	3				Home	Preferences Help
	Audible	e Touch Feedback	Off On			
		Screen Brightness	Min 25%	50% <mark>75%</mark>	Max	
		USB Mode	COM Disk			
		Startup Mode	Default	Custom Menu		
		Custom Menu	Enter		More	
HDMI/DVI: No signal	No TMDS clock	Cannot be analyzed	Not capable of HDMI 3D		Not capable of HDCP	No +5V detected
Interface: HDBaseT (8 bpc RGB)	Format: 720x480 60Hz	Pattern: Color Bars	3D: Disabled	Audio (HDMI): LPCM 2.0ch 48kHz	Enable HDCP	NO HDCP

2. Navigate to the second page using the More button.

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K	Preterences	(Page 2)				Home	Preferences Help
		AV Mute	Hot Plug Formats on Format Change	Off On Off On			
			RS-232 Baud Rate -232 Keypad Mode	< 115200			
		Bac					
I N	HDMI/DVI: No signal	No TMDS clock	Cannot be analyzed	Not capable of HDMI 3D	No GCP packets received	Not capable of HDCP	No +5V detected
0 U T	Interface: HDMI (8 bpc RGB)	Format: 3840x2160 30Hz	Pattern: Color Bars	3D: Disabled	Audio (HDMI): LPCM 2.0ch 48kHz	Enable HDCP	AVMUTEOFF (2) 04:18 NO HDCP 12-0 HPD FAIL (X) (2)

3. For the RS-232 Keypad Mode menu item, select the ON button.

When selected, the ON button will be highlighted green.

4. Under RS-232 Baud Rate, use the arrow keys to select the correct baud rate for the keypad to be used. For the Genovation keypad supplied by Quantum Data, choose 1200 baud. After selecting the correct baud rate, power-cycle the 780C so that the changes take effect.

## **13.3** Keypad Functionality

For keypad support, the 780C uses four configuration files stored in the root directory of the internal flash. Here are the names and functions of the four files:

- UserKeys.txt: This file provides mappings of key codes so that the 780C knows which key has been
  pressed. This file may be different for each model of keypad that is used. This file should be configured by
  Quantum Data Engineering, and should not be changed by the customer unless you wish to create a
  specific test sequence. Procedures for creating a test sequence in the UserKeys.txt file are provided further
  below. Please contact Quantum Data Applications Engineering if you need this file changed, or if you want
  to use a different model of keypad.
- fmtmap.txt: This file provides mapping of format numbers to specific formats on specific interfaces. Each
  interface has a range of format numbers associated with it, and these ranges are specified in file intmap.txt.
  An example of the mapping for this file is depicted in Table 13-2.
- intmap.txt: This file specifies the ranges of format numbers assigned to each video interface. An example
  of the mapping for this file is depicted in Table 13-3.
- **imgmap.txt:** This file provides a mapping of test pattern numbers to the actual test patterns. An example of the mapping for this file is depicted in Table 13-4.

Table 13-1 – Keypad Functions		
Кеу	Function	
Num Lock	Timing - Select a format	
1	Pattern - Select an image	
*	Program – Create a sequence	
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Keypad functions are assigned as shown in Table 13-1 below:

. or Del	Out or End
-	Go to Previous item
+	Go to Next item

## **13.4** Selecting a Format (Timing)

A format can be selected by pressing the TIMING key followed by the number that represents the desired timing and interface. The following is an example of how you would select a format using the Format Map file shown in Table 13-2 below. Table 13-3 further below shows a sample mapping between formats (timings) and interfaces.

TIMING

352

ENTER

This will change the timing format to 1080p60 on the HDMI interface. Then the "Previous" and "Next" keys can be pressed to sequence through the format list. The following table is an example of a map between formats and keypad numbers that you would select.

Table 13-2 – Example Forma		
Format Number	Format Name	Interface-Specific
301	NTSC44	
302	NTSC-J	
303	NTSC-M	
304	PAL-BDGH	
305	PAL-N	TV
306	PAL-NC	
307	PAL-M	
308	PAL-60	
310	480i30	
311	576i25	
312	480p59	
313	576p50	
314	720p60	
315	720p59	
316	720p50	
317	1035i30	
318	1035i24	BNC
319	1152i25	(YPbPr)
320	1080i25	
321	1080i24	
322	1080i29	
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323	1080i30	
324	1080p24	
325	1080p24	
326	1080p25	
327	1080p29	
328	1080p30	
329	1080p50	BNC (YPbPr)
330	1080p59	
331	1080p60	
332	480i24	
333	480p60	
334	1080i30	DVI
335	720p60	5.1
336	1080p59	
341	480i24	
342	480i24	
343	576i25	
344	480p60	
345	480p59	
346	576p50	
347	720p60	
348	720p50	
349	1080i30	
350	1080i25	HDMI
351	1080p50	
352	1080p60	
353	DMT0659	
354	DMT0860	
355	DMT1060	
368	1080p59	
370	720p59	
371	1080p50	
372	1080i25	
373	1080i24	
374	576i25	

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375	480i30	
396	720p59	
397	DMT0660	
398	480p60	

Table 13-3 – Format Range per Interface Map		
Interface Number	Interface Name	
301 - 309	TV	
310 - 331	BNC + S-Video + CVBS (ED/HD)	
332 - 336	DVI	
341 - 398	HDMI	
400 - 499	VGA(HD15) Analog RGB	
500 - 599	VGA(HD15) Analog YPbPr	

## 13.5 Selecting a Test Pattern (Image)

A test pattern (image) can be selected by pressing the PATTERN key followed by the number that represents the desired pattern. The following is an example of how you would select a test pattern using the Image Map file shown in Table 13-4 below.

PATTERN 001 ENTER

This will display the SMPTEBar pattern at the current format and on the current interface. Then the "Previous" and "Next" keys can be pressed to sequence through the pattern list.

Table 13-4 – Example Image Map File		
Image Number	Image Name	
001	SmpteBar	
002	TVBar100	
003	TVBar_75	
004	H_Stair	
005	Pluge	
100	Ramp	
101	SplitGray	
200	LG_V_CBAR	
300	EcoFlower	
301	Halation	
302	Loading	
400	Flat	

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401	Flat93
402	Flat87
403	Flat80
404	Flat73
405	Flat67
406	Flat60
407	Flat53
500	PRN24Bit

# **13.6** Programming a Test Sequence using the keypad

You can create and run test sequences in one of two ways.

- You can program a test sequence through the keypad using the procedures below.
- You can create a sequence by adding a set of commands to the UserKeys.txt file using the procedures below.

Keypad functions are assigned as shown in Table 13-5 below:

Table 13-5 – Keypad Functions		
Кеу	Function	
Num Lock	TIMING - Select a format	
1	PATTERN - Select an image	
*	Program PROG – Create a sequence	
. or Del	OUT or END	
-	Go to Previous item	
+	Go to NEXT item	

#### 1. Define a sequence as follows:

**Note**: Information after "//" are comments to help you understand.

OUT	// press the OUT key to start the creation of the sequence
001	// enter the sequence number
PROG	// press the PROG key to begin programming
TIMING	
344	// 480p60 HDMI
PATTERN	
001	// SmpteBar pattern
NEXT	
TIMING	
347	// 720p60 HDMI
PATTERN	
004	// horizontal stair
NEXT	
TIMING	

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```
352 // 1080p60 HDMI
PATTERN
100 // ramp
END // press the END key to halt the of sequence programming
2 Play back a pergraphic of follows
```

#### 2. Play back a sequence as follows.

```
OUT
001
NEXT
NEXT
(repeat NEXT or PREVIOUS)
```

#### 13.7 Programming a Test Sequence in the UserKeys file

You can also create a test sequence by including a set of commands in the UserKeys.txt file. The UserKeys.txt file is primarily used internally for mapping the keypad keys to a set of commands for general keypad use. However you can also use the UserKeys.txt file to store programming test sequences similar to macros.

The following is an example of a UserKeys.txt file which shows the keypad mapping and more importantly a test sequence instruction set (#F0, #F1 and #FF). Note that there are two macro test sequences defined #F0 and #F1. The #FF definition is a macro that simply disables manufacturing mode in the 804 test instrument. The #F0 macro also shows a special use case for the kbrd command. In this case the kbrd f0 command will cause the macro to loop back on itself such that the #F0 macro continuously loops.

**Note**: Do not change any of the keypad mapping commands. These are the commands such as xkpm, xkpkj, xkpu, xkpi. Modifying these commands will affect the general functions of the keypad.

S	xkpm	2
Т	xkpm	1
U	xkpm	4
V	xkpj	1
W	xkpj	-1
Х	xkpu	
Y	xkpi	1
Ζ	xkpi	2
[	xkpi	3
$\langle \cdot \rangle$	xkpi	4
]	xkpi	5
^	xkpi	6
_	xkpi	
•	xkpi	8
а	xkpi	9
b	xkpi	0
С	xkpm	3
h_ 10 50 #F 50	stair 80p60 00;kk 1 xvs	<pre>si 4;fmtl 720p60;imgl smptebar;fmtu;dlay 5000;fmtl 480p60;imgl c;fmtu;dlay 5000;fmtl 1080i30;imgl needle;fmtu;dlay 5000;fmtl 0;imgl decodchk;fmtu;dlay 5000;fmtl 480i30;imgl v_3bars;fmtu;dlay ord f0 si 4;fmtl cvt1460d;imgl checkby6;fmtu;dlay 5000;fmtl dmt1170_;fmtu;dlay ntl dmt0660;fmtu;dlay 5000 gm 0</pre>

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To run a test sequence macro stored in the UserKeys.txt file you use the kbrd command on the command line as follows.

KBRD F0 // This command would run the F0 macro in the UserKeys.txt file (case is not important)

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# 14 Upgrading the 780C

## 14.1 Upgrading the Firmware and Gateware on your 780C Handheld Test Instrument for HDMI

You can upgrade the firmware and gateware on your 780C through the USB interface. In order to upgrade the 780C firmware and gateware you have to put the 780C in the "Disk" mode. This is not the default mode.

**Important Note**: Be sure to check the Release Notes on the Quantum Data website for additional information on upgrading for a particular release. The instructions below may not apply in all upgrade scenarios. If you have any questions or encounter a problem with the upgrade, contact Quantum Data customer support.

Use the following procedure to upgrade the firmware and gateware for your 780C. Note that the files will also come with a bootstrp.bin file.

- 1. Download the 780C firmware and gateware (if necessary) files from the Quantum Data website <u>http://www.quantumdata.com/downloads/index.asp</u> to your PC and unzip the file.
- 2. Connect the 780C to a PC host via the USB cable provided.
- 3. Touch select the **Preferences** from the 780C top menu.
- 4. Choose Disk for the USB Mode (refer to the screen below).

Preferences	Home	Preferences	Help
Audible Touch Feedback	Off On		
Screen Brightness	Min 25% 50%	75% Max	
USB Mode			
Startup Mode	Default Cus	tom Menu	
Custom Menu	Enter	Mc	ore

5. Power cycle the 780C.

The 780C appears as a mass storage device like any other USB drive.

- 6. Transfer the bootstrp.bin from your PC to the 780C using standard Windows drag and drop techniques.
- 7. Transfer the new firmware (VP500app.bin) from your PC to the 780C using standard Windows drag and drop techniques.
- 8. (if necessary) Transfer the new gateware file (for 780: Xilinx.bin; for 780C: 780afpga.bin ) from your PC to the 780C using standard Windows drag and drop techniques.
- 9. Use Windows Eject function on the 780C USB device then physically disconnect the 780C from your PC.
- 10. Reboot the 780C.
- 11. Navigate to the Help window.

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elp	Home	Preferences	Help
USB Storage Flash	Erase		
Application Flash	Update		
FPGA Flash	Update		
Touchscreen	Calibrate		
	SW Ver. 11062955		

12. Activate the gateware (if you are updating the FPGA Flash) by touching the associated Update button.

A confirmation prompt is displayed. Touch select **Confirm** to initiate the firmware upgrade. (**Note**: The screen on your unit may appear slightly different.)

- Help	Home	Preferences	Help
USB Storage Flash	Erase		
Application Flash	Update		
FPGA Flash	Update	Confirm	•
	SW Ver. 10112413 PGA Ver. 10081601		

FPGA Ver. 10081601

The screen will show several messsages indicating the progress of the update. Once the gateware update has completed the following screen appears.

Help	Home	Preferences	Help
USB Storage Flash	Erase		
Application Flash	Update		
FPGA Flash	Update	Xilinx Update	əd
Pleas	se reboot the unit no	w.	

- 13. Reboot the 780C by power cycling.
- 14. Navigate back to the **Help** menu to access the upgrade screen.
- 15. Activate the firmware (Application Flash) by touch selecting the associated Update button.

A confirmation prompt is displayed as shown below. Touch select **Confirm** to initiate the firmware upgrade.

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Help	Home	Preferences	Help
USB Storage Flash	Erase		
Application Flash	Update	Confirm	n
FPGA Flash	Update		
	SW Ver. 10112413 PGA Ver. 10081601		

The screen will show several messsages indicating the progress of the update. Once the firmware update has completed the following screen appears.

- Help	Home	Preferences	Help
USB Storage Flash	Erase		
Application Flash	Update		
FPGA Flash	Update	Updated	
Please reboot the unit no	ow		
	Version 09041234 PGA Ver. 09042345		

- 16. Reboot the 780C by power cycling.
- 17. Touch select the **Preferences** from the 780C top menu.
- 18. Choose **COM** for the **USB Mode** (refer to the screen below).

Preferences	Home	Preferences	Help
Audible Touch Feedback	Off On		
Screen Brightness	Min 25% 50	% 75% Max	
USB Mode	COM Disk		
Hot Plug Formats	Off		

- 19. Power cycle the 780C.
- 20. Navigate back to the Help menu to verify the upgraded versions.

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