780 Handheld Test Instrument

for HDMI

User Guide

Rev: A2

1 Overview of the 780 Handheld Test Instrument

This section provides an overview of the 780 Handheld Test Instrument.

1.1 Introducing the 780 Handheld Test Instrument

The 780 Handheld Test Instrument is a battery-powered, portable multimedia pattern generator that enables you to conduct quick, on-site verification testing of your HDMI system and analog video displays. The 780 is equipped with both a reference source and a reference sink HDMI interface allowing you to test audio, video and protocols—HDCP, EDID, CEC & infoframes—of any type of HDMI device: sources, repeaters and sinks. Its portability makes it ideal for your bench and for use in the field. A color touch display makes the 780 easy and convenient to use. Because the 780 has both an HDMI output and an HDMI input, you can test your HDMI cables and systems with splitters, extenders and switches as well with the optional pixel error rate test feature.

1.2 Overview of 780 features

The 780 Handheld Test Instrument for HDMI provides a rich set of features. The following is a list of key features and benefits.

- Pattern testing for HDTVs - Enables you to conduct pattern testing for an HDTV through the HDMI and analog component outputs. Provides dozens of patterns with variation options on most.
- Custom bitmaps and pattern scrolling – The 780 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.
- Audio testing for AVRs and HDTVs – The 780 provides multi-channel digital audio test patterns through the HDMI, 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.
- HDCP test of an HDMI sink or input to a repeater device – The 780 enables you to run an HDCP functional test on an HDMI sink device directly or through a repeater device.
- EDID test of an HDMI HDTV or input to a repeater device – The 780 enables you to run an EDID functional test on an HDMI sink device directly or through a repeater device.
- Video test of an HDMI source device – The 780 provides an HDMI input for testing HDMI 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.
- Audio test of an HDMI source device – The 780 provides an HDMI input for testing HDMI source devices. You can run a verification test of an audio source which includes audio infoframes and audio sample packet headers including parsing out of the channel status bits.
- EDID test of an HDMI source device – The 780's HDMI input 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.
- HDMI cable & network test (optional) – Because the 780 has both an HDMI input and an HDMI output, you can loop a cable or entire HDMI network comprised of splitters, extenders, repeaters, switches, etc. from the 780's output to input and run a pseudo-random noise pattern test to determine pixel errors.
- Command line interface for automated testing.

1.3 What is in the 780 shipping box

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

Table 1-1: 780 Shipping Box Contents

Item Description	Part No.
780 Handheld Test Instrument for HDMI.	00-00220
12V DC (1.5 amp) Power Supply / Adapter / Charger	25-00094
Line cord for 12V Power Supply	30A00400A03
HDMI-to-HDMI Type A cable.	30-00146
Three (3) foot VGA to (3) RCA adaptor cable.	99-00503
Six (6) foot USB cable.	30-00163
Quick Start Guide.	68-00217

2 Physical Interfaces of the 780 Handheld Test Instrument for HDMI

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

2.1 Video Interfaces

The following table describes the video interfaces on the 780 test instrument, these interfaces are used to render test patterns for testing consumer electronic HDTVs and computer displays.

Table 2-1: 780 Video Interfaces

Video Interface	Description
HDMI (1) Output Type A	Single link HDMI output connector. Supports HDMI 1.3: ▪ Bit Depth: 24/30/36 bit. ▪ Colorimetry: RGB, YCbCr. ▪ Sampling: 4:4:4 and 4:2:2. ▪ Pixel rate: Timings up to 1080p60. ▪ DVI support through HDMI to DVI adapter cable (RGB, 4:4:4, 24 bit). ▪ Audio: LPCM, Dolby Digital and DTS (more details below).
Analog Output – Component and VGA (HD15F)	▪ Bit Depth: 24 bit color depth. ▪ Colorimetry: RGB, YPbPr. ▪ Pixel rate: 80MHz. ▪ Sync types: separate and composite.
HDMI (1) Input Type A (Optional Feature Package)	Single link HDMI input connector. Supports HDMI 1.3: ▪ Colorimetry: RGB, YCbCr. ▪ Sampling: 4:4:4 and 4:2:2. ▪ Pixel rate: Timings up to 1080p60.

2.2 Audio interfaces

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

Table 2-2: 780 Audio Interfaces

Interface	Description
HDMI (1) Output Type A	Single link HDMI output connector. Supports HDMI 1.3: ▪ Channels: 8. ▪ Bits per sample: 16, 20, 24. ▪ Sampling rates (kHz): 32.0, 44.1, 48.0, 88.2, 96.0, 176.4, 192.0. ▪ Formats: LPCM, Dolby Digital (clips), DTS (clips)
SPDIF - RCA	SPDIF RCA audio connector: ▪ Channels: 7 (clips) ▪ Bits per sample: 16, 20, 24. ▪ Sampling rates (kHz): 32.0, 44.1, 48.0, 96.0 ▪ Formats: LPCM, Dolby Digital (clips), DTS (clips)
Optical – JIS FOS	Optical audio connector: ▪ Channels: 7 (clips) ▪ Bits per sample: 16, 20, 24. ▪ Sampling rates (kHz): 32.0, 44.1, 48.0 ▪ Formats: LPCM, Dolby Digital (clips), DTS (clips)

2.3 Administrative Interface

The following table describes the administrative interface on the 780 test instrument. 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 basic commands to set the interface, select formats and patterns. This feature will be available in a future release.
- Disk - Mass Storage Mode. Used for downloading bitmaps, audio clips and upgrading firmware or gateware.

3 General Operation

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

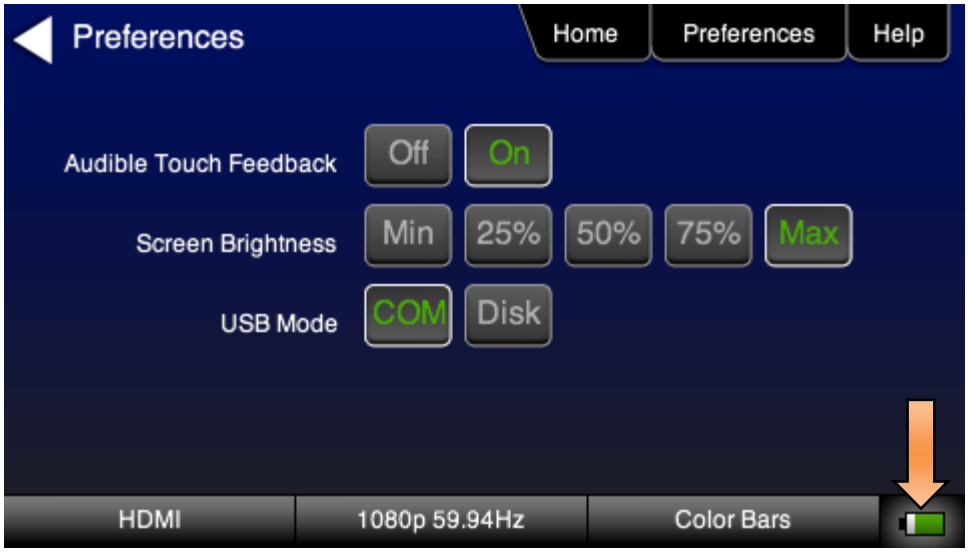
3.1 Power Considerations

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

The 780 is a portable battery powered test instrument. It is equipped with nickel metal hydride batteries. Typically, you can use the 780 on batteries for about 4 hours. It requires an overnight charge. Quantum Data recommends that you set the screen brightness to the minimum level required. Turn the unit off if you are not going to be using it for extended periods.

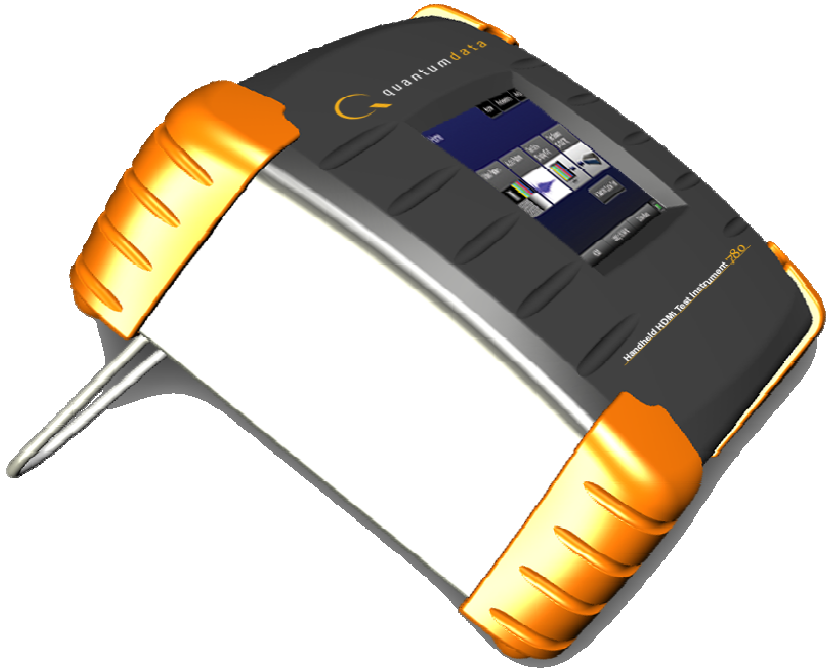
The 780 is supplied with the Part No 25-00094 12V DC power supply and charger as well as a part number 30A00400A03 line cord.

Important Note: Monitor the battery meter on the lower right. Do not continue using the 780 from battery power when the battery meter indicates that the batteries are exhausted. When you see a thin green line at the right most portion of the battery icon, turn the power off and switch to line power using the AC Charger adapter; then reapply power.



3.2 Tilt Bail

The 780 has support bail for convenience in viewing. This is depicted in the illustration below.



3.3 Navigating through the 780 User Interface

The 780 user interface is a color touch screen display 480 by 272. 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.

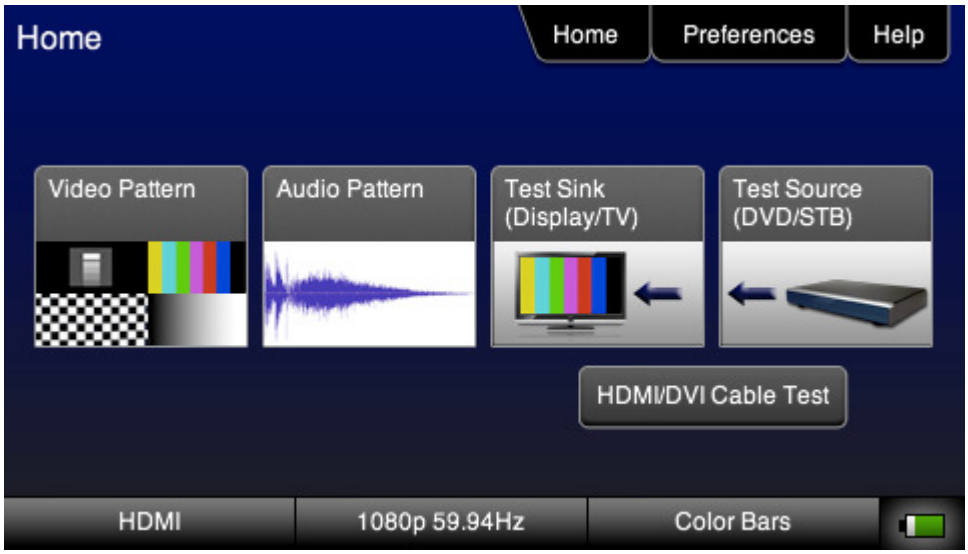


Table 3-1 below shows functions available in the top level menu.

Table 3-1: Top Level Menu

Item	Submenu - Pattern	Third Level Menu	Value
Top Menu Bar	Home	See Below	N/A
	Preferences	Audible Touch	▪ Off ▪ On
		Screen Brightness	▪ Min ▪ 25% ▪ 50% ▪ 75% ▪ Max
		USB Mode	▪ COM ▪ Disk
	Help	Upgrades	▪ Application Flash ▪ FPGA Flash
Function Buttons	Video Patterns	See below: Rendering Test Patterns on an HDTV	
	Audio Patterns	See below: Testing Digital Audio of an HDMI Sink Device	
	Test Sink (Display/TV)	See below: Using the 780 Test Instrument to Test HDMI Sink Devices	
	Test Source (DVD/STB)	See below: Using the 780 Test Instrument to Test HDMI Source Devices	
Bottom Status Buttons	Signal Type	See below: Selecting a Signal Type and Resolution	
	Resolution	See below: Selecting a Signal Type and Resolution	
	Video Pattern	See below: Rendering Test Patterns on an HDTV	
	Battery Icon	See: Power Considerations	

4 Using the 780 Test Instrument to Test Sink Devices

This section provides procedures for testing high definition equipment sink devices such as HDTVs and projectors. The following signal types are supported.

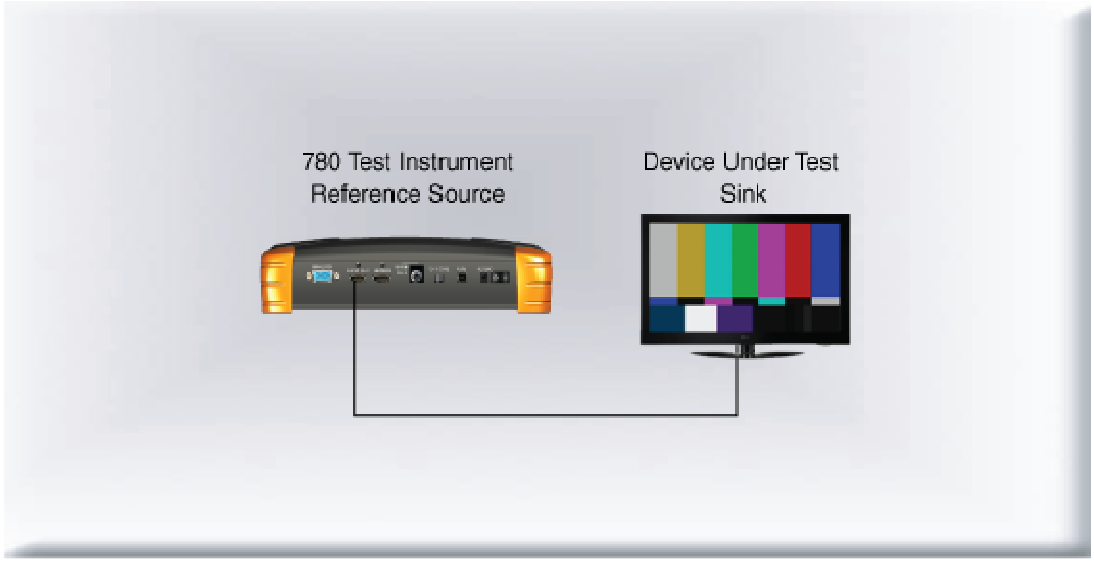
- HDMI (via the HDMI physical connector)
- DVI (via the HDMI physical connector)
- YPbPr Component analog (via the HD VGA connector)
- RGB Analog (via the HD VGA connector).

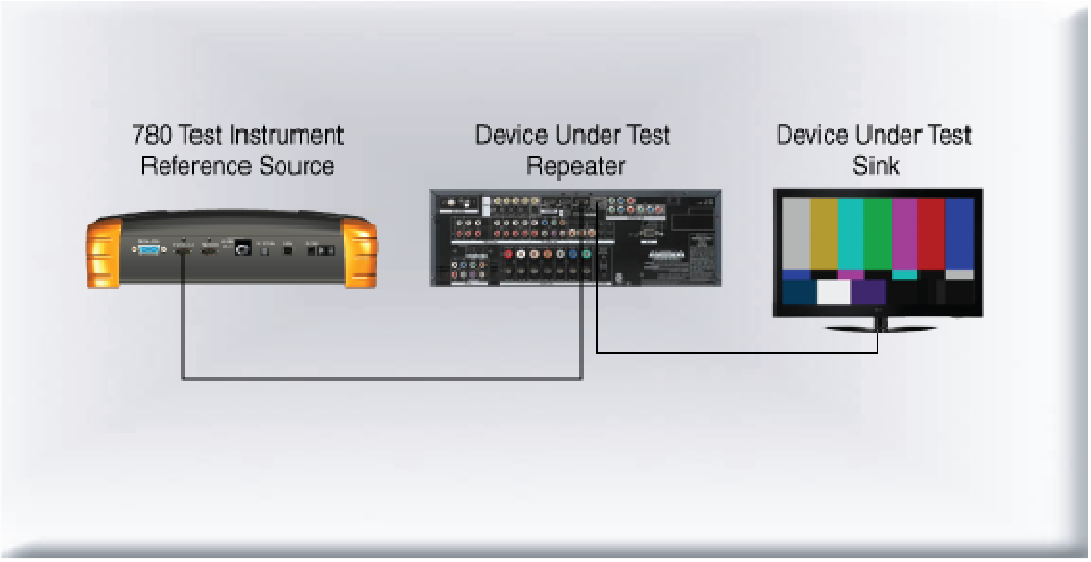
4.1 Selecting a Signal Type and Resolution

The first step in testing a sink device is to select the signal type of the sink device under test.

4.1.1 Configurations for Testing a Display Device

The following illustrations depict the typical test configurations.





4.1.2 Procedures for Selecting a Signal Type and Resolution

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

1. Power up the 780 using the rocker switch on the back panel. Review the guidelines for battery usage at: Power Considerations.

2. Make the cable connection between the appropriate output connector on the 780 and the input connector of the HDTV using the cables supplied. Refer to the figure above.

   Alternatively you may connect from the 780 to an HDTV through an HDMI repeater device. In this case make the HDMI connection between the HDMI output connector on the 780 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. Refer to the figure above.

3. Touch select the **Signal Type** activation button on the panel on the left (see screen example below).

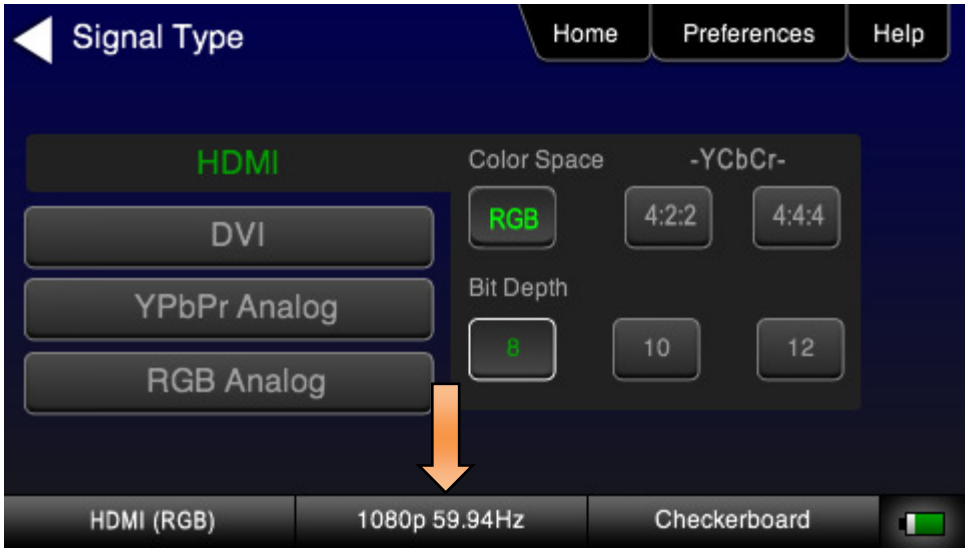
4. Touch select the desired signal type using the associated activation button.

5. 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 via HDMI to HDMI cable (provided)	Color Space	▪ YCbCr ▪ YCbCr 4:2:2 ▪ RGB
		Bit Depth	▪ 8 ▪ 10 ▪ 12
DVI	HDMI via HDMI to DVI cable (not provided)	Format Type	▪ TV ▪ Computer
YPbPr Analog	HD-15 (VGA) via HD to 3-RCA cable (provided)	Sync Type	▪ Sep[arate] Sync ▪ Sync on Green
RGB Analog	HD-15 (VGA)) via VGA cable (not provided)	Format Type	▪ TV ▪ Computer
		Sync Type	▪ Sep[arate] Sync ▪ Sync on Green

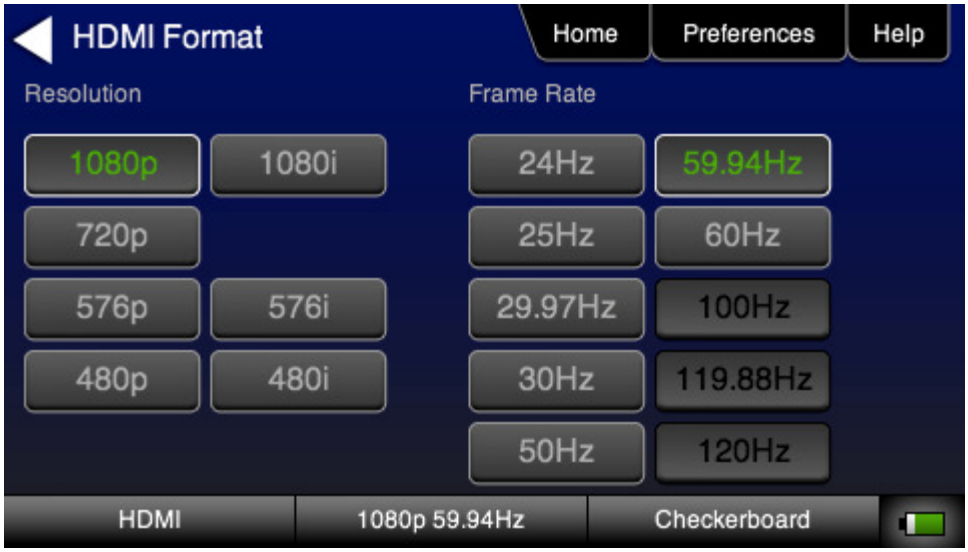
6. Touch select the resolution and frame rate (middle button on the bottom panel). Refer to the figure below.



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 **white** 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 Resolution with **green** lettering and with **white outline** – The Resolution that is currently selected.
- 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.
- A Frame Rate with **black** lettering but with **no outline** – The Frame Rate is not supported by the standard.

Note: When you make a physical connection to an HDMI HDTV, a hot plug event will occur. When the hot plug event occurs, the 780 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.



7. Use the information in Tables 4-2 and 4-3 below to select the proper video signal.

Table 4-2: HDTV (Consumer) Formats – Applies to HDMI, DVI (TV) and Analog YPbPr

Resolution	Frame Rates	Color Space	Sample Mode	Bit Depth
1080p (1920x1080) 1080i (1920x1080) 720p (1280x720) 576p (720x576) 576i (720x576) 480p (720x480) 480i (720x480)	24Hz 25Hz 29.97Hz 30Hz 50Hz 59.94Hz 60Hz 100Hz 119.88Hz 120Hz	YCbCr (HDMI, DVI) YPbPr (Analog only) RGB	4:4:4 (HDMI YCbCr only) 4:2:2 (HDMI only)	8 (HDMI only) 10 12 (HDMI only)

Table 4-3: Partial List of Computer Formats – Applies to DVI Computer and Analog RGB Video Signal Types

Resolutions	Name	Color Space	Sample Mode	Bit Depth
▪ 640x480 ▪ 800x600 ▪ 1024x768 ▪ 1280x768 ▪ 1280x1024 ▪ 1600x1024 ▪ 1920x1440	VGA SVGA XGA WXGA SXGA WSXGA WUXGA	RGB	4:4:4 (DVI)	8

4.2 Rendering Test Patterns on an HDTV

This subsection describes how to render test patterns on an HDTV once the desired signal type and format (resolution / frame rate) has bee selected.

4.2.1 Configurations for Rendering Test Patterns on an HDTV

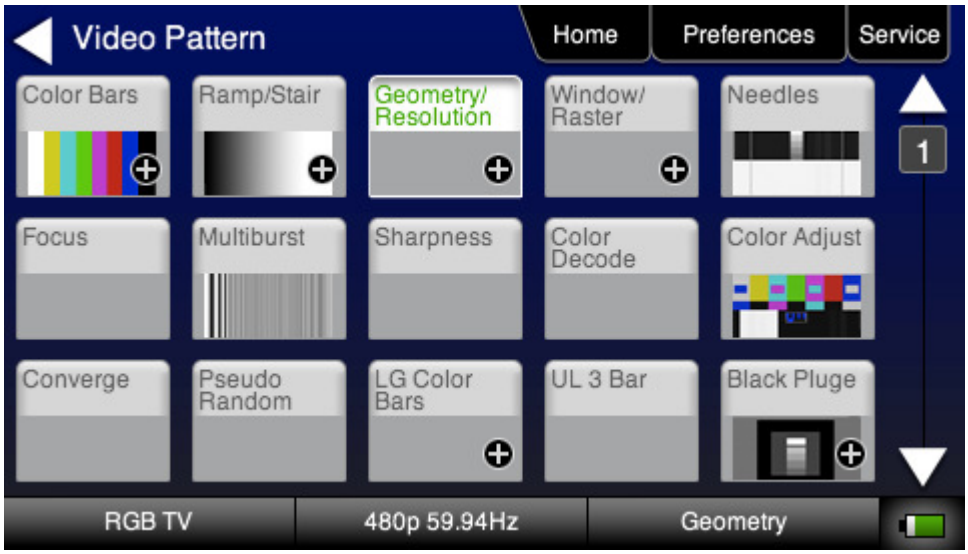
The illustrations shown in the procedure above for selecting the signal type, depict the configurations that apply when rendering test patterns on a sink device.

4.2.2 Procedures for Rendering Test Patterns on an HDTV

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

1. Touch select the desired test pattern from the menu shown below. You can select patterns that are standard with the 780 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 case you double touch select to access the lower level menu.



2. (If applicable) Specify the test pattern options. Use the information in Table 4-3 below as a guide:

Table 4-3: Test Patterns

Pattern Name	Variant	Options	Range of Values
ColorBar patterns Applications:	SMPTE	Orientation - Vertical	Direction: ▪ Left to Right ▪ Right to Left

Table 4-3: Test Patterns

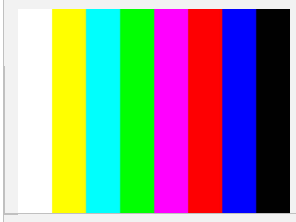
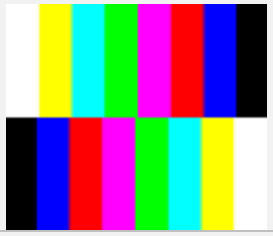
Pattern Name	Variant	Options	Range of Values
		Orientation - Horizontal	Direction: ▪ Top / Bottom ▪ Bottom / Top
	Full 	Orientation - Vertical	Direction: ▪ Left to Right ▪ Right to Left
		Orientation - Horizontal	Direction: ▪ Top / Bottom ▪ Bottom / Top
	Split 	Orientation - Vertical	Direction: ▪ Left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

Table 4-3: Test Patterns

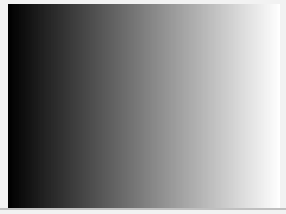
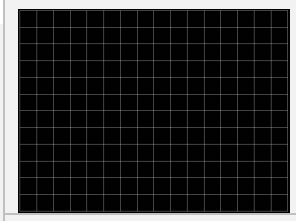
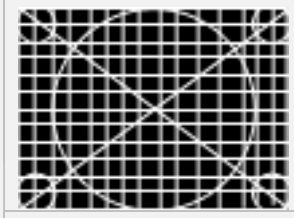
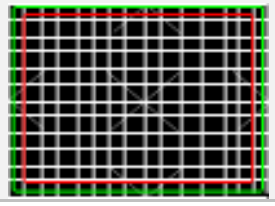
Pattern Name	Variant	Options	Range of Values
		Bars	▪ 5 ▪ 11 ▪ 21
		Color	▪ R ▪ G ▪ B ▪ C ▪ M ▪ Y ▪ W
	Ramp 	Color	▪ R ▪ G ▪ B ▪ C ▪ M ▪ Y ▪ W
Geometry/Resolution Patterns Applications: Grid – To check and adjust converchance of red, green and blue pictures. Linearity – for testing deflection linearity testing and alignment. Overscan – To check and adjust for the proper geometry of display including picture centering, size, pincushion and linearity.	Grid 	N/A	
	Linearity 	N/A	
	Overscan 	N/A	

Table 4-3: Test Patterns

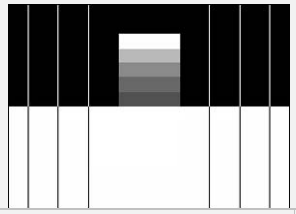
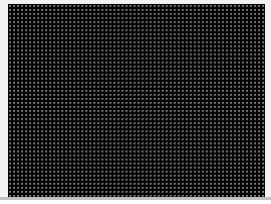
Pattern Name	Variant	Options	Range of Values
Needles Pattern Application: To detect whether scan velocity modulation is enabled on display.	N/A 		
Window/Raster Pattern Applications: Window1 - To calibrate display drive chromaticity. Window2 - To calibrate display cutoff chromaticity. Raster – To check color purity and display chrominance uniformity.	Window 	IRE Level	▪ -5 ▪ -1 ▪ 100 ▪ +1 ▪ +5
		IRE Label	▪ Off ▪ On
		Color	▪ R ▪ G ▪ B ▪ C ▪ M ▪ Y ▪ W
	Raster 	IRE Level	▪ -5 ▪ -1 ▪ 100 ▪ +1 ▪ +5
		IRE Label	▪ Off ▪ On
		Color	▪ R ▪ G ▪ B ▪ C ▪ M ▪ Y ▪ W
Focus Pattern Application: To detect whether scan velocity modulation is enabled on display.	N/A 		

Table 4-3: Test Patterns

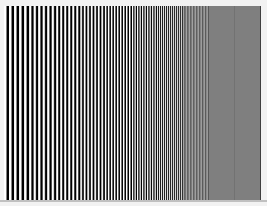
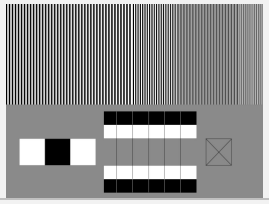
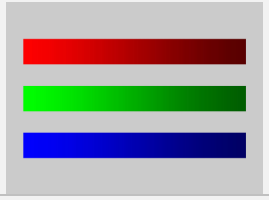
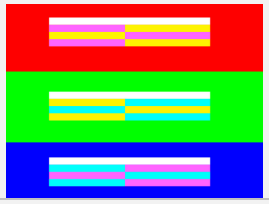
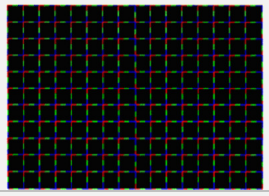
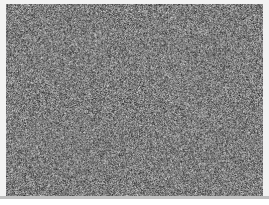
Pattern Name	Variant	Options	Range of Values
Multiburst Pattern Application: To check a display's ability to produce sharply defined stripes at equal brightness up to full resolution.	N/A 		
Sharpness Application: To align display sharpness, picture, aperature and scan velocity modulation adjustments.	N/A 		
Color Decode Application: To check the color decoder performance to determine if the decoder over-emphasizes red or green colors.	N/A 		
Color Adjust Pattern Application: To adjust a display's color decoder/matrix circuit for most accurate color reproduction.	N/A 		
Converge Pattern Application: To color converge a display throughout the entire picture area.	N/A 		
Pseudo Random Pattern Application: To test for pixel errors on an HDMI cable.	N/A 		

Table 4-3: Test Patterns

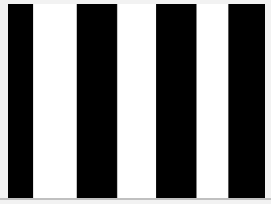
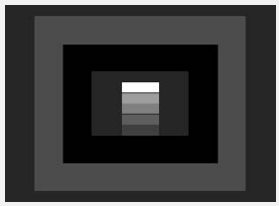
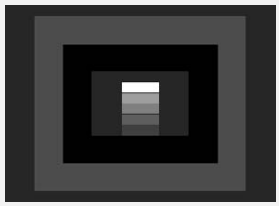
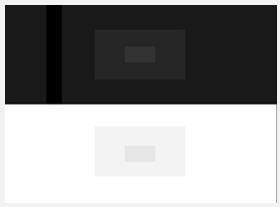
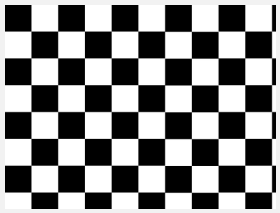
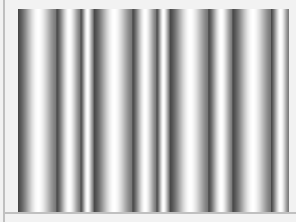
Pattern Name	Variant	Options	Range of Values
UL 3 Bar Pattern	N/A 		
Black Pluge Pattern Application: To set the picture black level and check the DC restoration performance of a display.	Fine 	APL	▪ High ▪ Medium ▪ Low
		Label	▪ Off ▪ On ▪ Low
		Color	▪ R ▪ G ▪ B ▪ C ▪ M ▪ Y ▪ W
	Course 	APL	▪ High ▪ Medium ▪ Low
		Label	▪ Off ▪ On ▪ Low
		Color	▪ R ▪ G ▪ B ▪ C ▪ M ▪ Y ▪ W
White Pluge Pattern Application: To set the contrast and brightness controls on fixed pixel displays.	Fine 	APL	▪ High ▪ Medium ▪ Low
		Label	▪ Off ▪ On ▪ Low
		Color	▪ R ▪ G ▪ B ▪ C ▪ M ▪ Y ▪ W

Table 4-3: Test Patterns

Pattern Name	Variant	Options	Range of Values
	Course 	APL	▪ High ▪ Medium ▪ Low
		Label	▪ Off ▪ On ▪ Low
		Color	▪ R ▪ G ▪ B ▪ C ▪ M ▪ Y ▪ W
Checkboard Pattern Application: To check the regulation of CRT video drive power supply circuits.	N/A 	Rows	▪ 2 ▪ 3 ▪ 4 ▪ 5 ▪ 6
		Columns	▪ 2 ▪ 3 ▪ 4 ▪ 5 ▪ 6
Zone Plate Pattern This is a bitmap that can be scrolled to test motion artifacts. You can replace particular bitmap with any other bitmap image to allow scrolling. You just need to ensure that you assign it the same name.	Vertical 	Vertical Movement	▪ Stop ▪ Slow ▪ Medium ▪ Fast
		Horizontal Movement	▪ Stop ▪ Slow ▪ Medium ▪ Fast

4.3 Importing Bitmaps

You can import your own bitmaps into the 780 through the USB interface. Note that when bitmaps are imported into the 780, 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.

4.3.1 Workflow for Importing Bitmaps

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

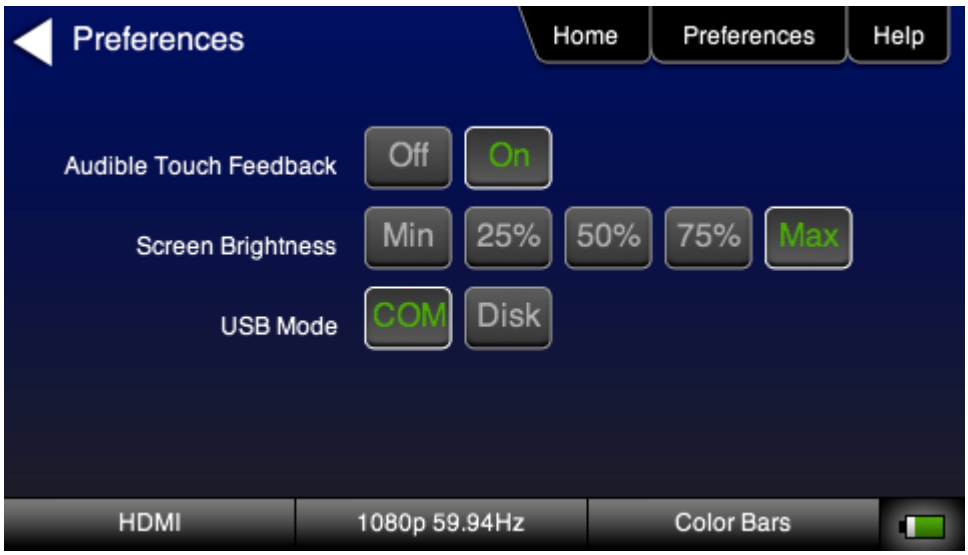
- Place the 780's USB interface in the **Disk** mode. This is not the default mode for the USB interface.

- 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 780 over the USB interface.
- Transfer the bitmap(s) over to the 780 flash memory through the USB interface.

4.3.2 Procedures for Importing Bitmaps

Use the procedures below to import bitmaps.

1. Connect the 780 to a PC host via the USB cable provided.
2. Select the **Preferences** from the 780 top level menu.



3. Choose **Disk** mode.

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

   The 780 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 780 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 4-4 below to construct your text file:

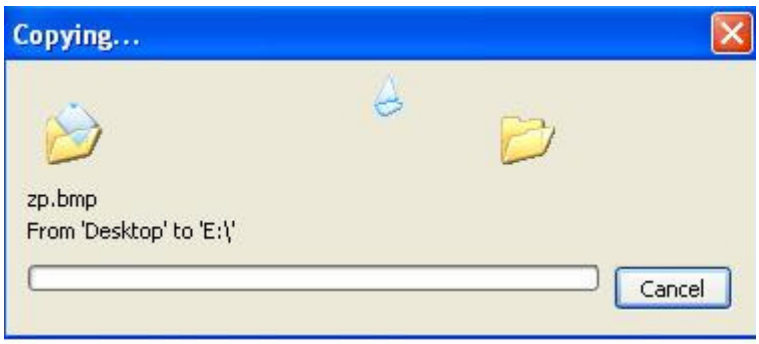
Table 4-4: Importing Bitmaps – UserPats.txt file

Bitmap Name (use 8.3 naming convention)	Bitmap Resolution	UserPats.txt Text File Structure
Mast480.bmp	720x480	The structure of the UserPats file is: <Bitmap Name> space <Description> The contents of the UserPats.txt text file would be: Mast480.bmp Master 720x480 Mast720.bmp Master 1280x720 Mast1080.bmp Master 1920x1080 **Note 1:** The bitmap name has to match the name of the stored bitmap. **Note 2:** The description is limited to 20 characters.
Mast720.bmp	128x720	
Mast1080.bmp	1920x1080	

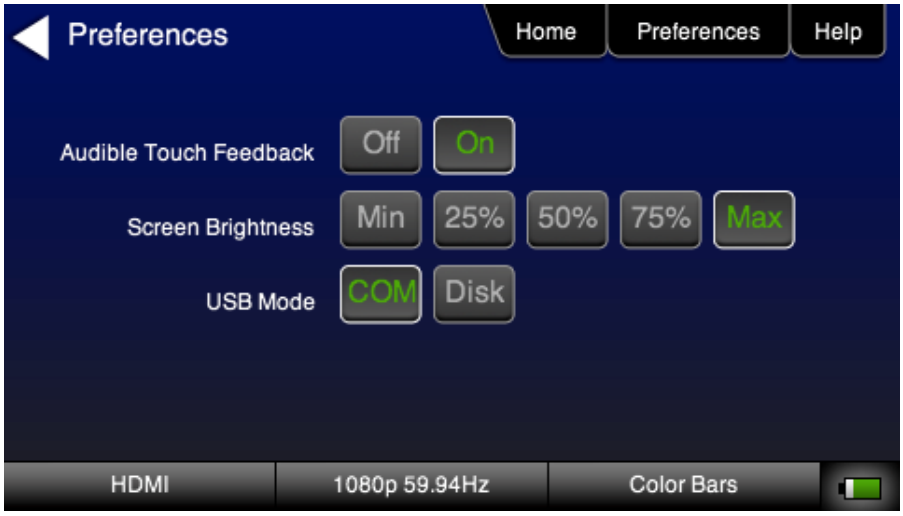
7. Transfer your UserPats.txt file from your PC to the 780 using standard Windows methods for transferring files to a USB drive, i.e. by dragging and dropping or copying and pasting.

   Note: Your bitmaps are limited to 8 characters with an extension (.bmp).

8. Transfer your bitmap(s) from your PC to the 780 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 780 top level menu. Refer to the screen below.

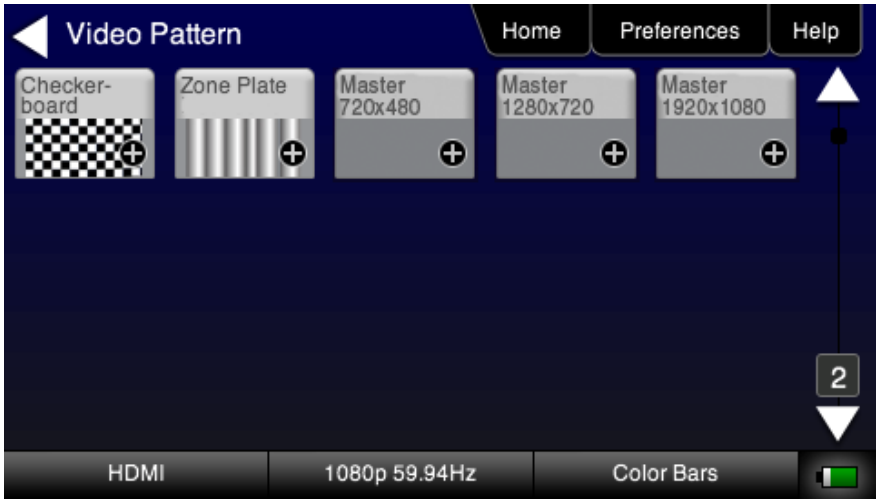


10. Touch select **COM** for the **USB Mode** (refer to the screen above).

11. Power cycle the 780.

12. Navigate to the **Video Pattern** menu.

    You should now see the new bitmap image(s) on the pattern list (below).



4.4 How to Scroll a Bitmap Pattern

This subsection describes how to scroll bitmaps on your 780

4.4.1 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 780 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 780.

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 780.

4.4.2 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.

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

   The **Zone Plate Options** menu appears:

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**.

4.5 How to Pan a Test Pattern

This subsection describes how to pan bitmap test patterns on your 780

4.5.1 Guidelines for Panning Bitmaps

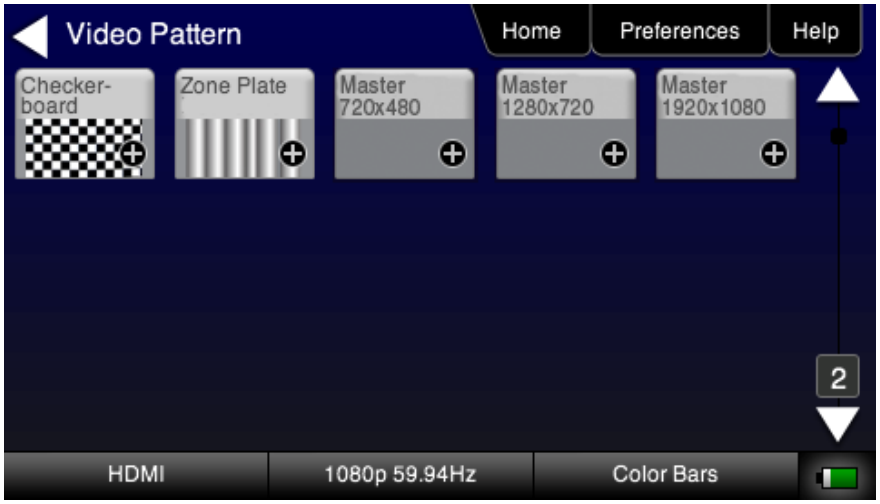
There are two ways you can animate a bitmap image: 1) image shifting (scrolling) 2) panning. Here are the rules and capabilities:

- You can pan bitmaps whose overall pixel resolution is greater than the resolution of the active format only to the extent of the difference between the resolution of the bitmap and the resolution of the format you currently have selected.
- You can pan bitmaps whose resolution is lower than the active format but only within the range of the excess space in the raster. You cannot pan the standard test patterns in the 780.

4.5.2 Procedures for Panning Bitmaps

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).



A message will appear informing you how to scroll the bitmap.

2. Drag and pan the test pattern.

4.6 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.

4.6.1 Configurations for Testing Audio

The 780 provides digital audio outputs on the following interfaces:

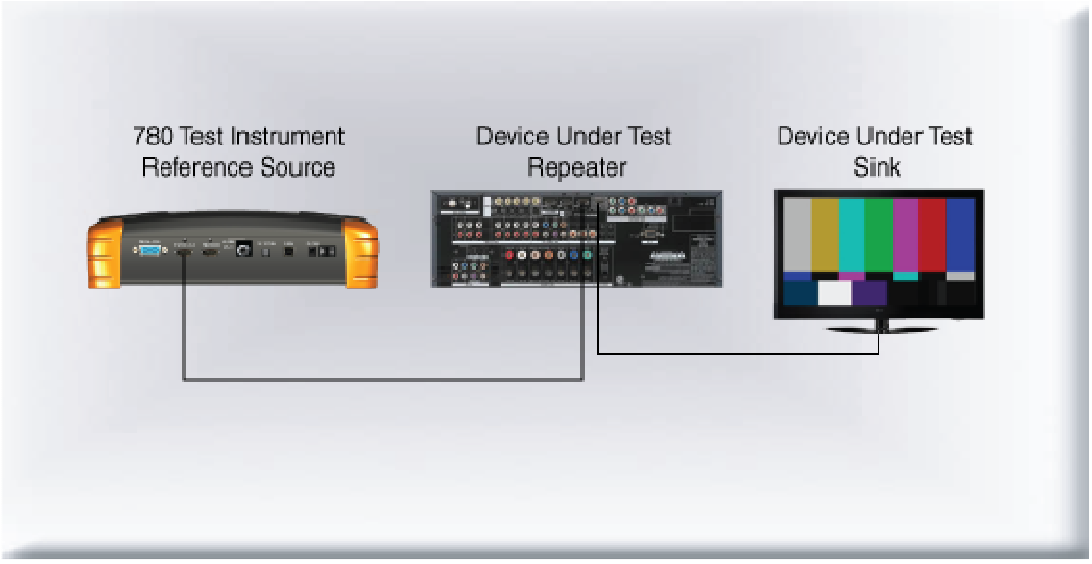
- HDMI
- SPDIF

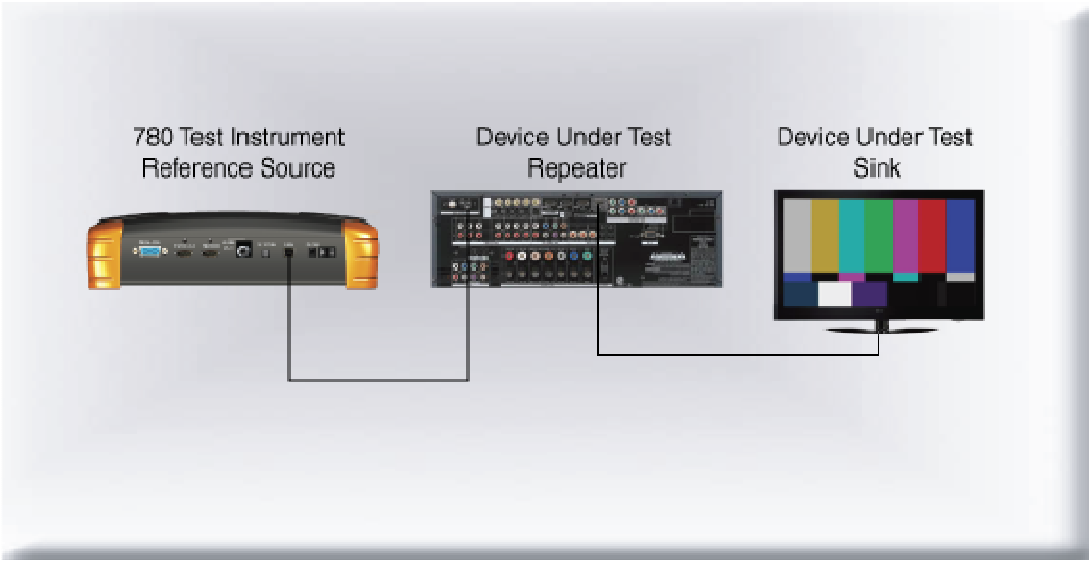
- Optical

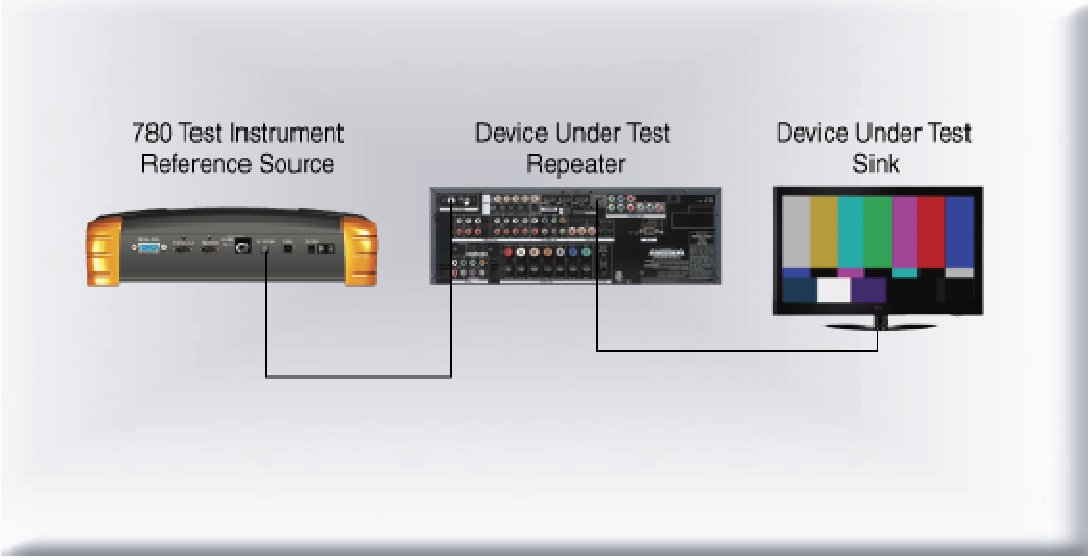
The 780 provides the following types of audio formats:

- Programmable LPCM sine wave
- Dolby and DTS compressed sine wave from clips – preset with sampling rate, frequency, amplitude and number of channels
- Dolby and DTS audio noise patterns from clips with selectable number of channels

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







4.6.2 Procedures for Testing with Programmable Sine Waves

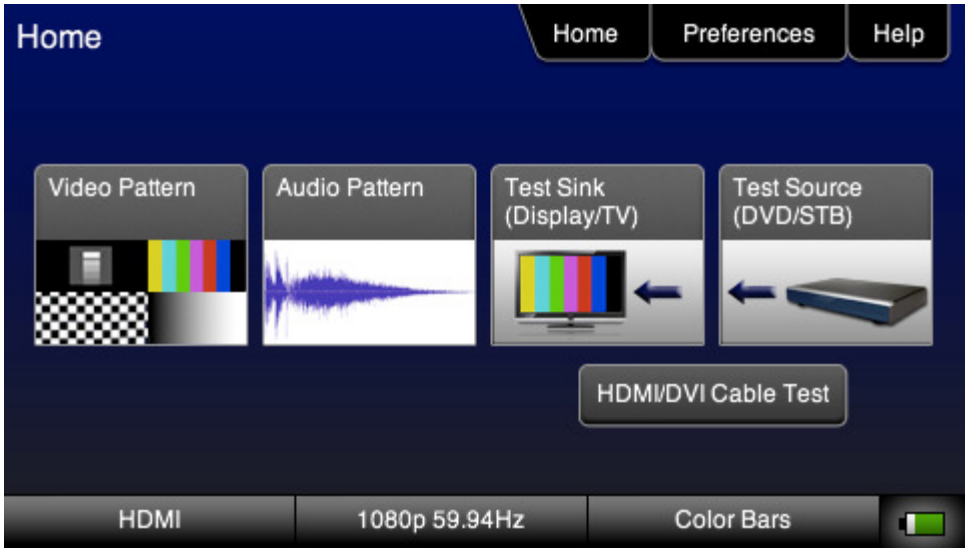
Use the procedures below for testing with programmable sine waves.

Table 4-5 below describes the audio sine wave parameters that can be configured.

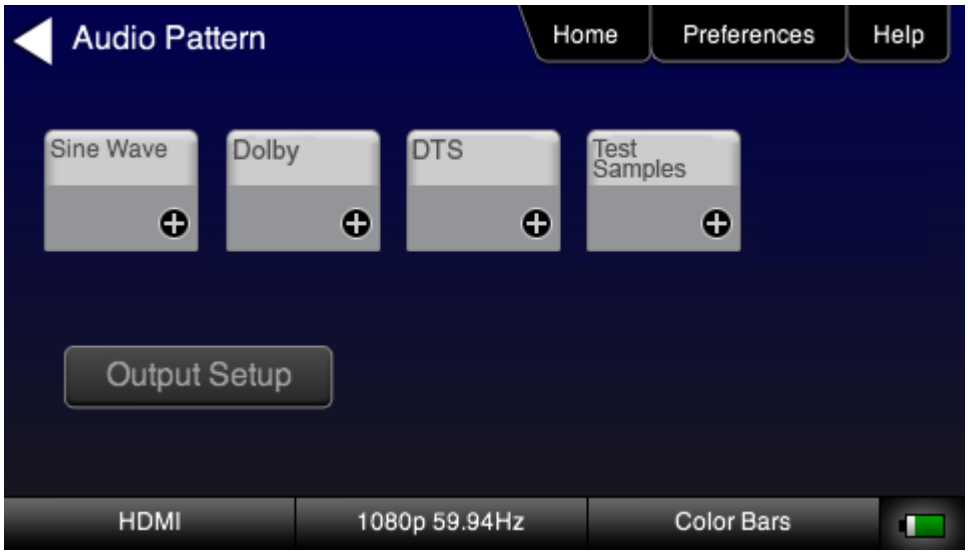
Table 4-5: Audio Pattern Tests

Pattern	Format	Interfaces	Range of Values
Sine Wave (programmable)	LPCM	HDMI	Channels: 8 Bit Depth: 16, 20, 24 Sampling Rate (kHz): 32, 44.1, 48, 88.2, 96, 176.4, 192
		SPDIF Optical	Channels: 2 Bit Depth: 16, 20, 24 Sampling Rate (kHz): 32, 44.1, 48

1. From the top level menu (shown in the figure below), select **Audio Patterns**.

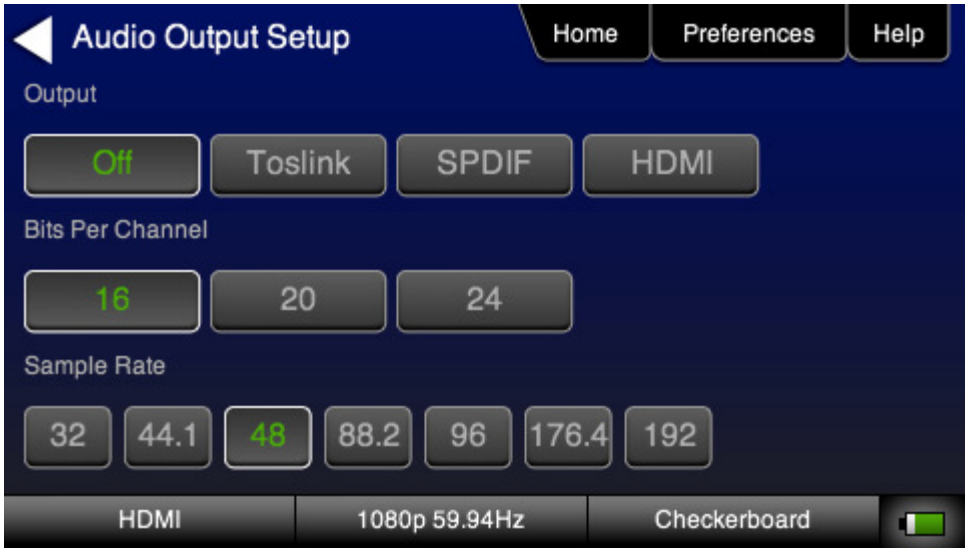


The **Audio Pattern** menu appears as shown below:



2. Touch select the **Output Setup** activation button (shown in the screen above) to select the digital audio output.

   The **Audio Pattern** menu appears as shown below:

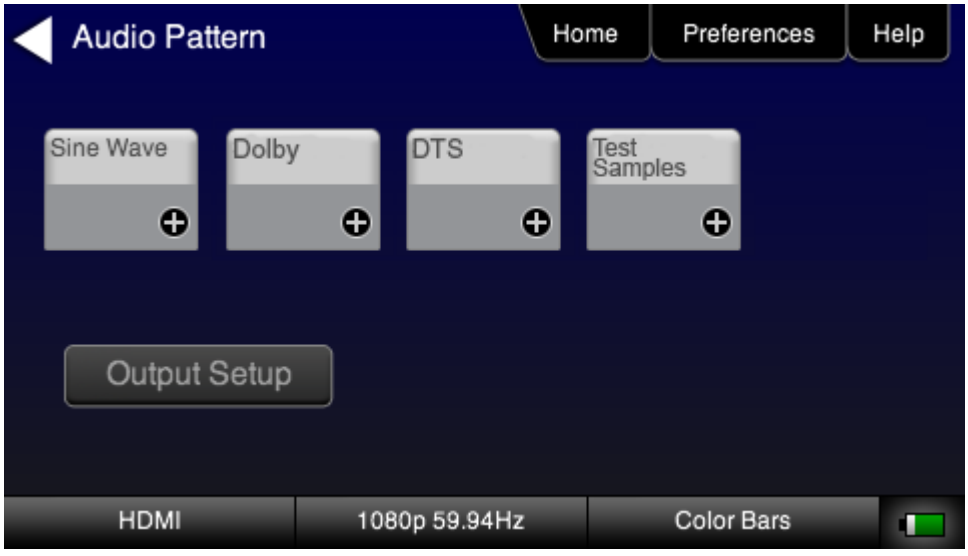


3. Touch select the digital **Output** or audio interface that you want to test from the **Audio Output Setup** menu as shown above**.** The options are Toslink, SPDIF or HDMI.

4. Touch select the values for the **Bits per Channel** and **Sampling Rate** from the **Audio Output Setup** menu as shown above.

5. Touch select the **Audio Output Setup** (back) button to return to the **Audio Pattern** menu.

6. Double touch select the **Sine Wave** item from the **Audio Pattern** menu shown in the screen example below.



The following screen appears:

7. Touch select the **Frequency** per channel using the touch buttons in the screen above. You select a channel or channels on the right then either increment or decrement the frequency using the touch buttons. The current value is shown in the middle between the two sets of four increment and decrement buttons.

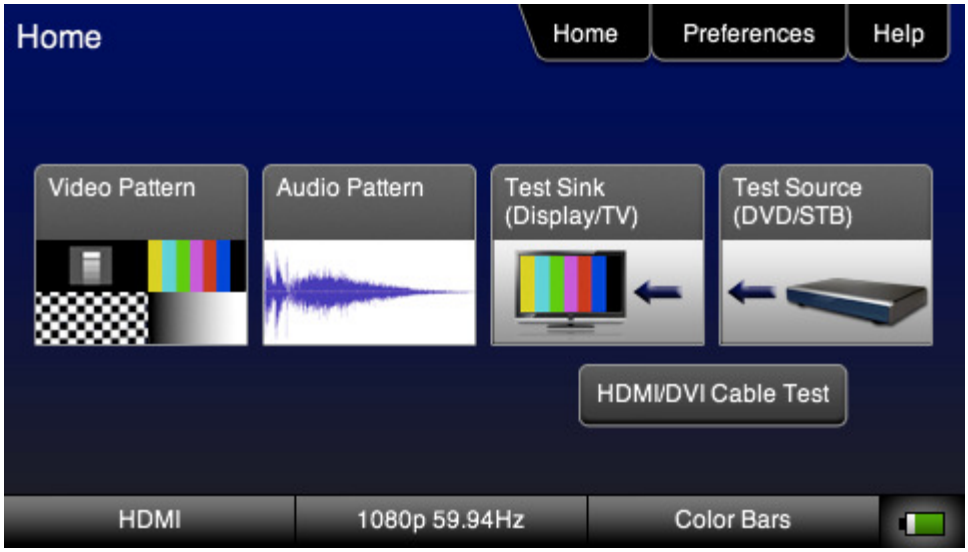
   Note: You will have to make at least one selection on the **Sine Wave** options screen to invoke the audio output if you have activated some other audio format.

8. Touch select the **Level** per channel using the touch buttons in the screen above. You select a channel or channels on the right then either increment or decrement the **Level** using the two touch buttons. The current value is shown in the middle between the two increment and decrement buttons.

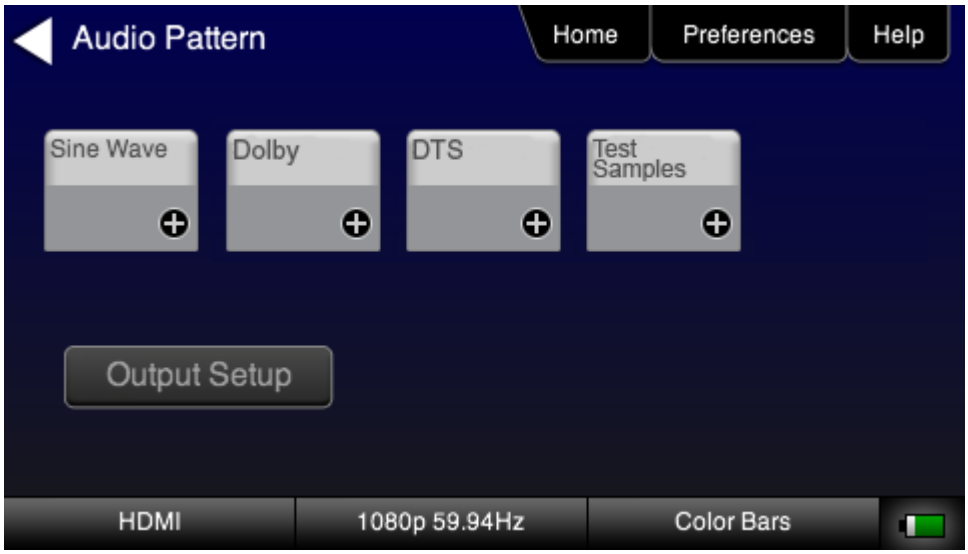
4.6.3 Procedures for Testing a Display with Dolby or DTS Sine Wave Clips

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

1. From the top level menu (shown in the figure below), select **Audio Patterns**.



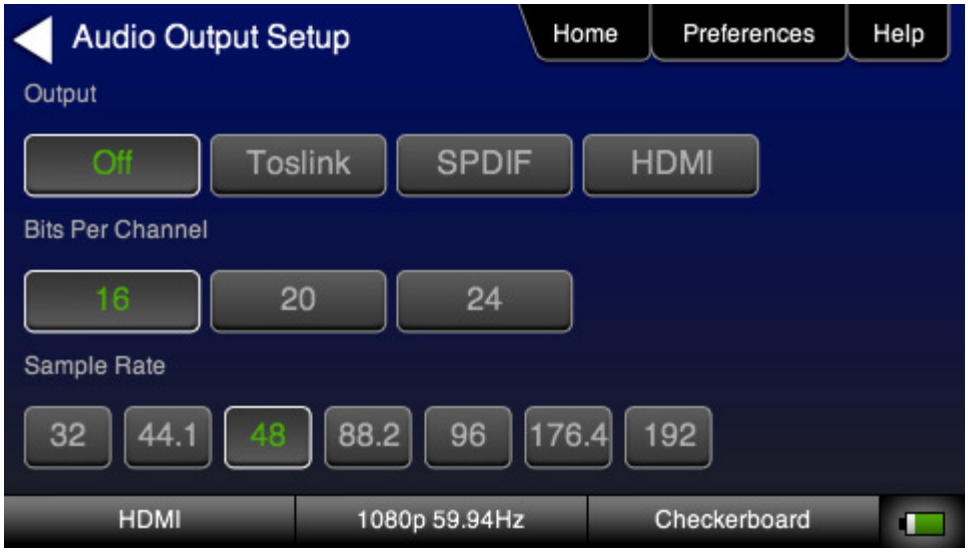
The **Audio Pattern** menu appears as shown below:



2. Touch select the **Output Setup** activation button (shown in the screen above) to select the digital audio output.

3. Touch select the digital **Output** or audio interface that you want to test from the **Audio Output Setup** menu as shown below**.** The options are Toslink, SPDIF or HDMI.

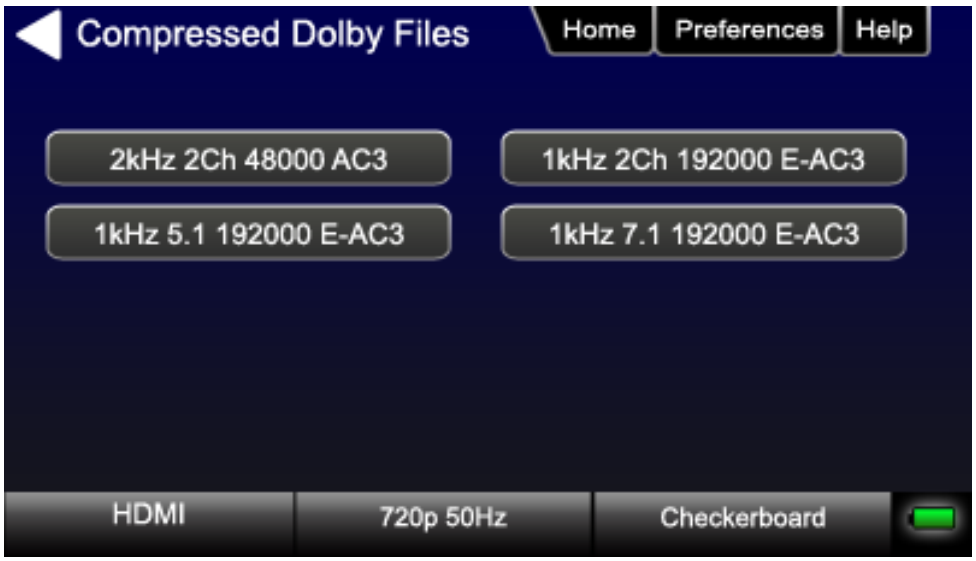
   Note: You do not need to make a selection on the **Bits Per Channel** or the **Sampling Rate** because these parameters are preset for the clips.



4. Touch select the **Audio Output Setup** (back) button to return to the **Audio Pattern** menu.

5. Double touch select the Dolby or DTS menu item from the **Audio Pattern** menu (shown further above).

   Either of the following screens will appear depending on whether you selected Dolby or DTS:



6. Touch select the desired sine wave audio clip. The clips are described in Table 4-6 below:

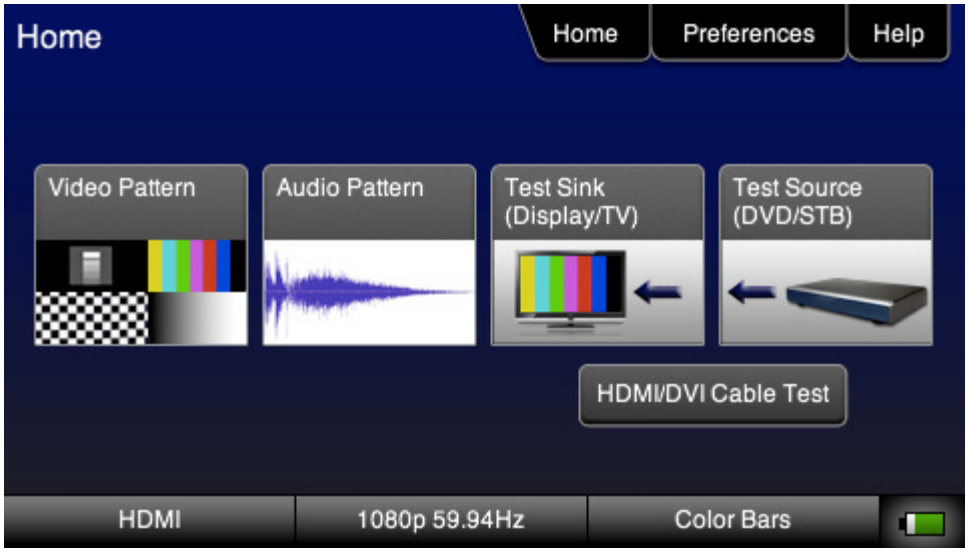
Table 4-6: Dolby & DTS Audio Clips

Pattern	Format	Interfaces	Range of Values
Sine Wave (compressed clips)	Dolby	HDMI SPDIF Optical	▪ 2kHz 2Ch 48000 AC3 ▪ 1kHz 2Ch 192000 E-AC3 ▪ 1kHz 5.1 192000 E-AC3 ▪ 1kHz 7.1 192000 E-AC3
	DTS	HDMI SPDIF Optical	▪ 48kHz 5.1 48000 ▪ 48kHz 6.1 48000 ES ▪ 48kHz 7.1 192000 HD HRA ▪ 48kHz 5.1 192000 HD HRA ▪ 96kHz 7.1 192000 HD HRA
			Naming Convention E.g.: 1kHz 5.1 192000 E-AC3 Explanation: 2kHz sine wave 5.1 (6 channel) audio 20dB amplitude 192kHz sampling rate Enhanced AC3 format

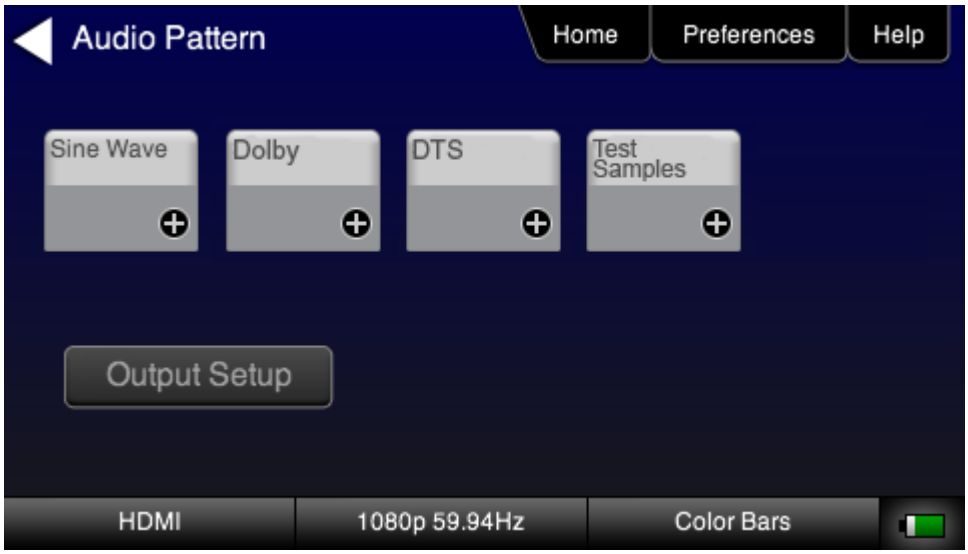
4.6.4 Procedures for Testing a Display with Dolby or DTS Audio Test Patterns

Use the following procedures to run audio tests using Dolby and or DTS test patterns.

1. From the top level menu (shown in the figure below), select **Audio Patterns**.



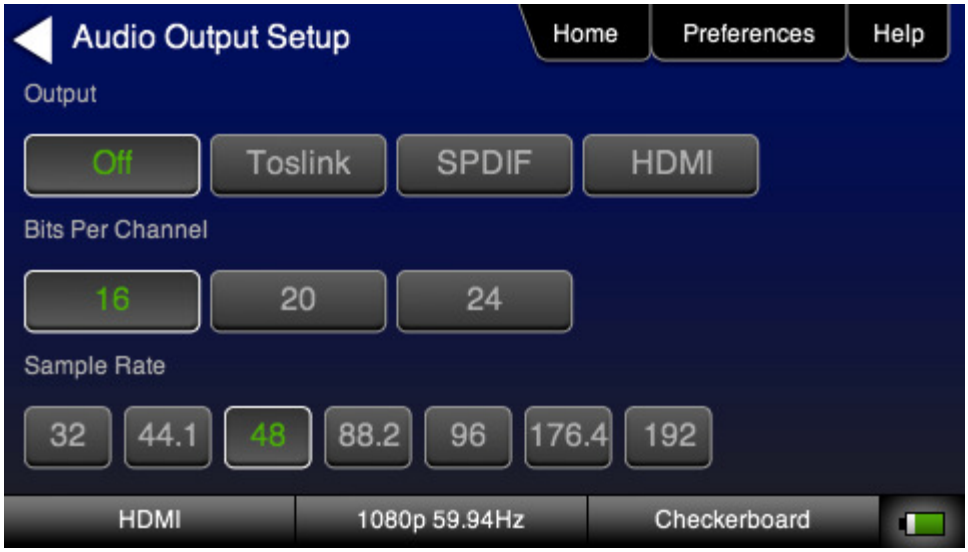
The Audio Pattern menu appears as shown below:



2. Touch select the **Output Setup** activation button (shown in the screen above) to select the digital audio output.

3. Touch select the digital **Output** or audio interface that you want to test from the **Audio Output Setup** menu as shown below**.** The options are Toslink, SPDIF or HDMI.

   Note: You do not need to make a selection on the **Bits Per Channel** or the **Sampling Rate** because these parameters are preset for the clips.



4. Touch select the **Audio Output Setup** (back) button to return to the **Audio Pattern** menu.

5. Double touch select the **Test Samples** menu item from the **Audio Pattern** menu (shown further above).

   The following menu(s) appear (examples):

6. Select the test pattern and **Audio Type** using the information in Table 4-7 below:

Table 4-7: Audio Pattern Tests

Pattern	Format	Interfaces	Range of Values
Pink Noise Patterns: ▪ 500-2kHz Pink noise ▪ 20-20kHz Pink noise Application: ▪ Tests sound pressure level ▪ Main speaker frequency response	Dolby 5.1	HDMI SPDIF Optical	▪ Individually selectable channels ▪ **Cycle** – cycling through each channel; 8 seconds per channel
	DTS 6.1	HDMI SPDIF Optical	
Sine Wave Pattern: ▪ 63Hz ▪ 125Hz ▪ 1kHz ▪ 4kHz Application: ▪ Speaker distortion	Dolby 5.1	HDMI SPDIF Optical	Channel selection: ▪ Select **All** channels or… ▪ **Cycle** – cycling through each channel; 8 seconds per channel
	DTS 6.1	HDMI SPDIF Optical	
Impulse Pattern Application: ▪ Early reflections	Dolby 5.1	HDMI SPDIF Optical	▪ Individually selectable channels ▪ **Cycle** – cycling through each channel; 8 seconds per channel
	DTS 6.1	HDMI SPDIF Optical	
Polarity Pattern Application:	Dolby 5.1	HDMI SPDIF Optical	▪ Individually selectable channels ▪ **Cycle** – cycling through each

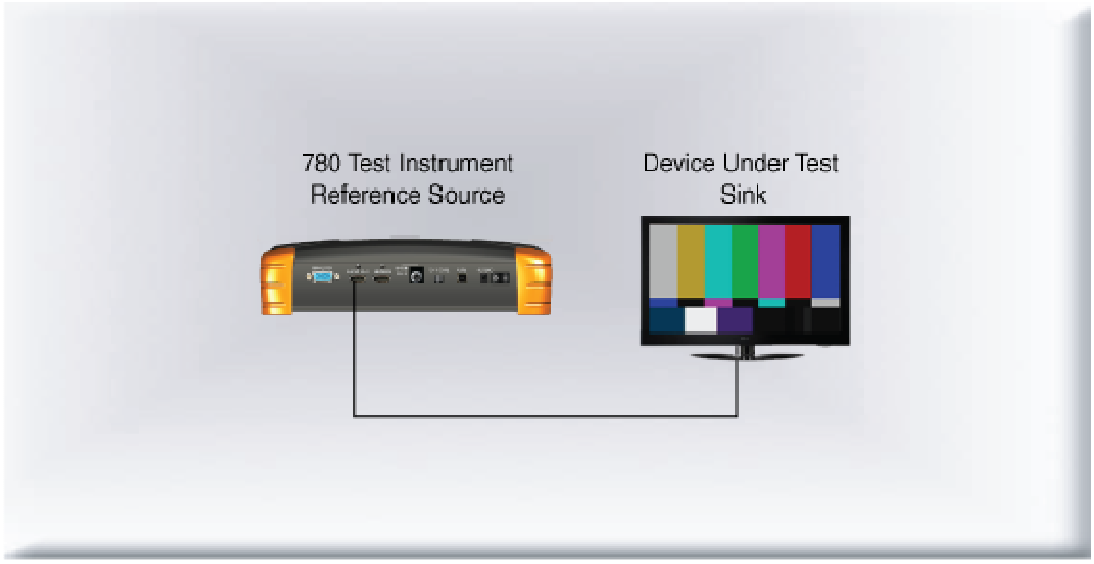
Table 4-7: Audio Pattern Tests			
Pattern	**Format**	**Interfaces**	**Range of Values**
	DTS 6.1	HDMI SPDIF Optical	

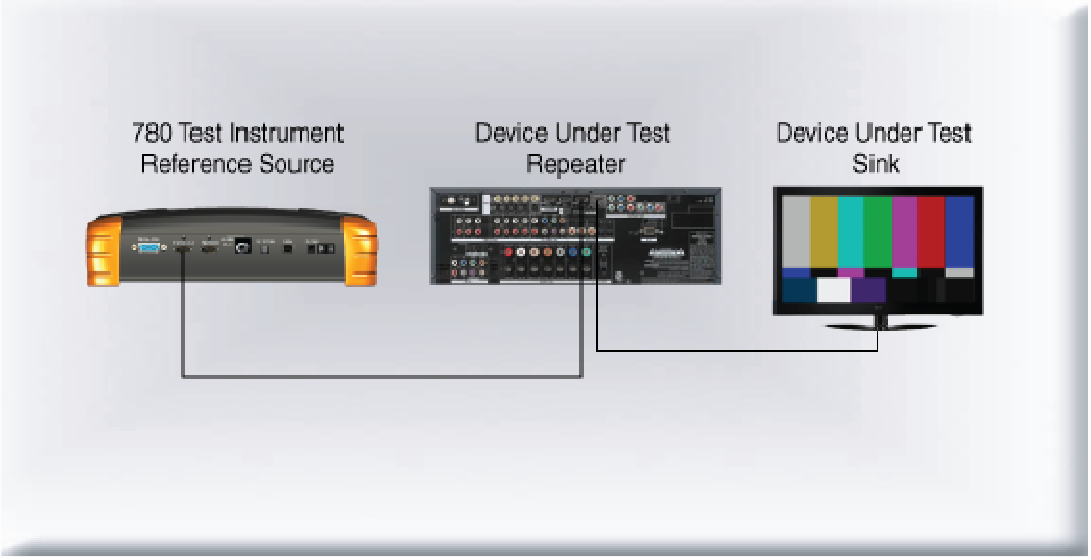
4.7 Testing HDCP on an HDMI HDTV or HDMI Repeater Device

This section provides procedures for testing HDCP on an HDMI equipped HDTVs.

4.7.1 Configurations for Testing HDCP on an HDMI Sink Device

You can run this test in two configurations: 1) 780 directly connected to an HDTV; 2) 780 connected to a repeater device which is then connected to a downstream HDTV. These configurations are shown below:



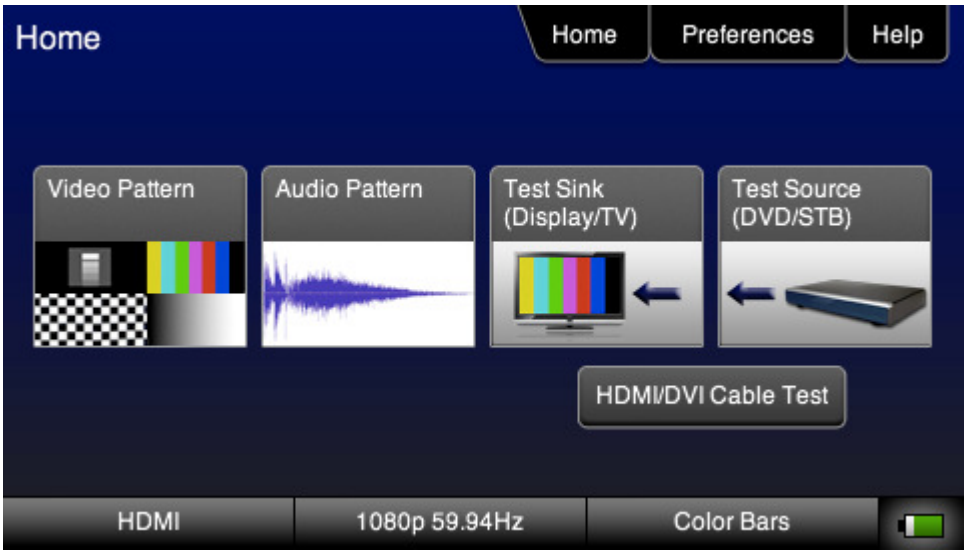


4.7.2 Procedures for Testing HDCP on an HDMI Sink Device

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

1. Follow the procedures above for Selecting a Signal Type and Resolution to enable the HDMI output.

2. Touch select **Test Sink (Display/TV)** from the top level menu shown below.



3. Select HDCP Test from the **Sink Tests (Display/TV)** menu shown below.

4. Touch select HDCP Test from the **Test Sink (Display/TV)** menu shown below.

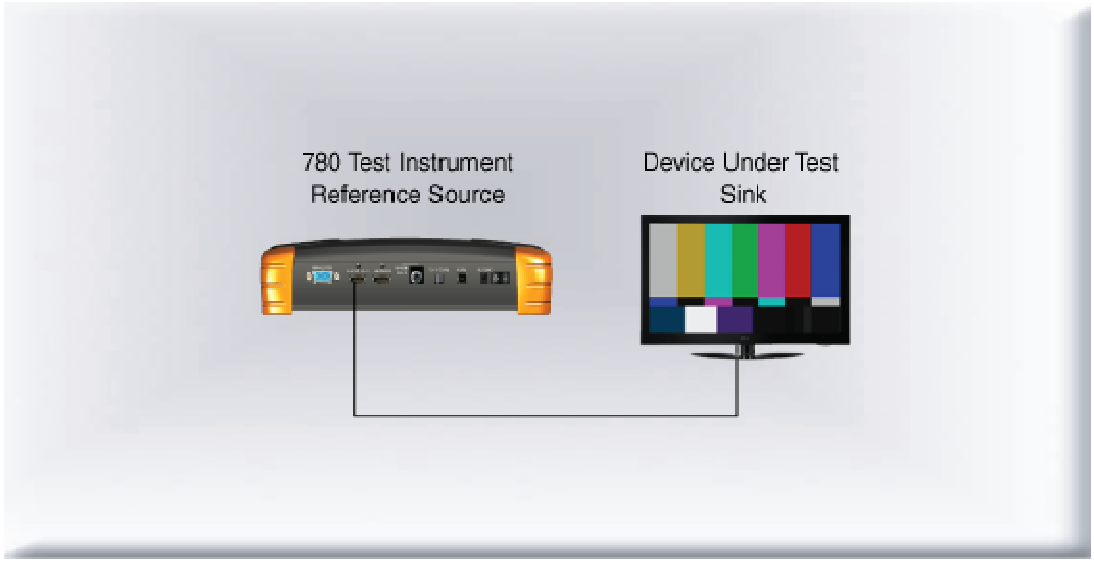
   The Pass/Fail results and the key values exchanged during the authentication are presented on the display as shown below:

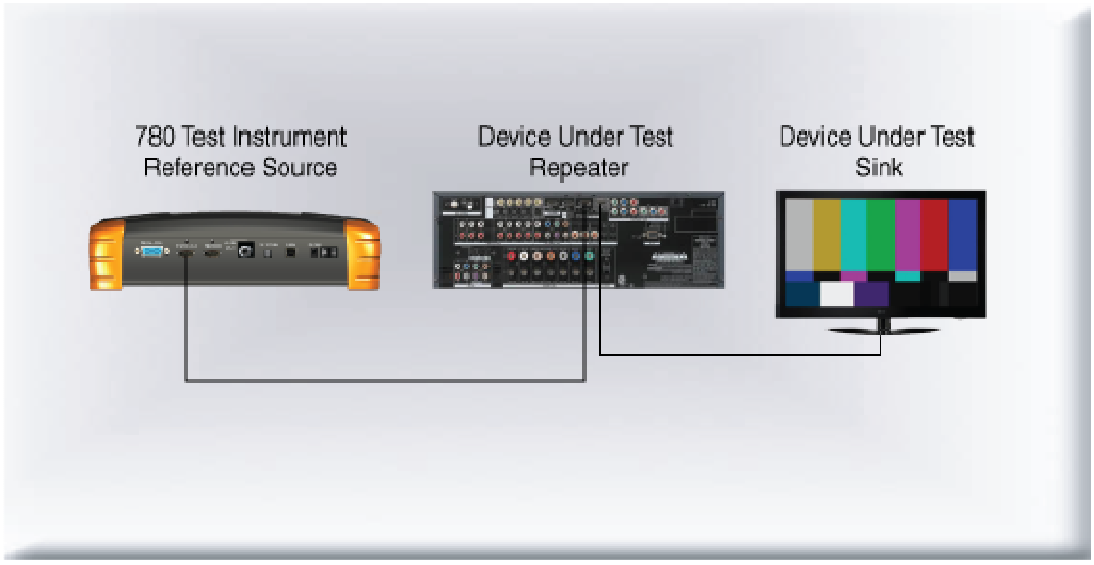
4.8 Verifying the EDID on an HDMI HDTV or HDMI Repeater Device

This section provides procedures for verifying the EDID of an HDMI HDTV or an HDMI repeater device such as an A/V receiver.

4.8.1 Configurations for Testing 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.



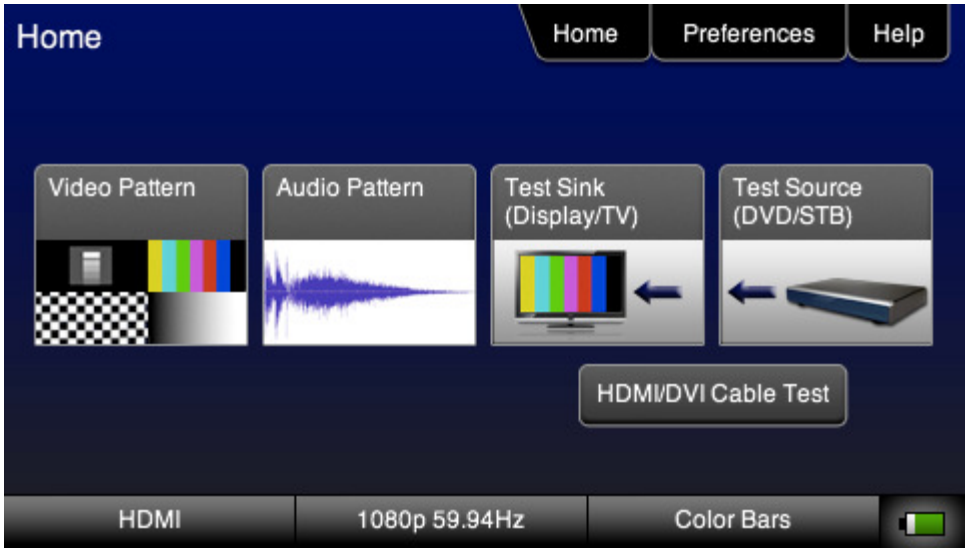


4.8.2 Procedures for Testing EDID on an HDMI Sink Device

Use the following procedures to test EDID on an HDMI sink device.

1. Follow the procedures above for Selecting a Signal Type and Resolution to enable the HDMI output.

2. Touch select **Test Sink (Display/TV)** from the top level menu shown below.



3. Touch select **EDID Test** from the **Sink Tests** menu shown below.

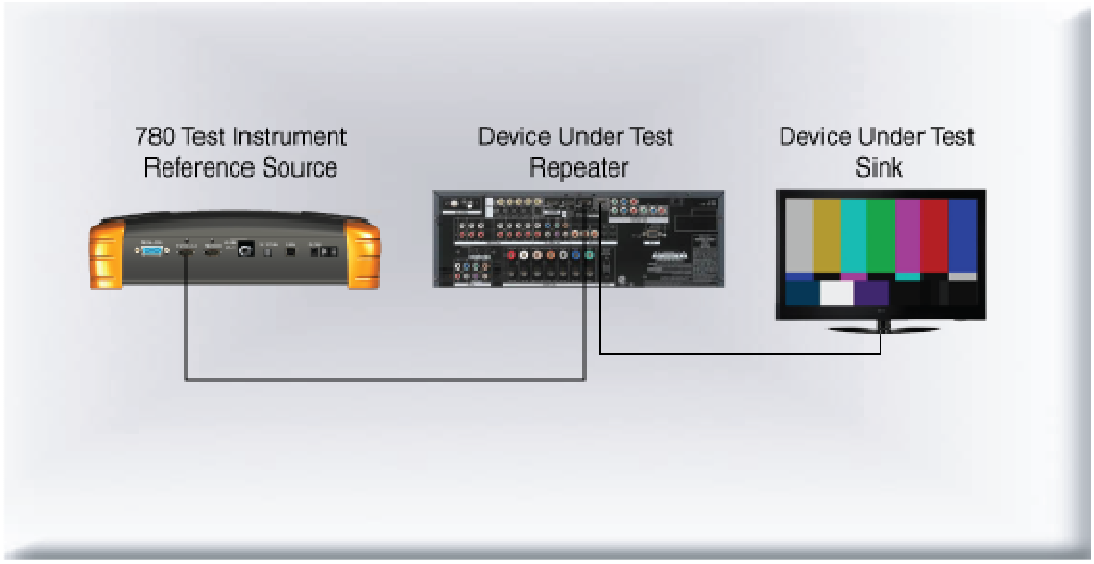
The EDID information is presented on the display as shown below. The EDID test runs a check on the EDID header and checksum to determine if the EDID is valid. It also reads the Vendor Product information and the EDID version and lists that information on the on-screen report. The EDID test also checks for the Vendor Specific Data Block in the EDID's CEA extension block to determine if the display is HDMI capable.

4.9 Viewing the CEC devices on an HDMI network

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

4.9.1 Configurations for Testing CEC on an HDMI Sink Device

The following illustration depicts a typical the test setup.

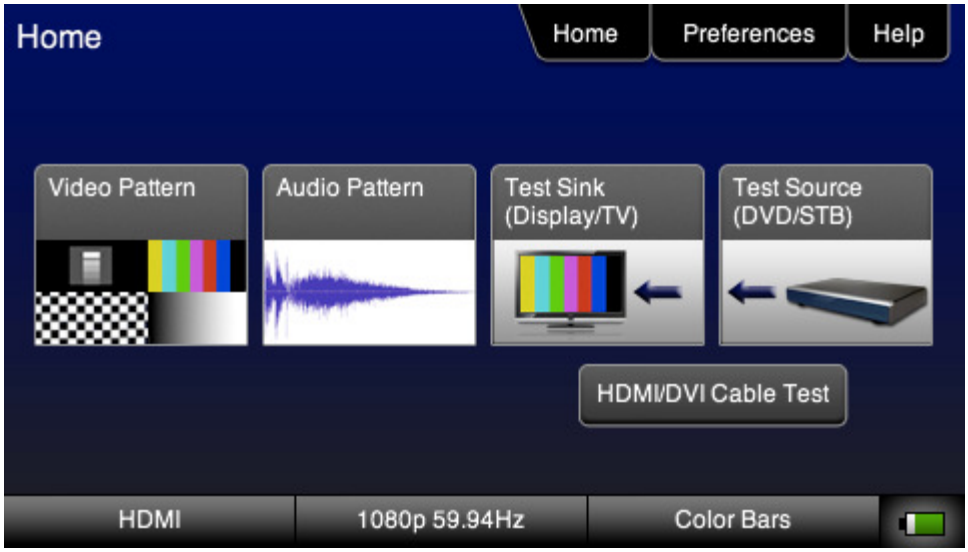


4.9.2 Procedures for Testing CEC on an HDMI Sink Device

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

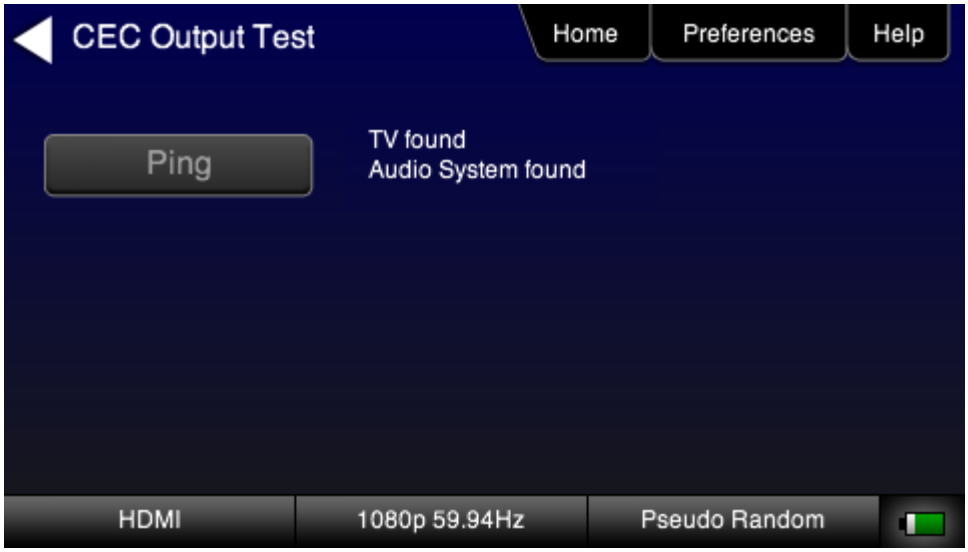
1. Follow the procedures above for Selecting a Signal Type and Resolution to enable the HDMI output.

2. Touch select **Test Sink (Display/TV)** from the top level menu shown below.



3. Touch select the **CEC Test** activation button from the **Sink Tests** menu shown below.

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


CEC Output Test
Home
Preferences
Help
Ping
TV found
Audio System found
HDMI
1080p 59.94Hz
Pseudo Random

5 Using the 780 Test Instrument to Test HDMI Source Devices

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

5.1 Testing Video from an HDMI Source Device

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

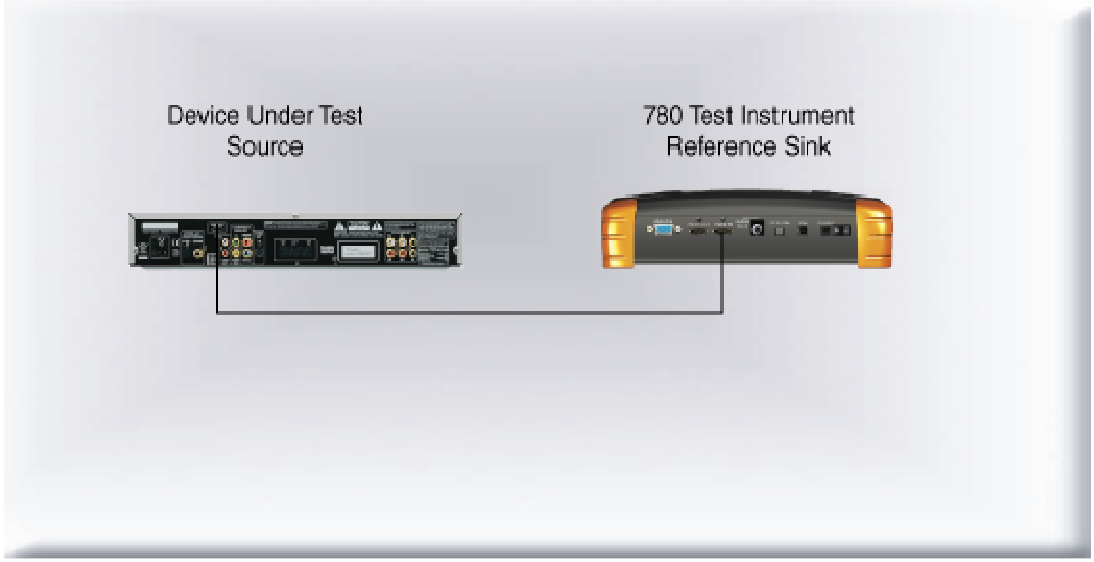
Note: You will not obtain correct results when you test a DVI device with computer formats.

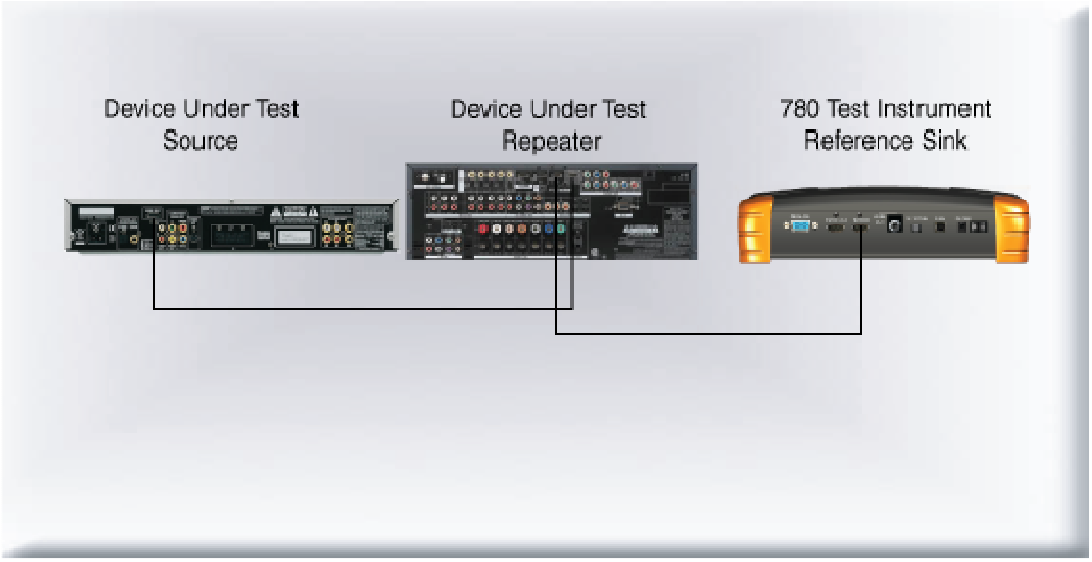
5.1.1 Configurations for Testing an HDMI Source Device

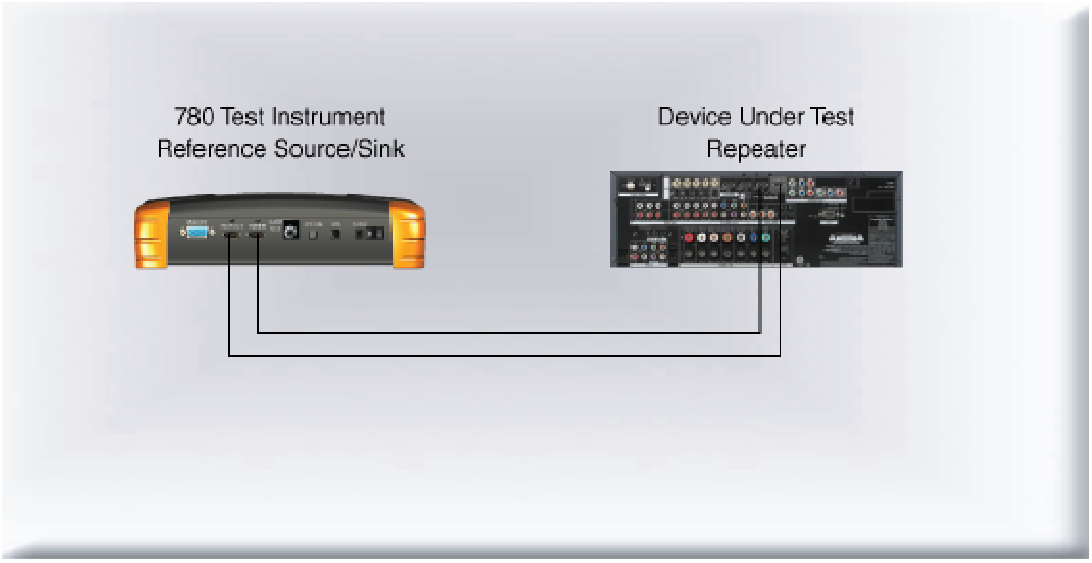
The 780's HDMI input port acts as a "reference" HDMI sink device. Therefore it enables you to emulate a known good HDMI sink device to conduct a basic confidence test of an HDMI source device. This test ensures that you are receiving a valid HDMI video signal by displaying the timing of the incoming 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 780
- Source device connected to the 780 through a repeater device
- 780 Tx and Rx 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 780 is emulating a sink to test an upstream source. In the third configuration, the 780 is emulating both an HMDI source and sink. These test configurations are shown below.



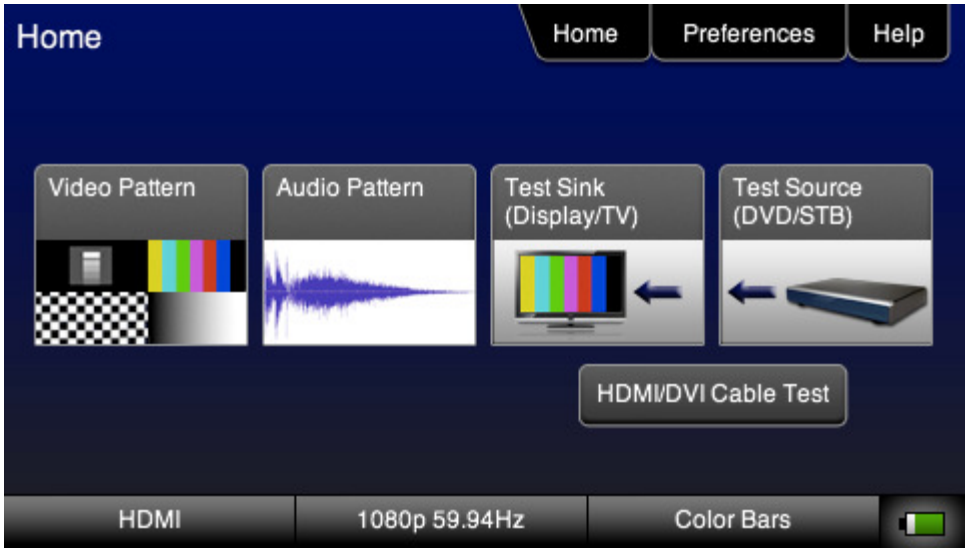




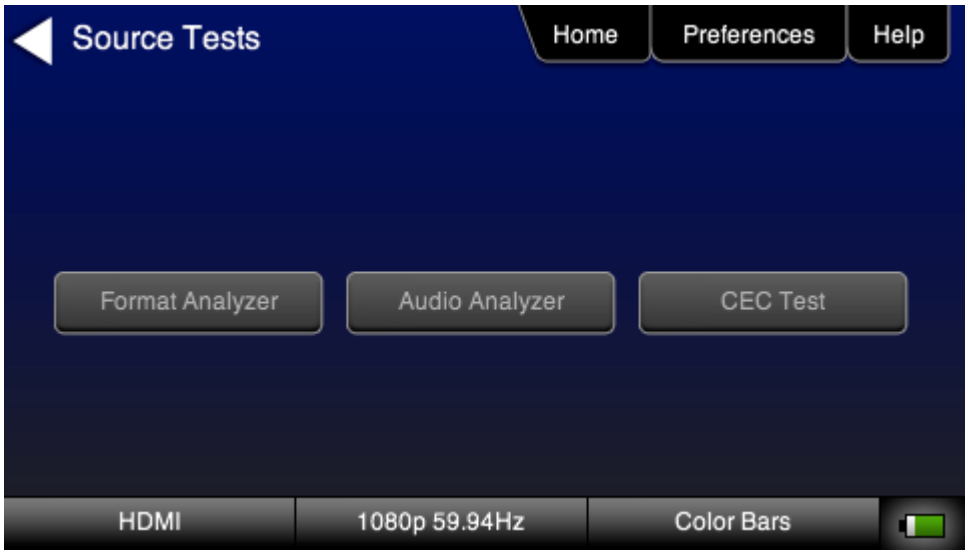
5.1.2 Procedures for Testing Video on an HDMI Source Device

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

1. Touch select **Test Source (DVD/STB)** from the top level menu shown below.

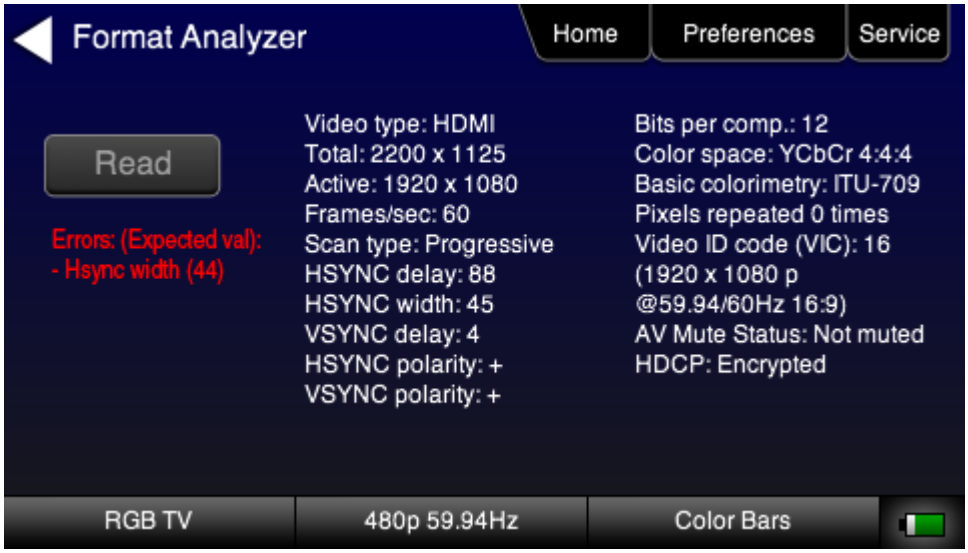


2. Touch select **Format Analyzer** from the **Test Source (DVD/STB)** menu shown below.



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.

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



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

Table 5-1 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 5-1: 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 pluse; either positive (+) or negative (-).
VSYNC polarity	The polarity of the vertical sync pluse; 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.
Color space	Color space and sampling Color space: ▪ YCbCr ▪ RGB ▪ xvColor Sampling: ▪ 4:4:4 ▪ 4:2:2
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.

5.2 Testing Audio of an HDMI Source Device

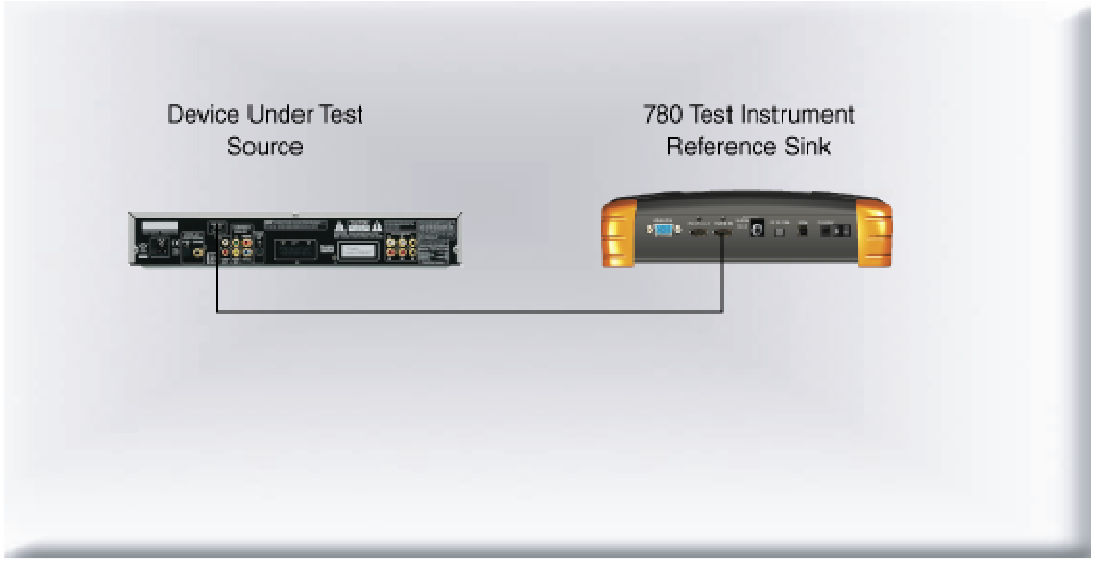
This subsection describes how to test the audio from an HDMI source device.

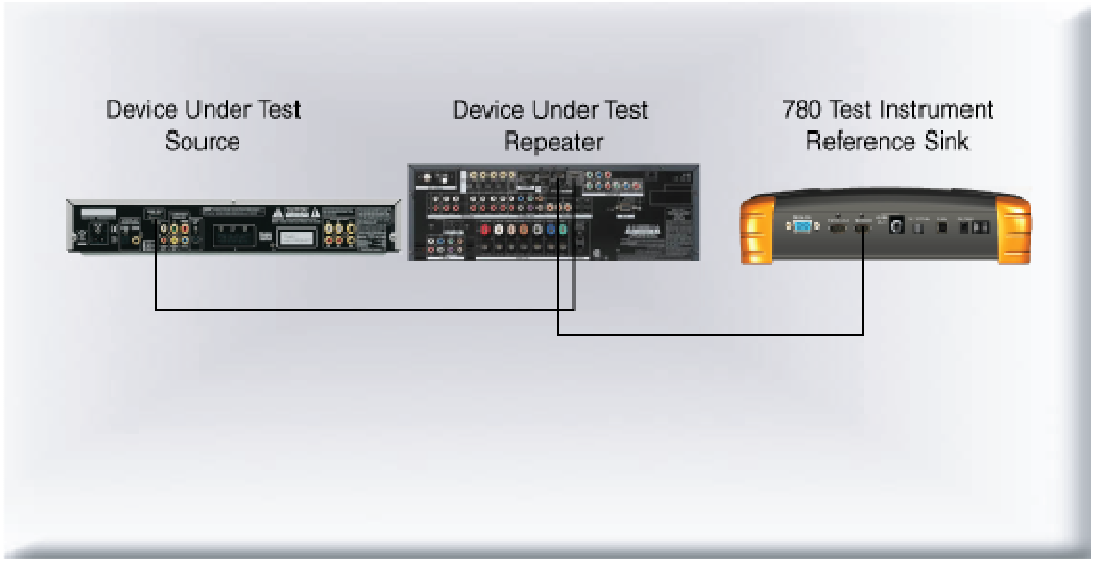
5.2.1 Configurations for Testing Audio on an HDMI Source Device

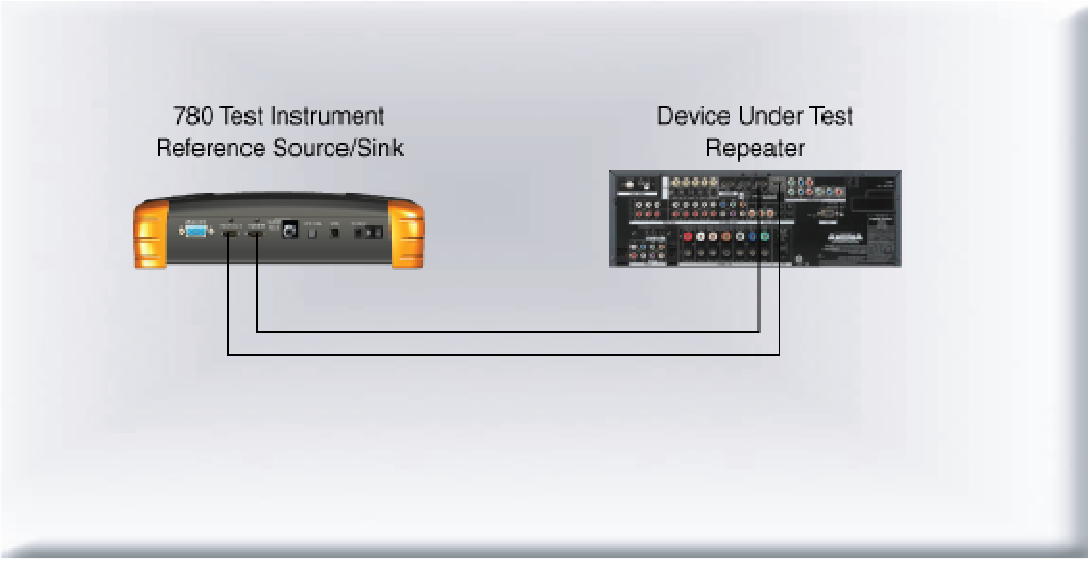
With the 780 you can run a test on the HDMI audio from a source device. This test shows you the audio infoframes and the audio sample packet header information transmitted from the connected source device which could be a DVD, set top box or the output of an A/V Receiver. You can run this test in three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

- Source device connected directly to the 780.
- Source device connected to the 780 through a repeater device.
- 780 Tx and Rx 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 780 is emulating a sink to test an upstream source. In the third configuration, the 780 is emulating both an HDMI source and sink. These test configurations are shown below.


Device Under Test
Source
780 Test Instrument
Reference Sink

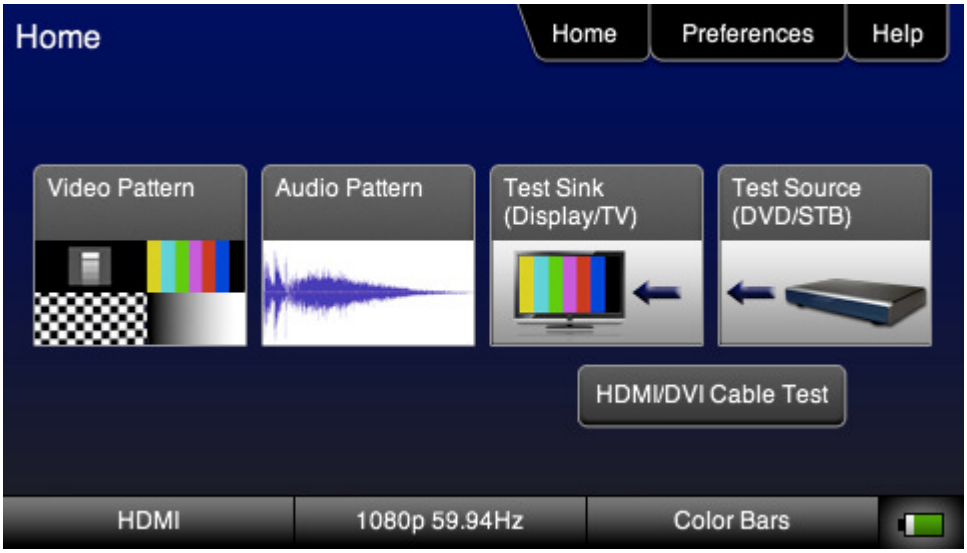

Device Under Test
Source
Device Under Test
Repeater
780 Test Instrument
Reference Sink



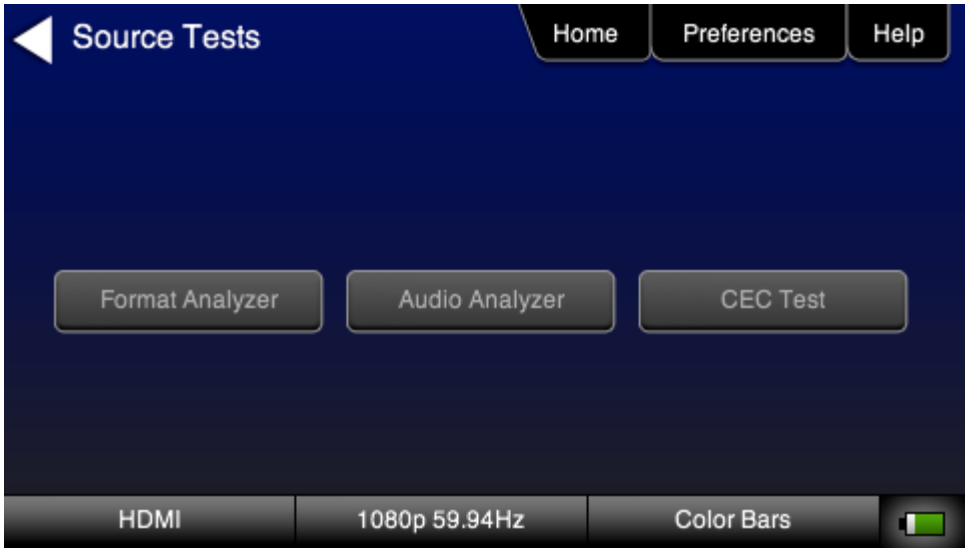
5.2.2 Procedures for Testing Audio on an HDMI Source Device

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

1. Select **Test Source (DVD/STB)** from the top level menu shown below.



2. Touch select **Audio Analyzer** from the **Sources Test** menu shown below.



3. Touch select the **Read** activation button to initiate the test.

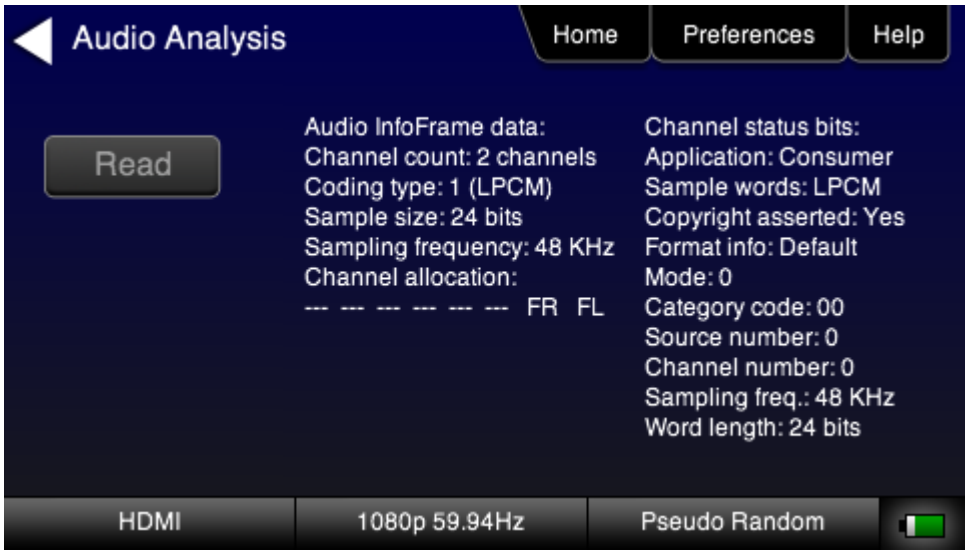


Table 5-2 below describes each field in the Audio Analyzer on-screen report. The audio infoframe information is shown on the left of the resulting screen and the channel status data from the audio sample packets received are displayed on the right.

Table 5-2: Audio Analyzer	
Audio Infoframe Data (left side)	**Description**

Table 5-2: Audio Analyzer	
Audio Infoframe Data (left side)	**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 + ▪ DTS-HD ▪ MAT ▪ DST ▪ WMA Pro
Sample Size	The sample size or bit depth. One of: ▪ Refer to Stream Header ▪ 16 bit ▪ 20 bit ▪ 24 bit
Sampling Frequency	The sampling frequency. One of: ▪ Refer to Stream Header ▪ 32kHz ▪ 44.1kHz ▪ 48kHz ▪ 88.2kHz ▪ 96kHz ▪ 176.4kHz ▪ 192kHz

Table 5-2: Audio Analyzer	
Audio Infoframe Data (left side)	**Description**
Channel Allocation	The speaker mapping and allocation. One or more of the following: ▪ FL ▪ FC ▪ FR ▪ RLC ▪ FRC ▪ RL ▪ RC ▪ RR ▪ RLC ▪ RRC ▪ LFE
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
Word length	Audio word length. One of: ▪ 16 bit ▪ 20 bit ▪ 24 bit

5.3 Testing an HDMI Source's Response to an EDID

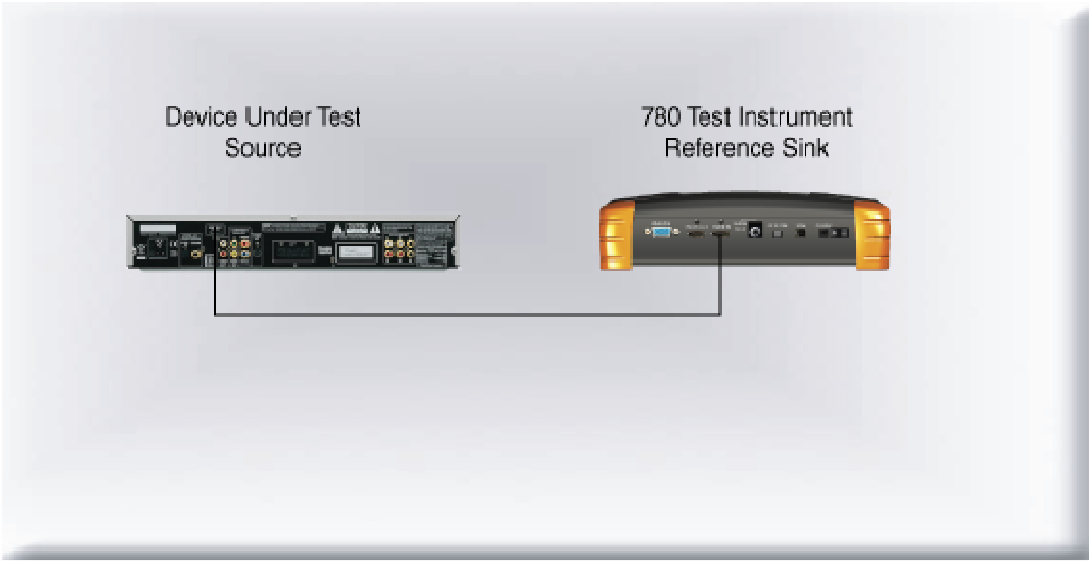
The 780 HDMI input emulates an HDMI sink device. Part of that emulation function is presenting an EDID to a source when the HDTV is powered and hot plug is asserted. The 780 is provisioned with a

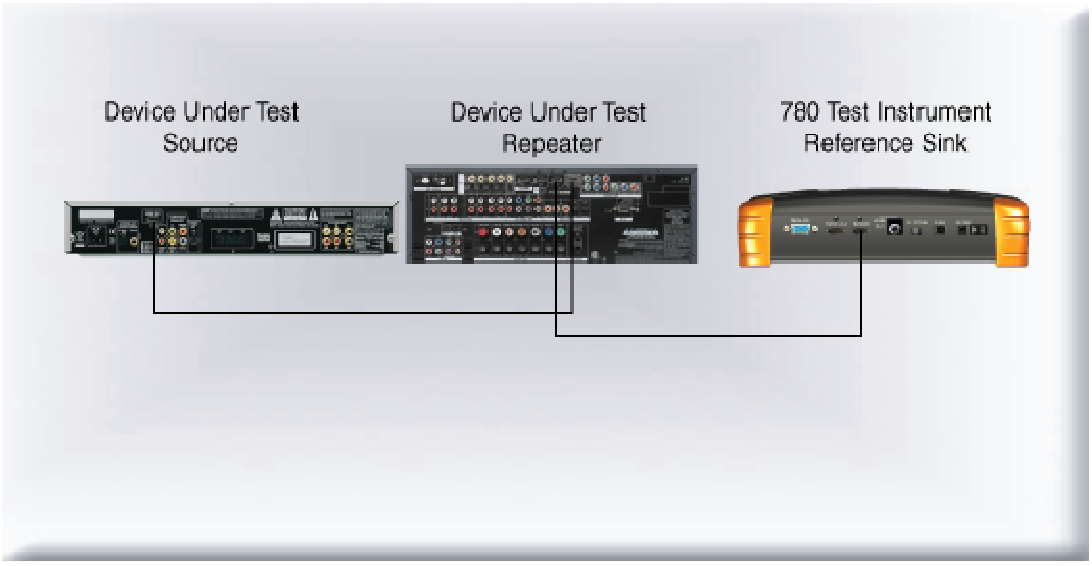
default EDID from the factory. However you can reprovision that EDID by connecting it to a sink device who's EDID you would like to use for testing.

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

5.3.1 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 780, 2) with your source device connected to the 780 through a repeater device. In both cases the 780 is emulating an HDMI sink to test an upstream source. These configurations are shown below.

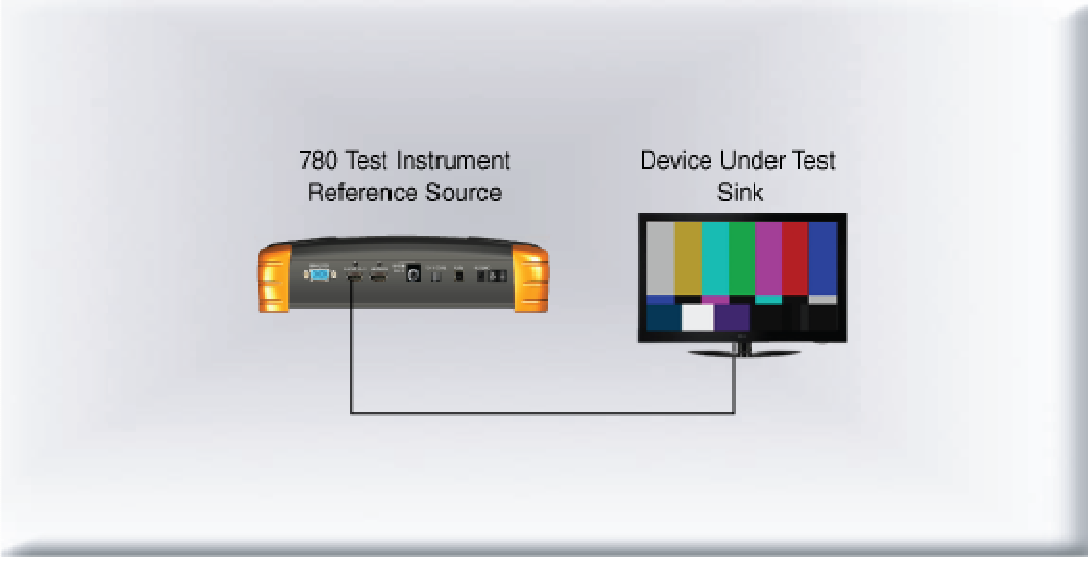




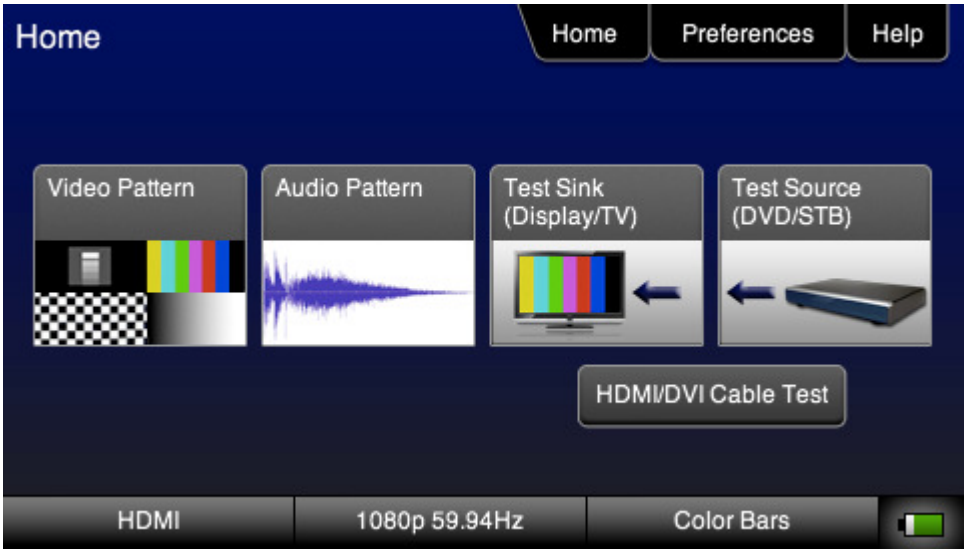
5.3.2 Procedures for Testing an HDMI Source Devices Response to an EDID

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

1. Connect the 780 Tx port to the HDMI input of a sink device whose EDID you wish to use for testing.



2. Touch select **Test Sink (Display/TV)** to access the EDID test from the top level menu (shown below).



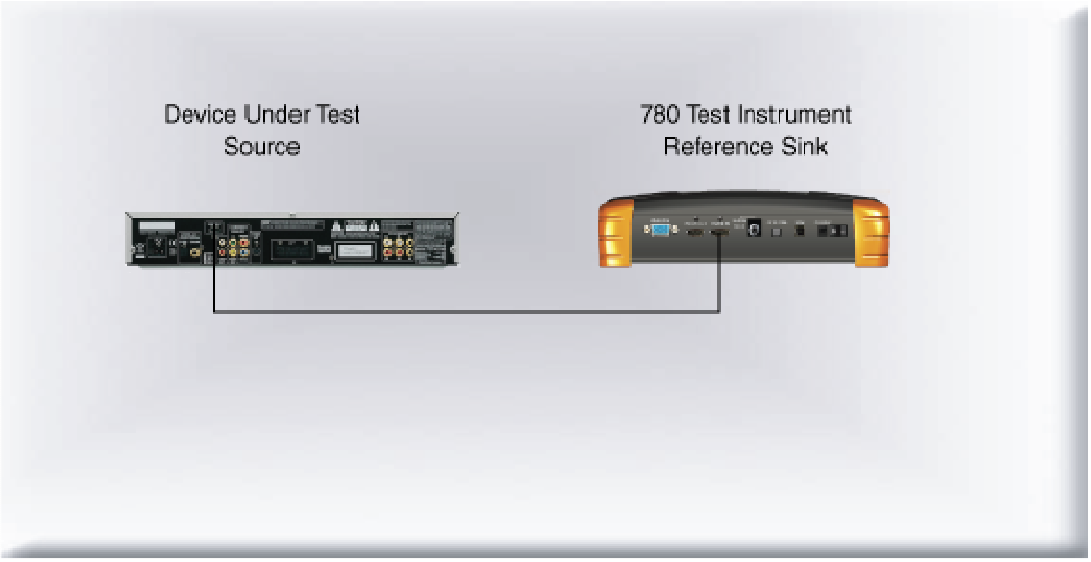
4. Touch select **EDID Test** from the **Sink Tests** menu shown below.

The following menu appears.

3. Touch select **Copy Rx** to provision the 780 HDMI Rx port with the EDID of the connected display. Alternatively, if you wish to reset the 780 HDMI Rx port to the default EDID of the 780, select **Reset Rx**.

4. You can test that you have provisioned a valid EDID by doing a quick loop test. You can loop the 780 HDMI Tx and Rx ports and run the EDID test from the HDMI Tx port as described in Reading the EDID on an HDMI HDTV or HDMI Repeater Device.

5. Connect the 780 Rx port to the HDMI output of a source device you wish to test.



6. Initiate a hot plug event to cause the source device under test to read the EDID of the 780 Rx port. Observe the source to determine how it responded to the EDID.

6 Using the 780 Test Instrument to Test HDMI Cable Equipment

This section provides procedures for testing HDMI cables, cable extenders, splitters, repeaters, etc. This function is an optional feature of the 780. The HDMI/DVI Cable Test runs a test on the TMDS leads, the 5V & hot plug leads and the DDC leads.

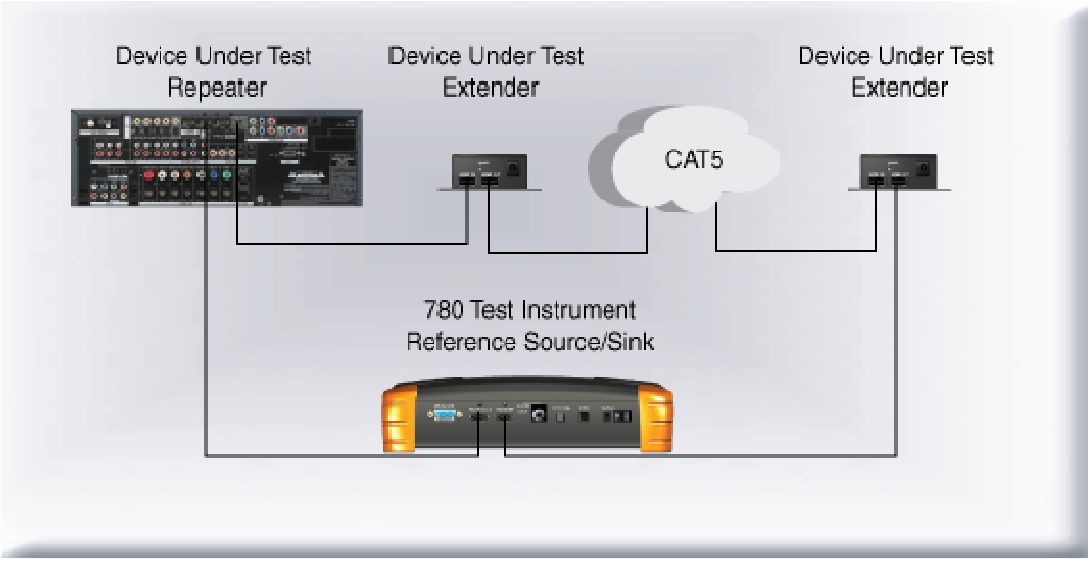
6.1 HDMI Cable or Network Test

The HDMI/DVI Cable Test runs a test on all the leads in the HDMI cable except the power and CEC bus as follows:

- Pixel error test using a pseudo-noise pattern on the TMDS lines using three separate timings:
    - 720p60 using 8 bit/component color
    - 1080p60 using 8 bit/component color
    - 1080p60 using 12 bit/component (deep color)
- Read/write test on the DDC leads. It reads an EDID at the output from the input.
- Continuity test on the 5V/Hot plug leads.

6.1.1 Configurations for Running an HDMI Cable or Network Test

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

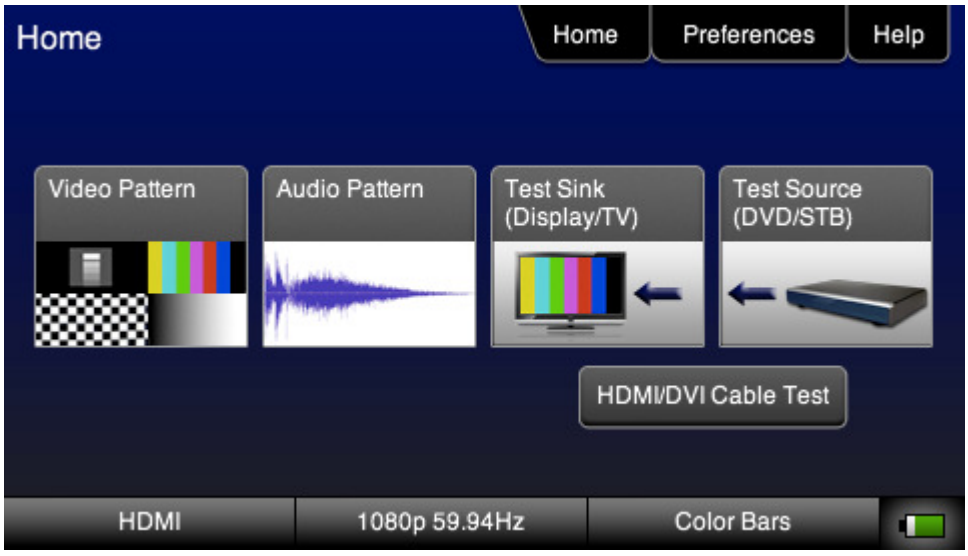


6.1.2 Procedures for Running an HDMI Cable or Network Test

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

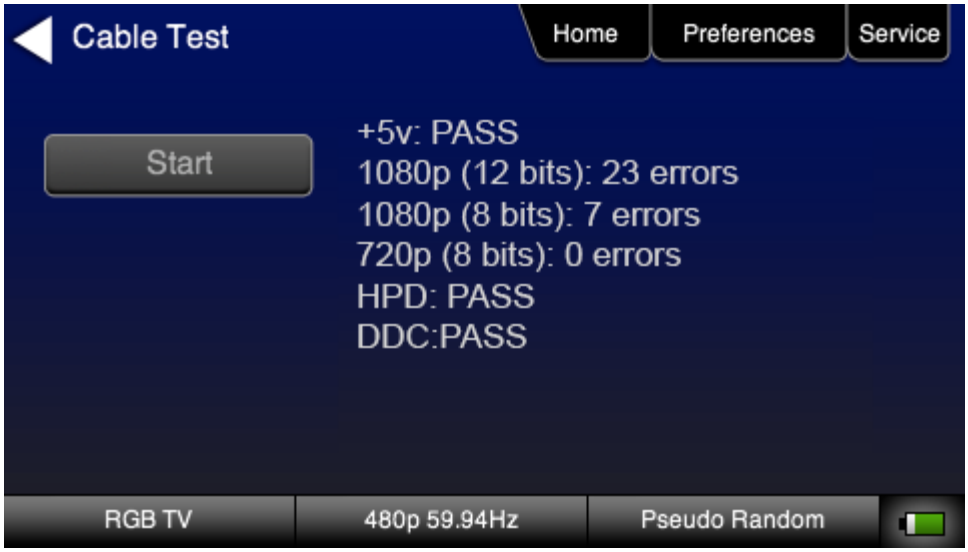
1. Follow the procedures above for rendering a Test Pattern on an HDMI HDTV Rendering Test Patterns on an HDMI HDTV.

2. Touch select **HDMI/DVI Cable Test** from the top level menu shown below.



3. Touch select **Start** to initiate the test.

   The pixel errors are displayed on the screen as shown below.


Cable Test
Home
Preferences
Service
Start
+5v: PASS
1080p (12 bits): 23 errors
1080p (8 bits): 7 errors
720p (8 bits): 0 errors
HPD: PASS
DDC:PASS
RGB TV
480p 59.94Hz
Pseudo Random

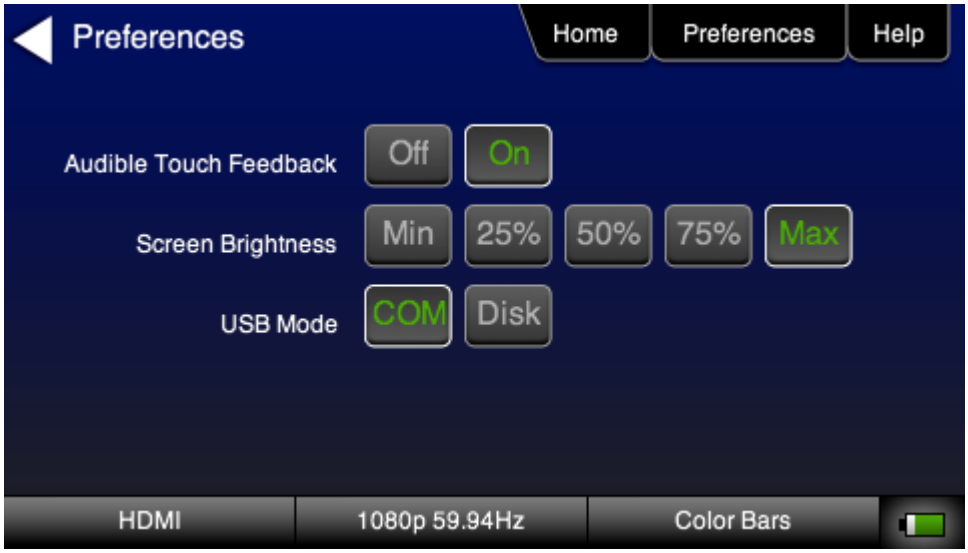
7 Upgrading the 780

7.1 Upgrading the Firmware and Gateware on your 780 Handheld Test Instrument for HDMI

You can upgrade the firmware and gateware on your 780 through the USB interface. In order to upgrade the 780 firmware and gateware you have to put the 780 in the "Disk" mode. This is not the default mode.

Use the following procedure to upgrade the firmware for your 780.

1. Download the 780 firmware and gateware files from the Quantum Data website http://www.quantumdata.com/downloads/index.asp to your PC and unzip the file.
2. Connect the 780 to a PC host via the USB cable provided.
3. Touch select the **Preferences** from the 780 top menu.
4. Choose **Disk** for the **USB Mode** (refer to the screen below).



5. Power cycle the 780.

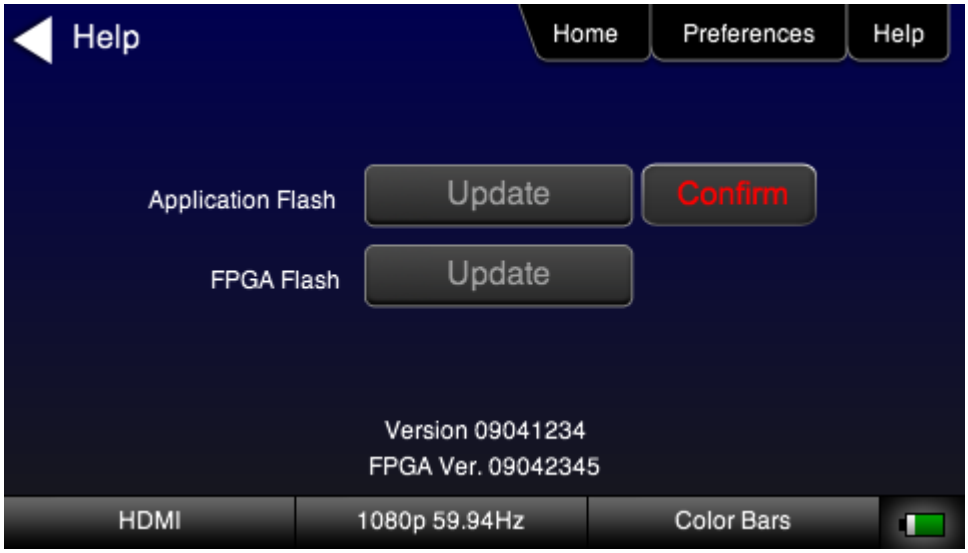
   The 780 appears as a mass storage device like any other USB drive.
6. Transfer the new firmware from your PC to the 780.
7. Transfer the new gateware from your PC to the 780.
8. Power cycle the 780.
9. Navigate to the Help window.

10. Activate the gateware (FPGA Flash) by touching the associated **Update** button.

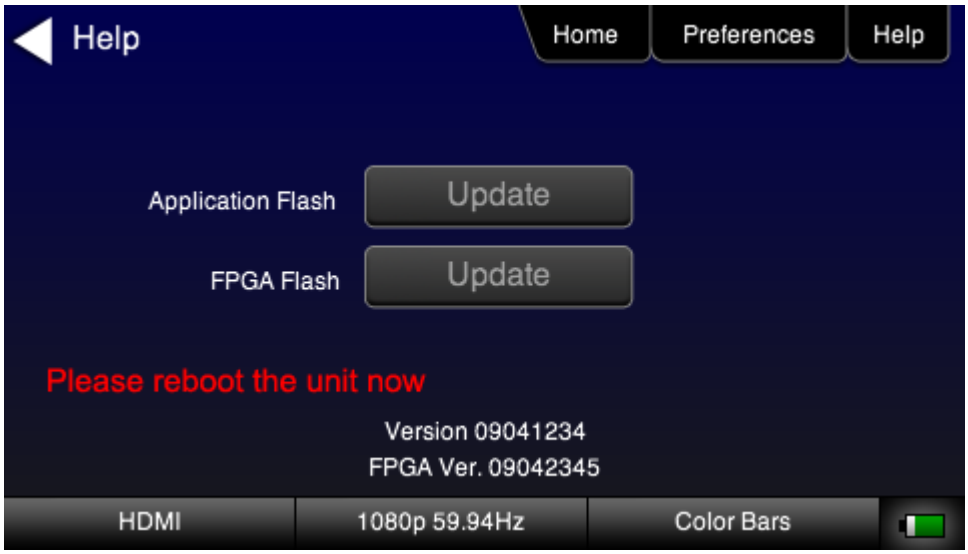
    A confirmation prompt is displayed. Touch select **Confirm** to initiate the firmware upgrade.

11. Activate the firmware (Application Flash) by touch selecting the associated **Update** button.

    A confirmation prompt is displayed. Touch select **Confirm** to initiate the firmware upgrade.

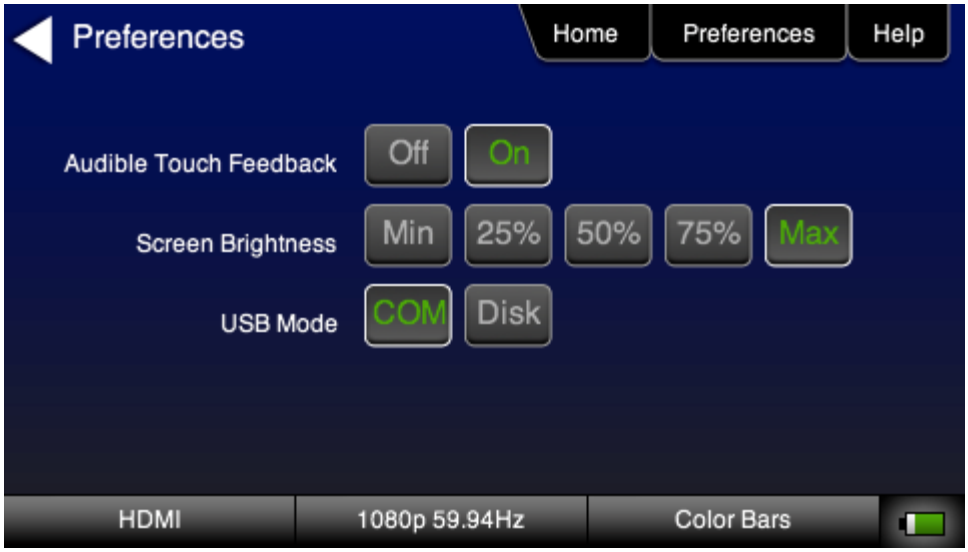


12. Power cycle the 780 when you see the prompt shown below.



13. Touch select the **Preferences** from the 780 top menu.

14. Choose **COM** for the **USB Mode** (refer to the screen below).



15. Power cycle the 780.

8 Command Interface

This chapter describes how to use the command line to control the 780. The command line is useful for automated control applications.

8.1 Guidelines for Using the Command Line

The command line is available through the 780 USB port. In order to use the command line you need to set the 780 USB port in COM mode. You may need to download a .INF file from the Quantum Data web site on the downloads page.

8.2 Procedures for Enabling the Command Line Interface

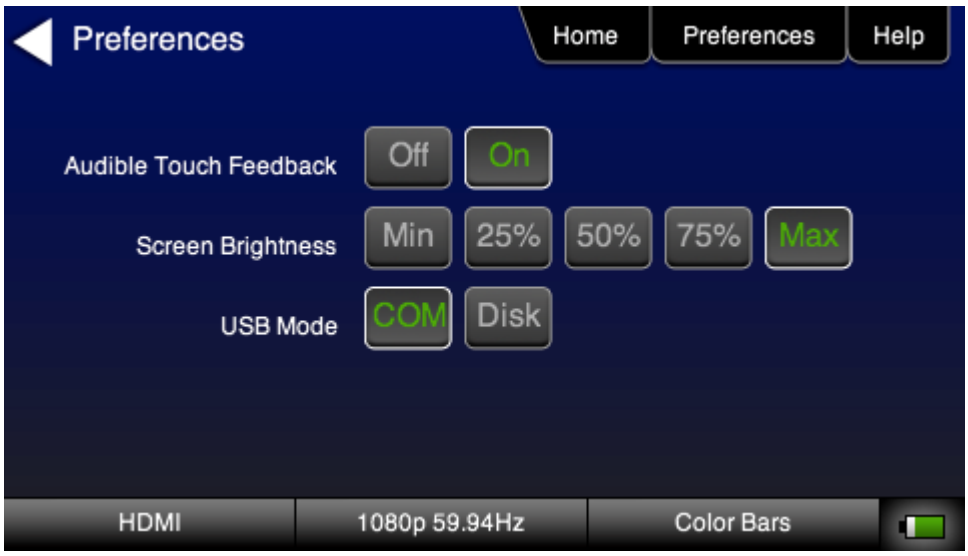
Use the following procedure to upgrade the firmware for your 780.

Please note if you experience a different behavior on your PC, refer to the 780 release notes on the Quantum Data webite at: http://www.quantumdata.com/downloads/index.asp.

1. Download the .INF file from the Quantum Data website http://www.quantumdata.com/downloads/index.asp to your PC and unzip the file. Store it in a convenient location on your PC.

2. Power up the 780 and touch select the **Preferences** from the 780 top menu.

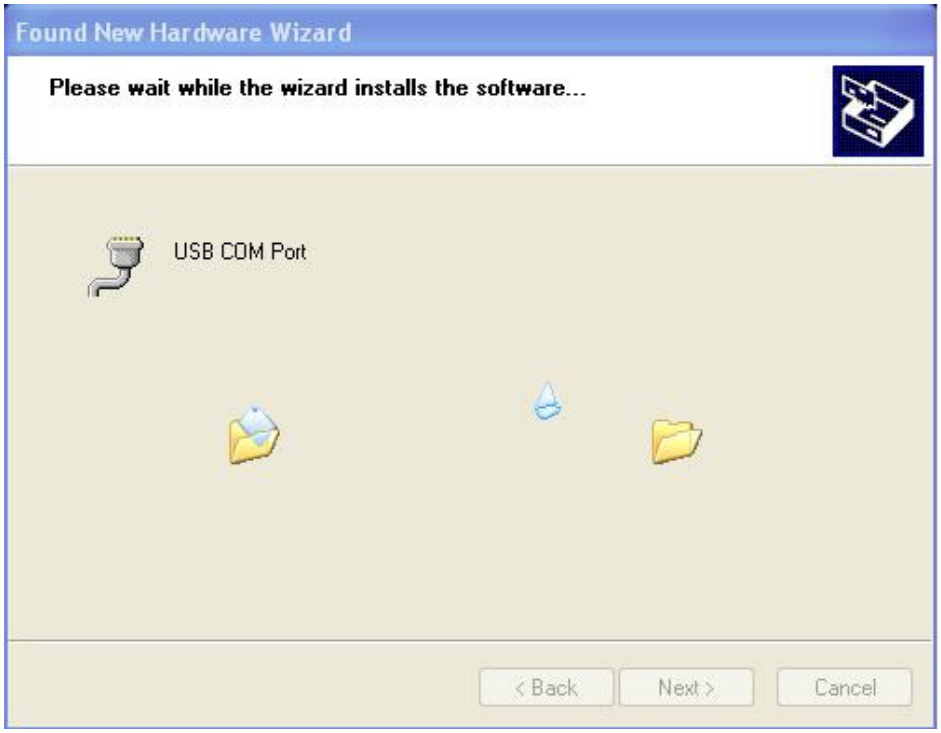
3. Choose **COM** for the **USB Mode** (refer to the screen below).



4. Connect the 780 to your host PC via the USB cable provided.

   The first time you connect 780 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.



6. Power cycle the 780.

8.3 Procedures for Entering Commands

Use the following procedure to connect to the 780 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 780 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 780 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 7-1 below provides the list of commands supported:

Table 7-1: List of Commands

Command	Description	Syntax	Parameters	Command Example
AVST	Selects the analog video format type.	AVST <*format_type*> AVST?	Where *format_type* is one of: 2 – RGB Analog 6 - Analog YPbPr	To set the analog video type: AVST 2 ALLU
DVSM	Digital video sampling mode. Applies only for HDMI.	DVSM <*sampling*> DVSM?	Where *sampling* is one of: 2 – 4:2:2 4 - RGB (4:4:4)	To set the HDMI sampling mode to RGB: DVSM 4 ALLU
FMTL	Loads a format.	FMTL <*format*>	Where *format* 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
IMGL	Loads an image (pattern).	IMGL <*image*>	Where *image* is one of the images listed in Table 7-4	See example below for IMGU

Table 7-1: List of Commands

Command	Description	Syntax	Parameters	Command Example
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	Number of bits per component. Applies only to HDMI	NBPC <*bit_depth*> NBPC?	Where *bit_depth* 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
SSST	Sets or queries the sync type. Applies only to analog outputs.	SSST <*sync_type*> SSST?	Where *format_type* is one of: 1 – separate sync 3 – sync on green	To set the analog sync type to separate sync: SSST 1 ALLU
XVSI	Selects the interface.	XVSI <*interface*> XVSI?	Where *interface* is one of: 2 – DVI (Computer) 3 – DVI (TV) 4 - HDMI 9 – Analog YpbPr or RGB)	To set the interface: XVSI 4 ALLU

Note: The commands are not case sensitive.

Table 7-2 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 7-2: 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 7-3 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 780 itself.

Table 7-3: 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 7-4 below lists the image names. For command line control you would use the image name as the argument for the IMGU command.

Table 7-4: 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

Table 7-4: 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		
Converge	IMGL Converge IMGU	Flat_Mag	IMGL Flat_Mag IMGU		