PQA600
Picture Quality Analyzer

Quick Start User Manual

071-2775-00

Tektronix

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www.tektronix.com
071-2775-00

Tektronix

Contacting Tektronix

Tektronix, Inc.
14150 SW Karl Braun Drive
P.O. Box 500
Beaverton, OR 97077
USA

For product information, sales, service, and technical support:

- In North America, call 1-800-833-9200.
- Worldwide, visit www.tektronix.com to find contacts in your area.

Warranty

Tektronix warrants that this product will be free from defects in materials and workmanship for a period of one (1) year from the date of shipment. If any such product proves defective during this warranty period, Tektronix, at its option, either will repair the defective product without charge for parts and labor, or will provide a replacement in exchange for the defective product. Parts, modules and replacement products used by Tektronix for warranty work may be new or reconditioned to like new performance. All replaced parts, modules and products become the property of Tektronix.

In order to obtain service under this warranty, Customer must notify Tektronix of the defect before the expiration of the warranty period and make suitable arrangements for the performance of service. Customer shall be responsible for packaging and shipping the defective product to the service center designated by Tektronix, with shipping charges prepaid. Tektronix shall pay for the return of the product to Customer if the shipment is to a location within the country in which the Tektronix service center is located. Customer shall be responsible for paying all shipping charges, duties, taxes, and any other charges for products returned to any other locations.

This warranty shall not apply to any defect, failure or damage caused by improper use or improper or inadequate maintenance and care. Tektronix shall not be obligated to furnish service under this warranty a) to repair damage resulting from attempts by personnel other than Tektronix representatives to install, repair or service the product; b) to repair damage resulting from improper use or connection to incompatible equipment; c) to repair any damage or malfunction caused by the use of non-Tektronix supplies; or d) to service a product that has been modified or integrated with other products when the effect of such modification or integration increases the time or difficulty of servicing the product.

THIS WARRANTY IS GIVEN BY TEKTRONIX WITH RESPECT TO THE PRODUCT IN LIEU OF ANY OTHER WARRANTIES, EXPRESS OR IMPLIED. TEKTRONIX AND ITS VENDORS DISCLAIM ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. TEKTRONIX' RESPONSIBILITY TO REPAIR OR REPLACE DEFECTIVE PRODUCTS IS THE SOLE AND EXCLUSIVE REMEDY PROVIDED TO THE CUSTOMER FOR BREACH OF THIS WARRANTY. TEKTRONIX AND ITS VENDORS WILL NOT BE LIABLE FOR ANY INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES IRRESPECTIVE OF WHETHER TEKTRONIX OR THE VENDOR HAS ADVANCE NOTICE OF THE POSSIBILITY OF SUCH DAMAGES.

[W2 – 15AUG04]

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General Safety Summary

Review the following safety precautions to avoid injury and prevent damage to this product or any products connected to it.

To avoid potential hazards, use this product only as specified.

Only qualified personnel should perform service procedures.

While using this product, you may need to access other parts of a larger system. Read the safety sections of the other component manuals for warnings and cautions related to operating the system.

To Avoid Fire or Personal Injury

Use proper power cord. Use only the power cord specified for this product and certified for the country of use.

Ground the product. This product is grounded through the grounding conductor of the power cord. To avoid electric shock, the grounding conductor must be connected to earth ground. Before making connections to the input or output terminals of the product, ensure that the product is properly grounded.

Observe all terminal ratings. To avoid fire or shock hazard, observe all ratings and markings on the product. Consult the product manual for further ratings information before making connections to the product.

Power disconnect. The power cord disconnects the product from the power source. Do not block the power cord; it must remain accessible to the user at all times.

Do not operate without covers. Do not operate this product with covers or panels removed.

Do not operate with suspected failures. If you suspect that there is damage to this product, have it inspected by qualified service personnel.

Avoid exposed circuitry. Do not touch exposed connections and components when power is present.

Do not operate in wet/damp conditions.

Do not operate in an explosive atmosphere.

Keep product surfaces clean and dry.

Provide proper ventilation. Refer to the manual's installation instructions for details on installing the product so it has proper ventilation.

Terms in This Manual

These terms may appear in this manual:

WARNING. *Warning statements identify conditions or practices that could result in injury or loss of life.*

CAUTION. *Caution statements identify conditions or practices that could result in damage to this product or other property.*

Symbols and Terms on the Product

These terms may appear on the product:

- DANGER indicates an injury hazard immediately accessible as you read the marking.
- WARNING indicates an injury hazard not immediately accessible as you read the marking.
- CAUTION indicates a hazard to property including the product.

The following symbol(s) may appear on the product:

Compliance Information

This section lists the EMC (electromagnetic compliance), safety, and environmental standards with which the instrument complies.

EMC Compliance

EC Declaration of Conformity – EMC

Meets intent of Directive 2004/108/EC for Electromagnetic Compatibility. Compliance was demonstrated to the following specifications as listed in the Official Journal of the European Communities:

EN 61326-1 2006. EMC requirements for electrical equipment for measurement, control, and laboratory use. [1] [2]

- CISPR 11:2003. Radiated and conducted emissions, Group 1, Class A
- IEC 61000-4-2:2001. Electrostatic discharge immunity
- IEC 61000-4-3:2002. RF electromagnetic field immunity
- IEC 61000-4-4:2004. Electrical fast transient / burst immunity
- IEC 61000-4-5:2001. Power line surge immunity
- IEC 61000-4-6:2003. Conducted RF immunity
- IEC 61000-4-11:2004. Voltage dips and interruptions immunity

EN 61000-3-2:2006. AC power line harmonic emissions

EN 61000-3-3:1995. Voltage changes, fluctuations, and flicker

European Contact.
Tektronix UK, Ltd.
Western Peninsula
Western Road
Bracknell, RG12 1RF
United Kingdom

1 **This product is intended for use in nonresidential areas only. Use in residential areas may cause electromagnetic interference.**

2 **Emissions which exceed the levels required by this standard may occur when this equipment is connected to a test object.**

Australia / New Zealand Declaration of Conformity – EMC

Complies with the EMC provision of the Radiocommunications Act per the following standard, in accordance with ACMA:

- CISPR 11:2003. Radiated and Conducted Emissions, Group 1, Class A, in accordance with EN 61326-1:2006.

Safety Compliance

EC Declaration of Conformity – Low Voltage

Compliance was demonstrated to the following specification as listed in the Official Journal of the European Communities:

Low Voltage Directive 2006/95/EC.

- EN 61010-1: 2001. Safety requirements for electrical equipment for measurement control and laboratory use.

U.S. Nationally Recognized Testing Laboratory Listing

- UL 61010-1:2004, 2nd Edition. Standard for electrical measuring and test equipment.

Canadian Certification

- CAN/CSA-C22.2 No. 61010-1:2004. Safety requirements for electrical equipment for measurement, control, and laboratory use. Part 1.

Additional Compliances

- IEC 61010-1: 2001. Safety requirements for electrical equipment for measurement, control, and laboratory use.

Equipment Type

Test and measuring equipment.

Safety Class

Class 1 – grounded product.

Pollution Degree Description

A measure of the contaminants that could occur in the environment around and within a product. Typically the internal environment inside a product is considered to be the same as the external. Products should be used only in the environment for which they are rated.

- Pollution Degree 1. No pollution or only dry, nonconductive pollution occurs. Products in this category are generally encapsulated, hermetically sealed, or located in clean rooms.
- Pollution Degree 2. Normally only dry, nonconductive pollution occurs. Occasionally a temporary conductivity that is caused by condensation must be expected. This location is a typical office/home environment. Temporary condensation occurs only when the product is out of service.
- Pollution Degree 3. Conductive pollution, or dry, nonconductive pollution that becomes conductive due to condensation. These are sheltered locations where neither temperature nor humidity is controlled. The area is protected from direct sunshine, rain, or direct wind.
- Pollution Degree 4. Pollution that generates persistent conductivity through conductive dust, rain, or snow. Typical outdoor locations.

Pollution Degree

Pollution Degree 2 (as defined in IEC 61010-1). Note: Rated for indoor use only.

Installation (Overvoltage) Category Descriptions

Terminals on this product may have different installation (overvoltage) category designations. The installation categories are:

Measurement Category IV. For measurements performed at the source of low-voltage installation.

Measurement Category III. For measurements performed in the building installation.

Measurement Category II. For measurements performed on circuits directly connected to the low voltage installation.

Measurement Category I. For measurements performed on circuits not directly connected to MAINS.

Overvoltage Category

Overvoltage Category II (as defined in IEC 61010-1)

Environmental Considerations

This section provides information about the environmental impact of the product.

Product End-of-Life Handling

Observe the following guidelines when recycling an instrument or component:

Equipment Recycling. Production of this equipment required the extraction and use of natural resources. The equipment may contain substances that could be harmful to the environment or human health if improperly handled at the product's end of life. In order to avoid release of such substances into the environment and to reduce the use of natural resources, we encourage you to recycle this product in an appropriate system that will ensure that most of the materials are reused or recycled appropriately.

This symbol indicates that this product complies with the applicable European Union requirements according to Directives 2002/96/EC and 2006/66/EC on waste electrical and electronic equipment (WEEE) and batteries. For information about recycling options, check the Support/Service section of the Tektronix Web site (www.tektronix.com).

Battery Recycling. This product may contain a rechargeable battery, which must be recycled or disposed of properly. Please properly dispose of or recycle the battery according to local government regulations.

Perchlorate Materials. This product contains one or more type CR lithium batteries. According to the state of California, CR lithium batteries are classified as perchlorate materials and require special handling. See www.dtsc.ca.gov/hazardouswaste/perchlorate for additional information.

Transporting Batteries

The capacity of the lithium ion rechargeable battery pack in this product is under 100 Wh. The lithium-equivalent content, as defined by the UN Manual of Tests and Criteria Part III Section 38.3, is under 8 g per pack and 1.5 g per individual cell. Consult your air carrier for applicability and determination of any special lithium ion battery transportation requirements.

Restriction of Hazardous Substances

This product is classified as Monitoring and Control equipment, and is outside the scope of the 2002/95/EC RoHS Directive.

Preface

About This Manual

This manual describes the installation and basic operation of the PQA600 Picture Quality Analyzer with Version 3.0 software.

Key Features

The PQA600 analyzer is the latest-generation Picture Quality Analyzer built on the Tektronix' Emmy Award winning PQA200/300 Picture Quality Analyzers. Based on concepts of the human vision system, the PQA600 analyzer provides a suite of repeatable, objective quality measurements that closely correspond with subjective human visual assessment:

- Fast, accurate, repeatable, objective picture quality measurement
- Predicts DMOS (Differential Mean Opinion Score) measurement based on model of the human vision system
- Picture quality measurements can be made on a variety of HD video formats (1080i, 720p) and SD video formats (525 or 625)
- Ability to make picture quality comparison across different resolutions from HD to SD, or HD/SD to CIF
- User-configurable viewing condition and display models for reference and comparison
- Attention/Artifact weighted measurement
- Automatic temporal and spatial alignment
- Easy regression testing and automation with XML scripting
- Optional SD/HD SDI Interface for generating and capturing video

Documentation

To read about	Use these documents
Installation and operation (overviews)	*PQA600 Picture Quality Analyzer Quick Start User Manual.* The quick start user manual contains general information about how to put your instrument into service, guides to user interface controls, and application examples.
In-depth reference information	*PQA600 Picture Quality Analyzer System Technical Reference.* The technical reference contains detailed information about the instrument, including how measurements are calculated and specifications.
PC platform information	Refer to the PC platform documentation for full information on the PC platform hardware and software. The PC platform documentation is provided on a CD.

Software Upgrades

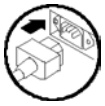
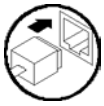
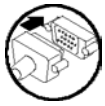
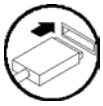
Periodic software upgrades might become available.

To check for upgrades:

1. Go to the Tektronix Web site (www.tektronix.com).
2. Select **Software and Drivers** to link to the **Software and Firmware Finder** Web page.
3. Enter the product name (PQA600) to find available software upgrades.

Conventions Used in This Manual

The following icons are used throughout this manual.

Sequence Step	Front panel power	Connect power	Network	PS2	SVGA	USB
						

Installing Your Instrument

This section contains information on installing your instrument. Unpack the instrument and check that you received all items listed as Standard Accessories. Check that you also received any of the listed Recommended Accessories that you ordered with your instrument. Check the Tektronix Web site (www.tektronix.com) for the most current information.

Standard Accessories

Accessory		Tektronix part number
PQA600 Picture Quality Analysis System Quick Start User Manual in English, and Simplified Chinese or Japanese translation if a language option was ordered		071-2775-XX
PQA600 Picture Quality Analysis System Release Notes		071-2781-XX
PQA600 Picture Quality Analysis System User Technical Reference, in PDF format on Documentation CD		071-2778-XX
PQA600 Picture Quality Analysis System Measurement Technical Reference		071-2779-XX
PQA600 Picture Quality Analysis System Specification and Performance Verification Manual in PDF format on Product Documentation CD		077-0487-XX
PQA600 Picture Quality Analysis System Measurement Declassification and Security Instructions in PDF format on Tektronix Web site, www.tektronix.com/manuals		077-0486-XX
PQA600 Picture Quality Analysis System Product Documentation CD, containing PDF files of the documentation set		063-4284-XX
PQA600 Picture Quality Analysis System Application Install CD		020-3054-XX
PQA600 Picture Quality Analysis System Video Sequences Recovery Disks		020-3053-XX
Dell Operating System Reinstallation DVD (Windows 7 Professional 64–Bit)		— — —
Dell Application CD		— — —
Dell keyboard		— — —
Dell optical mouse		— — —
Dell Warranty and Support Information, and Safety, Environmental, and Regulatory Information booklets		— — —
Roxio Creator DE CD		— — —
BNC to mini-BNC SDI cable (Option SDI only)		174-5466-XX
Power Cord	North America (Option A0)	161-0066-00
	Universal Euro (Option A1)	161-0066-09
	United Kingdom (Option A2)	161-0066-10
	Australia (Option A3)	161-0066-13
	North America 240V (Option A4)	161-0066-12
	Switzerland (Option A5)	161-0154-00
	Japan (Option A6)	161-0298-00
	China (Option A10)	161-0304-00
	India (Option A11)	161-0324-00
	No power cord or AC adapter (Option A99)	— — —

Options

You can add the following option to your Picture Quality Analyzer System:

- Option SDI - Adds SD/HD SDI Acquisition Card

Language Options

You must select one of the following language options for your Picture Quality Analysis System:

- Option L0 - English Quick Start User Manual
- Option L5 - Japanese Quick Start User Manual
- Option L7 - Simplified Chinese Quick Start User Manual

Operating Requirements

1. Place the instrument on a bench.
2. Before operating, ensure that the ambient temperature is between +50 °F and +95 °F (+10 °C to +35 °C).

CAUTION. *To ensure proper cooling, keep the front and rear of the instrument clear of obstructions.*

Installing the System

This section provides basic information about performing the PQA600 analyzer installation. For detailed information about the PC workstation hardware, see the documentation provided on the Dell T7500 Documentation CD.

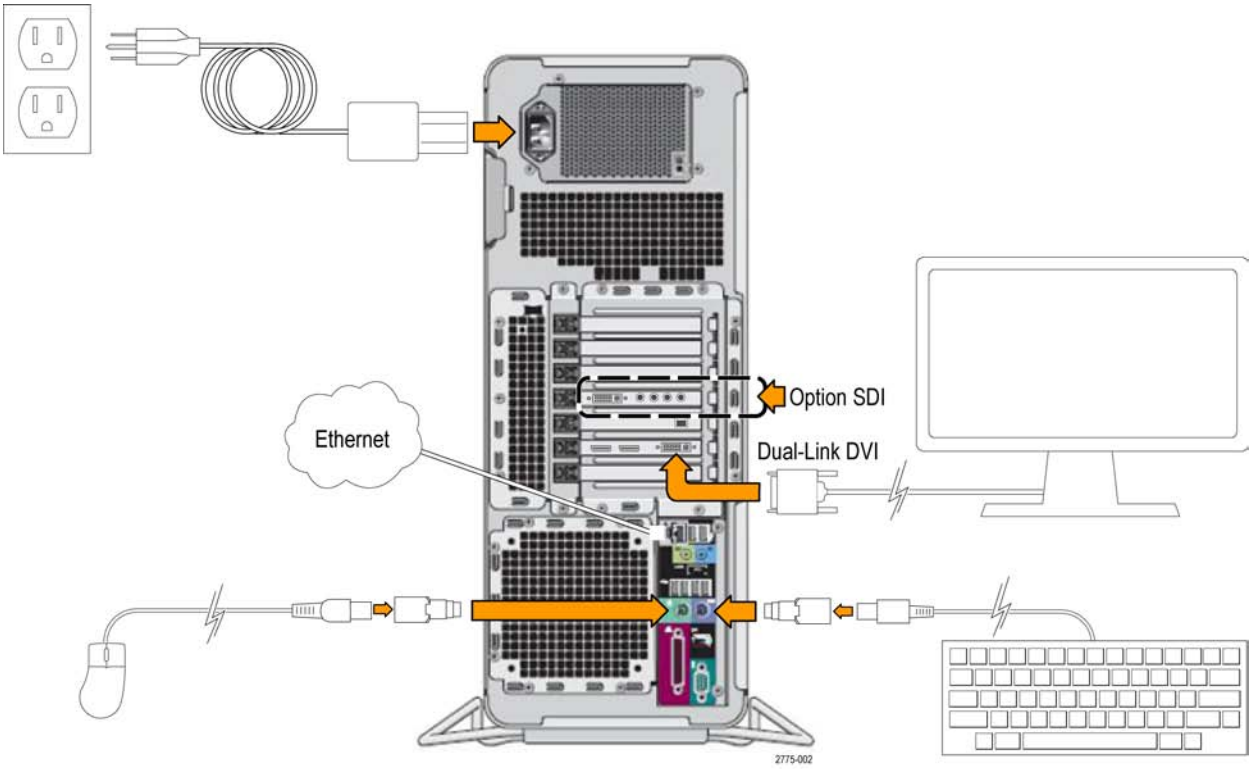
Hardware Prerequisites

Before installation, ensure that the following are available:

- Mains power, 115V/230 V, 50/60 Hz, 6A/3A. See Power Supply Requirements.
- Clearance around the unit to allow proper airflow
- An RJ45 network connection between the Gigabit Ethernet port and your network.
- An appropriate display monitor. The PQA600 analyzer is not supplied with a monitor, though it is configured with a high-performance video card.

CAUTION. *To prevent personal injury, always use two people to move the PQA600 analyzer.*

Installation Procedure



To install the PQA600 analyzer, perform the following generalized procedure:

1. Connect a display monitor to the video card connector on the rear panel.
2. Attach the keyboard and mouse using the USB-to-PS2 adapters to connect to the PS2 ports on the rear panel.
3. Connect power to the PQA600 analyzer.
4. Press the power button on the front panel.
5. To access the PC, click the PQA600 account icon. No password is required.

Powering On the Instrument

The following table lists the operating voltage requirements for the PQA600 instrument. All voltages are RMS values.

Power supply requirements

Source voltage	Frequency	Maximum Rated Input Current
115/230	50–60	12 Amps.

NOTE. *Connect the power cord (provided with the unit) to the power connector on the rear panel. Then connect the power cord plug to a properly grounded outlet.*

To power on the instrument (after making all connections):

1. Attach the power cord to the rear panel.
2. Press the power button on the front panel.

Shutting Down the Instrument

To shut down the instrument:

1. Select **Start** > **Shutdown**.
2. Select **Shutdown** from the drop-down list in the **Shutdown Windows** dialog and then select **OK**.

Removing the Power

To remove power from the instrument:

1. Shut down the instrument.
2. After Windows has completed the shutdown process, remove the power cord from the rear panel.

Connecting to a Network

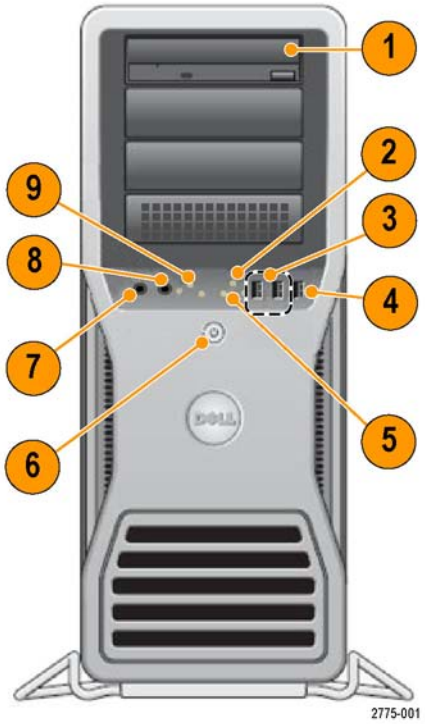
You can connect your instrument to a network for printing, file sharing, internet access, and other functions. Consult with your network administrator and use the standard Windows utilities to configure the instrument for your network.

Operating Your Instrument

Getting Acquainted with Your Instrument

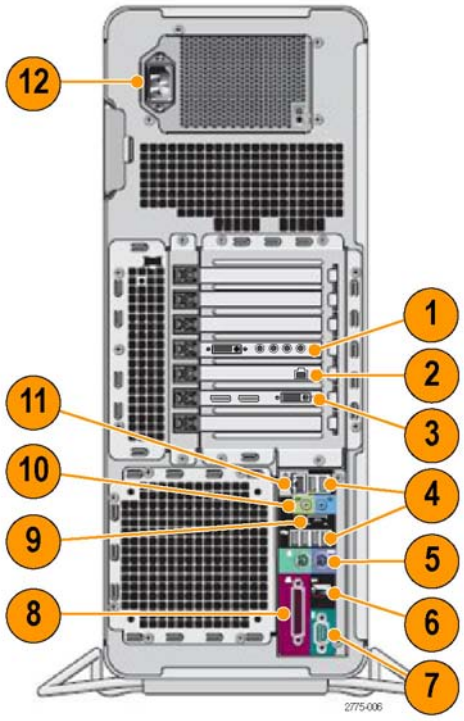
Controls and display elements are shown in the following illustrations and tables.

Front Panel Indicators



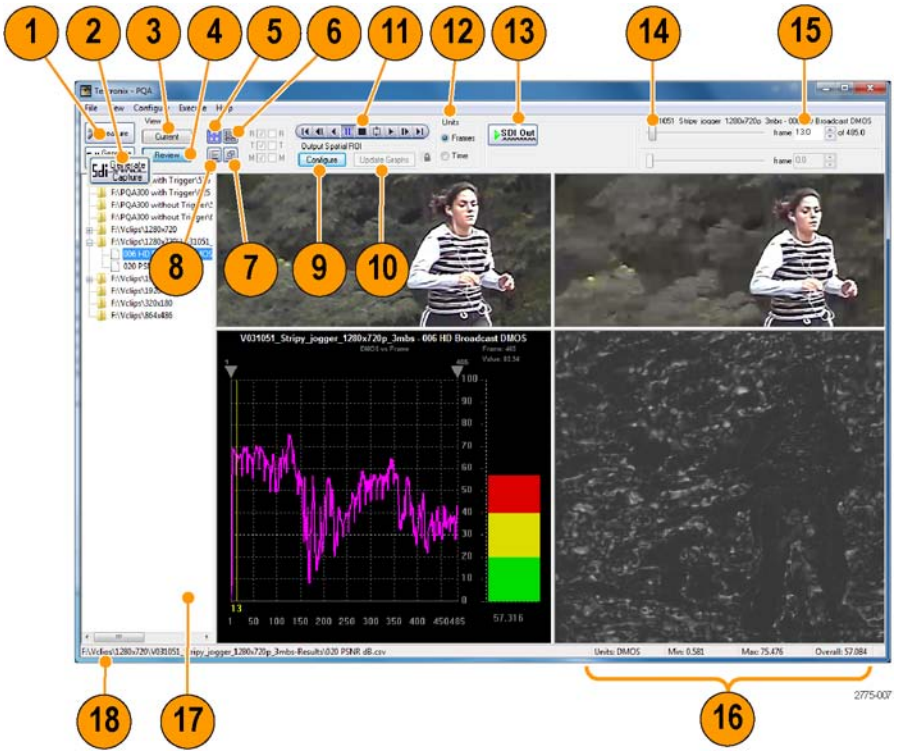
Ref number	Item	Description
1	Optical drive	DVD-R/W optical drive
2	Drive activity light	Random blinking light indicates hard disk drive activity Blinking green light indicates network activity
3	USB 2.0 connectors	USB 2.0 compliant ports
4	IEEE 1394	Connector for attaching external iEEE 1394 compliant devices
5	Diagnostic lights	Refer to Dell documentation for details
6	Power button	Turns the instrument on or off
7	Microphone connector	Used to attach a microphone
8	Headphone connector	Used to attach headphones
9	Link integrity indicator	Refer to Dell documentation for details

Rear Panel Connectors



Ref number	Item	Description
1	Video I/O card (optional)	SD/HD SDI Video I/O card. (Option SDI only)
2	Network card	Ethernet network card
3	Video display card	Dual-link DVI video display card
4	USB ports	USB 2.0 connectors (6)
5	Mouse and keyboard connectors	PS/2 mouse and keyboard connectors
6	IEEE 1394 connector	IEEE 1394 high-speed serial bus interface connector
7	Serial port	Serial port connector
8	Parallel port	Parallel port connector
9	eSATA connector	eSATA interface connector
10	Line in and line out connectors	Line-level audio input and output connectors
11	Network adapter	Ethernet network interface connector
12	Power connector	AC line connector

Software Interface and Display Elements



Ref number	Item	Description
1	Measure button	The Measure button performs multiple functions. Use it to display the Configure Measure window (which allows you to select or configure measurements), to initiate measurements, and to stop currently running measurements.
2	SDI Generate/Capture button	Use the SDI Generate/Capture button to generate a video output signal or capture a video input signal into a file (requires Option SDI).
3	Current button	Use the Current button to change the view to Current. In the Current view, you can configure and run measurements. You can also click this button to switch between reviewing results and checking the progress of a running measurement.
4	Review button	Use the Review button to change the view to Review. In the Review view, you can select video clips for review and analysis. You can use this button while a measurement is running to review results, though you cannot view running measurement results until they are complete.
5	Summary View button	Select to display the Summary View screen. The Summary View screen shows the reference video, test video, map, and the graph display.
6	Tile View button	Select to display the Tile View screen. The Tile View screen shows three screens in a horizontal arrangement: the reference video at the top, the test video in the middle, and the map at the bottom.

Ref number	Item	Description
7	Overlay View button	Select to display the Overlay View screen. The Overlay View screen mixes two sources for display. Using a slide bar, you can specify which source makes up most of the display.
8	Event Log	Select to display the Event Log screen. The Event Log displays measurements which exceed the settings for warnings and errors.
9	Configure button	Use the Configure button to control the Output Spatial ROI settings.
10	Update Graphs button	Use the Update Graphs button to recalculate measurements after you specify the Output Spatial ROI boundary.
11	Control bar	Controls the playback of video. Functions like the playback controls on a videotape or DVD player.
12	Units selector	Sets the selector bar to select video frames by frame number or elapsed time.
13	SDI Out	Select to output the Reference file to the Ch 1 connectors and output the Test file to the Ch 2 output connectors while reviewing the measurement results (or in review mode).
14	Frame selector	Use this slider bar to select which frame of the video clip to display.
15	Frame/Time readout	The readout indicates the display frame-by-frame number or time. You can also enter a frame number or time to display into this readout.
16	Measurement readout	The readout displays the minimum, maximum, and overall values for the selected measurement.
17	Navigation pane	The Navigation Pane is used to select measurement results for review.
18	Results path	The Results Path readout shows the path to the directory containing the selected measurement results file.

Table 1: Elements of the menu bar

Menu	Command	Description
File	Working Directories	Use to add directories to the Navigation Pane.
	Update Sequence List	Use to update contents of directories in the Navigation Pane.
	Import Measures	Use to import user configured measures that have been saved in another location or PQA600.
	Print	Sends a screen capture of the PQA600 application window to the printer.
	Exit	Quits the PQA600 application.
View	Current Measure	Sets the View to Current.
	Review	Sets the View to Review.
	Summary View	Sets the display area to Summary View.
	Tile	Sets the display area to Tile View.
	Overlay	Sets the display area to Overlay View.
	Event Log	Sets the display area to the Event Log.
	Result 1	Selects which sources are displayed in the Overlay view as Result 1.

Table 1: Elements of the menu bar (cont.)

Menu	Command	Description
	Result 2	Selects which sources are displayed in the Overlay view as Result 2 (two results files must be selected to display two results).
	Loop	Sets playback to loop mode.
Configure	Measures	Displays the Configure Measures window to enable you to create and configure measurements.
	Generation/Capture	Displays the Capture window to enable you to configure Capture settings.
	Display Settings	Displays the Display Settings window. From the Display settings window, you can set the brightness and contrast for result maps, specify the colors used in the Summary View Graph, and set videos to fit the window.
Execute	Measures	Initiates a measurement.
Help	Tektronix Home Page	Displays the Tektronix Web site in a browser window.
	About the PQA600	Displays information about the PQA600 Picture Quality Analyzer.

Starting or Exiting the Software

To start the PQA600 application software:

- Select **Start > Programs >Tektronix > PQA600** or double-click the desktop icon.

To exit the PQA600 application software:

- Select **File > Exit**.

The Analysis Process

Analyzing picture quality with the PQA600 analyzer is, broadly speaking, a two step process. First, you take a measurement and second, you review the analysis results. Once the measurement is complete, you can choose several ways to review the results.

In taking a measurement, you select a measurement (either a template measurement or a user-created measurement) from the Configure Measure dialog box. After selecting the measurement, you specify the video file(s) on which the measurement will be taken. Some measurements apply to a single file, though most compare a test file to a reference file. Once you have specified the video files on which to take the measurement, you initiate the measurement.

Selecting a Measurement

To select a measurement:

1. Click **Measure** to display the **Configure Measure** dialog box.
2. Select a measurement from the list of **Measures**.

Table 2: Measurements and their processing nodes

Measurement Name	Display Model	View Model	PSNR	Perceptual Difference	Artifact Detection	Attention Model	Summary Node
000 View Video	—	—	—	—	—	—	—
001 SD Broadcast PQR	✓	✓	—	✓	—	—	✓
002 HD Broadcast PQR	✓	✓	—	✓	—	—	✓
003 CIF and QVGA PQR	✓	✓	—	✓	—	—	✓
004 D-CINEMA PQR	✓	✓	—	✓	—	—	✓
005 SD Broadcast DMOS	✓	✓	—	✓	—	—	✓
006 HD Broadcast DMOS	✓	✓	—	✓	—	—	✓
007 CIF and QVGA DMOS	✓	✓	—	✓	—	—	✓
008 D-CINEMA DMOS	✓	✓	—	✓	—	—	✓

Table 2: Measurements and their processing nodes (cont.)

Measurement Name	Display Model	View Model	PSNR	Perceptual Difference	Artifact Detection	Attention Model	Summary Node
009 SD Broadcast ADMOS	✓	✓	—	✓	—	✓	✓
010 HD Broadcast ADMOS	✓	✓	—	✓	—	✓	✓
011 CIF and QVGA ADMOS	✓	✓	—	✓	—	✓	✓
012 SD Sports Broadcast ADMOS	✓	✓	—	✓	—	✓	✓
013 HD Sports Broadcast ADMOS	✓	✓	—	✓	—	✓	✓
014 Talking Head Broadcast ADMOS	✓	✓	—	✓	—	✓	✓
015 SD DVD from D-Cinema DMOS	✓	✓	—	✓	—	—	✓
016 CIF from SD Broadcast DMOS	✓	✓	—	✓	—	—	✓
017 SD from HD Broadcast DMOS	✓	✓	—	✓	—	—	✓
017-A Reference: SD, Test: HD Broadcast DMOS	✓	✓	—	✓	—	—	✓
018 QCIF from CIF and QVGA DMOS	✓	✓	—	✓	—	—	✓
019 Stand-alone Attention Model	—	—	—	—	—	✓	✓
020 PSNR dB	—	—	✓	—	—	—	✓
021 Removed Edges Percent	—	✓	—	—	✓	—	✓
022 Added Edges Percent	—	✓	—	—	✓	—	✓
023 Rotated Edges Percent	—	✓	—	—	✓	—	✓
024 DC Blocking Percent	—	✓	—	—	✓	—	✓
025 Removed Edges Weighted PSNR dB	—	✓	✓	—	✓	—	✓
026 Added Edges Weighted PSNR dB	—	✓	✓	—	✓	—	✓
027 Rotated Edges Weighted PSNR dB	—	✓	✓	—	✓	—	✓
028 DC Blocking Weighted PSNR dB	—	✓	✓	—	✓	—	✓

Table 2: Measurements and their processing nodes (cont.)

Measurement Name	Display Model	View Model	PSNR	Perceptual Difference	Artifact Detection	Attention Model	Summary Node
029 Artifact Annoyance Weighted PSNR dB	—	✓	✓	—	✓	—	✓
030 SD DVD from D-Cinema Artifact Weighted PSNR dB	—	✓	✓	—	✓	—	✓
031 CIF from SD Broadcast Artifact Weighted PSNR dB	—	✓	✓	—	✓	—	✓
032 SD from HD Broadcast Artifact Weighted PSNR dB	—	✓	✓	—	✓	—	✓
033 QCIF from CIF and QVGA Artifact Weighted PSNR dB	—	✓	✓	—	✓	—	✓
034 Attention Weighted PSNR dB	—	—	✓	—	—	✓	✓
035 No Reference DC Blockiness Percent	—	—	—	—	✓	—	✓
036 HD ADMOS ITU-BT500 with Interlaced CRT	✓	✓	—	✓	—	✓	✓
037 HD PQR ITU-BT500 with Interlaced CRT	✓	✓	—	✓	—	—	✓
038 HD DMOS ITU-BT500 with Interlaced CRT	✓	✓	—	✓	—	—	✓

Template Measurements

The PQA600 application software is configured with 38 template measurements. These measurements are optimized for a variety of uses. Although you cannot change the parameters of the template measurements, you can create new measurements based on a template measurement and save the new measurement under a different name. Measurements are defined through a series of configuration nodes. You change measurement parameters by selecting a configuration node and adjusting its settings to suit your requirements.

NOTE. *To accurately simulate the procedure called out in the ITU BT.500 standard, all DMOS predictions require a worst case training. To provide this training, take the selected DMOS measurement once with an example of the worst case video expected for the application according to ITU BT.500 worst case training recommendations. After you have taken the measurement, use the Import function in the Summary Node for the measurement to import the Minkowski value from the measurement results csv file.*

Table 3: Template measurements

Measurement Class	Measurement Name
	000 View Video
Subjective Prediction: Full Reference	
Noticeable Differences	
SD Display and Viewing	001 SD Broadcast PQR
HD Display and Viewing	002 HD Broadcast PQR
CIF Display and Viewing	003 CIF and QVGA PQR
D-Cinema Projector and Viewing	004 D-CINEMA PQR
Subjective Rating Predictions	
SD Display and Viewing (with preliminary BT.500 training)	005 SD Broadcast DMOS
HD Display and Viewing (with preliminary BT.500 training)	006 HD Broadcast DMOS
CIF Display and Viewing (with preliminary BT.500 training)	007 CIF and QVGA DMOS
D-Cinema Projector and Viewing (with preliminary BT.500 training)	008 D-CINEMA DMOS
Attention Biased Subjective Rating Predictions	
SD Display and Viewing (with preliminary BT.500 training)	009 SD Broadcast ADMOS
HD Display and Viewing (with preliminary BT.500 training)	010 HD Broadcast ADMOS
CIF Display and Viewing (with preliminary BT.500 training)	011 CIF and QVGA ADMOS
SD Sports (with preliminary BT.500 training)	012 SD Sports Broadcast ADMOS
HD Sports (with preliminary BT.500 training)	013 HD Sports Broadcast ADMOS
SD Talking Head (with preliminary BT.500 training)	014 SD Talking Head Broadcast ADMOS

Table 3: Template measurements (cont.)

Measurement Class		Measurement Name
Repurposing: Reference and test are independent: Use any combination display model and viewing conditions with each measurement above		
	Format Conversion: Cinema to SD DVD (with preliminary BT.500 training)	015 SD DVD from D-Cinema DMOS
	Format Conversion: SD to CIF (with preliminary BT.500 training)	016 CIF from SD Broadcast DMOS
	Format Conversion: HD to SD (with preliminary BT.500 training)	017 SD from HD Broadcast DMOS
	Format Conversion: SD to HD (with preliminary BT.500 training)	017-A HD from SD Broadcast DMOS
	Format Conversion: CIF to QCIF (with preliminary BT.500 training)	018 QCIF from CIF and QVGA DMOS
Attention		
		019 Stand-alone Attention Model
Objective Measurements: Full Reference		
General Difference		
		020 PSNR dB
Artifact Measurement		
	Removed Edges	021 Removed Edges Percent
	Added Edges	022 Added Edges Percent
	Rotated Edges	023 Rotated Edges Percent
	% of original deviation from block DC	024 DC Blocking Percent
Artifact Classified (Filtered) PSNR		
	Removed Edges	025 Removed Edges Weighted PSNR dB
	Added Edges	026 Added Edges Weighted PSNR dB
	Rotated Edges	027 Rotated Edges Weighted PSNR dB
	% of original deviation from block DC	028 DC Blocking Weighted PSNR dB
Artifact Annoyance Weighted (Filtered) PSNR		
	PSNR with default artifact annoyance weights	029 Artifact Annoyance Weighted PSNR dB
Repurposing: Use view model to resample, shift and crop test to map to reference		
	Format Conversion: Cinema to SD DVD	030 SD DVD from D-Cinema Artifact Weighted PSNR dB
	Format Conversion: SD to CIF	031 CIF from SD Broadcast Artifact Weighted PSNR dB
	Format Conversion: HD to SD	032 SD from HD Broadcast Artifact Weighted PSNR dB
	Format Conversion: CIF to QCIF	033 QCIF from CIF and QVGA Artifact Weighted PSNR dB
Attention Weighted Objective Measurements		
General Difference		

Table 3: Template measurements (cont.)

Measurement Class	Measurement Name
PSNR	034 Attention Weighted PSNR dB
Objective Measurements: No Reference	
Artifact	
DC Blockiness	035 No Reference DC Blockiness Percent
Measurements with Performance Report [1]	
ADMOS	036 HD ADMOS ITU-BT500 with Interlaced CRT
PQR	037 HD PQR ITU-BT500 with Interlaced CRT
DMOS	038 HD DMOS ITU-BT500 with Interlaced CRT

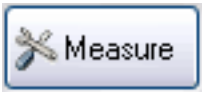
1 Please refer to the application note *Objective Measurements and Subjective Assessment* (literature number 28W-24876-0) on the Tektronix Web site: www.tektronix.com.

Creating New Measurements

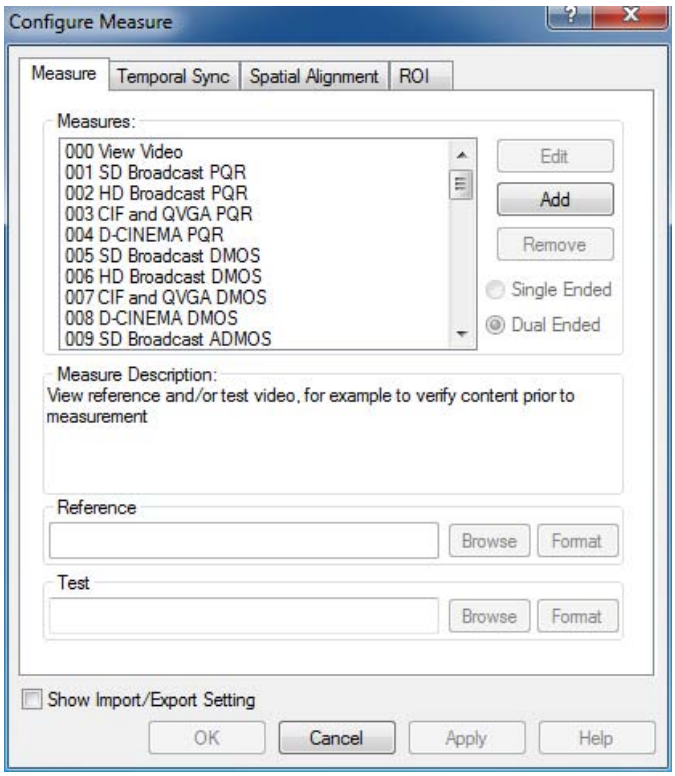
You can create measurements by modifying an existing template measurement or by adding a measurement and then adjusting the necessary parameters in the processing nodes.

To create a new measurement:

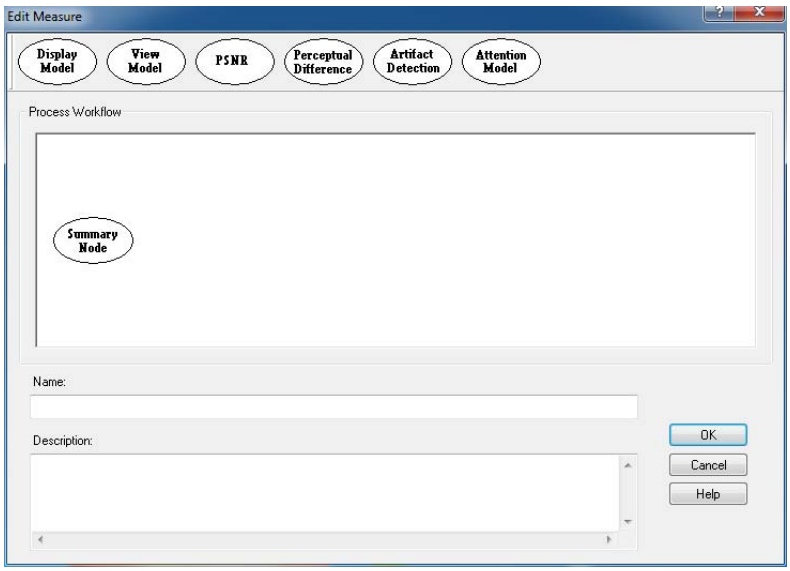
1. Click the Measure button.



2. To create a new measurement based on a template measurement, select a numbered template measurement from the Measures list and click **Edit**.
3. To add a new measurement, click **Add**.



If you click Add to create a new measurement, the PQA600 analyzer displays the **Edit Measure** window with only one processing node. The measurement has no name or description.

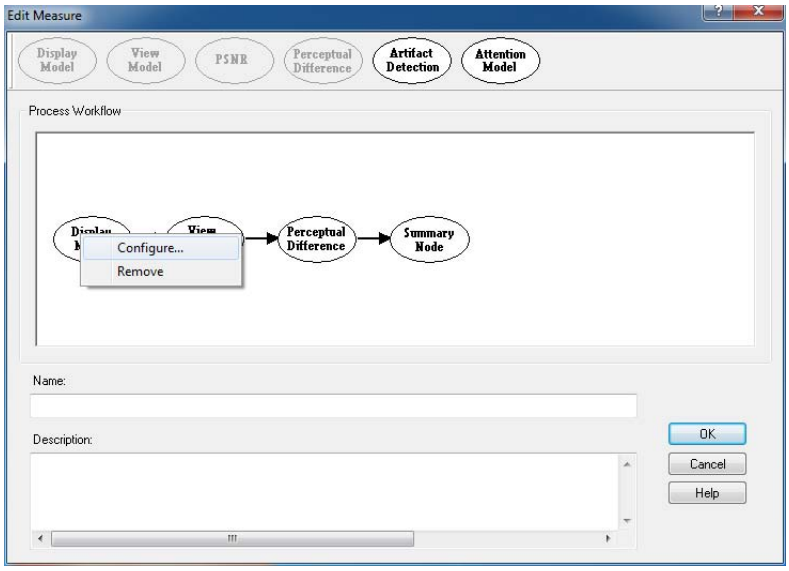


4. To change the parameters of your measurement, right-click on a processing node and select **Configure**. Change the parameters to suit your requirements.

   - To add a processing node to your measurement, select the desired node at the top of the window and drag it into the Process Workflow area.

NOTE. *The PSNR and Perceptual Difference processing nodes are mutually exclusive. A measurement cannot contain both nodes.*

   - To remove a processing node from your measurement, right-click on the processing node and select **Remove**.

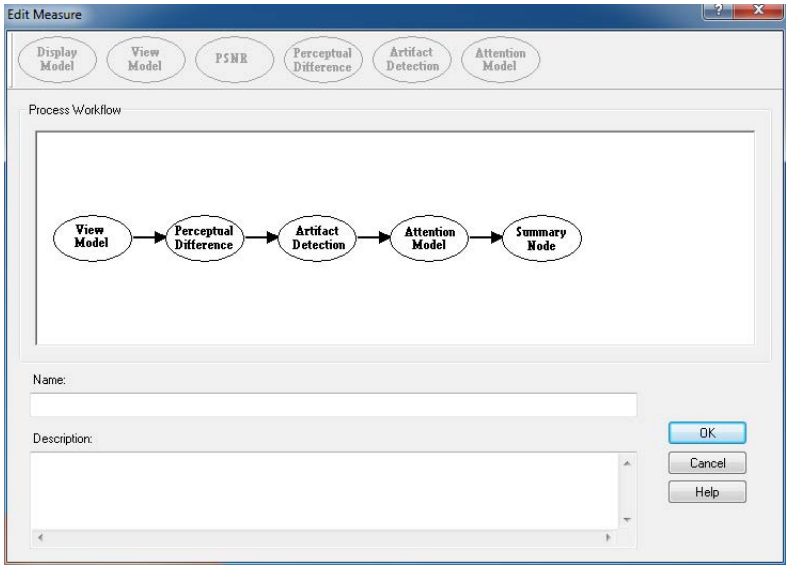


5. When you are finished setting the parameters for your new measurement, type a name for the measurement in the **Name** field.

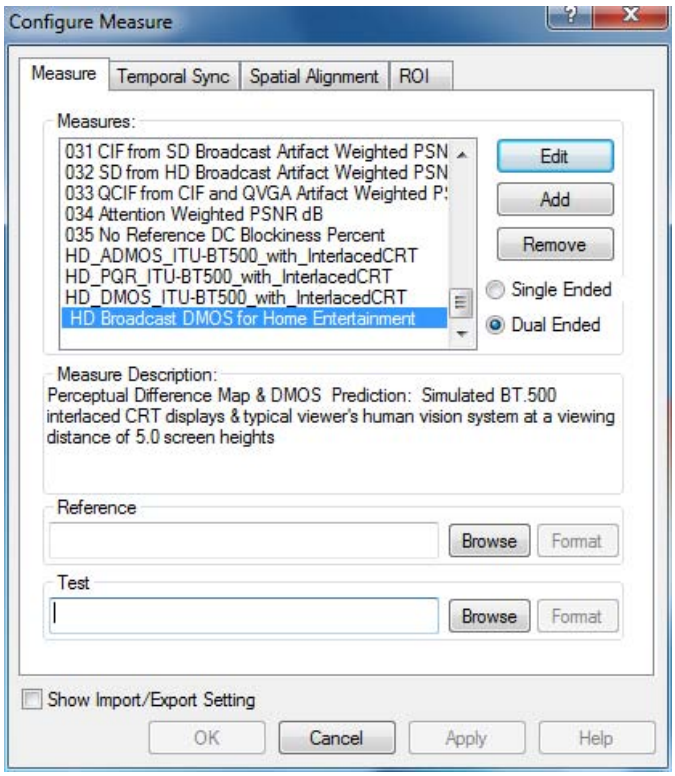
   - If you based your measurement on a template measurement, the Name field already has a name in it based on the template measurement (*Copy of* <template name>). The PQA600 analyzer will not allow you to replace a template measurement.

6. If you wish, enter a description for your measurement in the Description field.

7. Click **OK** to save your new measurement.



Your new measurement will now appear at the bottom of the list of measurements in the Configure Measure window.



Importing Measures

You can add measures that were created on another PQA600 into your PQA600 by using the Import Measures function. The Import Measures function works by reading a configuration (.cfg) file, which is the file that contains all measure definitions. PQA600 measure definitions are saved in a file named Measures.cfg. This file is a binary file and cannot be edited.

NOTE. *Importing measures from another PQA600 will not remove the factory defined measures, numbered 001 through 038. Importing measures only adds user-defined measures.*

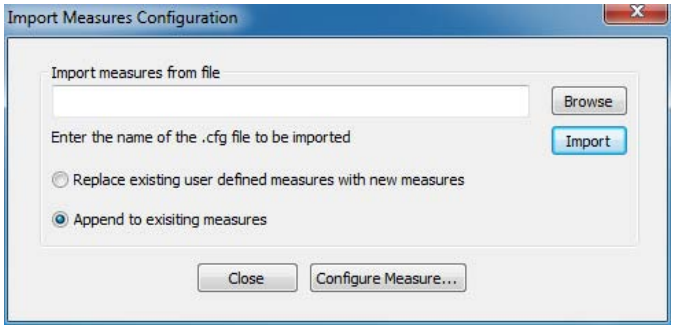
To import a measure from another PQA600:

1. Make a copy of the Measures.cfg file in the C:\Program Files (x86)\Tektronix\PQA directory of the source PQA600 (the instrument you are importing from).

NOTE. *If the source PQA600 can be accessed across a network, you can skip ahead to step 3.*

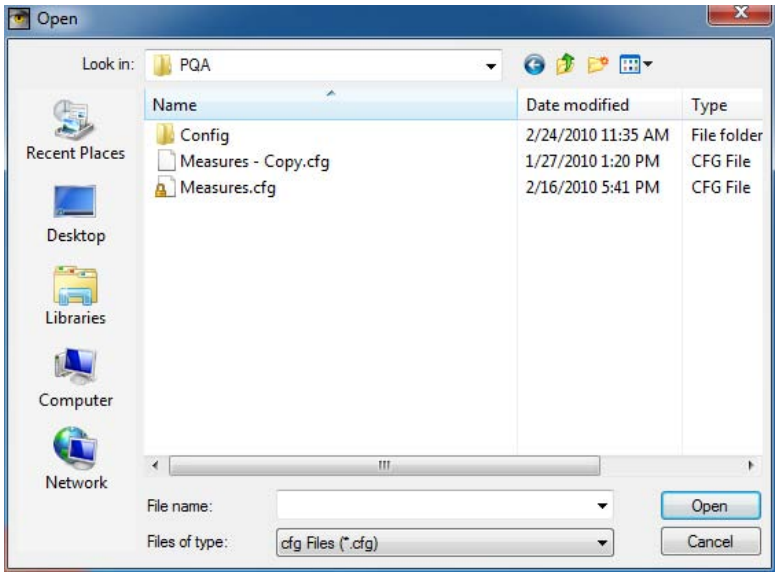
2. Copy the copied Measures.cfg file into a directory on the PQA600 on which you want to add the measure (the destination instrument).

3. Select **File** > **Import Measures**. This displays the Import Measures Configuration dialog box.



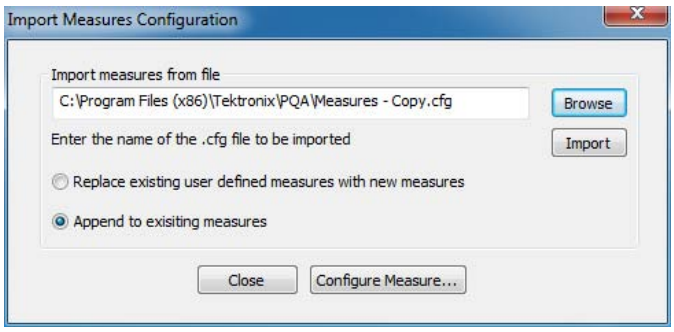
4. Click **Browse**. This opens a dialog you can use to select the .cfg file you want to import.

5. Select the .cfg file that contains the measure you want to import and click **Open**.



6. Select how you want the user defined measures to be imported.

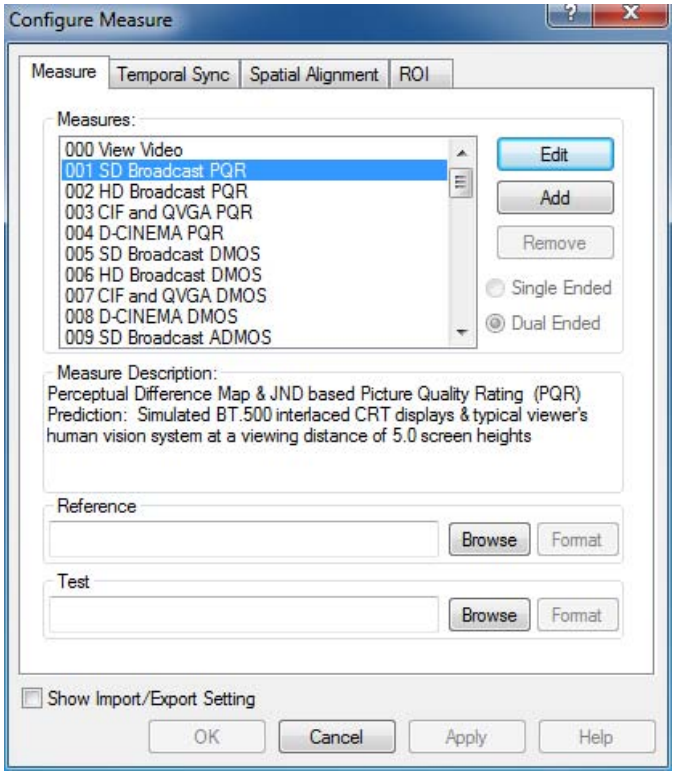
- Select **Append to existing measures** to add measures to your machine without replacing measures you have already created,
- Select **Replace existing user defined measures with new measures** to replace all the user-defined measures in your instrument with the user-defined measures in the imported .cfg file.



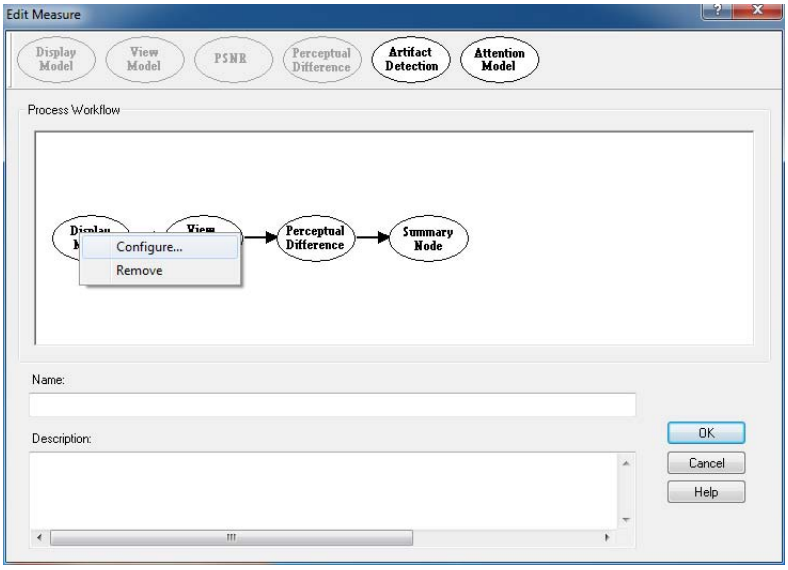
7. Click **Import** to load the new measures.
8. Click **Close** to remove the Import Measure dialog or click **Configure Measure** to display the Configure Measure window.

Changing Measurement Parameters

You change the parameters of a measurement by adjusting the configuration nodes for the measurement. To access the configuration nodes of a measurement, select **Edit** from the Configure Measure window.



You change the parameters in a configuration node by right-clicking on the configuration node and selecting **Configure** from the pop-up menu.



The following table lists the configuration nodes and the parameters they control. Some of these nodes are not included in every measurement. Two of the nodes (PSNR and Perceptual Difference) are mutually exclusive.

Table 4: Measurement configuration nodes

Node	Parameters controlled by this node
Display Model	Display technology: CRT, LCD, or DMD. Each technology has user-configurable parameters (Interlace/Progressive, Gamma, Response time, and more). Reference Display and Test Display can be set independently.
View Model	Viewing distance, Ambient Luminance for Reference and Test (can be set independently), image cropping and registration: automatic or manual control of image cropping and test image contrast (ac gain), brightness (dc offset), horizontal and vertical scale and shift.
PSNR	There are no parameters for PSNR. You can only choose whether or not the PSNR result is included as part of the measurement.
Perceptual Difference	The viewer characteristics (acuity, sensitivity to changes in average brightness, response speed to the moving object, sensitivity to photosensitive epilepsy triggers, and more).
Attention Model	Overall attention weighting for measures as well as for each class of attention attractor: ■ Temporal (motion). ■ Spatial (center, people (skin), foreground, contrast, color, shape, size). ■ Distractions (differences).

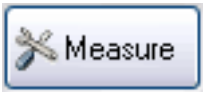
Table 4: Measurement configuration nodes (cont.)

Node	Parameters controlled by this node
Artifact Detect	Added Edges (Blurring), Removed Edges (Ringing/Mosquito Noise), Rotated Edges (Edge Blockiness) and DC Blockiness (Removed detail within a block)
Summary Node	Statistical Units (PSNR, Perceptual Difference, Blockiness). Measure Map settings: Gain, Offset, display as signed data. Worst Case Training for ITU-R BT.500 Training (Default or User application tuned: Determined via Worst Case).

Display Model

To change the display model parameters:

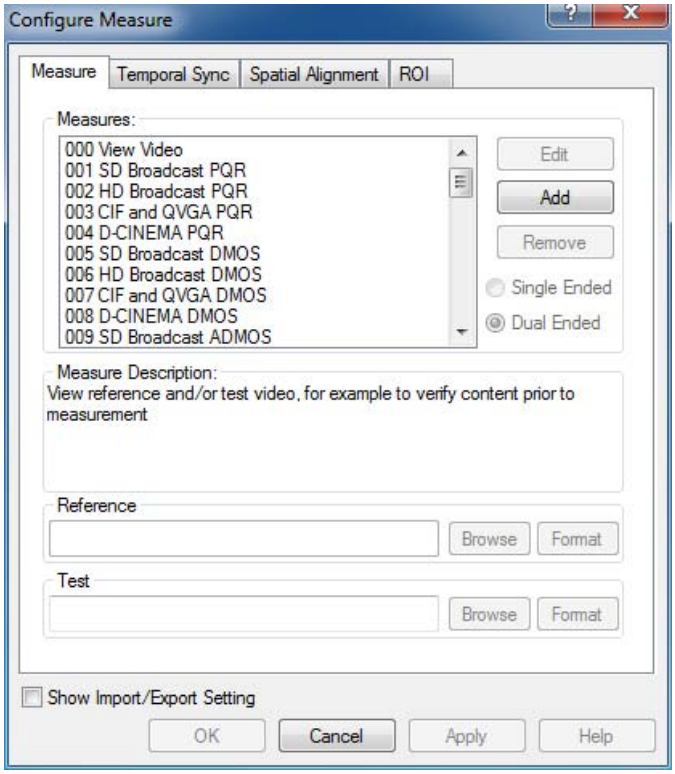
1. Click the Measure button.



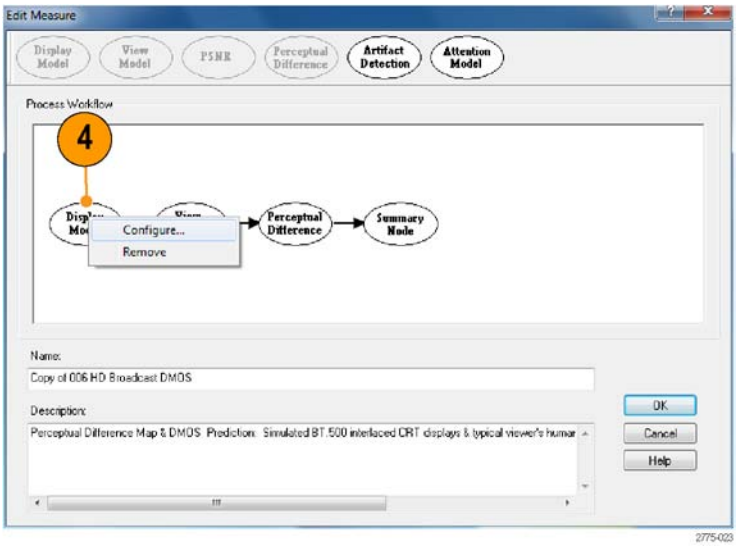
2. Select the desired measurement from the Configure Measure window.

NOTE. *If you choose a template measurement, you will have to save the changed measurement under a new name.*

3. Click **Edit**.

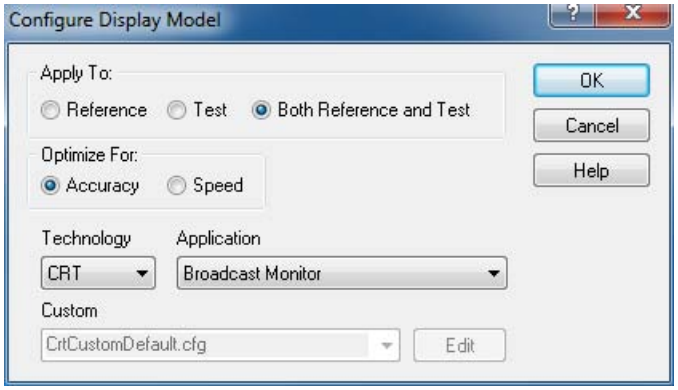


4. Right-click on **Display Model** and select **Configure**.



5. Adjust the parameters of the display model as necessary.

- To change the application setting, select the Technology first. This defines the choices available for application.

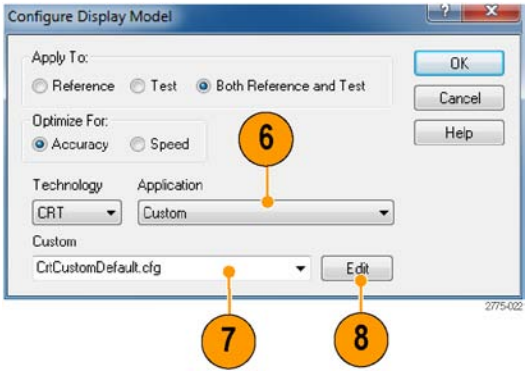


You can customize display properties to better suit your requirements by setting **Application** to **Custom** then editing the display properties.

6. Set the Application setting to **Custom**.

7. Type a name for your custom settings in the **Custom** field or select a previously created configuration file from the drop-down list.

8. Click **Edit** to display the **Edit Custom** window.

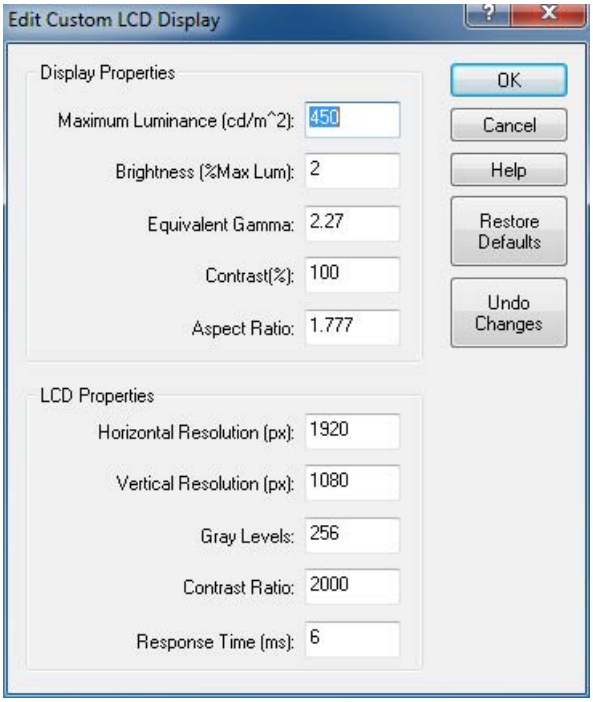


The Edit Custom window contains two groups of settings: Display Properties and CRT/DMD/LCD Properties. The settings in the Display Properties group are the same for every display technology, though the values for the settings differ. The settings in the CRT/DMD/LCD Properties group change depending on the selected technology. The illustrations to the right show the difference in the properties for an LCD display and a DMD (Digital Micro-mirror Device) display.

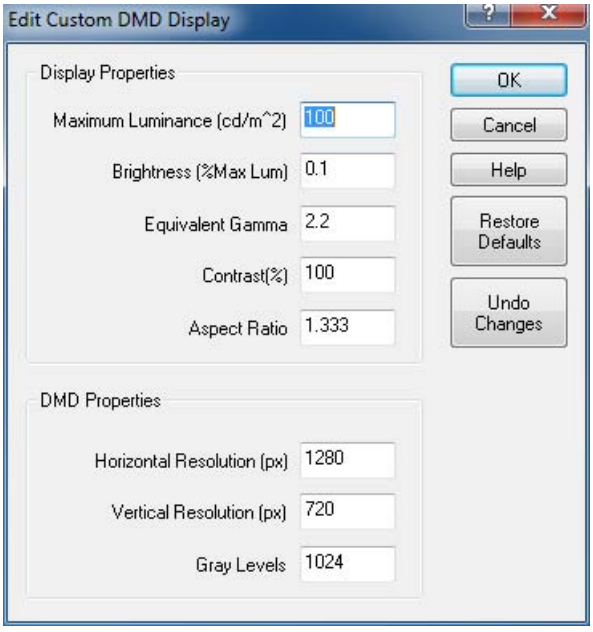
9. Edit the settings as necessary to suit your requirements.

- Click **Restore Defaults** to return all settings to the initial factory values.
- Click **Undo Changes** to return all settings to the previously saved values.

10. When you have completed making your changes, click OK to save your changes.



LCD display properties



DMD display properties

The following table lists the parameters that can be set in the Display Model configuration node. For details on these parameters, see the *PQA600 Picture Quality Analyzer Technical Reference*, Tektronix part number 071-2778-XX.

NOTE. *If the Display Model Technology parameter is set to CRT and the CRT scan method is set to Interlaced, the PQA600 expects the source video file to have a "Top Field First" format.*

Table 5: Display model parameters

Parameter	Setting
Apply To:	Reference
	Test
	Both Reference and Test
Optimize for	Accuracy
	Speed
Technology	CRT / DMD / LCD
	Application
Display Properties	Maximum Luminance (cd/m^2 = nits)
	Brightness (%Max Luminance)
	Equivalent Gamma
	Contrast (%)
	Aspect Ratio
LCD Properties	Horizontal Resolution (pixels)
	Vertical Resolution (lines)
	Gray levels
	Contrast Ratio
	Response Time (ms)
DMD Properties	Horizontal Resolution (pixels)
	Vertical Resolution (lines)
	Gray levels

View Model

The View Model specifies the conditions under which the display viewed and, optionally, performs spatial alignment, cropping, gain, and DC offset adjustment to match the test video to the reference video. You can set values such as the viewing distance and ambient luminance level.

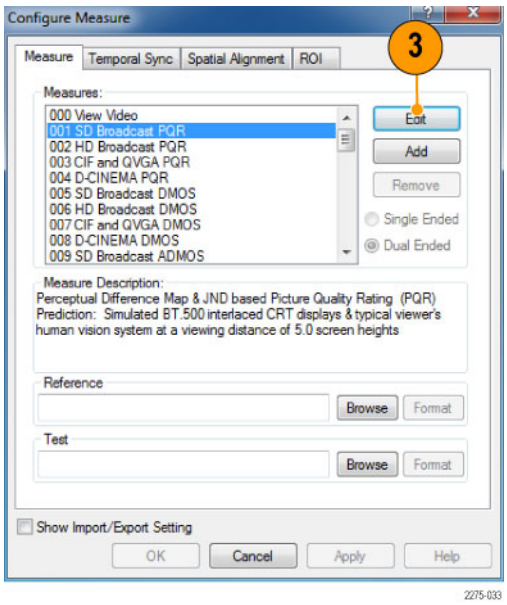
To change the view model parameters:

1. Click the **Measure** button.

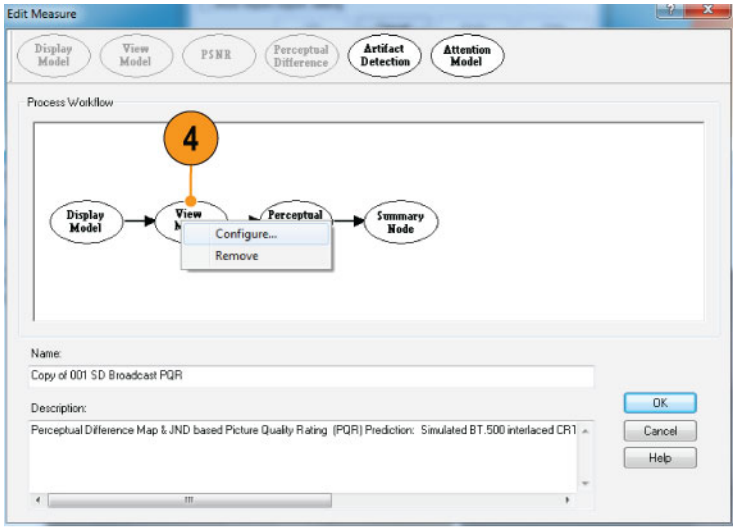
2. Select the desired measurement from the Configure Measure window.

NOTE. If you choose a template measurement, you will have to save the changed measurement under a new name.

3. Click **Edit**.



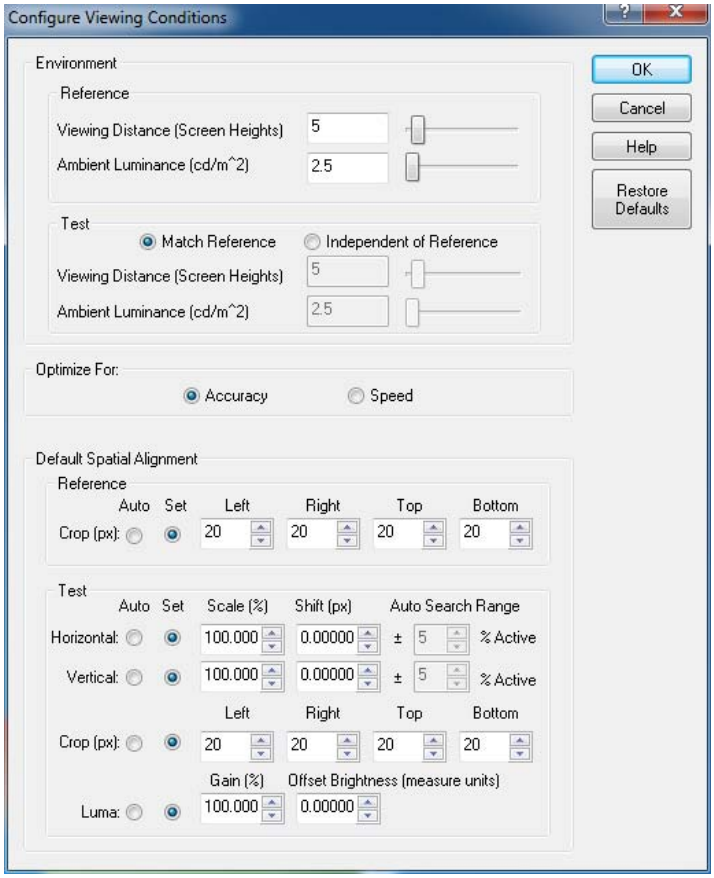
4. Right-click on **View Model** and select **Configure**.



5. Edit the settings as necessary to suit your requirements. Note that all cropping and shift values of the test are in reference pixel units (use post scale values). Also, offset brightness is in units input to the view model. For example, if the output of a display model is input, the units are nits (candelas per square meter) while if video is directly input, the units are LSBs.

   - Click **Restore Defaults** to return all settings to the initial factory values.

6. When you have completed making your changes, click **OK** to save your changes.



The following table lists the parameters that can be set in the View Model configuration node. For details on these parameters, see the *PQA600 Picture Quality Analyzer Technical Reference*, Tektronix part number 071-2778-XX.

Table 6: View model parameters

Parameter	Setting
Reference	Viewing Distance (Screen Heights)
	Ambient Luminance (cd/m^2)
Test	Match Reference
	Independent of Reference
	Viewing Distance (Screen Heights)
	Ambient Luminance (cd/m^2)
Optimize For:	Accuracy
	Speed
Default Spatial Alignment – Reference	Crop (pixels and lines)
Default Spatial Alignment – Test	Horizontal
	Vertical

Table 6: View model parameters (cont.)

Parameter	Setting
	Crop (pixels and lines)
	Luma Gain and Offset

Changing the Spatial Alignment. You may need to change the spatial alignment between your test and reference video files to accommodate changes in the test file due to processing. Video files must be spatially aligned to get meaningful results.

Perceptual Difference

The Perceptual Difference node includes the human vision model for quantifying perceptual sensitivities to the video tested, including differences (including artifacts from codecs, noise or any visible difference of any kind) optionally relative to a reference, changes in perception due to changes in displays, viewing distances, and more. The output of this node is a Perceptual Difference Map in units of percent perceptual contrast. The Perceptual Difference node allows you to adjust parameters for viewer characteristics (such as acuity, sensitivity to changes in average brightness, response speed to the moving object, sensitivity to photosensitive epilepsy triggers, and more).

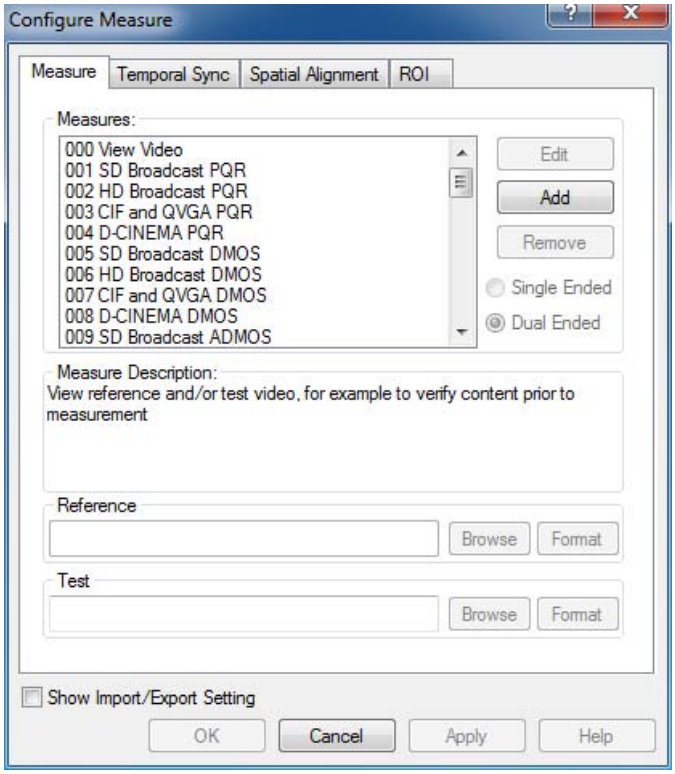
To change the Perceptual Difference parameters:

1. Click the Measure button.

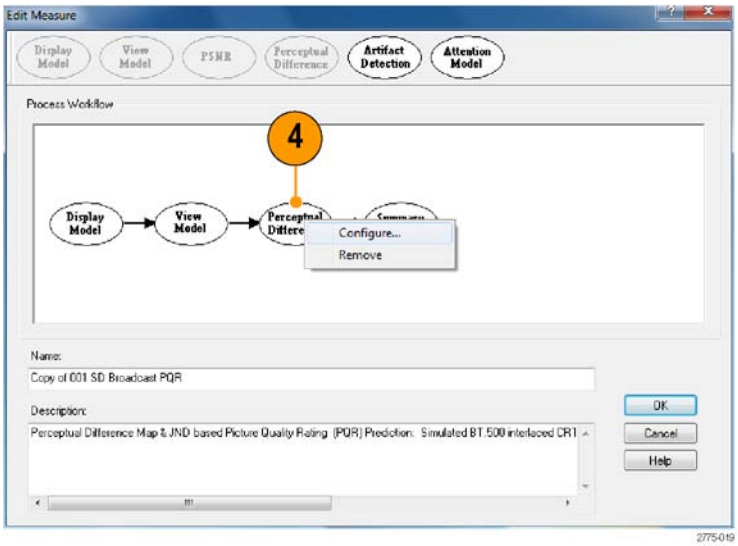
2. Select the desired measurement from the **Configure Measure** window.

NOTE. *If you choose a template measurement, you will have to save the changed measurement under a new name.*

3. Click **Edit**.

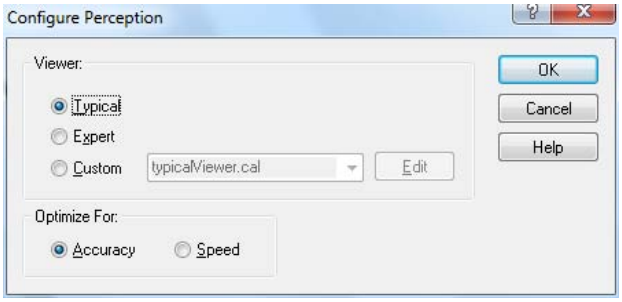


4. Right-click on **Perceptual Difference** and select **Configure**.

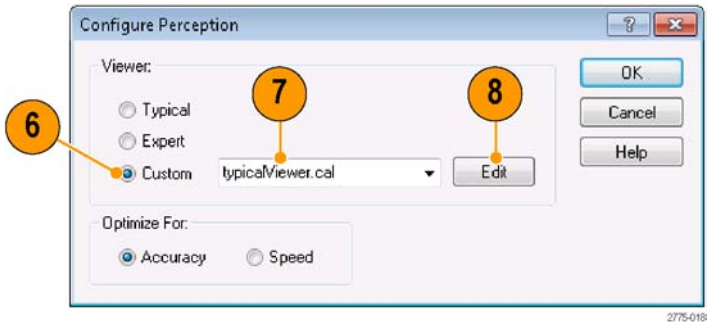


5. Edit the settings as necessary to suit your requirements.

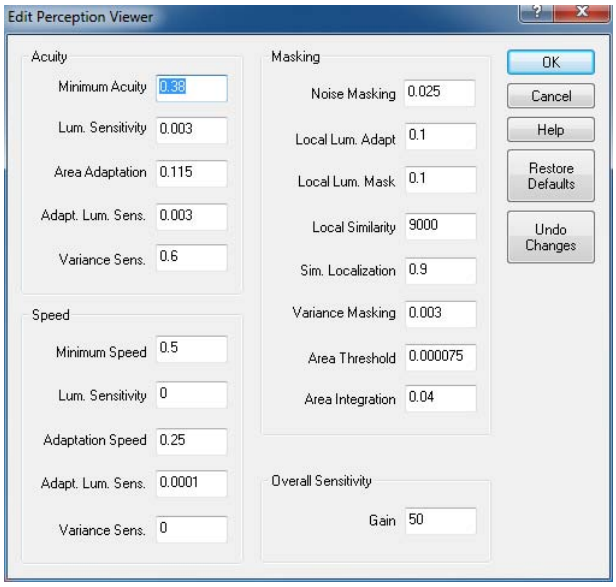
If the Typical or Expert viewer does not meet your needs, you can specify the parameters for a custom viewer.



6. Click **Custom**.
7. Type a name for the custom viewer parameters in the Custom field or select a previously created configuration file from the drop-down list.
8. Click **Edit** to display the **Edit Perception Viewer** window.



9. Edit the settings as necessary to suit your requirements.
   - Click **Restore Defaults** to return all settings to the initial factory values.
   - Click **Undo Changes** to return all settings to the previously saved values.
10. When you have completed making your changes, click **OK** to save your changes.



The following table describes the parameters that can be set in the Perceptual Difference configuration node. For details on these parameters, see the *PQA600 Picture Quality Analyzer Technical Reference*, Tektronix part number 071-2778-XX.

Table 7: Perceptual difference parameters

Parameter	Setting
Acuity	Minimum Acuity: 0 (legally blind) to 1 (perfect, super-human acuity). This parameter controls the acuity (center spatial frequency response) in the darkest areas of the image.
	Lum. Sensitivity: 0 (in-human, no adaptation) to 1.0 (hyper-sensitive). This parameter controls how the local acuity increases with increases in local average luminance.
	Area Adaptation: 0 (the entire visible area) to 1.0 (smallest resolved area). This parameter controls (surround spatial frequency) how large an area is integrated to determine the local luminance used for the local luminance sensitivity adaptation. Larger values make adaptation to luminance more localized.
	Adapt. Lum. Sens.: 0 (in-human, no adaptation) to 1.0 (hyper-sensitive). This parameter controls the (surround spatial frequency) luminance sensitivity to the area integration adaptation. Large values accelerate the localization of the acuity adaptation to luminance.

Table 7: Perceptual difference parameters (cont.)

Parameter	Setting
	Variance Sens.: 0 (non-human: no adaptation) to 1.0 (hyper-sensitive). This parameter controls how the acuity changes from a stimulus of threshold contrast to supra-threshold contrast. Higher values correspond to bigger differences in acuity for low contrast versus high contrast stimuli.
Speed	Minimum Speed: 0 (extremely slow) to 1.0 (instant response / zero response time). This parameter controls the speed of visual response in darkness.
	Lum. Sensitivity: 0 (always as slow as in darkness) to 1.0 (fast even for slightly lighter than darkness). This parameter controls how much response time decreases with increase in average local luminance.
	Adaptation Speed: 0 (virtually no speed adaptation to local luminance) to 1.0 (instantaneous speed adaptation to local luminance). This parameter controls how quickly response time changes to local luminance.
	Adapt. Lum. Sens.: This parameter controls temporal integration used for determining the local luminance value to which speed adapts. Use 0 for static and 1.0 for extreme photosensitive epilepsy.
	Variance Sens.: 0 (non-human: no adaptation) to 1.0 (hyper-sensitive). This parameter controls how the response speed changes from a stimulus of threshold contrast to supra-threshold contrast. Higher values correspond to bigger differences in response speed for low contrast versus high contrast stimuli.
Masking	Noise Masking: This parameter sets the baseline threshold of perception (1 JND) for the highest sensitivities.
	Local Lum. Sensitivity: This parameter sets sensitivity to changes in luminance (for example, between reference and test).
	Local Lum. Mask: This parameter controls how much luminance masks (or simple Weber's Law) verses other masking.
	Local Similarity: This parameter controls how much masking is due to local image pattern similarities.
	Sim Localization: This parameter specifies the localization of similarity masking. For example, 0 is used for no localization and 1 is used for 100% localization of masking due to local similarity.
	Variance Masking: Conceptually, this is a local complexity masking control.
	Area Threshold: Approximately, this parameter controls the support region area for variance masking by clipping regions below a threshold.
	Area Integration: This parameter controls the localization of variance masking: use 0 for no localization and use 1 for 100% localization.
Overall Sensitivity	Gain: This parameter sets the overall sensitivity.

PSNR

The PSNR configuration node does not contain any parameters. The node is present so that the PSNR result can be added to a measurement. Note that PSNR and Perceptual Difference results are mutually exclusive. A measurement can include either PSNR or Perceptual Difference, but not both.

Artifact Detection

The Artifact Detection configuration node allows you to specify parameters that control the measurement of spatial artifacts. There are two mutually exclusive artifact detection measurements that can be performed at any one time:

- Spatial Gradient Artifacts
- DC Blockiness Artifacts

The chosen measurement can be used to weight any upstream measurement result via a cross-fade between the input result map and a 100% artifact weighted result via the "Overall Artifact Weighting" control. A setting of 0 corresponds to making artifact detection transparent (as if the node did not exist in the processing chain), while a setting of 100% gives full artifact weighting. Full artifact weighting filters the previous map, for example PSNR or perceptual contrast such that areas with no artifact are 0 and areas with 100% artifact are passed unchanged.

Spatial Gradient Artifacts. The three classes of spatial gradient-related artifacts measured are:

- reduction in gradient magnitude at each point (% Lost Edges, usually associated with blurring).
- increase in gradient magnitude at each point (% added edges, usually associated with ringing, mosquito noise and similar artifacts).
- rotated gradient orientations (% rotated edges, usually associated with blocking).

The weighting for Lost, Added Edges and Rotated Edges is relative: the total is internally normalized to 100%. Note however, that measurement values for added and lost edges are complimentary: if 100% lost edges are measured, zero added measures will measured.

The Produce complimentary data setting produces a one's compliment of the normalized-to-one result map before being applied to the input result map, if any. If this setting is chosen, areas without the enabled artifacts are bright in the results map and a perfect (no detected artifact) result is 100% when no upstream node is present, or no change for PNSR, DMOS, etc.

DC Blockiness Artifacts. This measurement attempts to find a blocking grid structure and then, for full reference (dual ended) measurements, measures the difference between each pixel and the mean value within the block in which the pixel resides, normalized by the corresponding difference in the reference video. If all pixel values are equal to the block mean in the test, but corresponding pixels in the reference are not equal to the block mean, the measurement result is 100% DC Blockiness.

Notice that the denominator can be zero. In this case, the contributing pixel term is zero. Thus, perfect images may have less than 100% results. For example, flat (no detail) areas of the image that occupy a block will all be zero. However, for video, artifact free video will measure very close to 100%.

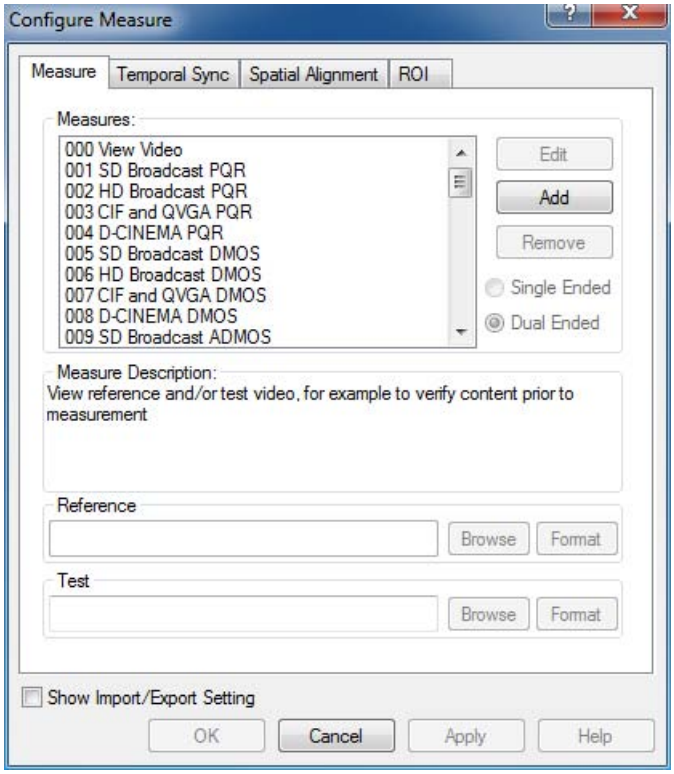
To configure the Artifact Detection parameters:

1. Click the Measure button.

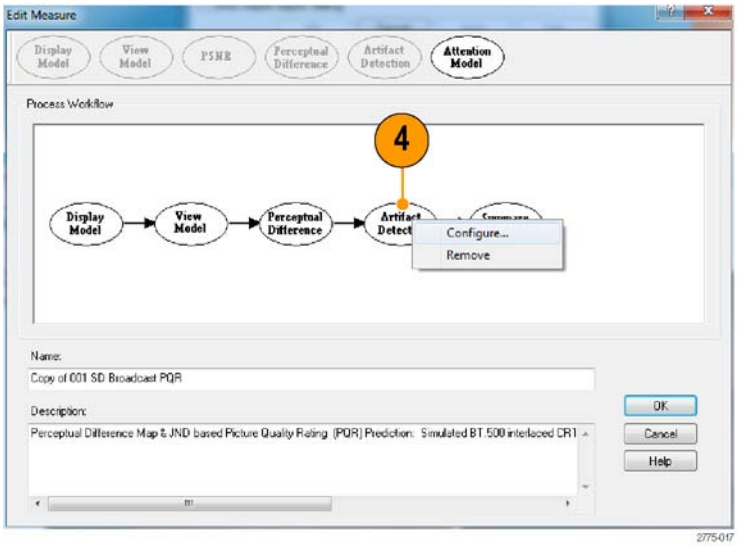
2. Select the desired measurement from the **Configure Measure** window.

NOTE. *If you choose a template measurement, you will have to save the changed measurement under a new name.*

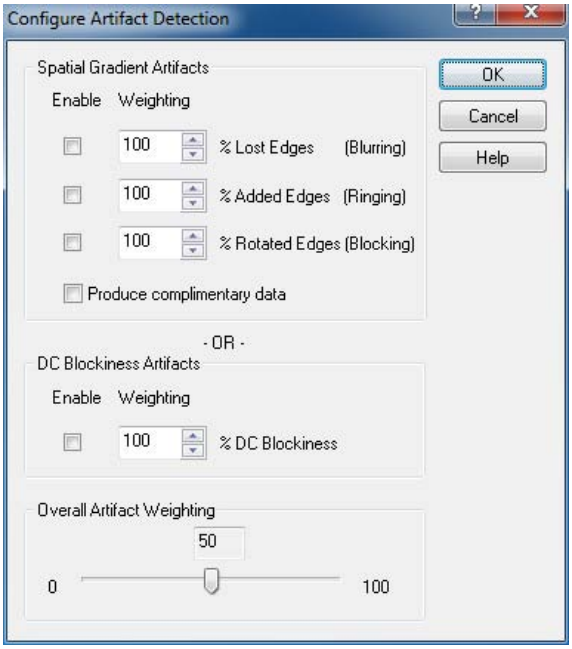
3. Click **Edit**.



4. Right-click on **Artifact Detection** in the Process Workflow area and select **Configure**.



5. Edit the settings as necessary to suit your requirements.
   - Select or deselect the **Enable** checkbox to determine whether or not the associated artifact is detected in the measurement.
   - Adjust the value next to each artifact type to specify how much importance is given to the associated artifact.
6. When you have completed making your changes, click **OK** to save your changes.



The following table lists the parameters that can be set in the Artifact Detection configuration node. For details on these parameters, see the *PQA600 Picture Quality Analyzer Technical Reference*, Tektronix part number 071-2778-XX.

Table 8: Artifact detection parameters

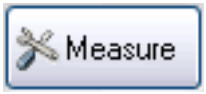
Parameter	Setting
Spatial Gradient Artifacts	% Lost Edges (Blurring)
	% Added Edges (Ringing)
	% Rotated Edges (Blocking)
	Produce complimentary data
DC Blockiness Artifacts	% DC Blockiness
Overall Artifact Weighting	Range: 0–100

Attention Model

The Attention Model configuration node allows you to specify how attention is measured and the weighting for selected characteristics.

To configure the Attention parameters:

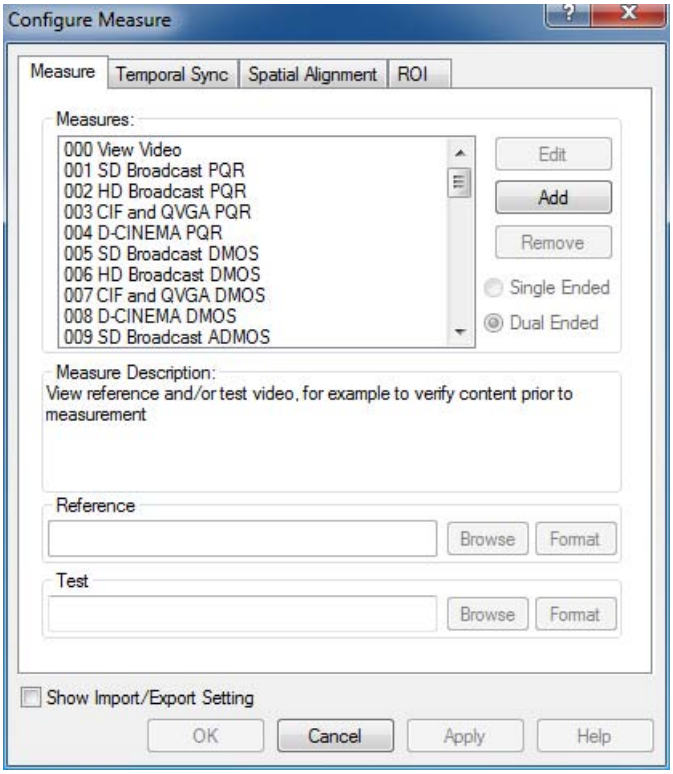
1. Click the Measure button.



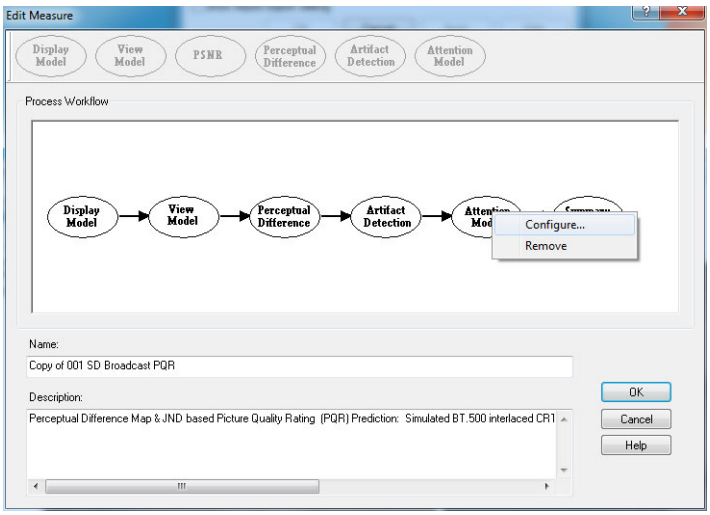
2. Select the desired measurement from the **Configure Measure** window.

NOTE. *If you choose a template measurement, you will have to save the changed measurement under a new name.*

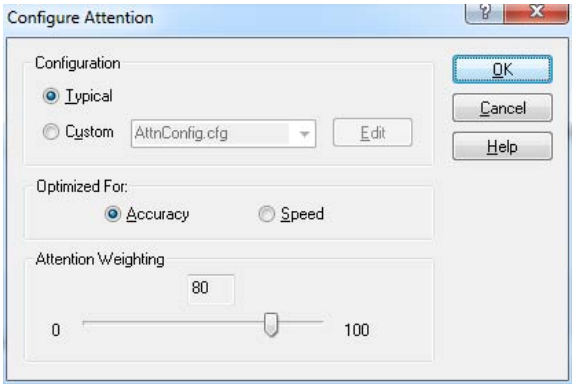
3. Click **Edit**.



4. Right-click on **Attention Model** and select **Configure**.

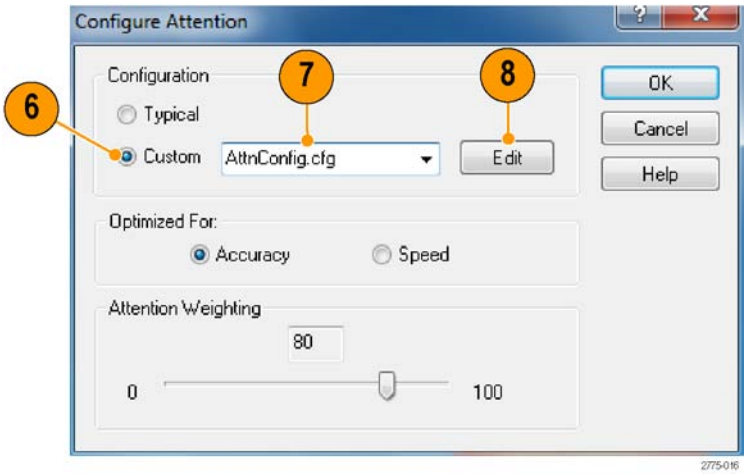


5. Edit the settings as necessary to suit your requirements.

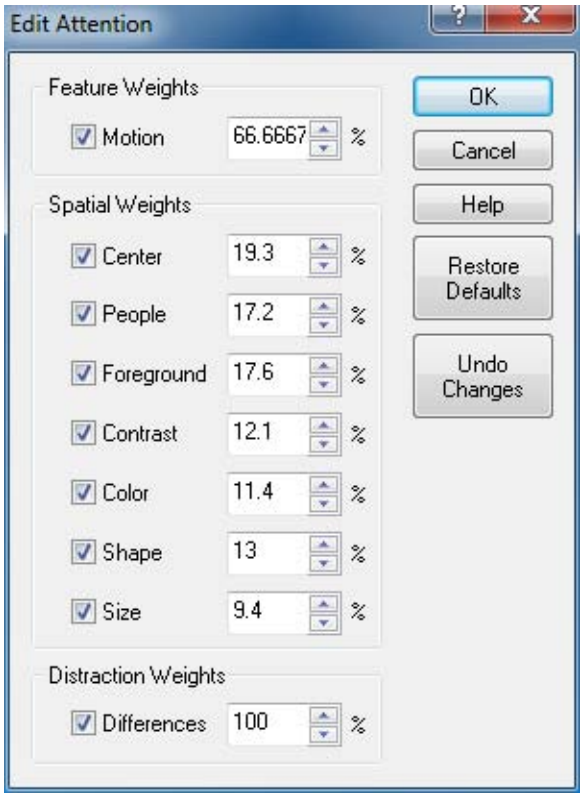


If the Typical configuration does not meet your needs, you can specify the parameters to specify a custom attention model.

6. Click **Custom**.
7. Type a name for the custom attention model parameters in the Custom field or select a previously created configuration file from the drop-down list.
8. Click **Edit** to display the **Edit Attention** window.



9. Edit the settings as necessary to suit your requirements.
   - Select or deselect the checkbox next a setting to determine whether or not the setting is included in the measurement.
   - Click **Restore Defaults** to return all settings to the initial factory values.
   - Click **Undo Changes** to return all settings to the previously saved values.
10. When you have completed making your changes, click **OK** to save your changes.



The following table lists the parameters that can be set in the Attention Model configuration node. For details on these parameters, see the *PQA600 Picture Quality Analyzer Technical Reference*, Tektronix part number 071-2778-XX.

Table 9: Attention model parameters

Parameter	Setting
Feature Weights	Motion
Spatial Weights	Center

Table 9: Attention model parameters (cont.)

Parameter	Setting
	People
	Foreground
	Contrast
	Color
	Shape
	Size
Distraction Weights	Differences: Weights distractions outside the probable focus of attention. Distractions include artifacts, large differences between reference and test, or other things that might make someone look at an area normally not of interest in program material.

Summary Node

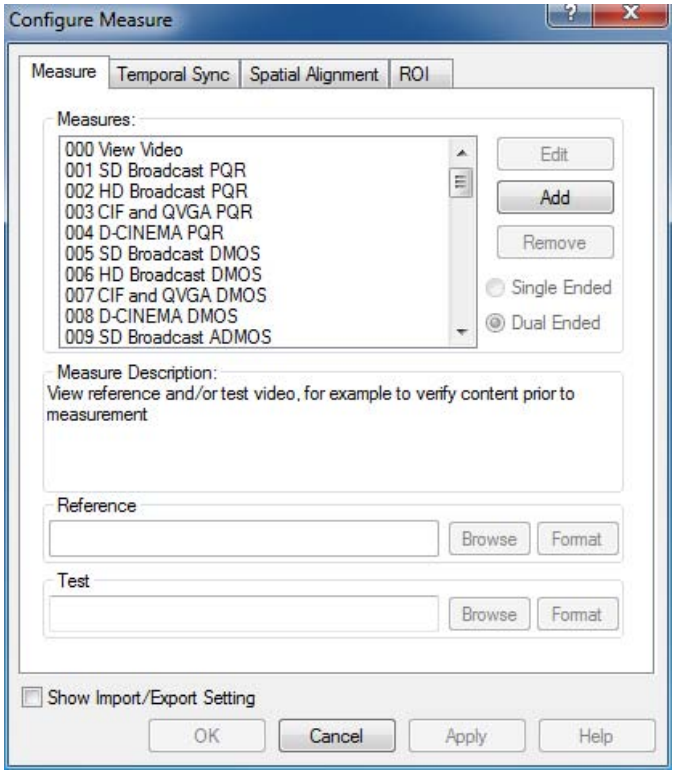
The Summary Node specifies how results are reported. You can specify statistical units for measurements, whether or not results are saved and how they are saved, display characteristics of the map, and levels for warnings and errors.

1. Click the Measure button.

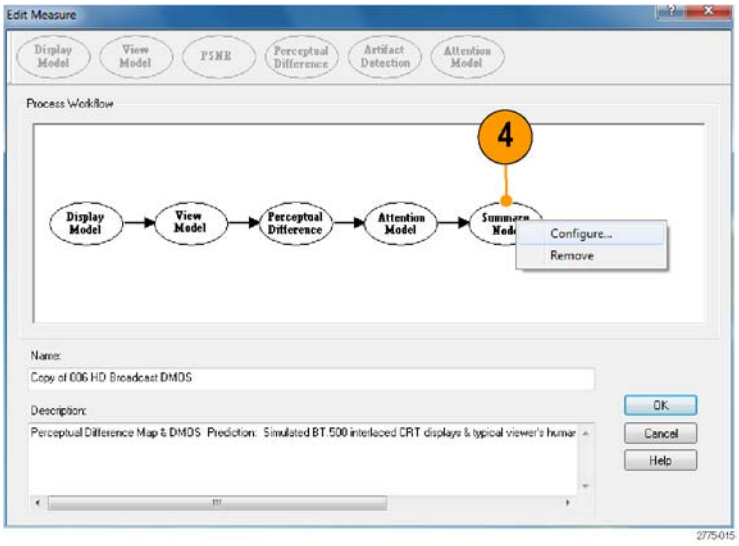
2. Select the desired measurement from the **Configure Measure** window.

NOTE. *If you choose a template measurement, you will have to save the changed measurement under a new name.*

3. Click **Edit**.



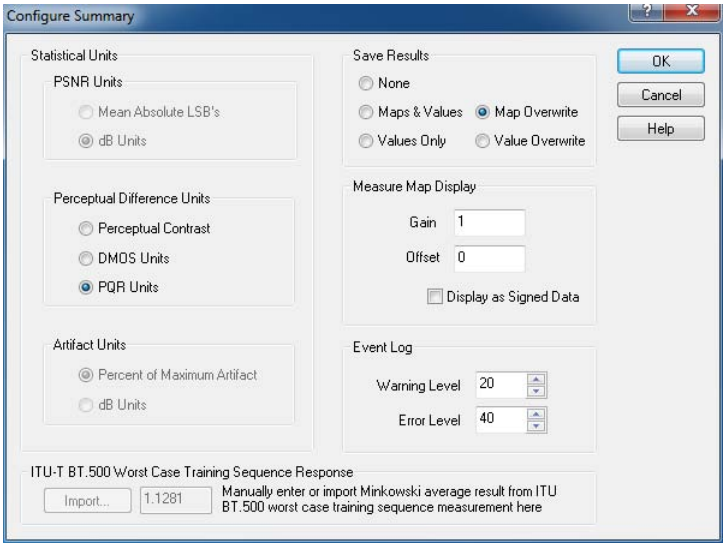
4. Right-click on **Summary Node** and select **Configure**.



5. Edit the settings as necessary to suit your requirements.

   Note that the **PSNR** and **Perceptual Difference** settings are mutually exclusive. Only one setting will be accessible at a time.

6. When you have completed making your changes, click **OK** to save your changes.



The following table describes the parameters that can be set in the Summary Node configuration node.

Table 10: Summary node parameters

Parameter	Setting	Description
PSNR	Map Units	Sets PSNR results units to map units. Only selectable when measuring PSNR.
	dB Units	Sets PSNR results units to dB. Only selectable when measuring PSNR. The reference level is 235.
Perceptual Difference	Perceptual Contrast	Sets the units used in the graph display to Perceptual Contrast when the Perceptual Difference node is part of the measurement.

Table 10: Summary node parameters (cont.)

Parameter	Setting	Description
	DMOS Units	Sets the units used in the graph display to DMOS Units when the Perceptual Difference node is part of the measurement.
	PQR Units	Sets the units used in the graph display to PQR Units when the Perceptual Difference node is part of the measurement.
Artifacts	Percent Max Artifact	Sets the units used in the graph display to Percent Max Artifact when the Artifact Detection node is part of the measurement. For example, if the artifact detection selected is DC Blockiness, an output of 100% corresponds to the entire image block being a constant ("DC") value, whereas 0% corresponds to no change from the reference.
	dB Units	Sets the units used in the graph display to dB Units when the Artifact Detection node is part of the measurement.
Save Results	None	When selected, no measure map or measurement values are saved to disk when the measurement is completed.
	Maps & Values	When selected, both the measure map and measurement values are saved to disk when the measurement is completed. The map and results filenames are incremented by one (file1, file2, file3, etc.), for each subsequent run of the measurement.
	Map Overwrite	When selected, both the measure map and measurement values are saved to disk when the measurement is completed. The map and results files are overwritten for all subsequent runs of the measurement.
	Values Only	When selected, only measurement values are saved to disk when the measurement is completed. The results filename is incremented by one (file1, file2, file3, etc.), for each subsequent run of the measurement.
	Value Overwrite	When selected, only measurement values are saved to disk when the measurement is completed. The results file is overwritten for all subsequent runs of the measurement.
Measure Map Display	Gain	Change to adjust the brightness level of the results map. This is useful when optimum contrast for the test and reference video is different from that of the results map.
	Offset	Change to shift the baseline of the results map. This parameter can be used in combination with Gain to enhance relatively minor differences in the measure map. This is useful when the optimum reference and test video brightness setting on the display are different from the optimum brightness setting for the results map.

Table 10: Summary node parameters (cont.)

Parameter	Setting	Description
	Display as Signed Data	When this option is not selected, results map pixels have intensity proportional to the absolute value of the measurement being made. So for example, for PSNR, brighter pixels correspond to larger differences, both positive and negative differences, between the test and reference. However, when this option is selected, the sign is retained at each pixel so that with a positive offset (see Measure Map Display Offset above) is added, no difference is gray, with positive differences being brighter and negative differences being darker.
Event Log	Warning Level	Sets the green-to-yellow transition point on the indicator bar in the Graph portion of the display.
	Error Level	Sets the yellow-to-red transition point on the indicator bar in the Graph portion of the display.
ITU-T BT.500 Worst Case Training Sequence Response	Import	Normally this button is selected to calibrate a given DMOS measurement. First, the DMOS measurement is run with worst case video, then the measurement is edited, this "Import" button is pressed and the DMOS results selected, thereby importing the Minkowski metric of the perceptual contrast difference (which represents the training result).

Video File Formats Supported for Measurements

The PQA600 recognizes the following file formats for taking measurements. All formats are 8-bits resolution except .v210 and .vcap10 files. Measurements on the .v210 and .vcap10 file formats are made only on the 8 most significant bits.

Supported Video Formats

File format	File extension	Frame structure options
CbYCrY (601-4:2:2), UYVY	.yuv	Non-Interlaced, Field 1 First, Field 2 First, Planar
YCbYCr (4:2:2), YUY2	.yuv	Non-Interlaced, Field 1 First, Field 2 First, Planar
YCbCr 4:2:0	.yuv	Planar only
CbYCrY 4:2:2 (601-4:2:2), UYVY (10bit)	v210	Non-Interlaced
YUV 4:4:4	.yuv	Non-Interlaced, Field 1 First, Field 2 First, Planar
BGR	.rgb	Non-Interlaced, Field 1 First, Field 2 First, Planar
ARIB YUV	.yyy, .rrr, .bbb	Not applicable
AVI (Uncompressed UYVY, YUY2, RGB, RGB32, v210)	.avi	Not applicable
Vcap 8-bit (Captured by optional SDI card.)	.vcap	Not applicable
Vcap 10-bit (Captured by optional SDI card.)	.vcap10	Not applicable

When you select a file format that is headerless (yuv or rgb), the PQA600 will prompt you to specify the file format (width, height, frame rate, frame structure, and format).

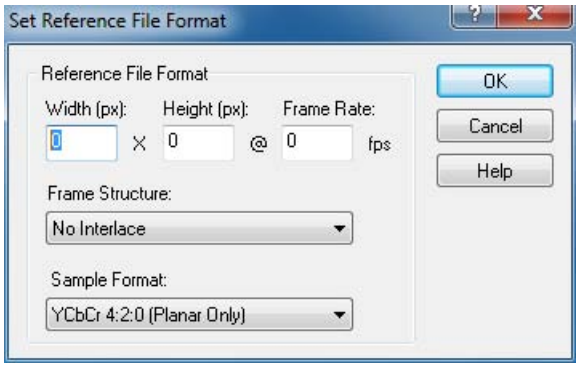


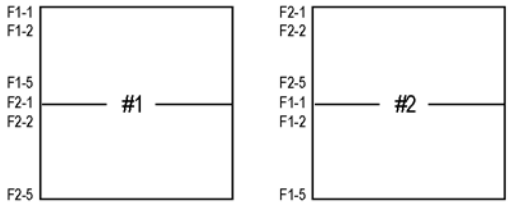
Figure 1: File format dialog box

Use the following guidelines for specifying the file format:

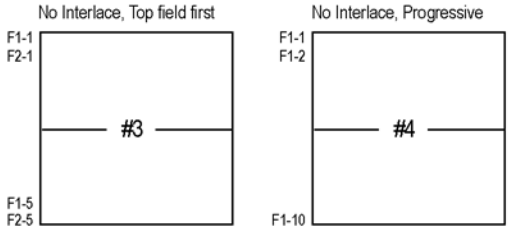
- If the selected file is in interlaced format and the line construction matches #1 in the following figure, select “Field 1 First” for Frame Structure.
- If the selected file is in interlaced format and the line construction matches #2, select “Field 2 First” for Frame Structure.
- If the selected file is interlaced scanning and it has a de-interlaced format like #3, select “No_Interlace”.
- If the selected file has the progressive scanning like #4, select “No_Interlace”.
- If the selected file has the 4:2:0 planar format like #5, select “No_Interlace” and “YCbCr 4:2:0 (Planar Only)” at Sample format selection.

The interlaced video content is supposed to be “Top field first”.

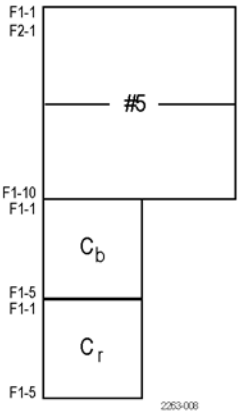
Line/Field order in file



Picture Re-construction



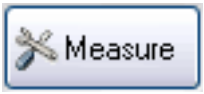
Planar



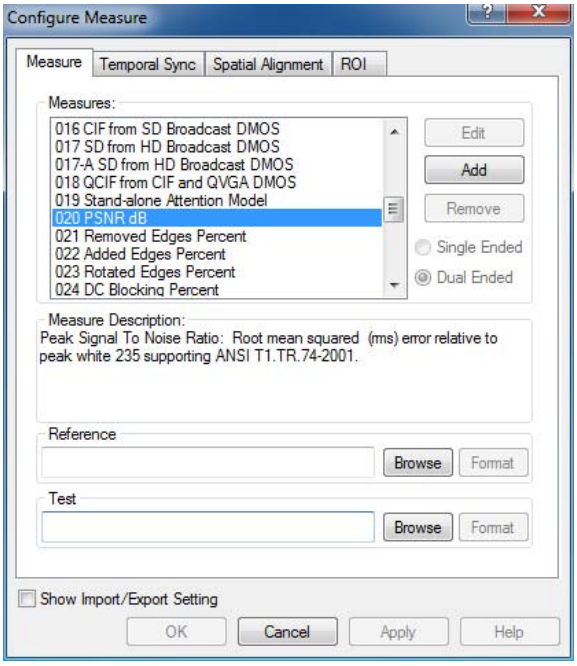
Taking a Measurement

To take a measurement:

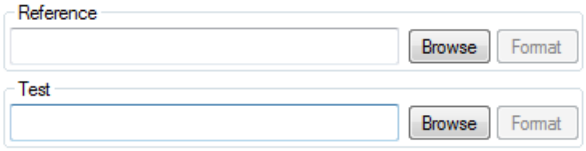
1. Click the Measure button.



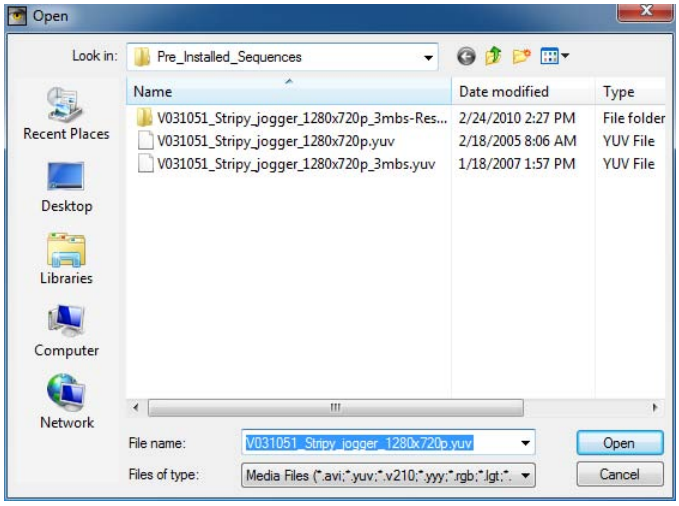
2. Select a Measure from the Measures list.



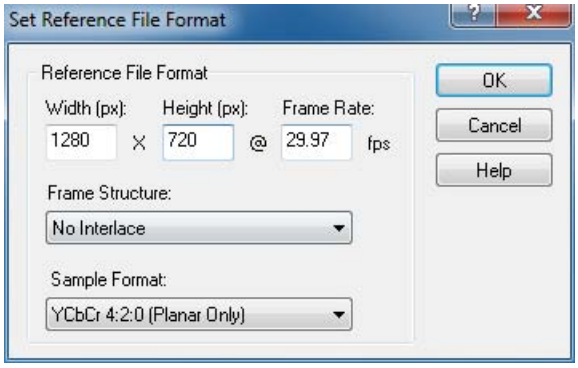
3. In the **Reference** box, click **Browse**.



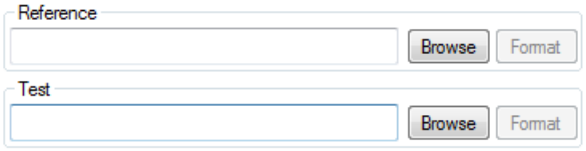
4. Select the reference file to be used for the measurement.



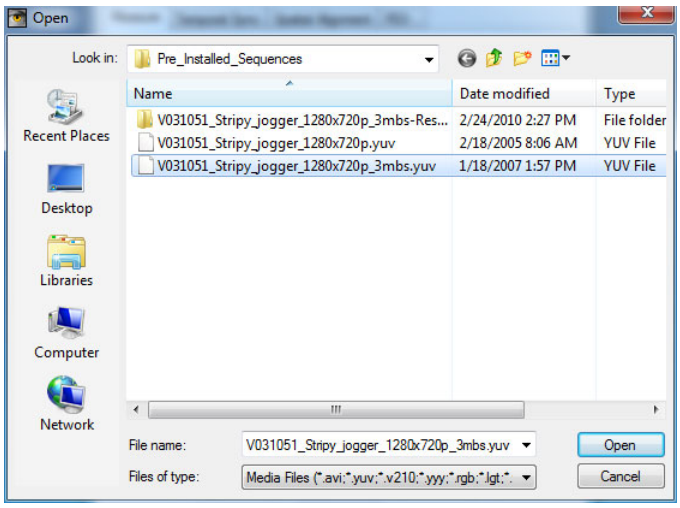
5. In the **Set Reference File Format** dialog, enter the values appropriate for the file.
6. Click **OK**.



7. In the **Test** box, click **Browse**.

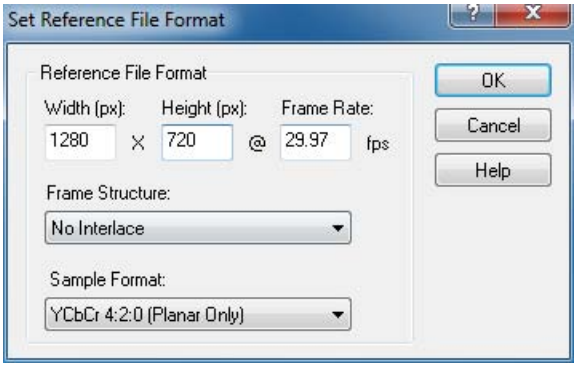


8. Select the test file to be used for the measurement.

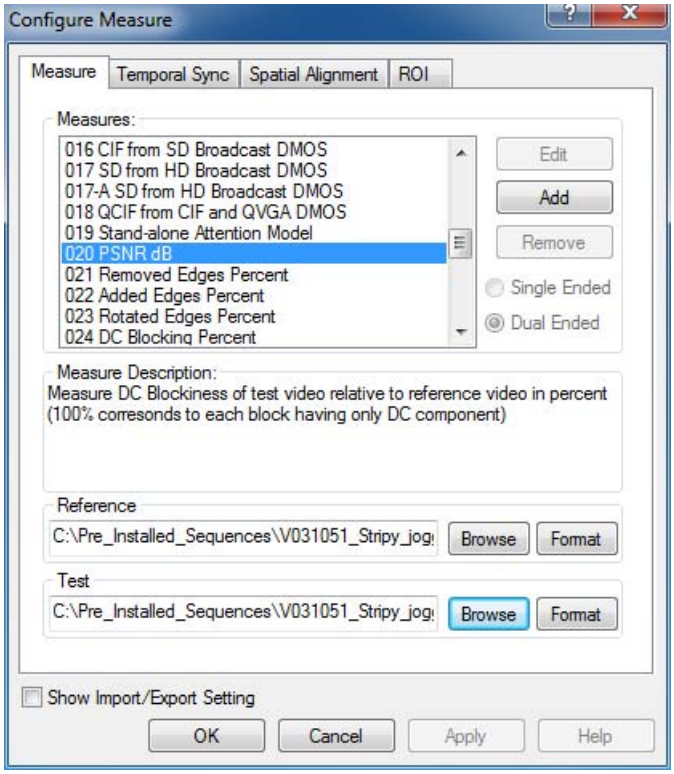


9. In the **Set Test File Format** dialog, enter the values appropriate for the file.

10. Click **OK**.

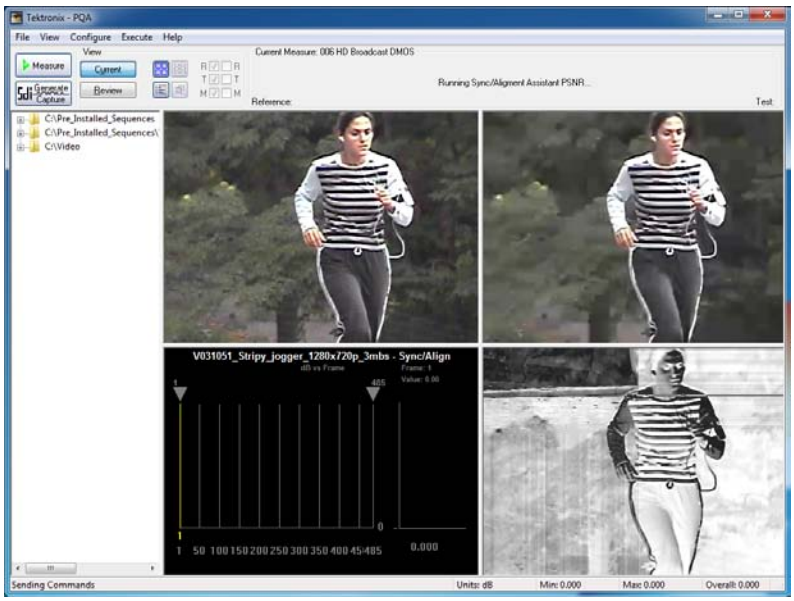


You might need to adjust the temporal and spatial alignments. If you know the reference and test sequences are aligned temporally and spatially, you don't need to perform any alignment procedure before continuing with the measurement. If the spatial alignment parameters of the View Node for the selected measurement are properly configured, you don't need to adjust the spatial alignment settings before proceeding, though you will need to temporally align the files. If you do not know that the test and reference files are aligned, you must align the files temporally and spatially before proceeding with the measurement.(See page 49, *Performing Temporal Synchronization and Spatial Alignment of Sequences*.)



11. Click OK in the Configure Measure window.

12. Click the Measure button to start the measurement.



Keep the following points in mind when taking a measurement:

- When .rgb or AVI_RGB format files are used for the reference or test video sequence, the PQA600 converts to files to the YUV format internally (with a CCIR 601 color matrix) before starting the measurement.
- When the measurement has Display Model node is set to Interlaced CRT, the PQA600 expects the file video format is "Top Field First".

Performing Temporal Synchronization and Spatial Alignment of Sequences

For the PQA600 to take valid measurements, the reference and test video sequences must be temporally synchronized and spatially aligned. There are two tabs on the Configure Measure window that are used to synchronize and align sequences: the **Temporal Sync** tab and the **Spatial Alignment** tab.

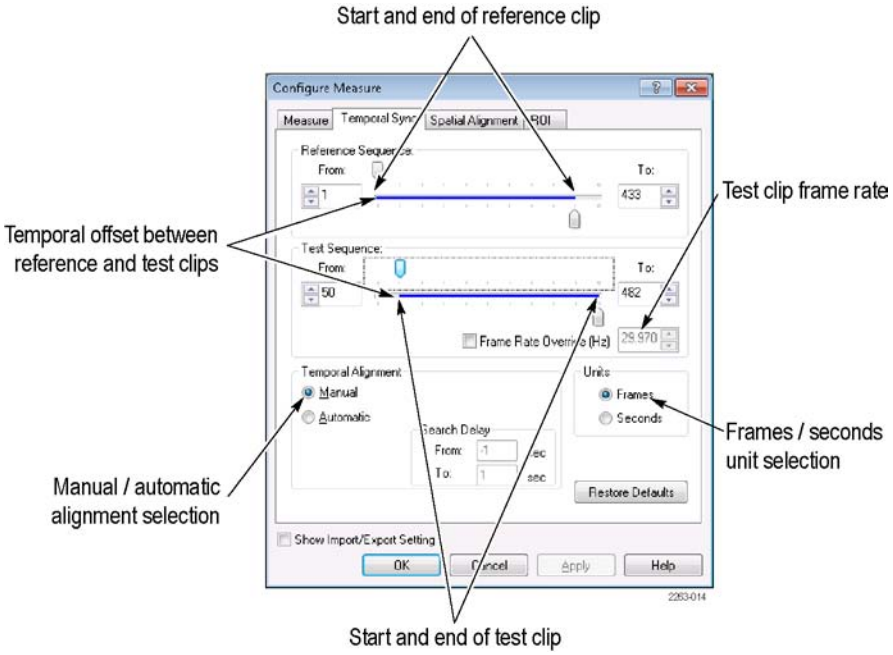


Figure 2: Temporal Sync tab

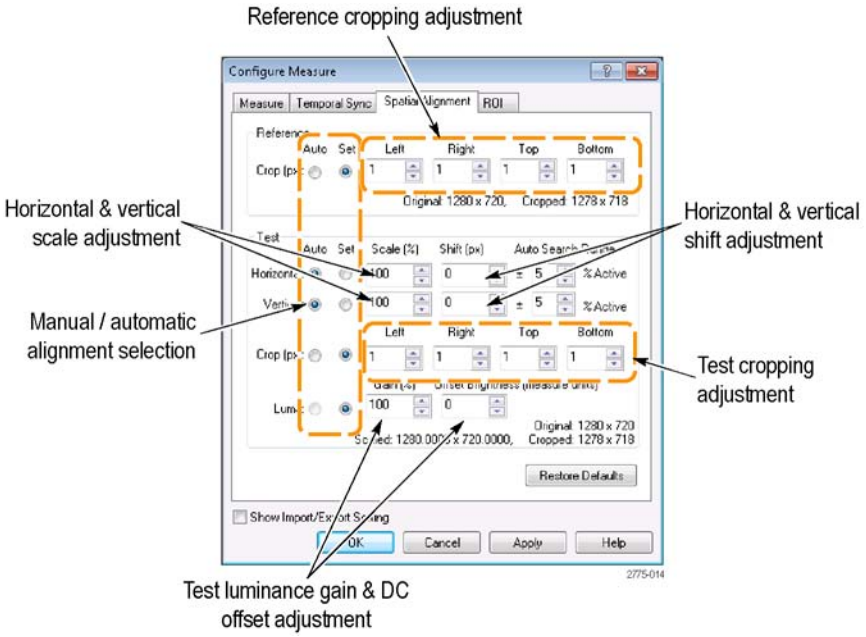


Figure 3: Spatial Alignment tab

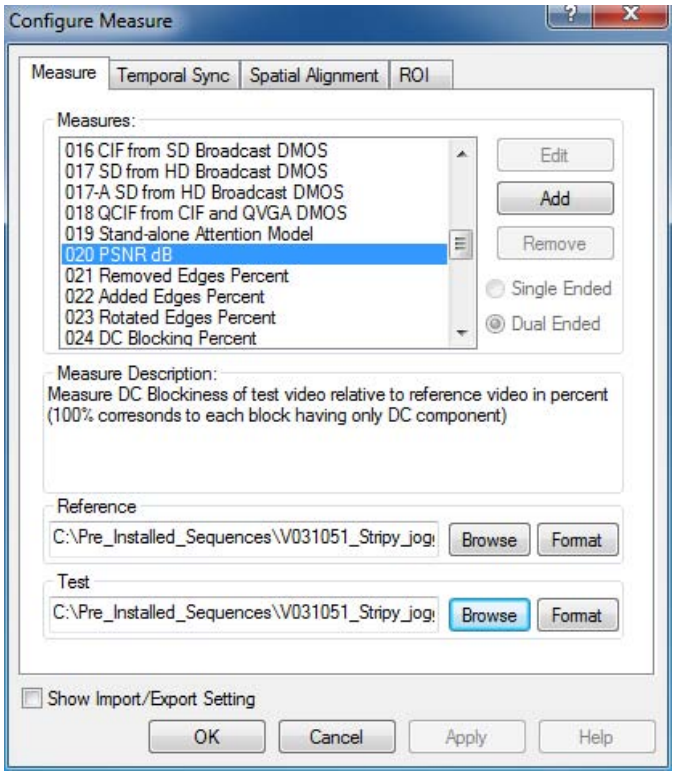
Temporal Sync

Use the Temporal Sync tab to match the starting and ending frames of the reference and test video sequences. You can synchronize video sequence either manually or automatically. In manual mode, you specify the start and end frames of the sequences. In automatic mode, the PQA600 compares a range of frames in the test sequence to the start frame of the reference sequence to synchronize the video sequences.

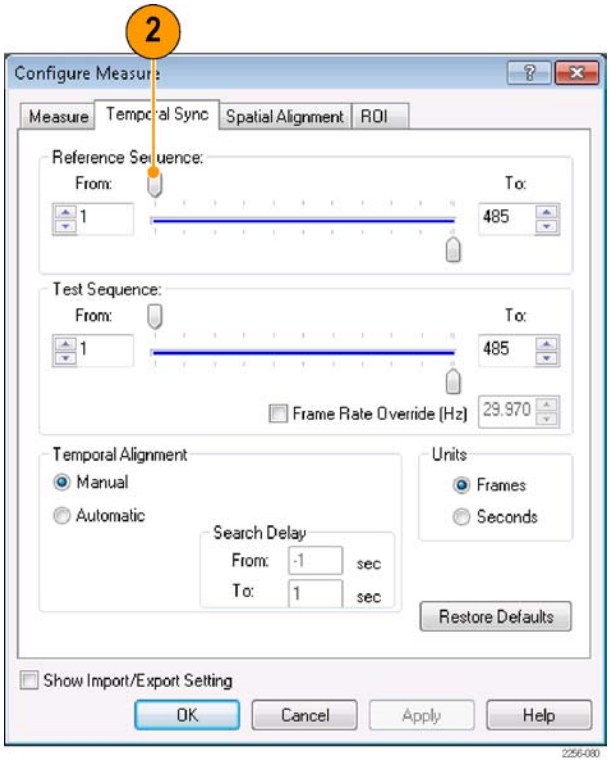
Manual Temporal Alignment. In a Manual Temporal Sync, you manually adjust the starting frames of the reference and test sequences until they are aligned, using a PSNR map for guidance. To perform a Manual Temporal Alignment, you will start by specifying the **From** frame for the reference and test sequences. You will then adjust the From frame for the test sequence. Using a PSNR map that indicates differences in the selected frames, you will adjust the test sequence frame until the PSNR map indicates a minimum of differences between the selected frames.

To temporally synchronize the reference and test sequences manually:

1. With the Measures dialog box displayed, click the **Temporal Sync** tab.

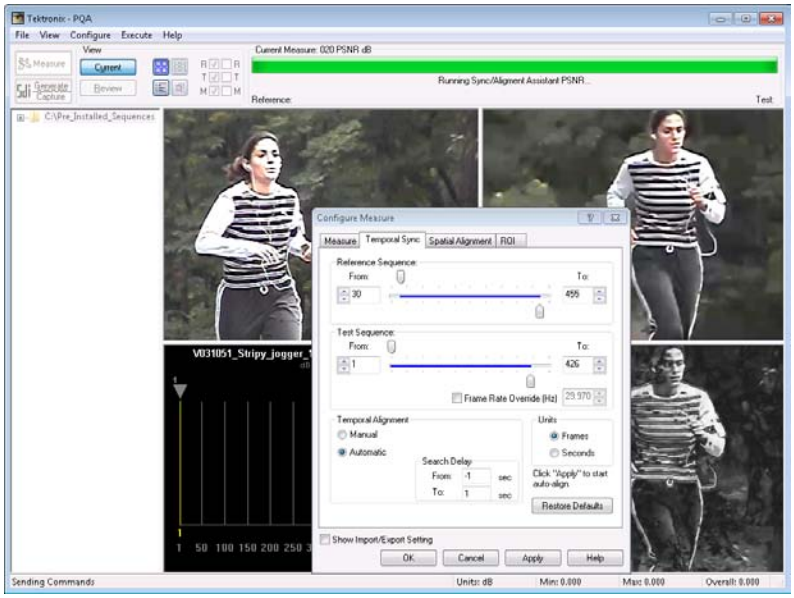


2. To set the starting frame of the reference sequence, adjust the top slider on the **Reference Sequence** bar. If needed, you can use the number entry box to change the starting frame one frame at a time.

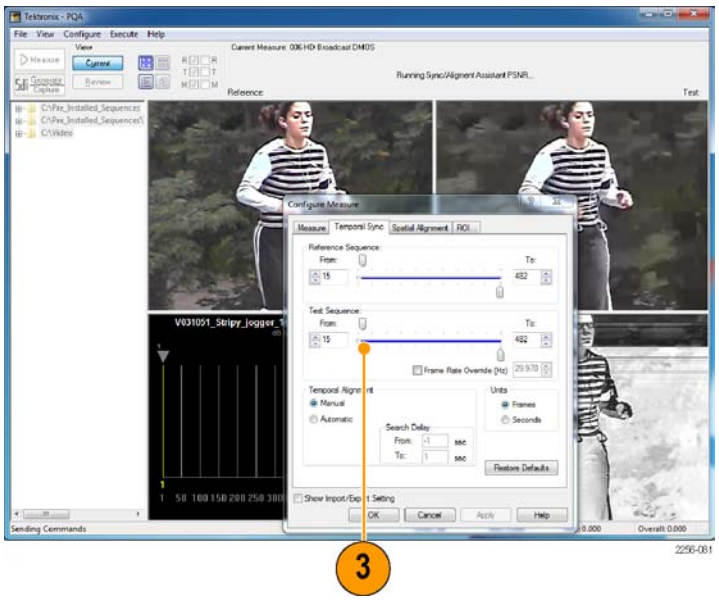


NOTE. *To view the sequence by time rather than by frame, select* ***Seconds*** *in the Units section.*

As you adjust the slider, the image in the Reference window changes to show the selected frame.

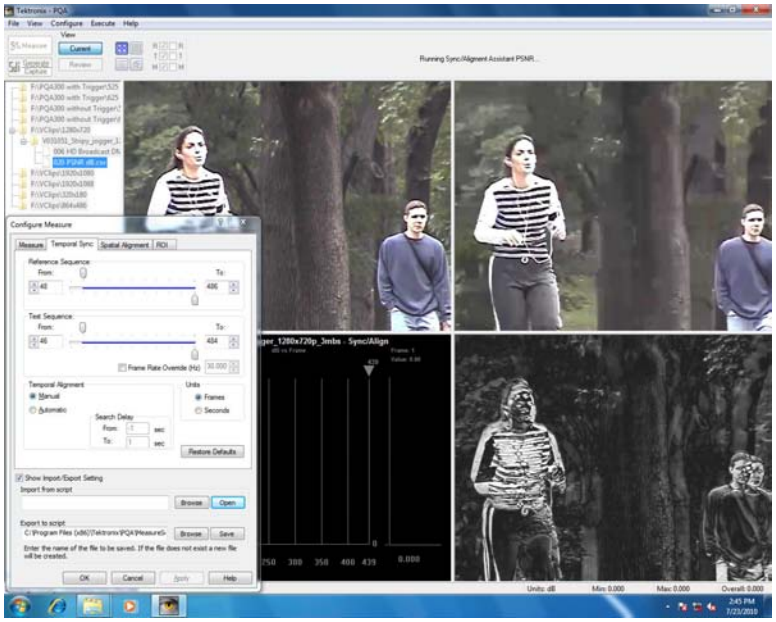


3. To set the starting frame of the test sequence, adjust the top slider on the **Test Sequence** bar. If needed, you can use the number entry box to change the starting frame one frame at a time.

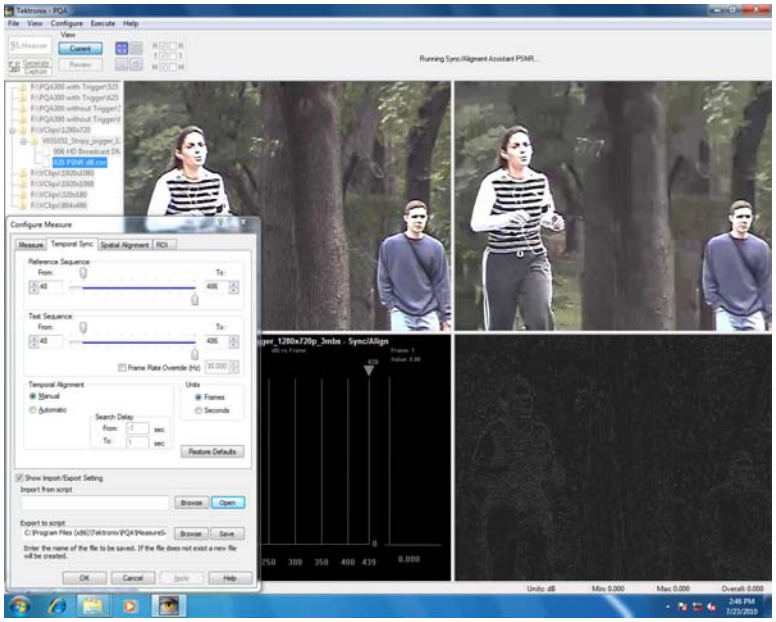


Once video sequences have been specified on the Measure tab, the PQA600 displays a PSNR map in the Results Map frame. You can use this map to align the two video sequences. Adjust the test sequence to achieve the darkest possible PSNR map (black is best). On the PSNR map, any differences between the reference start frame and the test start frame will be highlighted. The illustration at the top-right shows how a difference of two frames appear in the PSNR map. The illustration below it shows how the PSNR map appears when the two sequences are aligned.

The PSNR map shows both temporal and spatial alignment. Thus, you might also have to use the Horizontal and Vertical Shift settings on the Spatial Alignment tab to properly align the reference and test sequences.



PSNR map with frames temporally unaligned



PSNR map with frames temporally aligned

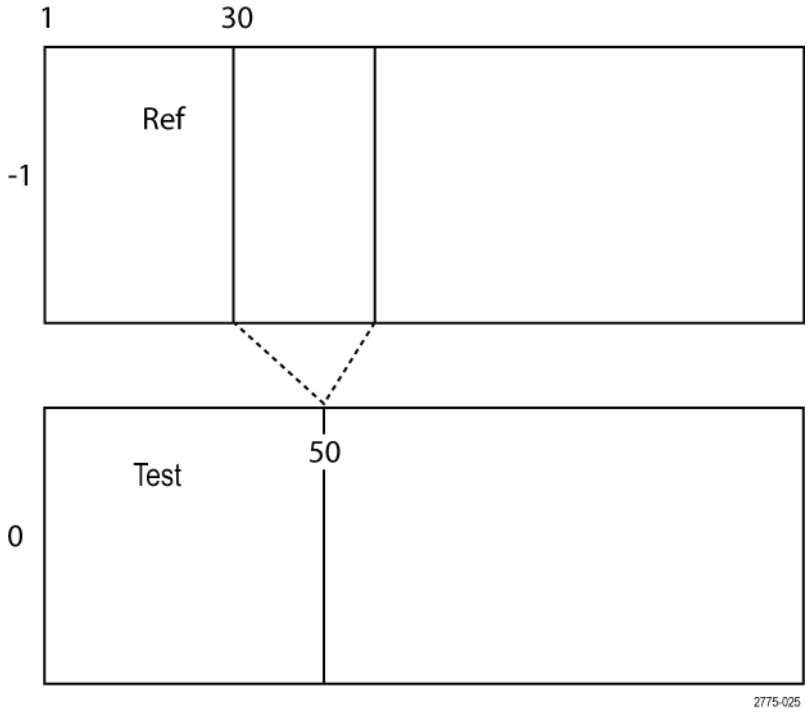
Automatic temporal alignment. In an Automatic Temporal Sync, the PQA600 compares a range of frames of the reference and test sequences and adjusts the starting frame of the test sequence until alignment is achieved (if possible). As with the manual temporal alignment, you must specify the From frame for both the reference and test sequences. Then you must specify a range of frames to use for comparison.

The range of frames compared is specified by setting values for the Search Delay. The Search Delay is specified in seconds. For example, if the frame rate is 30 frames per second, specifying a search delay of 1 second will result in 30 frames being compared. The Search Delay setting has two elements: From and To.

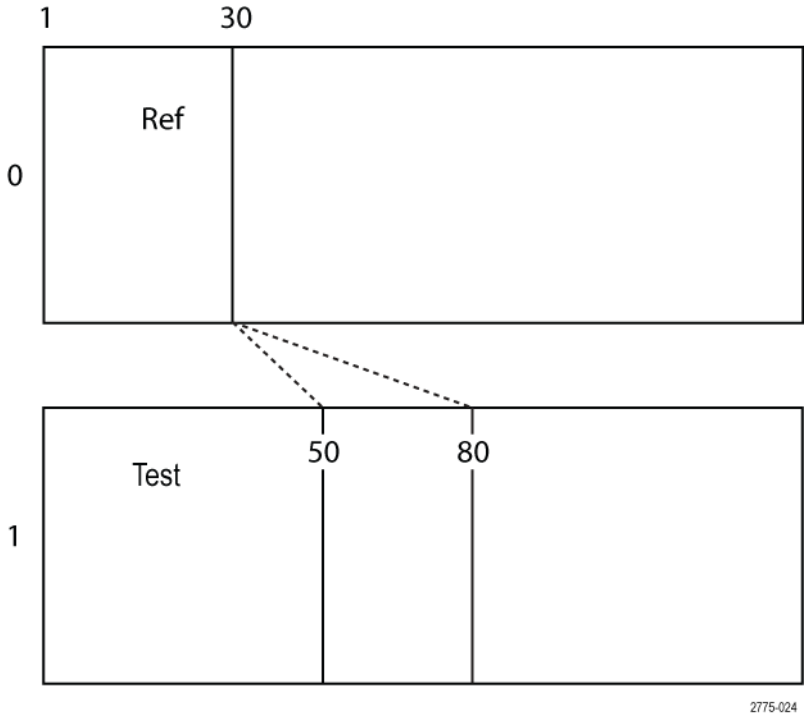
When performing a automatic temporal alignment, the PQA600 is attempting to determine the offset between frames in the reference and test sequences which are temporally aligned. You control the search range by setting the values for Search Delay From and Search Delay To.

To illustrate how the values for From and To interact, assume the following: the frame rate is 30 Hz, the Reference From frame is 30, and the Test From frame is 50.

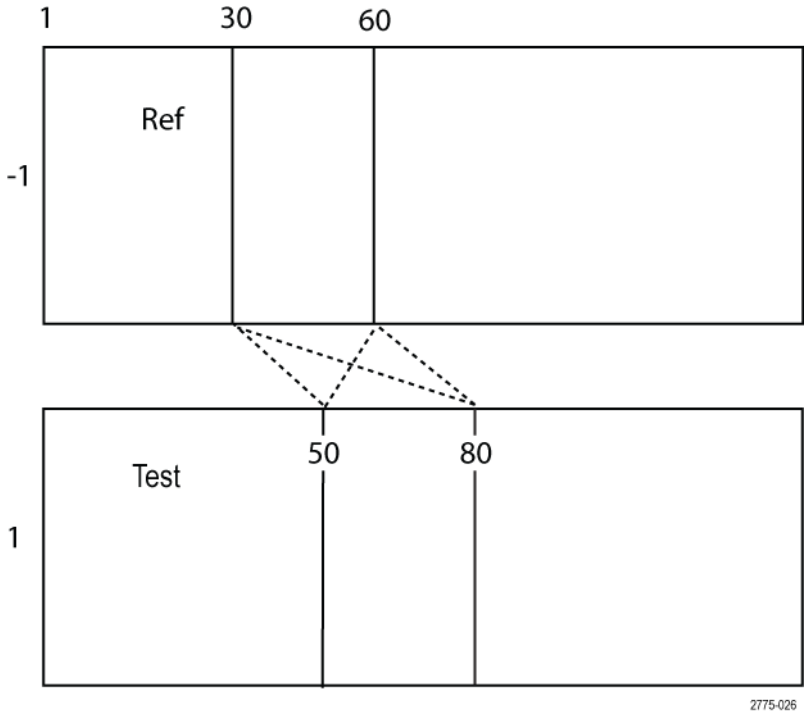
- **Example 1**: When **Search Delay From** is set to -1 and Search Delay To is set to 0, the PQA600 will compare Reference frames 30–60 against Test frame 50 to achieve temporal synchronization. See the following figure.



- **Example 2**: When **Search Delay From** is set to 0 and Search Delay To is set to 1, the PQA600 will compare Reference frame 30 against Test frames 50–80 to achieve temporal synchronization. See the following figure.



Example 3: When **Search Delay From** is set to -1 and Search Delay To is set to 1, the PQA600 will compare Reference frames 30–60 against Test frames 50–80 to achieve temporal synchronization. See the following figure.

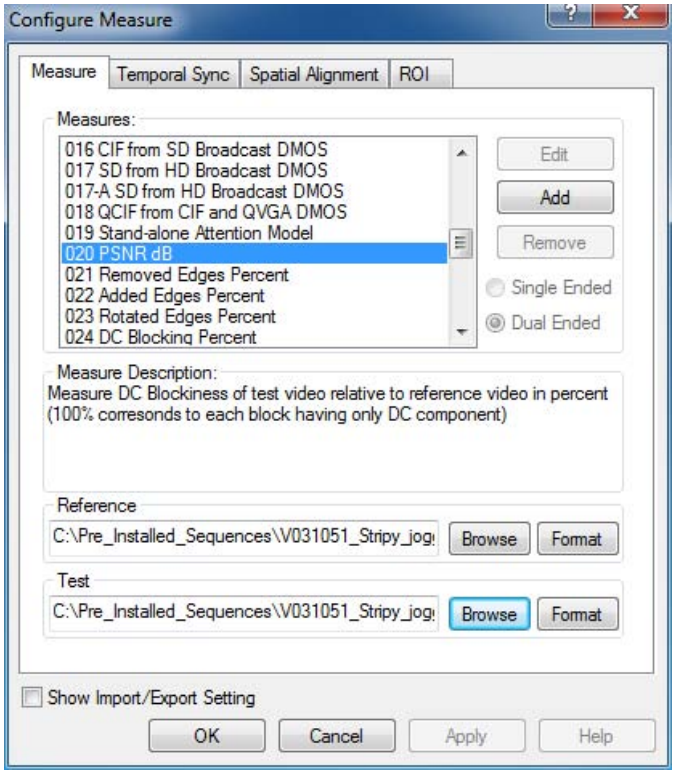


When performing an automatic temporal alignment, keep the following in mind:

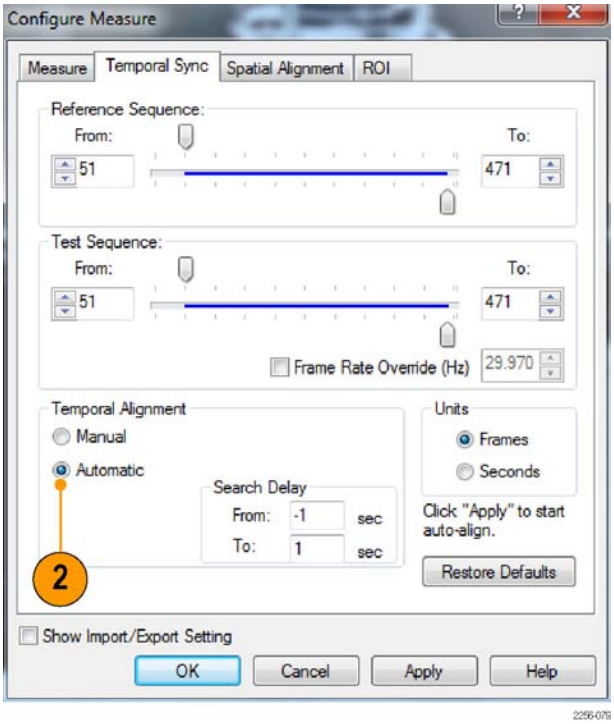
- You can select any start frame for the reference and test sequences. Alignment does not have to begin with the first frame.
- In some cases, when test sequence is badly distorted, you may get a warning the PQA600 is not able to align perfectly. However, the auto alignment function still provide the best possible match.
- If test sequence has frozen or skipped frames, the PQA600 might display a warning that the offset (difference between aligned frames) is not constant for the entire sequence. The reference and test frames on the Temporal Sync tab will be set according to measured initial offset.
- The more frames that are compared to determine temporal alignment, the more time will be used. If you have an idea of the location where the sequences will align, you can set the From values in the Reference and Test Sequences and the Search Delay to minimize the time spent searching for aligned frames. For example, if you think that frame 100 in the reference sequence will align with frame 150 in the test sequence, you can set the From values to 90 and 140, respectively, and the Search Delay values to -1 and 1, respectively, to minimize the time spent aligning the sequences rather than setting the From values to 1 and the Search Delay values to -6 and 6 and then waiting for the software locate the aligned frames.

To temporally synchronize the reference and test sequences automatically:

1. With the Measures dialog box displayed, click the **Temporal Sync** tab.



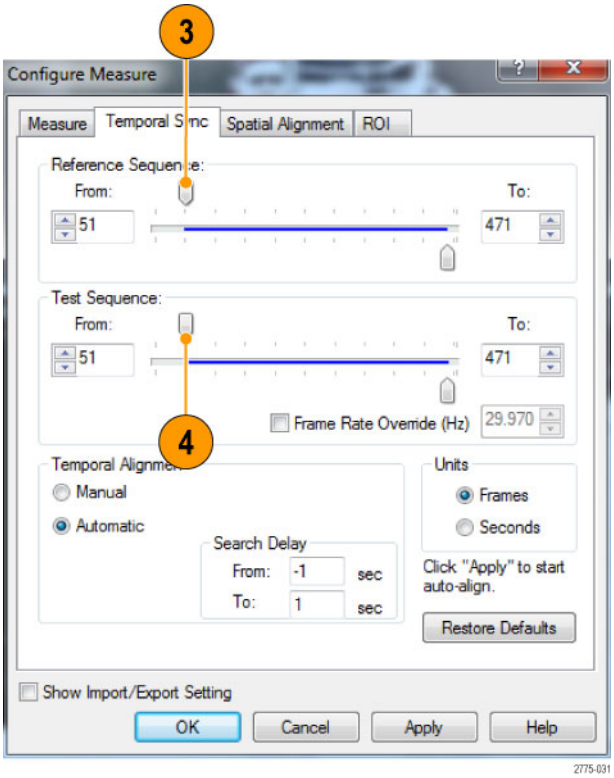
2. Click the **Automatic** option button under **Temporal Alignment**.



3. To set the starting frame of the reference sequence, adjust the top slider on the **Reference Sequence** bar. If needed, you can use the number entry box to change the starting frame one frame at a time.

NOTE. *To view the sequence by time rather than by frame, select* ***Seconds*** *in the Units section.*

4. To set the starting frame of the test sequence, adjust the top slider on the **Test Sequence** bar.

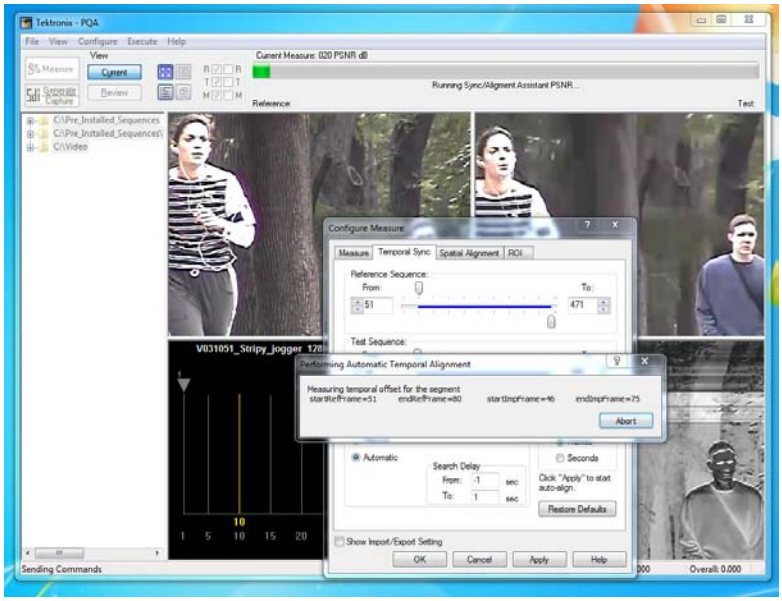


5. To specify the frames of the reference sequence used for comparison, enter a value for the Search Delay **From** parameter.

6. To specify the frames of the test sequence used for comparison, enter a value for the Search Delay **To** parameter.

7. To start the automatic temporal alignment process, click **Apply**.

The figure at the right shows the automatic temporal alignment process running. When the process completes, the From values for reference and test sequences will match (if a matching frame in the test sequence was found within the search range).

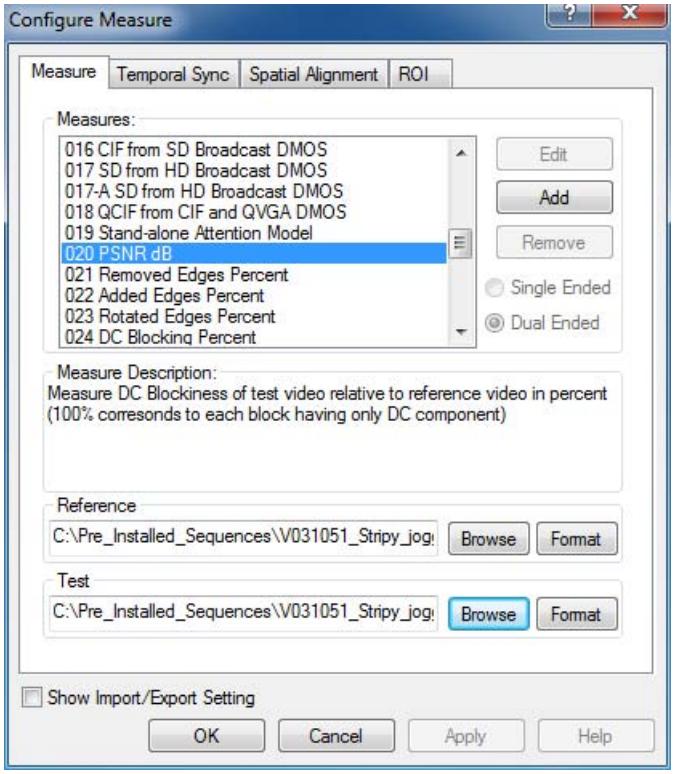


Spatial Alignment

Use the Spatial Alignment tab to match areas of the reference and test sequences that are compared. You can spatially align the reference and test sequences either manually or automatically. The reference and test sequences must be spatially aligned to achieve meaningful measurement results.

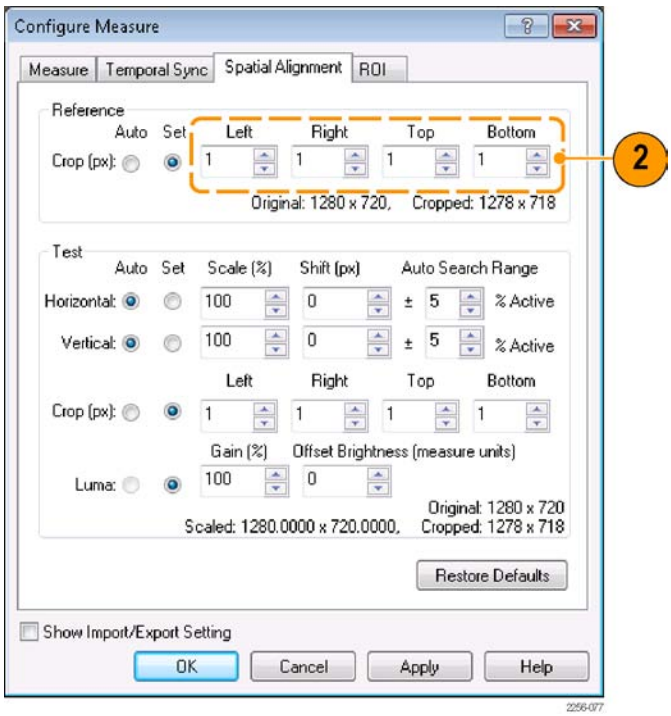
To spatially align the reference and test sequences manually:

1. Click the **Spatial Alignment** tab.



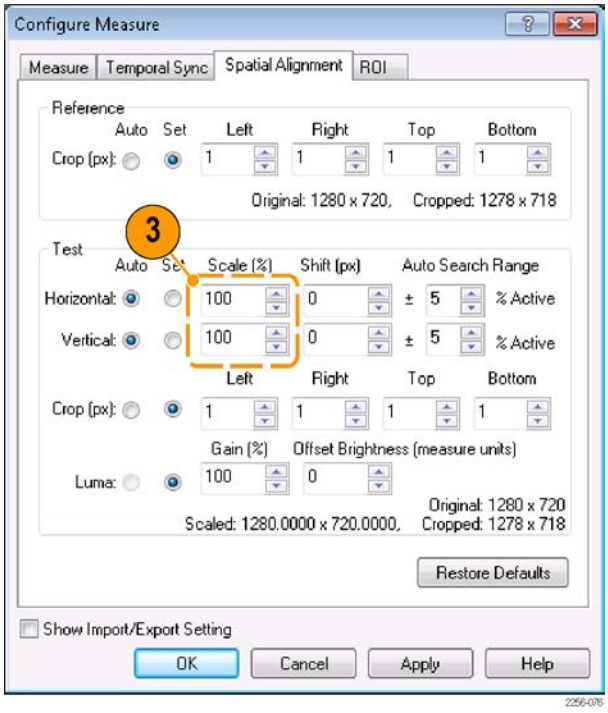
2. To manually crop the reference sequence, enter a number into the **Left**, **Right**, **Top**, and **Bottom** boxes in the Reference section.

NOTE. *As you adjust the values for cropping, the values for* ***Cropped*** *will change*

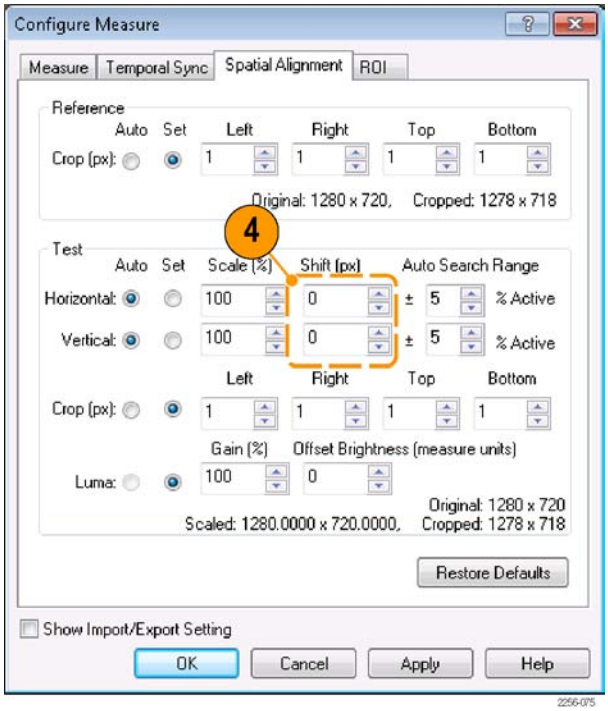


If the resolution of the test sequence does not match the resolution of the reference sequence, you must scale the test sequence. For example, if the reference sequence is 640 x 480 and the test sequence is 1280 x 720, you must scale the test sequence so that the scaled value is equal to 640 x 480.

3. To scale the test sequence, adjust the values in the Scale number entry boxes for both horizontal and vertical values.

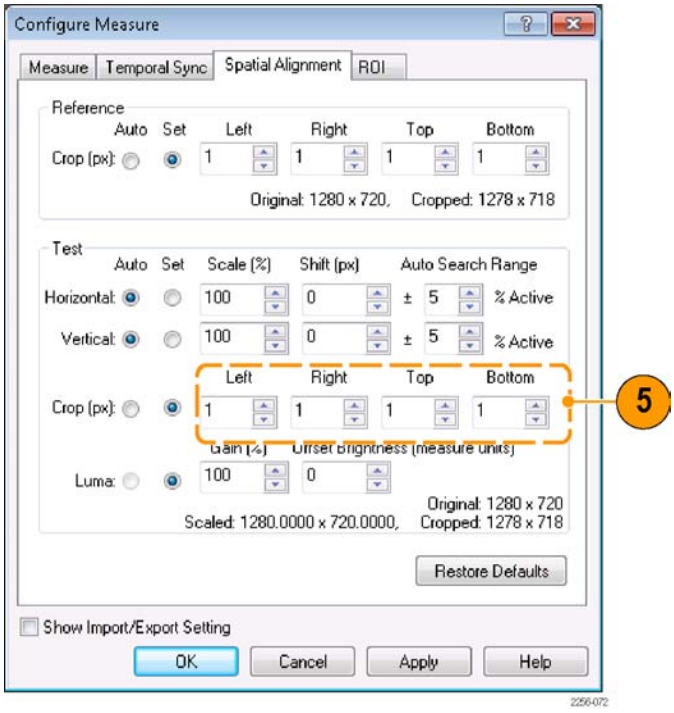


4. If the reference and test sequences do not align vertically, adjust the **Shift(px)** values so that the test sequence matches the reference sequence.



5. If you have to shift the test sequence to align it with the reference sequence, you might need to crop the test sequence (remember the PSNR map will highlight any differences between the sequences).

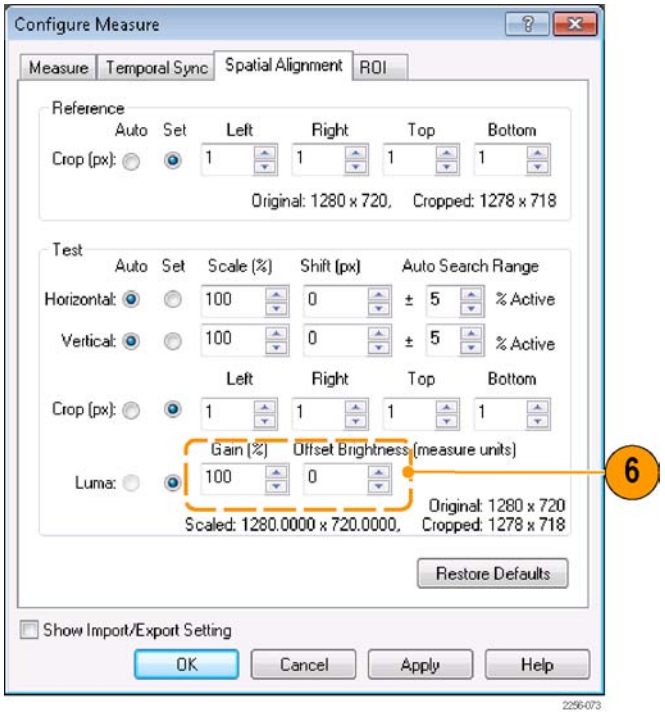
   Crop the test sequence by adjusting the **Left**, **Right**, **Top**, and **Bottom** boxes in the Test section.



6. If you need to adjust the luminance of the test sequence to match the reference sequence, adjust the Luma values **Gain** and **Offset Brightness** in the Test section.

NOTE. If the selected Measure contains a View Model node, this Luma setting is overridden by the values in the View Model node.

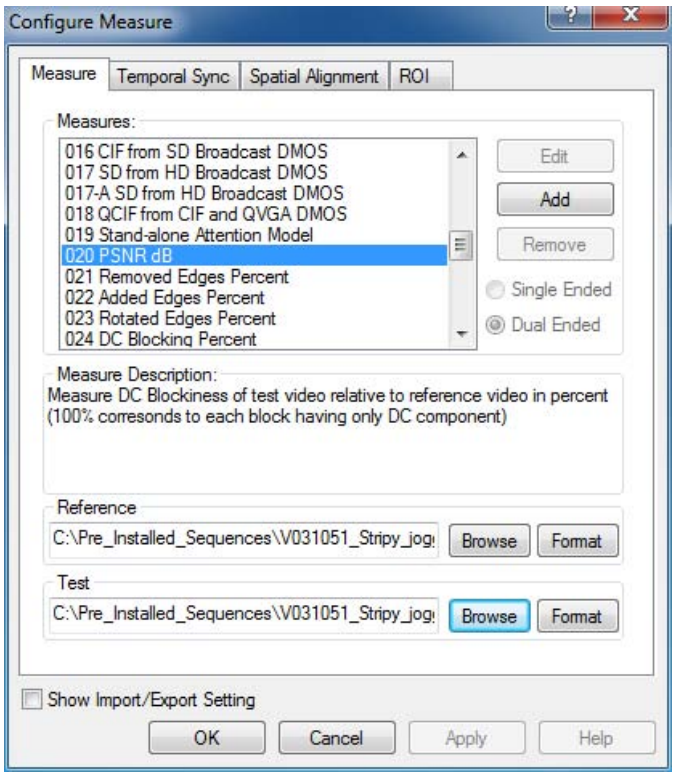
7. After you make the spatial alignment adjustments, click **OK**.



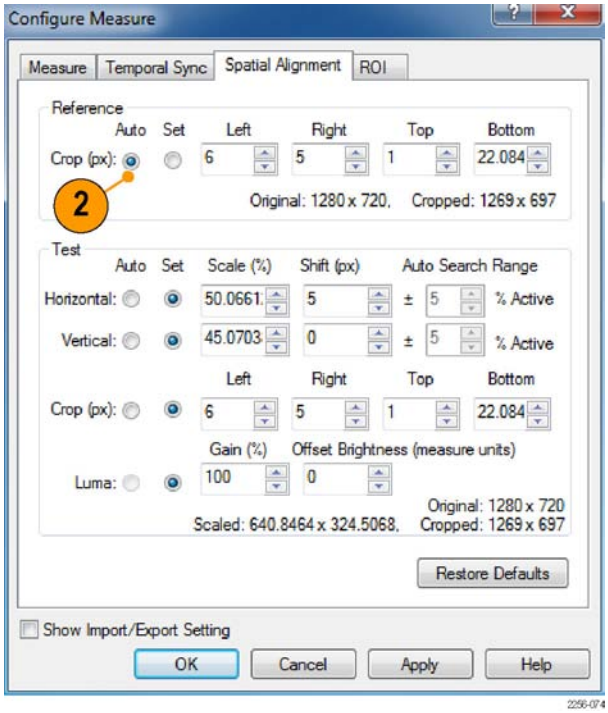
You can allow the PQA600 to spatially align the reference and test sequences.

To spatially align the reference and test sequences automatically:

1. Click the **Spatial Alignment** tab.

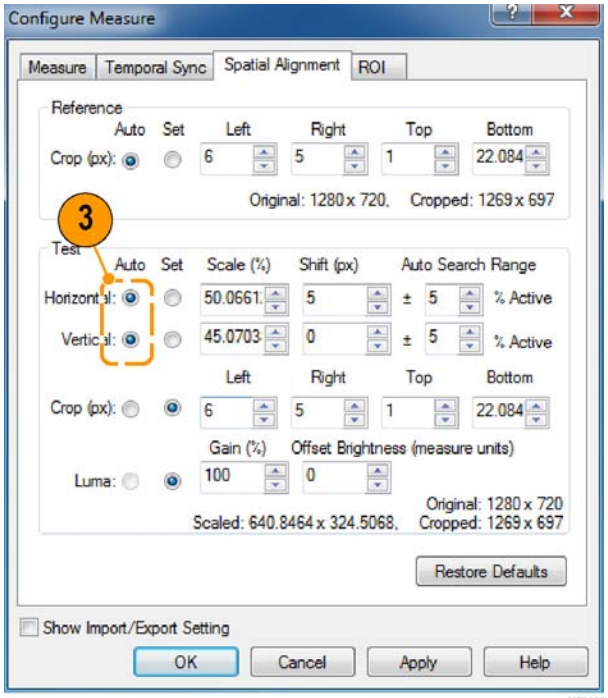


2. To automatically crop the reference sequence, select **Auto** in the Reference section.

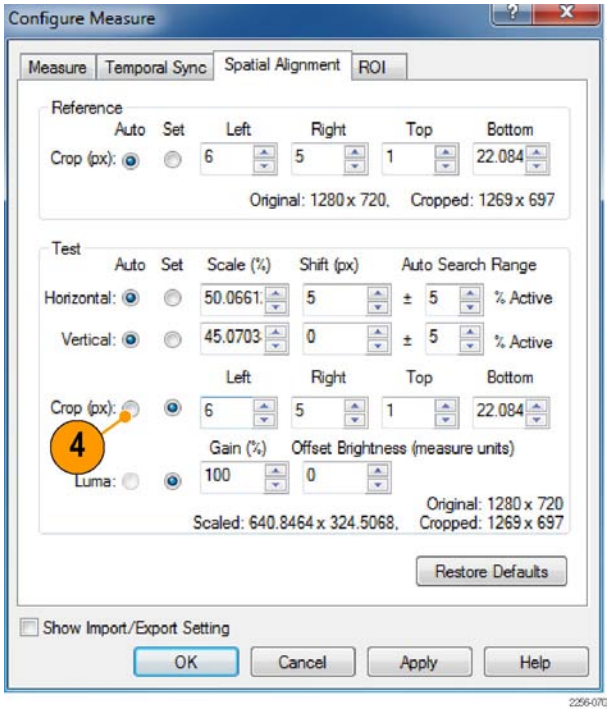


3. To automatically scale the test sequence, select **Auto** for both the Horizontal and Vertical settings.

The PQA600 will compare up to ±30% of the test sequence horizontal and vertical pixels to the reference sequence searching for alignment.



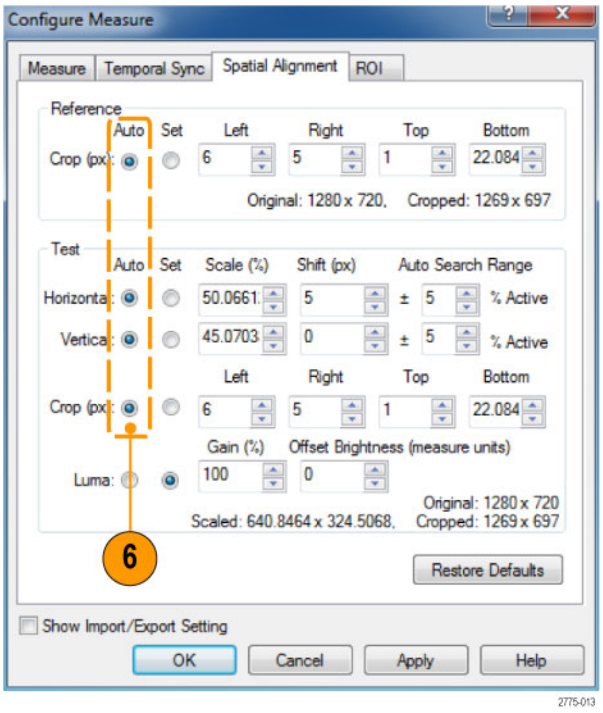
4. To automatically crop the test sequence to match the reference sequence, select **Auto** for the Crop (px) setting.



5. To adjust the Luma of the test sequence, enter values for the Gain and Offset parameters.

NOTE. *If the selected Measure contains a View Model node, this Luma setting is overridden by the values in the View Model node.*

6. After you select Auto for the adjustments you need to make, click **OK** to automatically align the reference and test sequences.



Tips

- If you receive a low correlation warning message after running the automatic temporal or spatial alignment, expand the Auto Search Delay or Auto Search Range and run the alignment again.
- Auto alignment works best when the video sequences contains moving objects. Try to select a portion of the video sequences that contain a moving object if you will be using auto alignment.
- If the video sequence contains scenes that pan and zoom, the automatic temporal / spatial alignment process might have difficulty achieving alignment. You might have to use automatic alignment repeatedly or use manual alignment to properly align the sequences.
- If you are measuring the sequences with different frame rate, ensure that the start frame for the reference and test sequences align on exactly the same start frame. Any phase offset difference between the start frames will result in poor measurements.
- If you are measuring sequences that are part of a 3:2 pull-down process (for example, the reference is 23.98p and the test is 59.94i with the 3:2 pull-down process), the start frames for reference and test must be aligned with the first frame in a 3:2 sequence.
- The Gain and Offset settings on the Spatial Alignments tab are manual only. If you want to use automatic Gain and Offset compensation, you must edit the View node of the measurement and enable the Auto option for Gain and Offset.

Using the Region-of-Interest

Region-of-Interest Basics

Region-of-Interest (ROI) is a feature that limits measurements to a region of a video sequence that is used for measurements. An ROI can be applied before a measurement is taken, which is named an Input ROI; or an ROI can be applied after measurements are taken, which is named an Output ROI. An Input ROI is used to exclude portions of the video sequence from being used in a measurement. The Output ROI is used to limit the calculation of measurement results to a specific region, which can make it easier to determine the source of impairments.

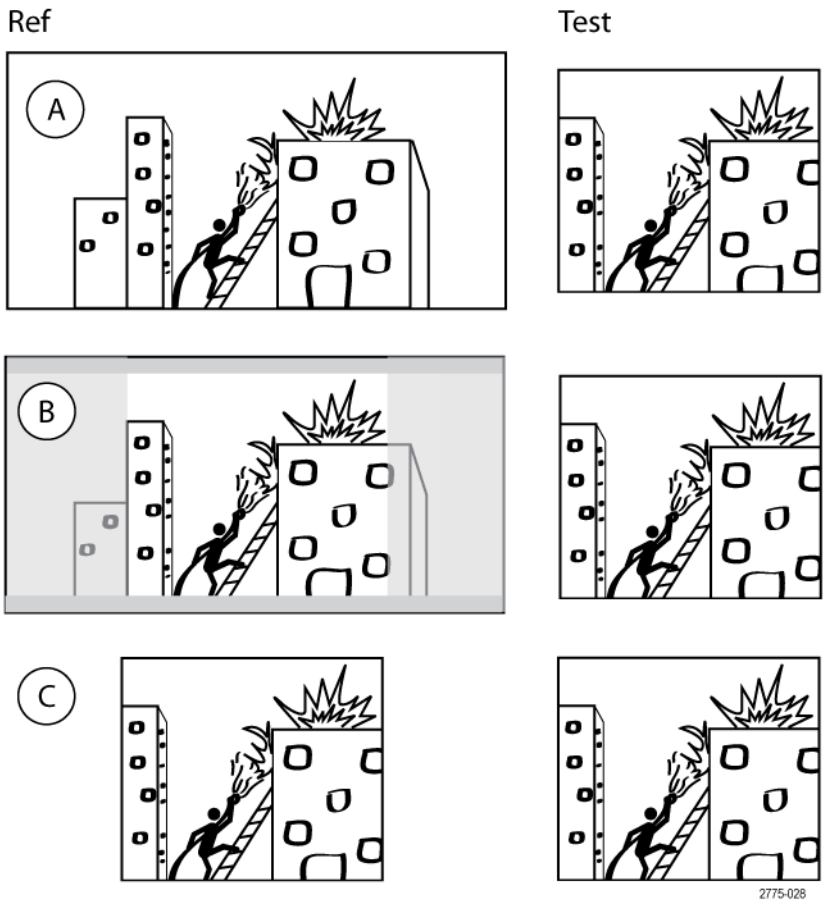
An Input ROI is applied to the reference and test video sequences prior to any other processing and the region outside an Input ROI is excluded from the alignment or measurement. An Output ROI is applied to the measurement result and the overall score can be recalculated for the specified region.

You can specify ROI in spatial terms (an area within a frame), or in temporal terms (which frames to include within a measurement). Spatial ROI defines the region of interest by specifying the pixels contained within the region of interest. A Spatial ROI is the same for all frames within a video clip. A Temporal ROI defines the region of interest by specifying the frames contained within the region of interest. It is these specified frames, in the case of an Output Temporal ROI, that are used to calculate the *Overall* measurement value. For example, if the test sequence is 1000 frames long, you could specify an Output Temporal ROI to limit measurements to frames 200 through 800.

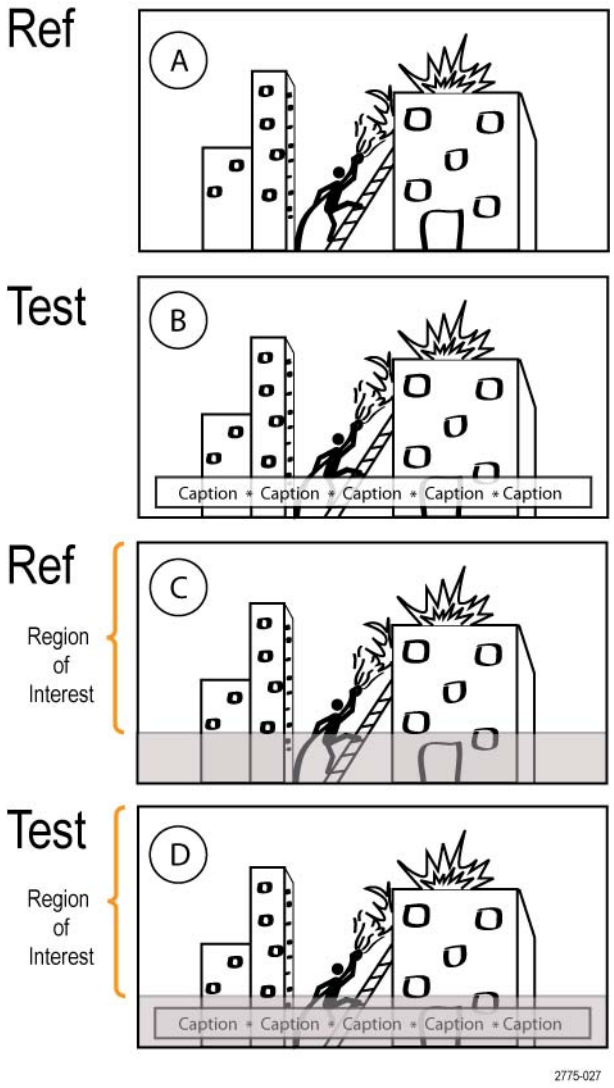
An Output Spatial ROI is a rectangular region within the result map. The overall score can be recalculated for a subregion even after measurement is run.

ROI Examples

One use for an Input Spatial ROI is to specify portions of the reference video sequence to ignore when taking a measurement, which would improve the measurement accuracy. If you were using a 16x9 video sequence as the reference sequence, and a 4x3 video sequence as the test test sequence (A in the following figure), you would need to specify the Input Spatial ROI settings to limit the portion of the reference sequence used for measurements to a 4x3 area (B in the following figure), that results in a reference sequence ROI that aligns with the test video sequence (C in the following figure).



Another example of how to use an Input Spatial ROI is to exclude a portions of sequences which do not match from being compared. For example, if the test sequence contains a caption that does not appear in the reference sequence, you can specify an Input Spatial ROI to limit measurements to the regions of the two sequences that match. The following illustration shows how an Input Spatial ROI would be applied in this situation, A represents the reference sequence. B represents the test sequence, which contains a caption that does not appear in the reference sequence. To ensure a valid measurement, you would specify an Input Spatial ROI that limits the region of the reference sequence and the test sequence that is used for measurements. C shows how the ROI applies to the reference sequence. D shows the portion of the test sequence that is not included in the comparison with the reference sequence.



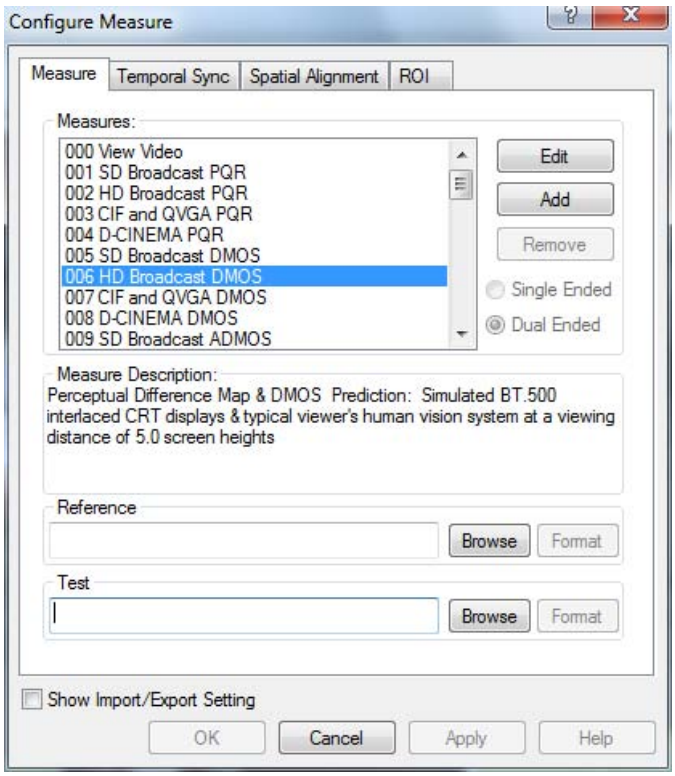
Specifying an ROI

To specify an ROI, you use the ROI tab of the **Configure Measure** window.

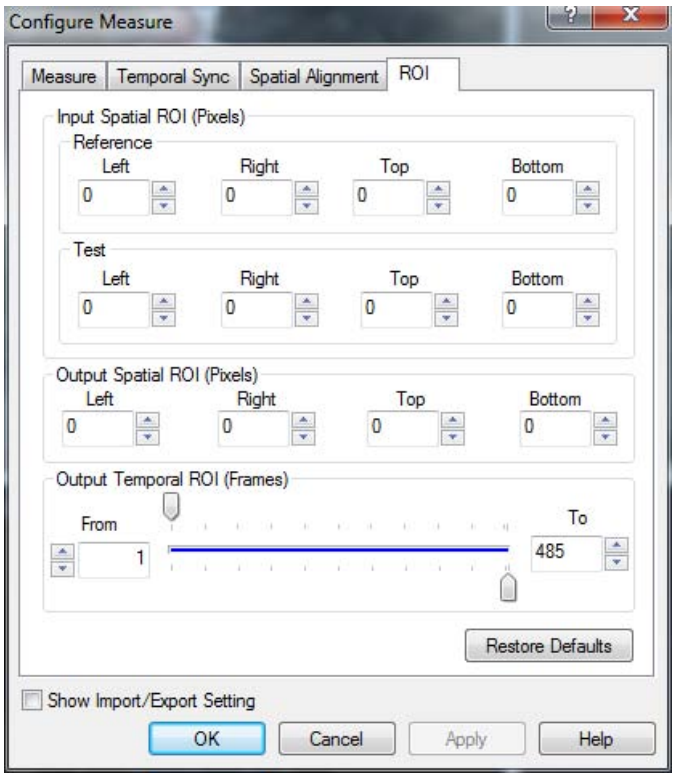
To specify ROIs using the ROI tab in the Configure Measure dialog:

1. Click the **Measure** button.

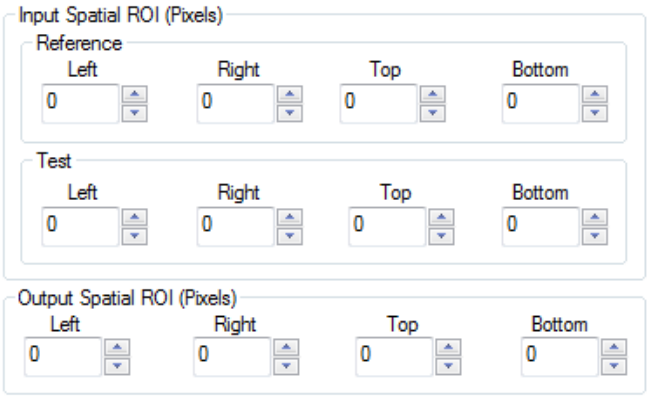
2. Select the measurement you wish to run and specify the Reference and Test files as required.



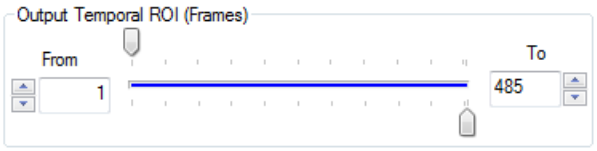
3. Select the **ROI** tab.



4. Enter values for the Input Spatial ROI (both Reference and Test) and the Output Spatial ROI parameters.



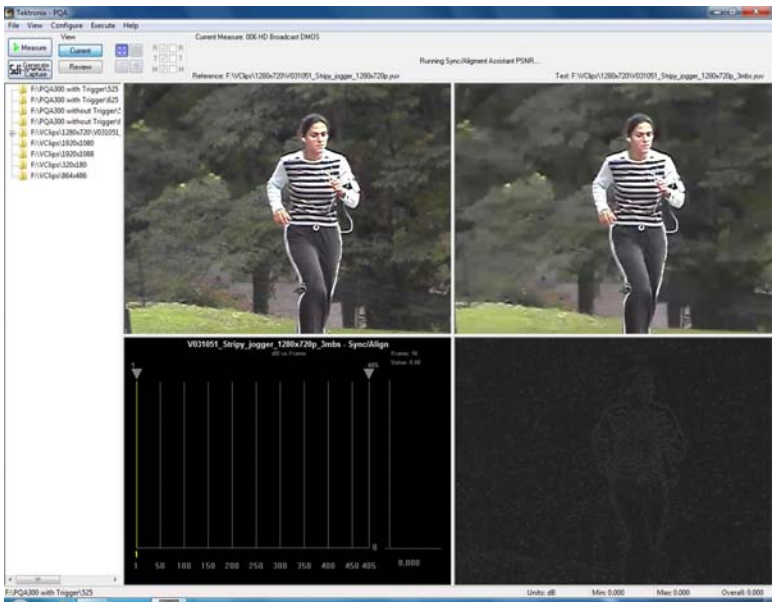
5. To configure the Output Temporal ROI, specify the range of frames to which you wish to limit the *Overall* measurement.



NOTE. *When the measurement is run, the measurement will be calculated for all the frames specified on the Temporal Sync tab. The frames specified on the ROI tab are only the frames used to calculate the Overall measurement value.*

6. Click **OK** to save your measurement selections.

7. Click the **Measure** button to begin the measurement.



Generating and Capturing Video (Requires Option SDI)

The PQA600, with Option SDI installed, can generate SDI video signals using a file as a source. The PQA600 can also capture video signals to a file for later review and analysis.

Simultaneous Generation and Capture

The PQA600 can generate and capture video on two channels simultaneously. Using this capability, you can generate a video signal, route that signal to a device-under-test, and then route the device-under-test output back into the PQA600 for analysis. When used in this way, the video formats must match. Both the generation and capture capabilities can be used independently. The two-channel capture and generate capability can be configured to generate two channels simultaneously, capture two channels simultaneously, or generate one channel and capture one channel simultaneously.

The PQA600 enables you to swap the two output channels so that you can view either output even if you have only a single monitor. The ability to simultaneously generate two outputs can be used to perform subjective picture quality evaluation that complements the PQA600 objective measurements. The ability to simultaneously capture two channels enables you to capture both the reference and test signal simultaneously, which can be useful in broadcast operations.

Supported Source Video File Formats

The PQA600 requires a video file as a source to generate a video signal. The PQA600 supports the following file formats. All formats are 8-bits resolution.

Supported video formats for generation

File format	File extension	Frame structure options
CbYCrY (601-4:2:2), UYVY	.yuv	Non-Interlaced, Field 1 First, Field 2 First, Inverted
YCbYCr (4:2:2), YUY2	.yuv	Non-Interlaced, Field 1 First, Field 2 First, Inverted
BGR	.rgb	Non-Interlaced, Field 1 First, Field 2 First, Inverted
CbYCrY (601-4:2:2), UYVY (10-bit)	.v210	Non-Interlaced
AVI (Uncompressed UYVY, YUY2, RGB, RGB32, v210)	.avi	Not applicable
Vcap (Captured by optional SDI card.)	.vcap	Not applicable
Vcap 10-bit (Captured by optional SDI card.)	vcap10	Not applicable

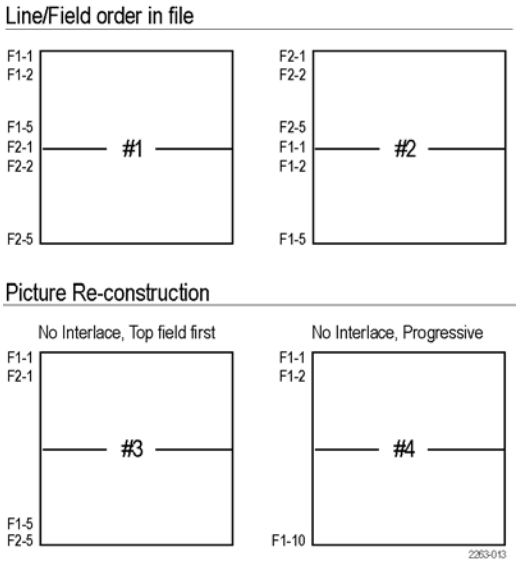
When you select a file format that is headerless (yuv or rgb), the PQA600 will prompt you to specify the file format (Width, Height, frame rate, frame structure, and format). Use the following guidelines for specifying the file format.

- If the selected file is in interlaced format and the line construction matches #1 in the following figure, select "Field 1 First" for Frame Structure.
- If the selected file is in interlaced format and the line construction matches #2, select "Field 2 First" for Frame Structure.
- If the selected file is interlaced and it has a noninterlaced format like #3, select “No_Interlace”.
- If the selected file has progressive scanning like #4, select “No_Interlace”.

NOTE. *If the selected file is in AVI format, the PQA600 converts the file to a raw file format (yuv, vcap10, or rgb) before beginning generation (the filename extension indicates the format). After the conversion is completed, the file format dialog appears and asks you to confirm the file format before starting the generation.*

NOTE. *If the yuv file or the converted data from an rgb file selected for generation contains values of "0" or "255",in the output data these values are replaced by"1" or "254", respectively, due to the SDI standard requirements.*

The interlaced video content is supposed to be "Top field first".



The following table lists the resolution and start lines for each output format.

Resolution and start lines for each format

Format	Resolution	Start Lines
525i	720 x 486	F1-21/F2-20 (On generation, the second line in the file is F2-20 and the F1-263 is a copy line of F2-262) (On capture, the topmost line in the captured file is a copy line of F2-20 and the bottommost line in the captured file is F2-262).
625i	720 x 576	F1–23 / F2–23
720p	1280 x 720	F1–26
1080i	1920 x 1080	F1–21 / F2–21
1080p	1920 x 1080	F1–42

Supported SDI Video Formats

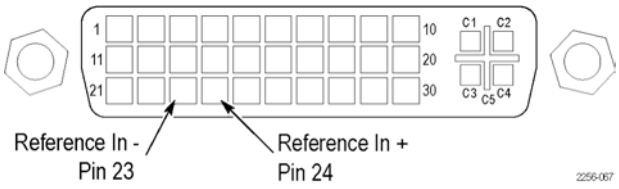
The PQA600 can generate and capture the SD and HD SDI video formats listed in the following table.

Supported video formats

Format	Frame Rates
SD-SDI	525i/59.94
	625i/50
HD-SDI	720p/50, 720p/59.94, 720p/60
	1080i/50, 1080i/59.94, 1080i/60
	1080psF/23.98, 1080psF/24, 1080p/23.98 1080p/24, 1080p/25, 1080p/29.97, 1080p/30

Synchronizing to an External Reference

You can synchronize video generation or capture with the PQA600 internal clock or an external bi-level or tri-level sync signal. If you use an external clock, you must connect the bi-level or tri-level sync reference to two pins on the SDI Interface Card DVI connector. Connect the Reference – signal to pin 19. Connect the Reference + signal to pin 20. Refer to the following figure.



Generating Video Output

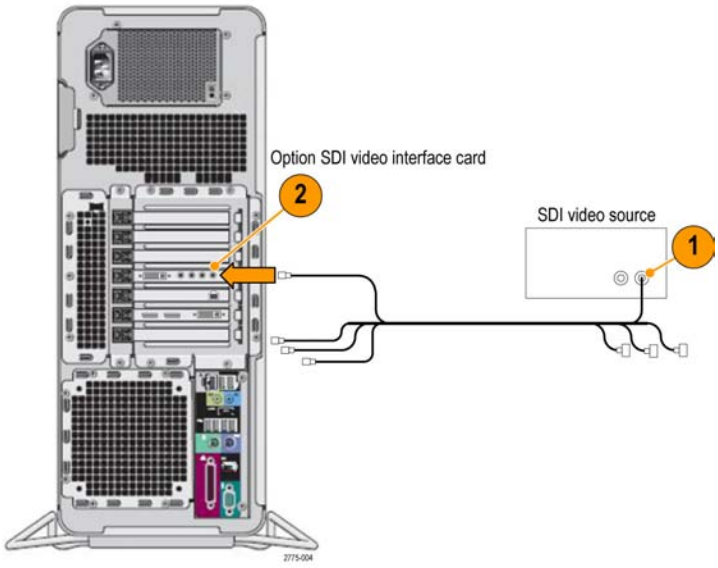
If you have Option SDI installed in your instrument, you can generate a video output signal using a video file as a source. To connect an external device-under-test to the instrument, use the SDI cable supplied with your instrument.

SDI cable

Connecting Signals to the SDI Video Interface Card

Connect the PQA600 analyzer SDI video interface card as follows:

1. Connect one of the BNC connectors on the SDI cable to the device-under-test.
2. Connect the appropriate SDI OUT mini-connector to the **OUT 2/B** connector on the video generation card.



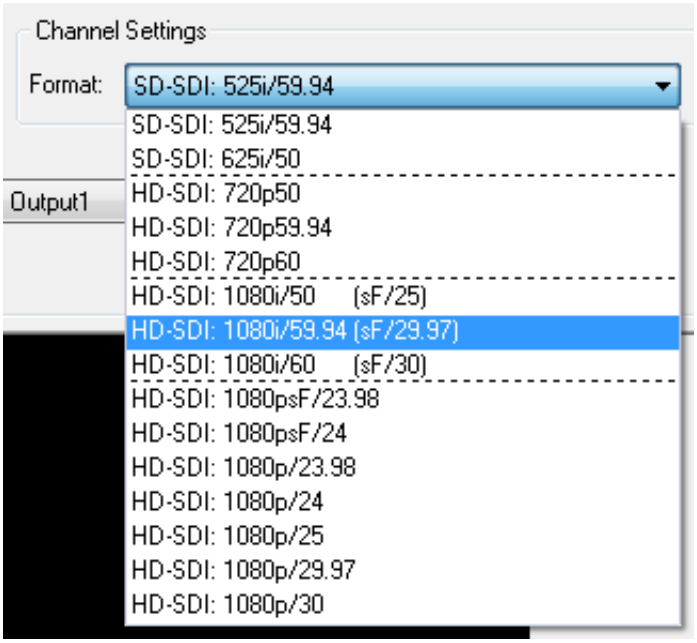
The PQA600 analyzer is now ready to signal to the device under test.

Generating a Video Output Signal

To generate an output signal:

1. Click the **Sdi Capture/Generate** button.

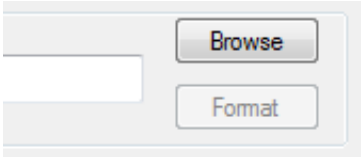
2. Select the format for the generated signal from the **Format** drop-down list.



3. Select the appropriate Clock Selection. If you need to synchronize the video output with an external system, select **External Reference**, otherwise, select **Internal Reference**.

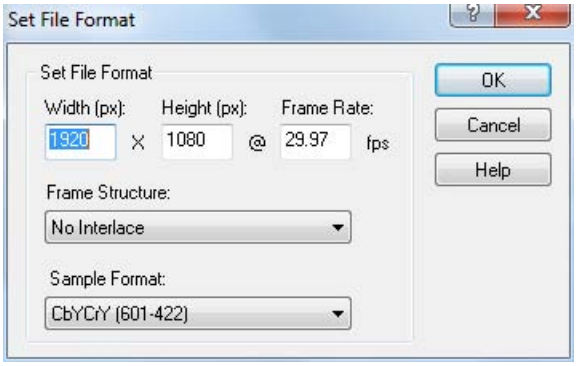
4. Select the channel you will use to generate your signal by setting **Channel 1 Mode** to **Generate to Output1**.

5. Click the **Browse** button and locate the source file to be used.



6. The instrument will prompt you to enter parameters for video format.

   Enter the appropriate Width, Height, Frame Rate, Frame Structure, and Format for the file you have selected.



Set File Format dialog for YUV file formats

7. Using the **From** box, set the starting frame number. Use the **To:** box to specify the ending frame number.

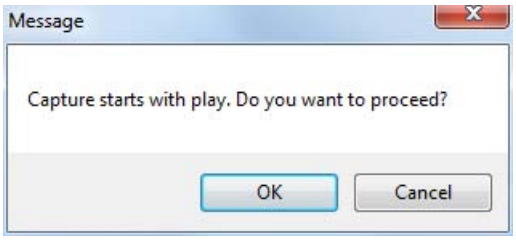
   Use the current frame slider control to quickly locate the area where the video signal should begin.

   Use the Current Frame box to specify exact frame where you want to video signal to start. You can copy the number in the Current Frame box to the From box to set the video generation start frame. This operation also works for the To box.

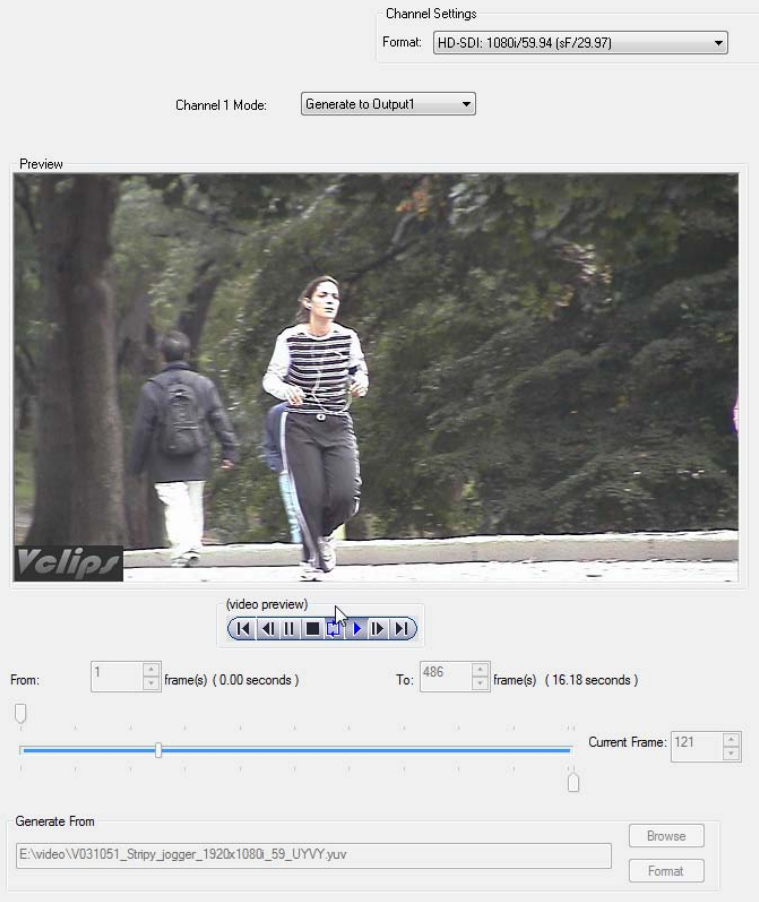
8. Select the loop button if you want the video generation to loop continuously.

9. Click the **Play** button to begin the signal generation.

10. If you have configured the instrument to capture video when Play begins, a dialog box will remind you that the instrument is set up to capture video when play begins. Click OK to continue.



The figure on the right shows an example of video signal generation running in loop mode.



Swapping Output Channels

If you are generating two outputs simultaneously, you can swap the output channels so that Channel 1 is output on Channel 2 and Channel 2 is output on Channel 1. This enables you to view both generated outputs even if you have only one monitor available. Use the Swap OUT1↔OUT2 button to swap the output channels. The following illustration shows the location of the Swap OUT1↔OUT2 button. The button appears only when both channels are set to generate a signal.

To swap the output channels:

1. Click *and hold* the **Swap OUT1↔OUT2** button. As long as you hold the Swap OUT1↔OUT2 button down, the two channel outputs are swapped.

Swap OUT1↔OUT2 when held down

2. To return the channels to their original output, release the mouse button so you are no longer holding down the Swap OUT1↔OUT2 button.

Capturing Video

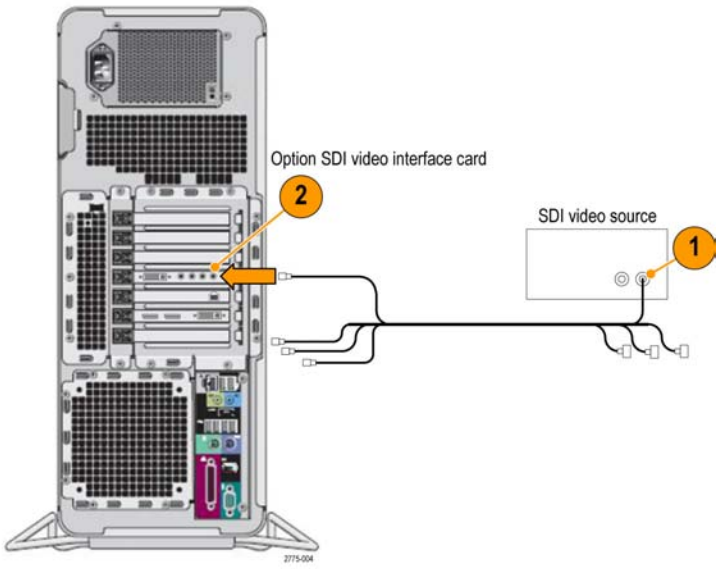
If your instrument has Option SDI installed, you can capture two SDI video signals to files for analysis. To connect your video source to the PQA600 analyzer, use the SDI cable supplied with the PQA600 analyzer.

SDI cable

Connecting Signals to the Video Capture Card

Connect your video source to the PQA600 analyzer video capture card as follows:

1. Connect one of the SDI IN BNC connectors on the SDI cable to the video source.
2. Connect the appropriate SDI IN mini-connectors to the **IN 1/A** or IN 2/B connectors on the video capture card.



The PQA600 analyzer is now ready to capture video to a file.

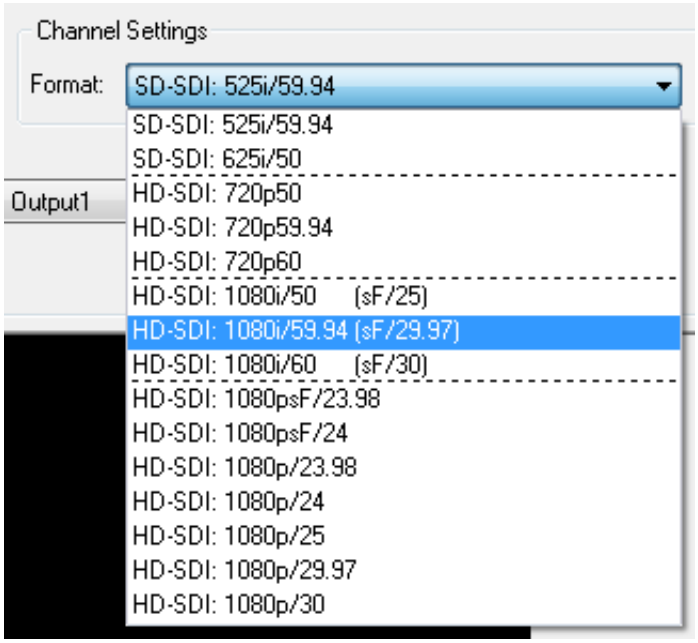
Capturing Video to a File

To capture video to disk:

1. Click the **Capture** button.

2. Select the format of the input video signal from the drop-down list.

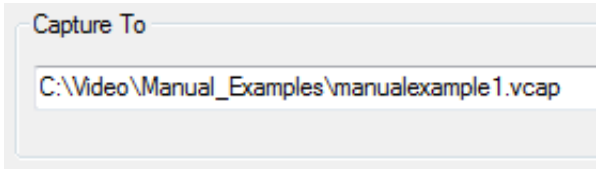
NOTE. *If you are capturing video generated by the PQA600, the format selected here must match the format of the generated video.*



3. Specify which channel you will use to capture your input signal by setting **Channel 2 Mode** to **Capture from Input2**.

NOTE. *You can set either Channel 1 or Channel 2 to capture a signal. You can also set both channels to capture a signal simultaneously.*

4. Specify the name of the file that the video should be captured to using the Capture To entry box. Use the Browse button to select a location from a dialog box.

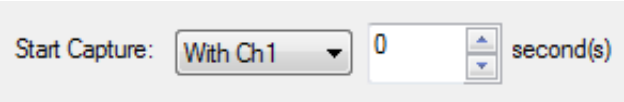


5. Set the **Save as Type** to either VCAP (8-bit format) or VCAP10 (10-bit format).

6. Set the Start Capture method.

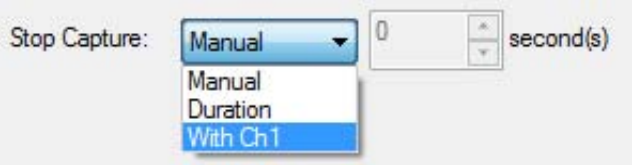
   - Select **Manual** if you want to begin a capture when you select **Rec**.

- Select **With Ch1** to capture video when you are generating a signal with the PQA600. If you want to insert a delay between the time the signal generation starts and the time the capturing starts, enter a value in the second(s) box.

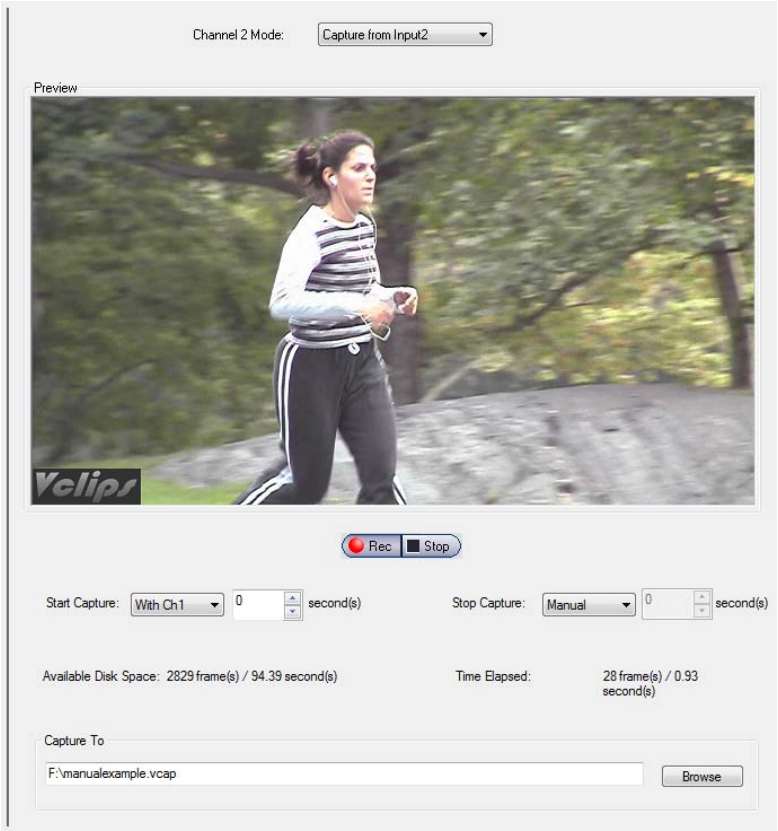


7. Set the Stop Capture method.

- Select **Manual** if you want to stop capture when you select **Stop**.
- Select **Duration** if you want to capture video of a specified duration. If you select Duration, enter the length of time you want to capture video.
- Select **With Ch1** to stop capturing video automatically when the PQA600 stops generating a signal (based on the Generate settings).



8. To begin the capture:
   - If you specified Manual for the Start Capture method, click **Rec**.
   - If you selected With Play, capture begins automatically when you select the play button on the GENERATE side of the window.
9. To stop the capture:
   - If you specified Manual for the Stop Capture method, click **Stop** when you have captured enough video.
   - If you selected Duration for the Stop Capture method, capture will stop when the Time Elapsed equals the duration that you specified.
   - If you selected With Play as the stop capture method, capture stops when the Play cycle completes (assuming Play is not set to Loop).



Converting Video Files

Many programs cannot use the VCAP files generated by the PQA600. To use VCAP files with other programs, the PQA600 includes a DOS command line program, TekFileConverter.exe, that converts AVI or VCAP files to RGB, YUV, or V210 file format. The format to which the files are converted depends on the format within the source AVI or VCAP file. For example, if the source AVI file contains video data in RGB format, the converter program converts the AVI file to a RGB format file (video data only, no audio data). If the AVI file contains video data in YUV format, the converter program converts the AVI file to a YUV format file (video data only, no audio data). If the source file is in VCAP format (8-bit), the converter program converts the VCAP file to a YUV format file. If the source file is in VCAP10 format (10-bit), the converter program converts the VCAP10 file to a V210 format file.

How output files are named. The output file is named according to the source file name and the video format contained in the file. For example, suppose you capture a video signal with the PQA600 that is saved as `tutorial.vcap`. The format of the file is encoded within the file structure. The file converter program uses that internal data to name the converted file. Thus, the output of the file converter using tutorial.vcap might be `tutorial_1920X1080_2997fps_NoInterlace_CbYCrY.yuv`.

To convert an AVI or VCAP file:

1. Display a **Command Prompt** window (**Start** > **All Programs** > **Accessories** > **Command Prompt**).
2. In the Command Prompt window, change directories to the directory that contains the file you want to convert.
3. Type the following: `TekFileConverter.exe filename` where filename is the name of the file you want to convert. Press the **Enter** key.

After the file converter starts, it displays its progress: `Converted XX of XXXX frames....`

When the conversion is complete, the converter displays the name of the converted file:

- `The converted file is – tutorial_1920X1080_2997fps_NoInterlace_CbYCrY.yuv`

Reviewing Measurement Results

Once you have taken a measurement, you can view the measurement results in several ways. The PQA600 analyzer has four display views that allow you to inspect video clips, analyze measurement data, or compare video clips and results.

- The Summary View display allows you to simultaneously review each frame of the reference clip, test clip, and the map with a graph of the selected measurement
- The Tile view allows you to view the reference file, test file, and map simultaneously.
- The Event Log displays points in the test clip where measurements exceed specified levels.
- The Overlay view allows you to display two views (one on top of the other) to compare variations between the two views.

Where Measurement Results Are Saved

Measurement results are saved in the folder that contains the test file. The results files are saved in a folder named after the test file with "`-Results`" appended to the file name. For example, the PQA600 analyzer includes a sample file named V031051_Stripy_jogger_1280x720p_3mbs.yuv. If you run measurements on this file, all measurement results will be saved in a folder named "`V031051_Stripy_jogger_1280x720p_3mbs-Results`", which will be located in the same folder as the V031051_Stripy_jogger_1280x720p_3mbs.yuv file.

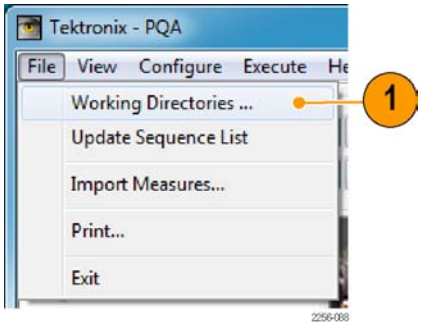
NOTE. *Do not move the reference and test files once you have run a measurement. The measurement results file points to the location of the reference and test files and displays those files when you review the measurement results. If you move the reference and test files after running a measurement, the PQA600 will not be able to find the files in their new location. If you must move the reference and test files, you must edit the measurement results file to point to the new location of the reference and test files.*

Selecting Measurement Results for Display

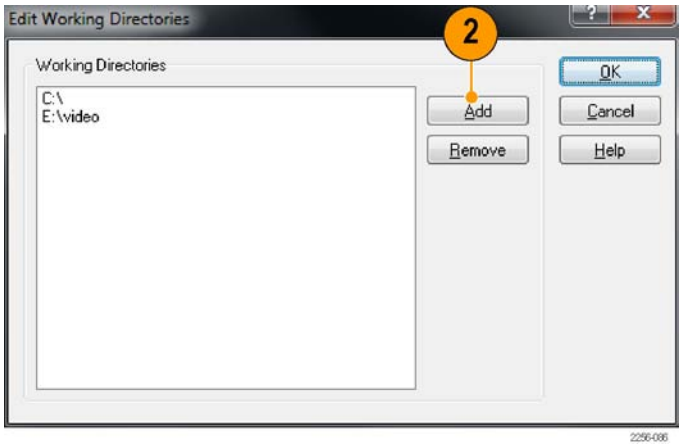
You select measurement results for display from the Results Navigation pane. To select results from the Navigation pane, you must first add directories to the Navigation pane.

To add directories to the Navigation pane:

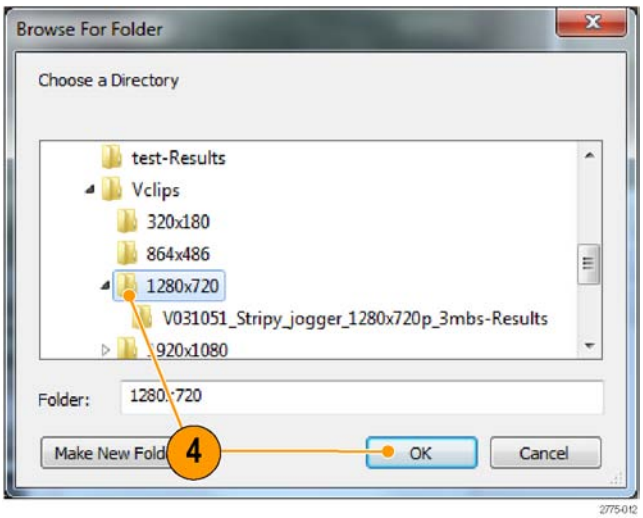
1. Select **Working Directories** from the File menu.



2. From the **Edit Working Directories** dialog, select **Add**.

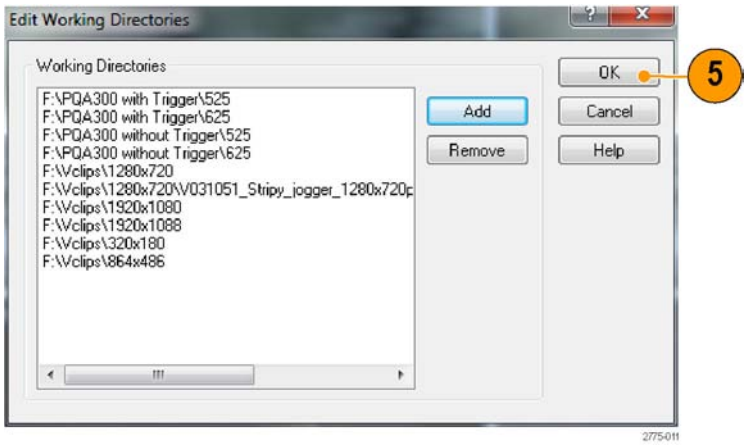


3. From the **Browse For Folder** dialog, navigate to the folder that contains your test video clips.
4. Select the folder that contains the test video clips and click **OK**.



When the Edit Working Directories dialog is displayed, you can see the directory you just added now appears in the list of Working Directories.

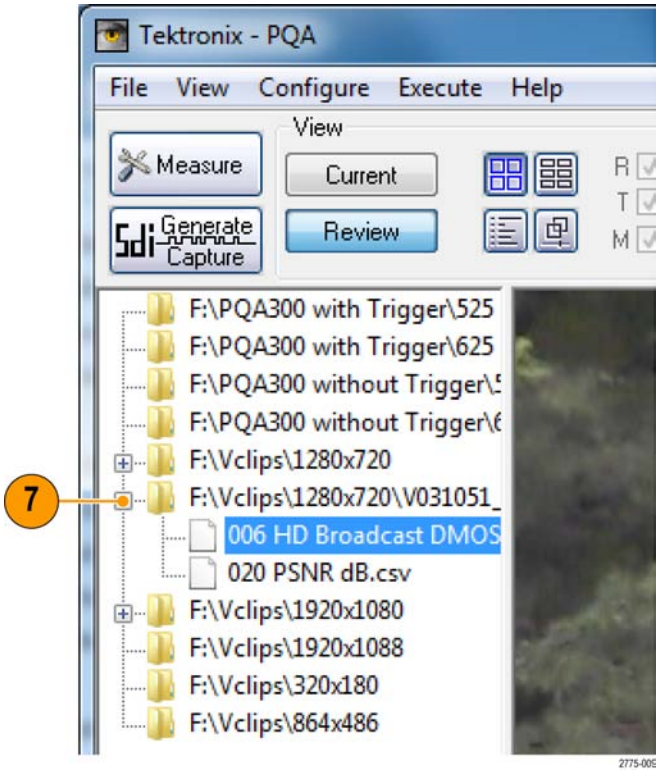
5. In the Edit Working Directories dialog box, click **OK**.



6. In the main application window, click the **Review** button.

7. Click the + symbol next to the folder for the directory you just added to the working directory list.

   The results located in the selected directory will appear when you click the + symbol.

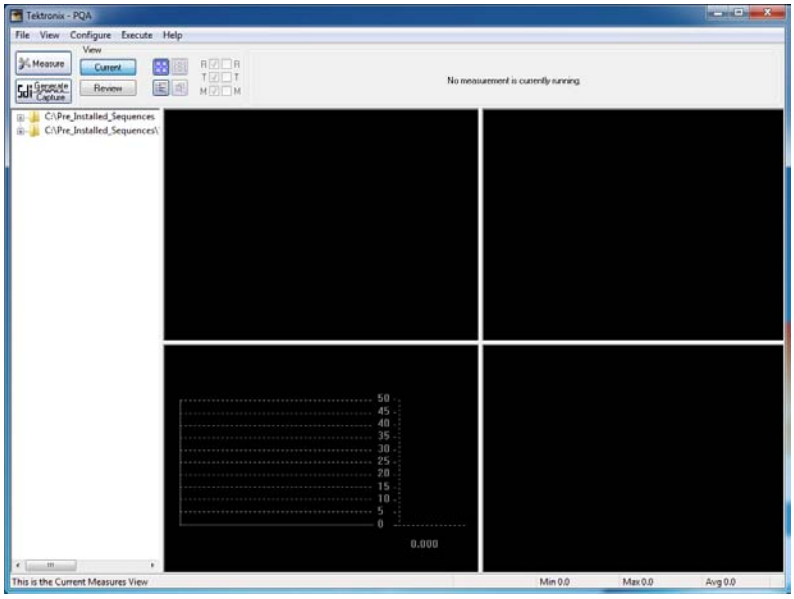


The Summary View Display

The Summary View display consists of four tiles that show the reference clip, the test clip, the map, and a graph.

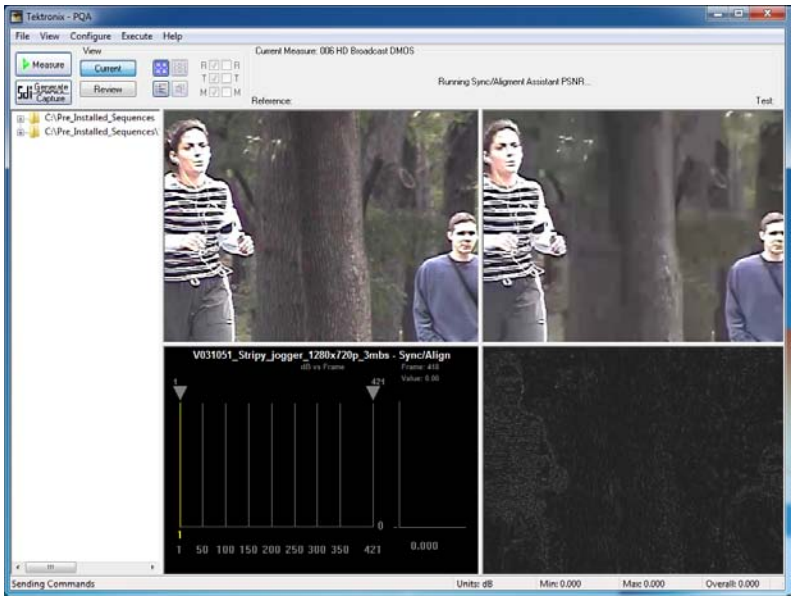
1. To show the Summary View Display, click the Summary View button.

This is how the Summary View display appears in Current view with no measurement running.



This is how the Summary View display appears when ready to begin a measurement.

- The Reference video clip appears in the upper-left tile.
- The Test video clip appears in the upper-right tile.
- The graph of the primary measurement appears in the lower-left tile.
- The impairment map appears in the lower-right tile.



This is the Summary View display in Review mode.

- Controls appear above the tiles that you can use to select which frame is displayed.
- A readout appears at the bottom-right corner of the window that shows the Minimum, Maximum, and Average values of the primary measurement (the measurement that is shown in the graph).
- The yellow line in the graph indicates the currently displayed frame.

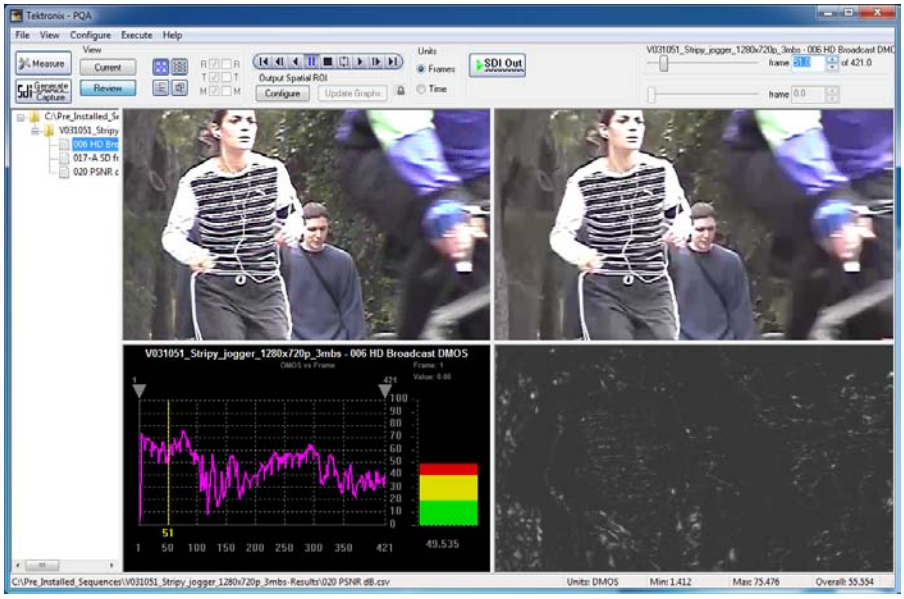


Table 11: Elements of the control bar

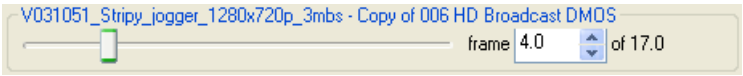
Control	Description
	The control bar controls replay of the video clips.
	The frame selector allows you to choose which frame of the video clip is displayed.

Table 11: Elements of the control bar (cont.)

Control	Description
	The Units selector allows you to specify the displayed frame by frame number or time.
	Selecting SDI Out outputs the Test file on the Ch 2 and outputs the Reference file on Ch 1. This enables you to view the Test and Reference files on a standard monitor independent of the PQA600 display. This function is only available when the format of the Reference and Test files is the same and supported by the SDI card. Click the SDI Capture / Generation button to play the review contents in real time. The application converts avi file to raw file format (yuv, rgb or v210) when it is selected for Reference or Test.

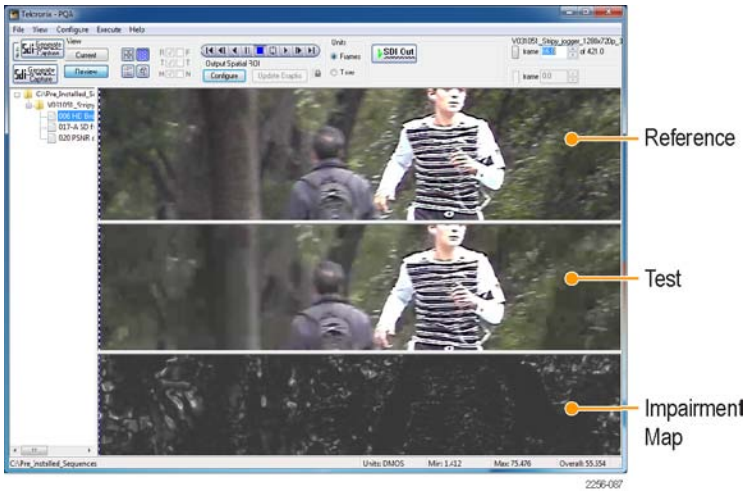
The Tile View Display

The Tile View enables you to view the reference, test, and map at normal size, in a vertical arrangement. Each tile acts like a window view of the video clip or map. You drag the clip within the window to focus on a particular portion of the clip. You can also resize the tiles by dragging the bars that separate the tiles.

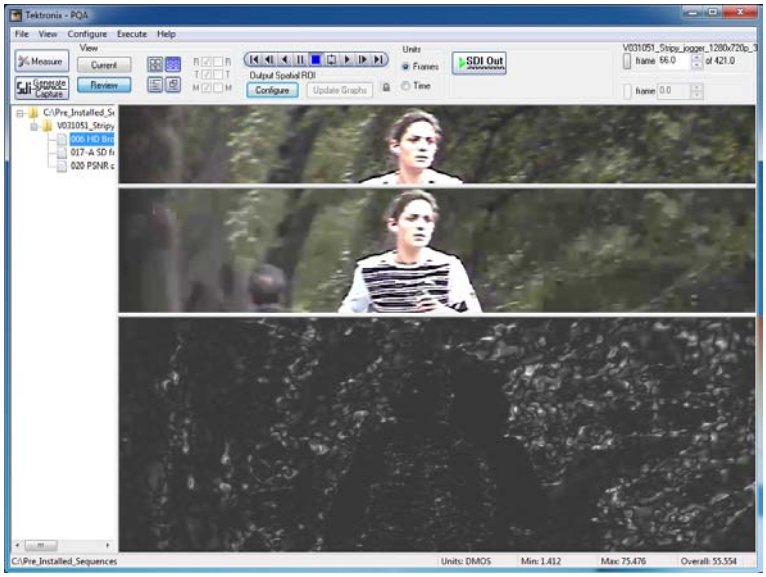
1. To display the Tile View Display, click the Tile View button.

This is the Tile View display in Review mode. The Tile View cannot be displayed in Current mode.

- The Reference clip appears in the top tile. The Test clip appears in the middle tile. The map appears in the bottom tile.
- You can play the video clip in the Tile View using the control bar and frame selector at the top of the window.

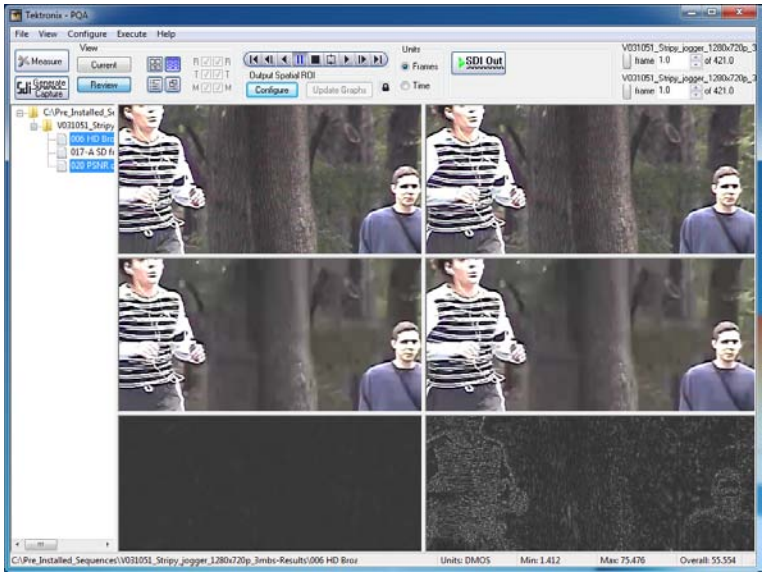


2. You can change which portion of the video clip appears in the tile by clicking and dragging the video clip in the tile. The same frame number is used for all three tiles, but you can view different portions of the frame in each tile. You can also enlarge or shrink the tiles by dragging the bars that separate the tiles.



3. You can compare two measurement results in the Tile View. To do this, use the Ctrl key to select two results files in the Navigation pane and then select the Tile View button.

   For example, you could compare an Attention Weighted PSNR measurement to a DMOS measurement.



NOTE. *In the control bar that there is a lock icon. The lock icon indicates whether the two frame selectors are tied together. If the lock is closed, the frame selectors are tied together and changing one selector changes the other. If the lock is open,*  *, then you change either frame selector without changing the other.*

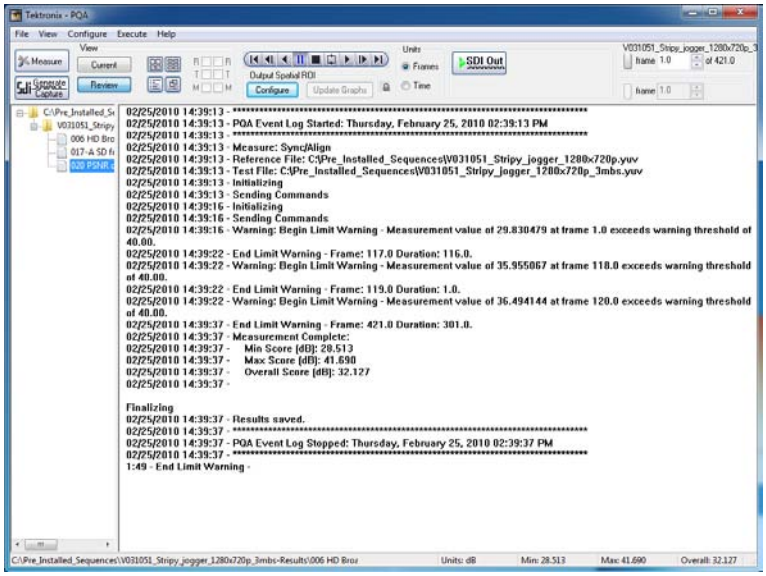
NOTE. *Having the frame selectors locked does not require that they be set to the same frame number. Each frame selector can be set to a different frame number.*

The Error Log Display

The Error Log display contains entries that identify events when the Error and Warning levels have been exceeded. The measurement that is shown in the Error Log depends on the selected measurement. You set the values for Error and Warning levels in the Summary configuration node.

- To display the Error Log Display, click the Tile View button.

The Error Log is a listing of all the events that exceed the Warning and Error levels as specified in the Summary Node for the selected measurement. The Error Log is only a listing, there are no controls associated with the Error Log display.



The following paragraph shows a subset of lines from an error log. Line numbers are added here for the sake of discussion; the line numbers do not appear in an actual error log.

```
1.  05/24/2010 15:50:38 - Measure:  034 Attention Weighted PSNR dB

2. 05/24/2010 15:50:38 - Reference File:  f:Vclips\1280x720p\V031051_Stripy_jog-
ger_1280x720p.yuv

3. 05/24/2010 15:50:38 - Test File:  f:Vclips\1280x720p\V031051_Stripy_jog-
ger_1280x720p_3mbs.yuv

4. 05/24/2010 15:50:42 - Warning:  Begin Limit Warning - Measurement value of
25.937963 at frame 1.0 exceeds warning threshold of 45.00.
```

```
5. 05/24/2010 15:50:42 - Error:  Begin Limit Violation - Measurement value of
25.937963 at frame 1.0 exceeds error threshold of 30.00.

6. 05/24/2010 15:57:11 - End Limit Violation - Frame:  165.0 Duration:  164.0.
```

Every line begins with the date and time of the error log entry. Line 1 identifies the measurement selected. Lines 2 and 3 identify the path and name of the reference and test files, respectively. Line 4 identifies an event where the PSNR exceeded the warning level. The line lists the measurement value, the frame number where the event occurred and the level that was violated (the warning threshold of 45.00). Line 5 lists another event, in this case the Error level was violated. Line 6 shows that the limit violations have ended. The violation end point is identified by frame number and the duration of the violation is also listed.

The Overlay View Display

The Overlay View allows you to compare the reference and test video clips or a video clip (reference or test) and a map by stacking one on top of the other. You can shift the mix of video clip or map from 0% to 100%, with the default mix set at 50% of each. You can use the Overlay View to easily match features in a video clip with features in an map.

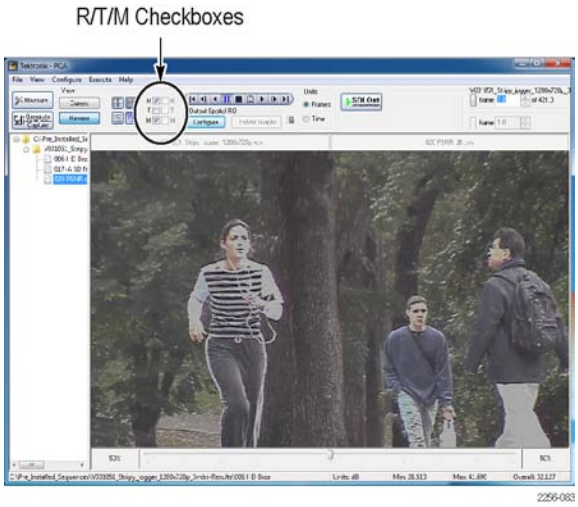
- To display the Overlay View Display, click the Overlay View button.

  The Overlay View defaults to a 50/50 mix which is indicated by the slider at the bottom of the Overlay View display.

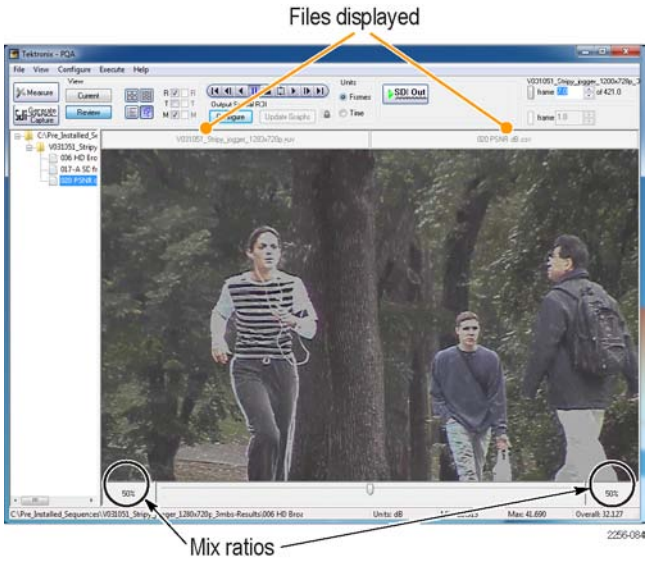
- To select which two sources are compared, use the R/T/M check boxes next to the view buttons.

  - Select **R** to chose the Reference clip. Select **T** to choose the Test clip. Select **M** to choose the map.



This example view compares the Test video clip with the map. The mix in this view is 50% test clip and 50% map. The ratio of the mix is shown by the numbers at the bottom right and bottom left of the Overlay view.

At the top of the Overlay view are readouts of the source file name assigned to each side of the slider. In this example, moving the slider to the right will increase the mix in favor of the map (filename.csv) and moving it to the left increases the mix in favor of the test clip (filename.yuv).



The Graph Display

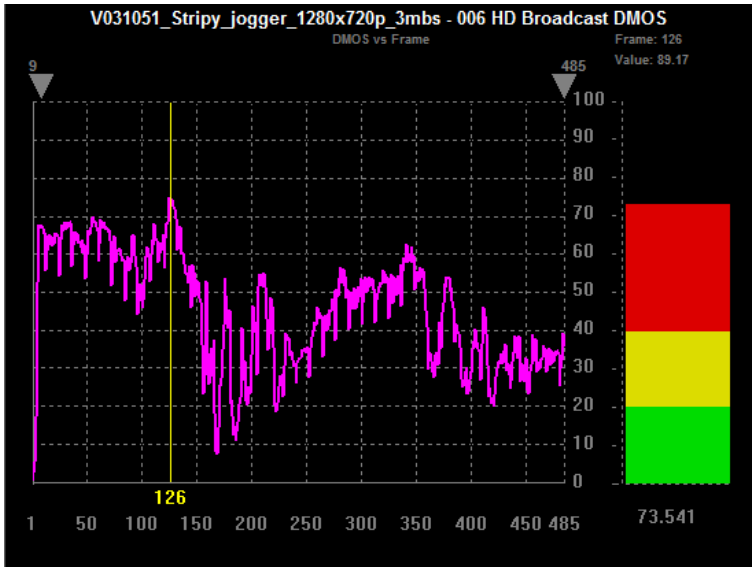
The Graph display plots several measurement values against frame number. The particular measurements shown in the Graph display depend on the selected measurement.

To display the Graph display:

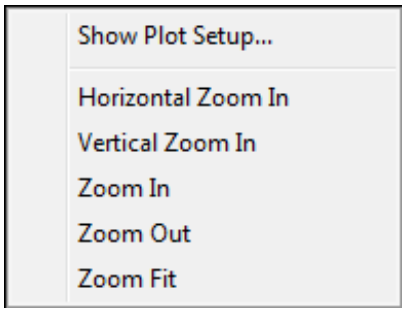
- Select either the Tile View or Summary View.

This is the Graph display in Review mode.

- The graph of measurements (relevant to the selected measurement) are plotted versus frame number shown at the top of the graph.

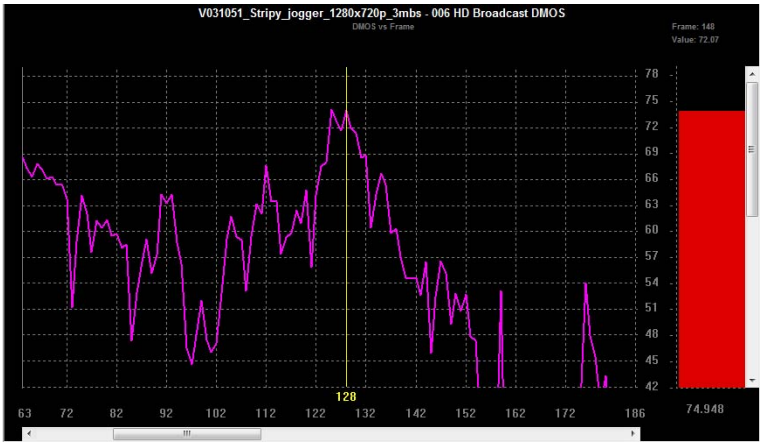


Right-click on the Graph to display the Graph pop-up menu. You can adjust the display of the graph using the commands:

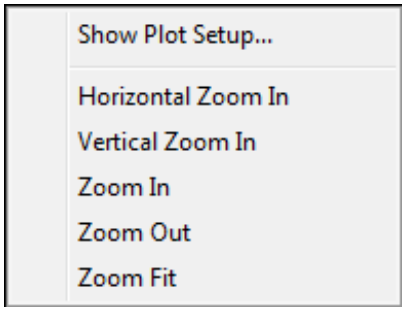


- Expand the horizontal scale of the graph by selecting **Horizontal Zoom In**.
- Expand the vertical scale of the graph by selecting **Vertical Zoom In**.
- Select **Zoom In** or **Zoom Out** to resize the graph as desired.
- To reset the graph to its original scale, select **Zoom Fit**.

This illustration shows the appearance of the graph after selecting **Zoom In**.



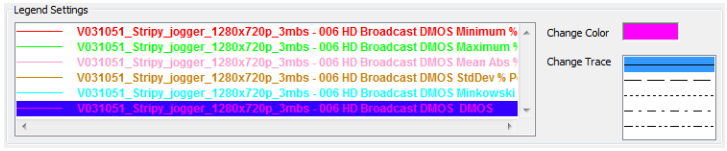
To change the Graph display properties, select **Show Plot Setup**.



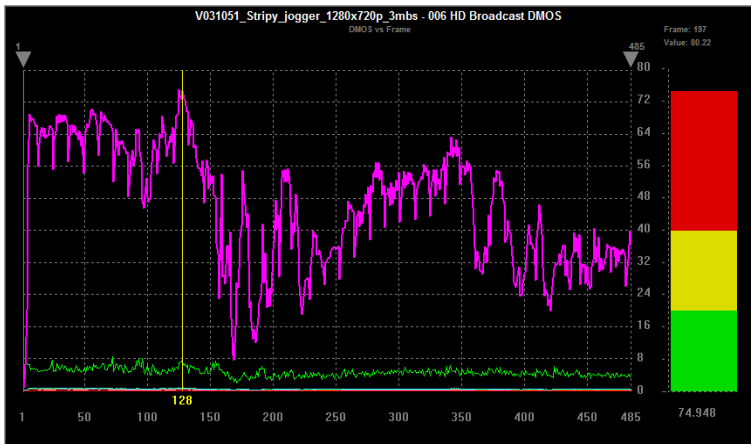
To select additional statistics for the selected measurement, select the statistics you wish to display by checking the box next to the measurement.

To change the appearance of a plot line:

1. Select the measurement.
2. Click on the **Change Color** box and select a color.
3. Select a line from the Change Trace box to use a different line for the measurement.

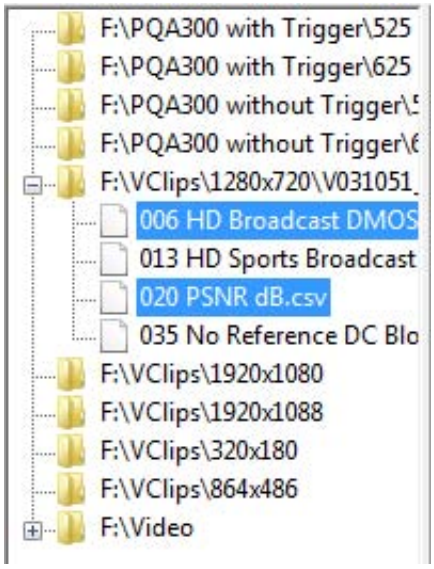


This illustration shows a Graph display with all available measurements displayed.

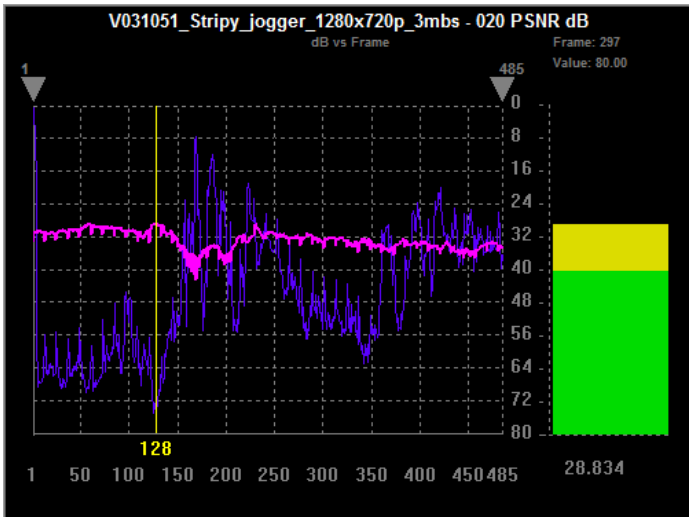


You can easily compare the results of two measurements by plotting both measurements on the Graph display at the same time.

1. To add existing results to the current Graph view, locate the measurement you want to add in the Working directory pane and control-click on the result.



The measurement result you selected will be added to the current graph.

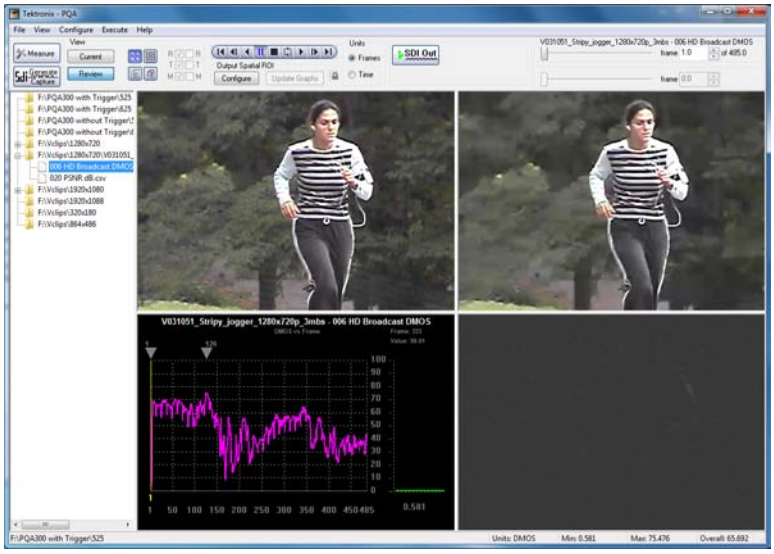


Using Output Region-of-Interest to Review Results

Output Spatial ROI. To specify the region of interest, you draw a box over the region in the video in which you are interested and then update the measurements. The measurement result is then recalculated for the region you have selected.

To specify an Output Spatial ROI in Review mode:

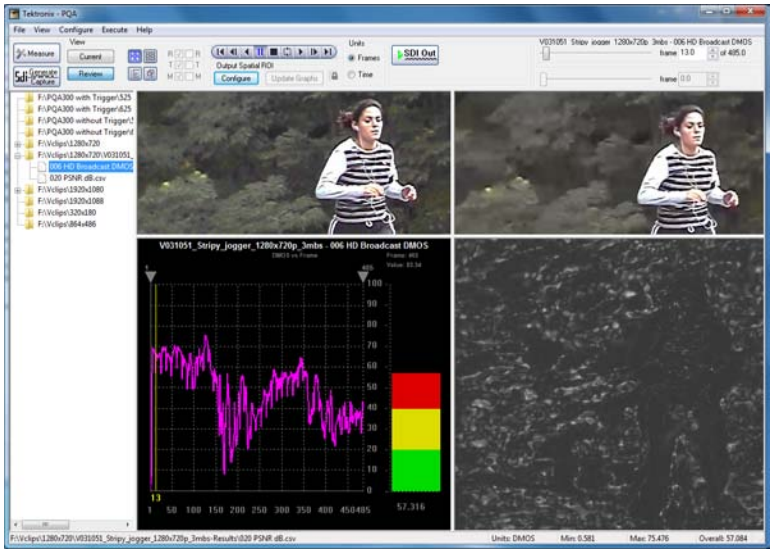
1. Set up and run a measurement on the video clip of interest.



2. Select a frame which you can use to select the region of interest.

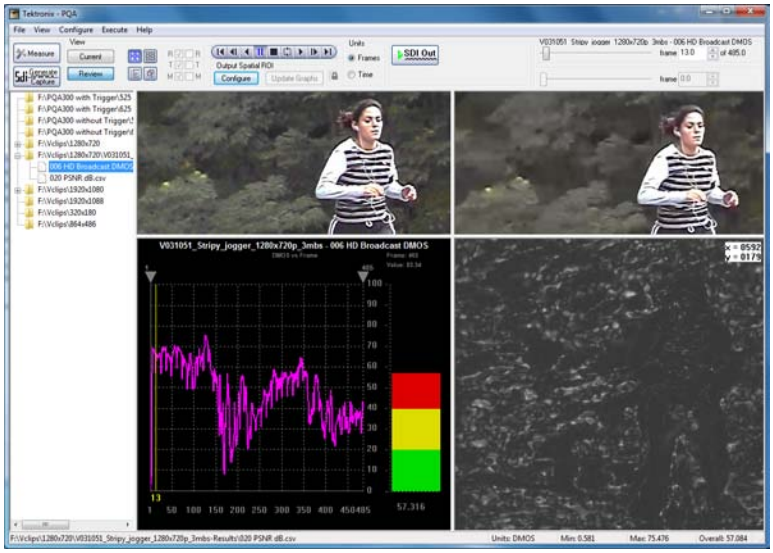
   The region of interest that you specify will be applied to each frame in the test clip.

NOTE. *Note that the Configure button is highlighted and the Update Graphs button is not selectable.*



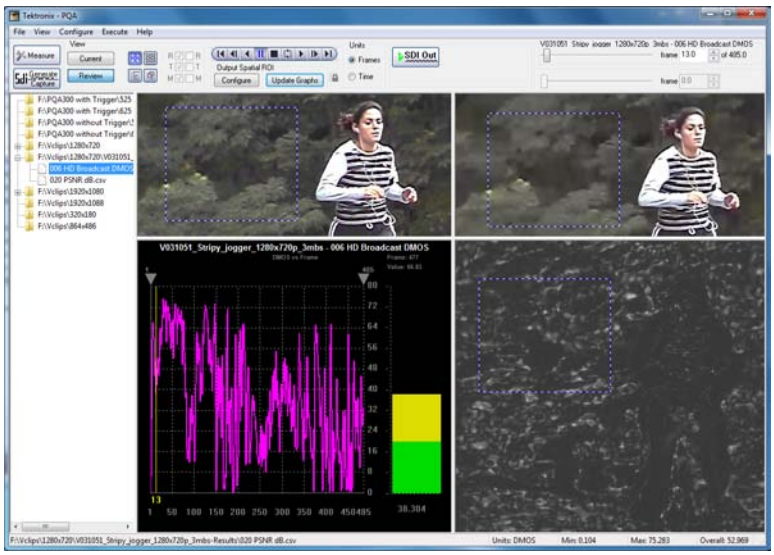
3. Shift-click and drag over the region of the Results Map that you wish to limit the measure to (if you do not use Shift, you will just drag the video clip within the window).

As you start to drag the pointer over the region of interest, a box will appear on the Results Map that displays the location of the pointer.



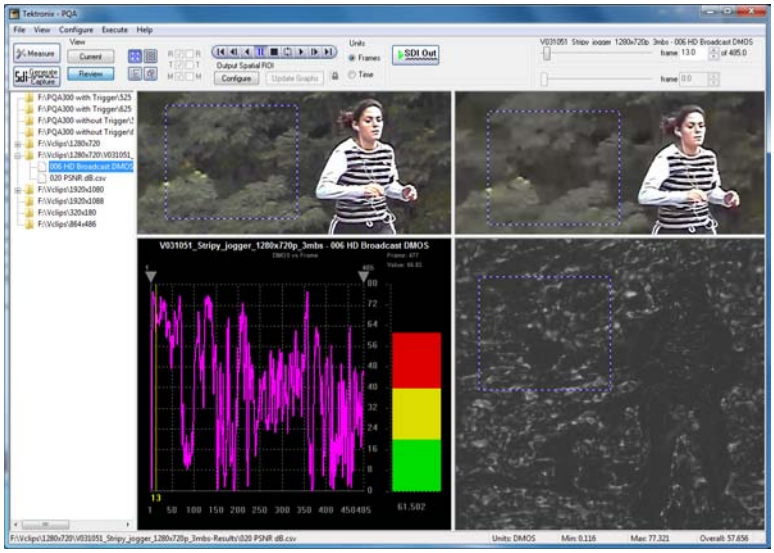
Note that as you click and drag, the selection box is drawn over the Reference video, Test video, and Results Map at the same time.

Once you have specified the region of interest, the **Update Graphs** button is selectable.

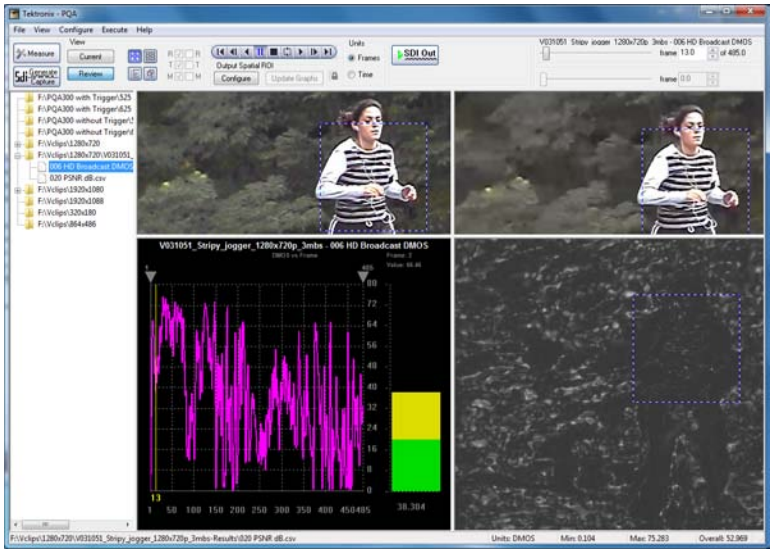


4. To evaluate the measurement only for the region of interest, click the **Update Graphs** button.

The measurement result in the graph area is updated to reflect the measurement limited to the region of interest. Both the graph and the bar readout change to reflect the new measurement results.



This screen shows the result of selecting a region of interest that has a lower DMOS result.



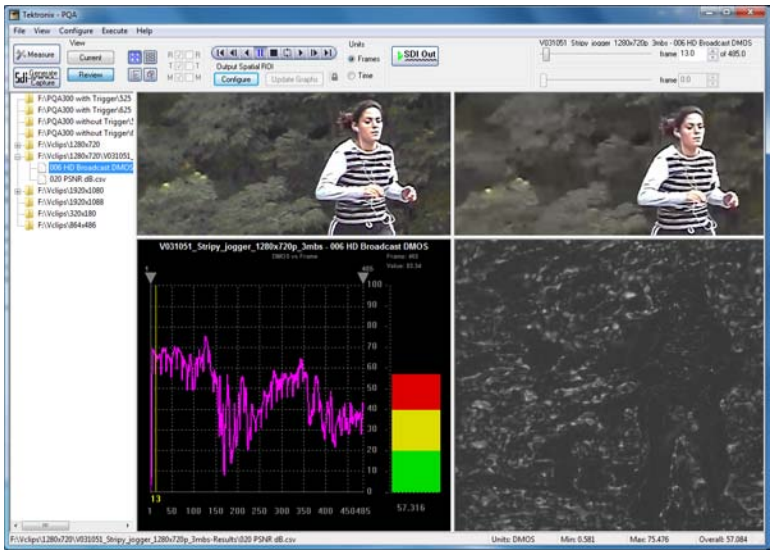
Output Temporal ROI. To specify an Output Temporal ROI, you select the frames of the video clip you wish to analyze. After you specify the frames to which you want to limit your measurement, the measurement results are updated immediately.

A typical use for Temporal ROI is when you wish to analyze a portion of a concatenated test clip.

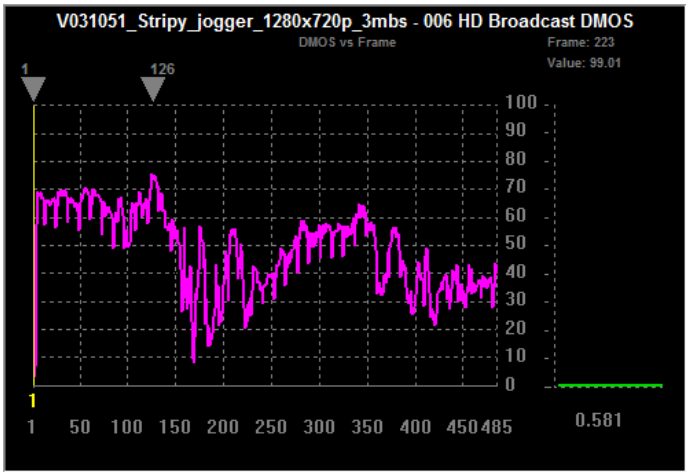
To specify an Output Temporal ROI:

1. Set up and run a measurement on the video clip of interest.

NOTE. *After the measurement is complete, look at the measurement results in the lower-right corner of the window. Note the value for Overall.*

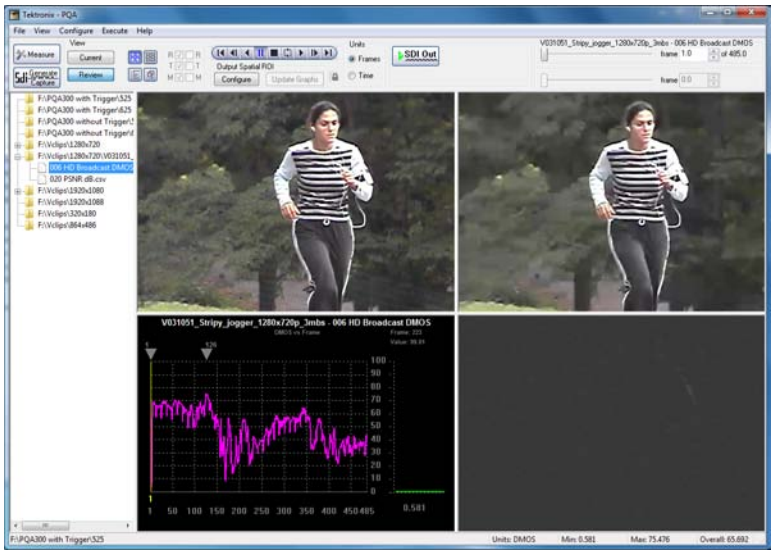


2. Adjust the gray triangles above the plot in the Graph display to select the frames to which you wish to limit the measurement.



The measurement results are updated immediately after you specify the frames used in the measurement. You do not have to initiate an update to the results.

Compare the **Overall** measurement result in the lower-right corner of the window with the value you saw before you limited the frames used in the measurement. In this example, the Overall value for the whole video clip is 57.084. But the Overall value after specifying the Temporal ROI is 65.692.



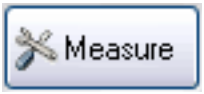
Applications

PSNR Measurement

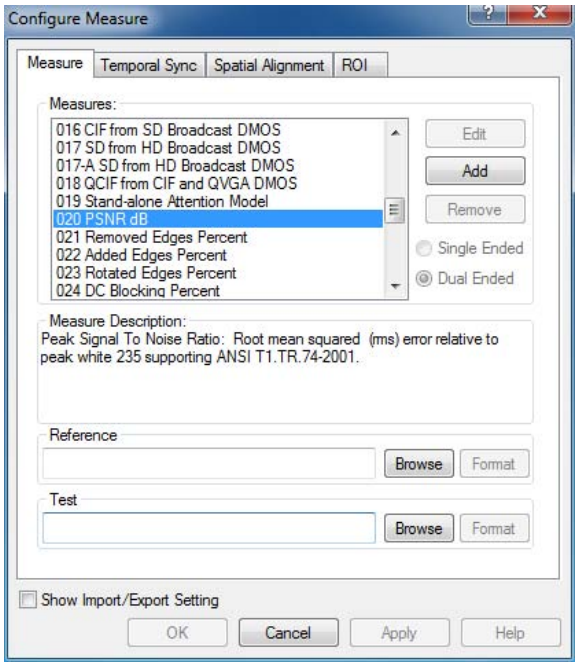
PSNR Measurement shows the difference between the reference sequences and test sequences by subtracting them. It does not take into account the human vision model, so the result shows the absolute difference between the reference and test sequences. PSNR is useful for identifying small errors that the human can not recognize. The highlighted white areas of a PSNR map show the areas of greatest difference between the original and degraded image. This measurement is useful at the beginning of the CODEC debugging process.

The PQA600 analyzer provides PSNR results for overall sequence and each frame. It also provides the PSNR map that is used to find the location where there are differences. The brightness and contrast for the PSNR map can be controlled from the Configure > Display Settings dialog. By adjusting the brightness and contrast you can make it easier to find differences on the PSNR map when it appears there is little difference between the reference and test sequences.

1. Click the **Measure** button.

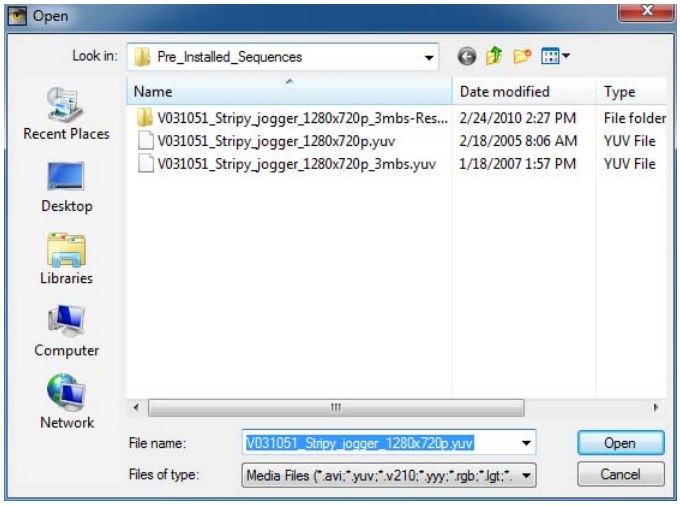


2. Select the **020 PSNRdB** measurement from the **Configure Measure** window.
3. In the **Reference** box, click **Browse**.



4. In the **Open** dialog box, browse to the directory: **F:\Vclips\1280x720p**.

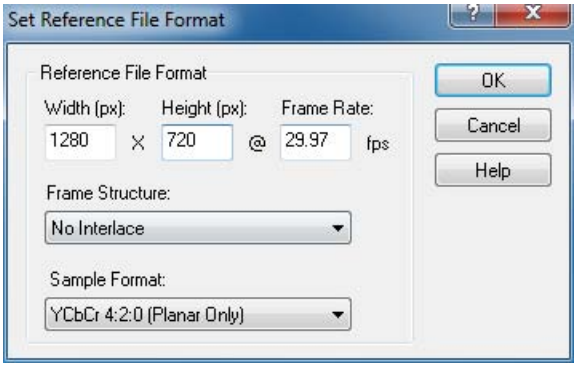
5. Select the file **V031051_Stripy_jogger_1280x720p.yuv** and click **Open**.



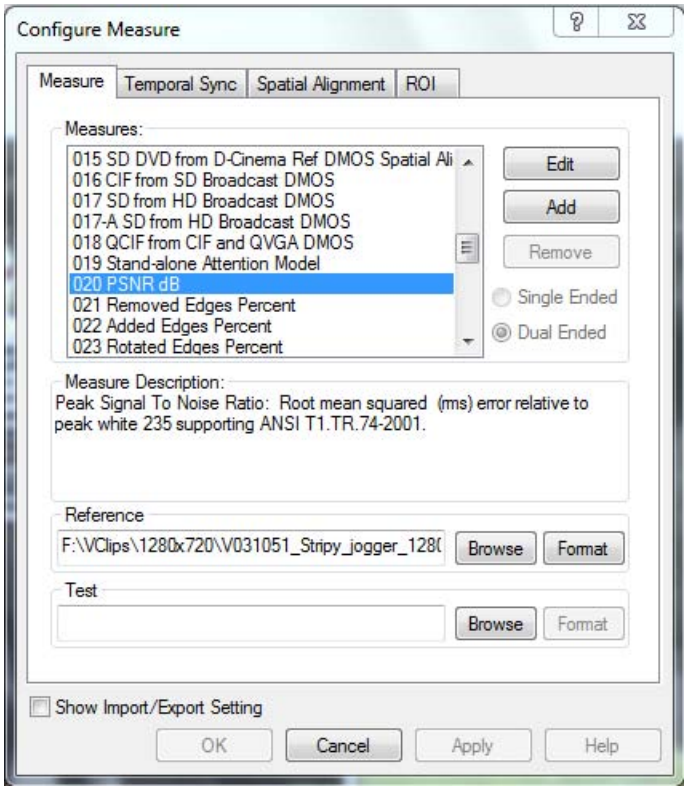
6. In the **Set Reference File Format** dialog, enter the following values:

   - Width: 1280
   - Height: 720
   - Frame Rate: 30
   - Sample Format: YCbCr 4:2:0 (Planar Only)

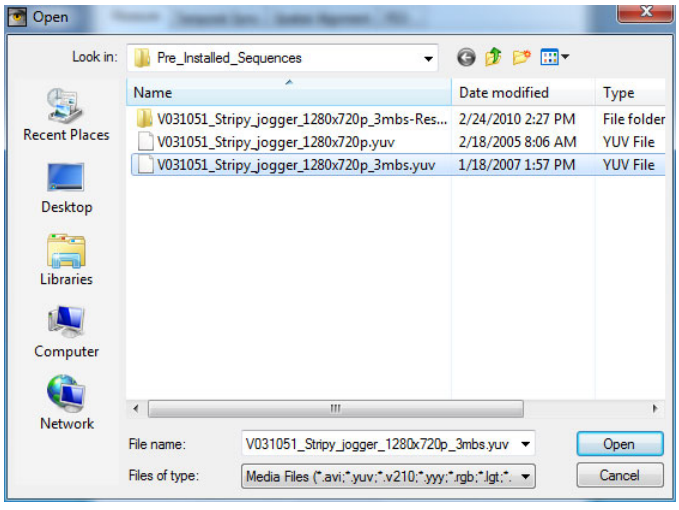
7. Click **OK**.



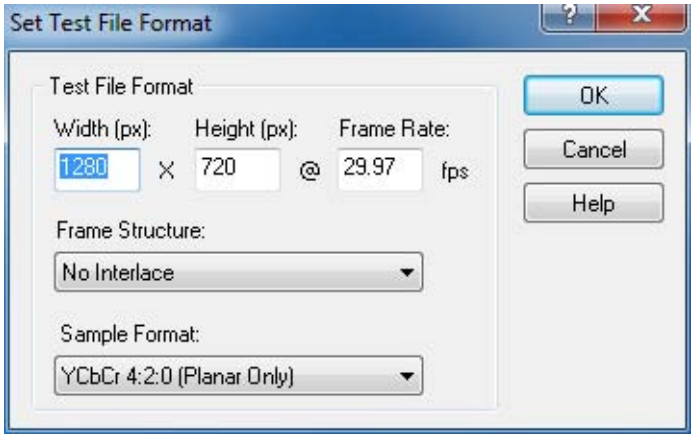
8. In the **Test** box, click **Browse**.



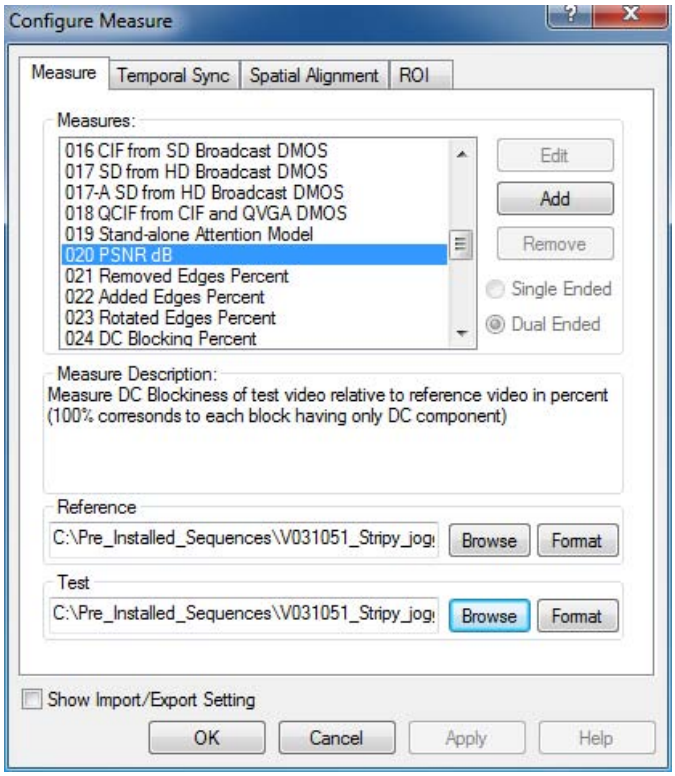
9. Select the file **V031051_Stripy_jogger_1280x720p_3mbs.yuv** and click **Open**.



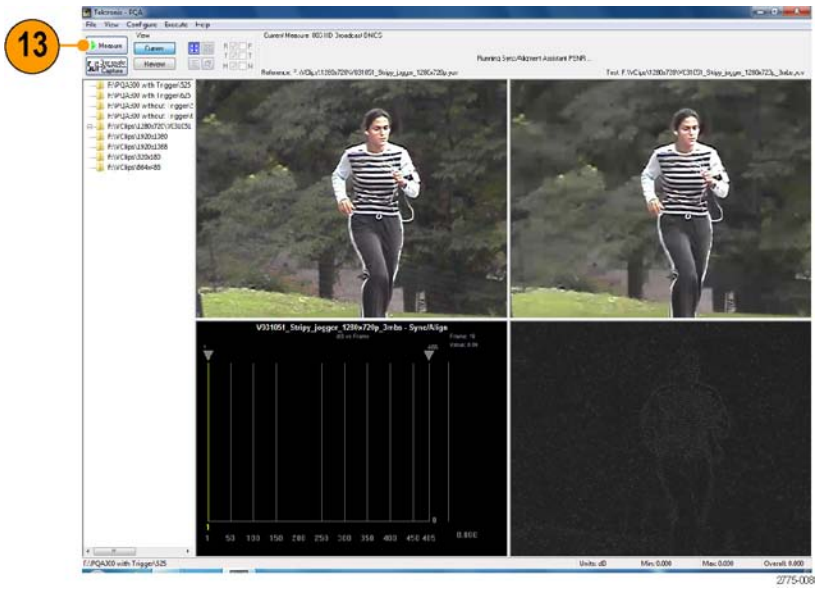
10. In the **Set Test File Format** dialog, enter the following values:
    - Width: 1280
    - Height: 720
    - Frame Rate: 30
    - Sample Format: YCbCr 4:2:0 (Planar Only)
11. Click **OK**.



12. Click **OK** in the Configure Measure dialog box.

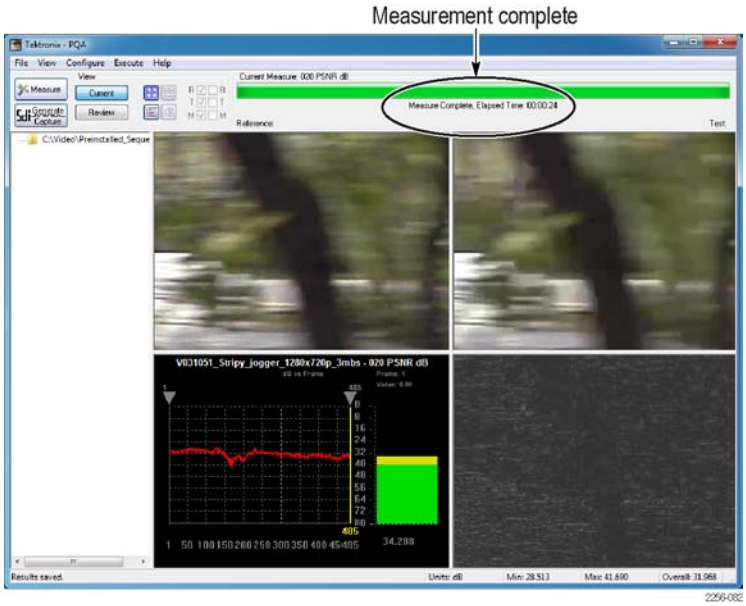


13. Click the **Measure** button to begin the measurement.

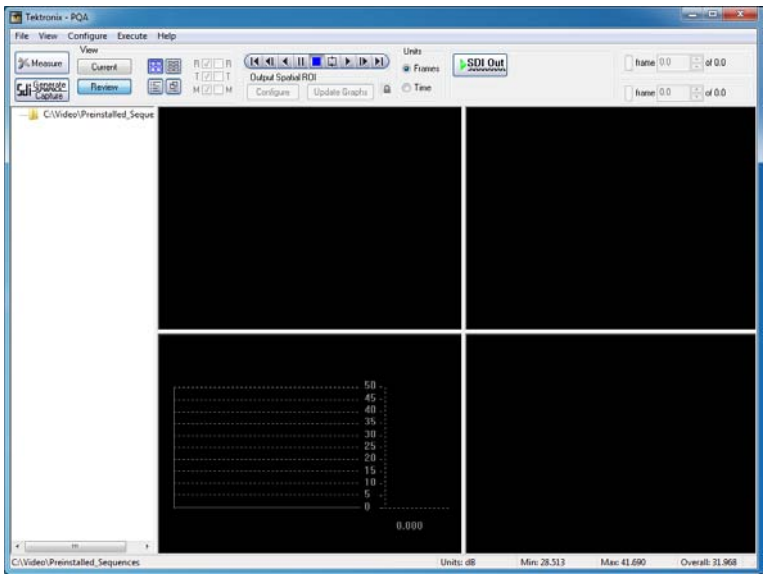


When the measurement is complete, the progress bar will display **Measure Complete** and display the elapsed time the measurement required.

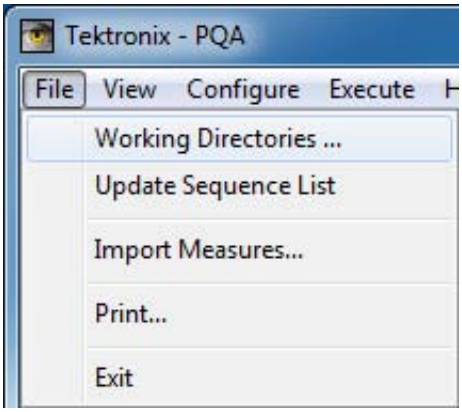
14. To view the results of the measurement, click the **Review** button.



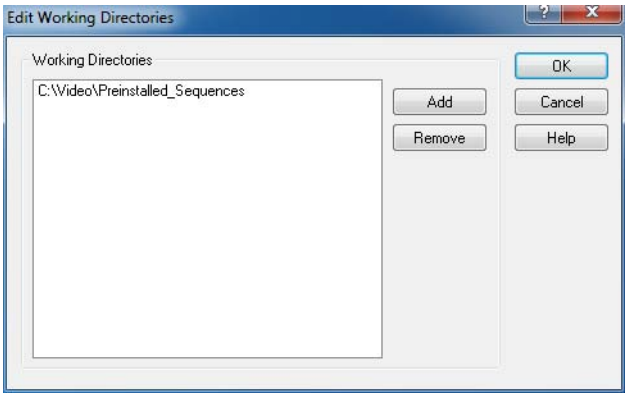
When you select the Review view, the existing display will change to the one shown at the right. To review results, you select them from the Navigation pane. To select a results file for review, the directory that contains the results file must be selectable in the Navigation panel. Since there are no directories currently in the navigation pane, we will add them.



15. To add directory containing measurement results to the navigation pane, select **File > Working Directories**.

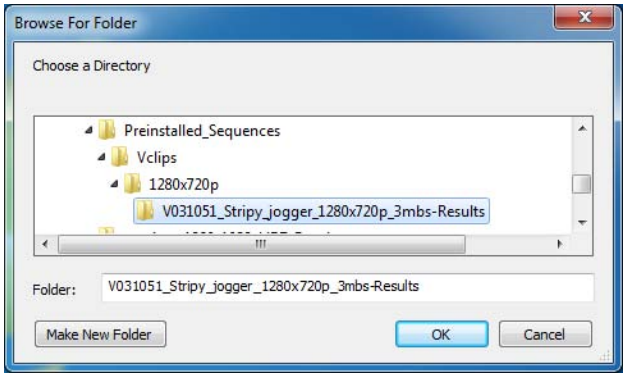


16. From the Edit Working Directories dialog, select **Add**.



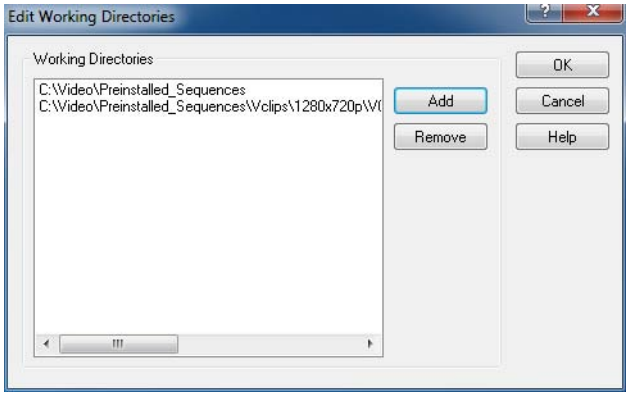
17. From the **Browse For Folder** dialog, navigate to the folder that contains the video clips you tested.

18. Select the folder that contains the video clips and click **OK**.

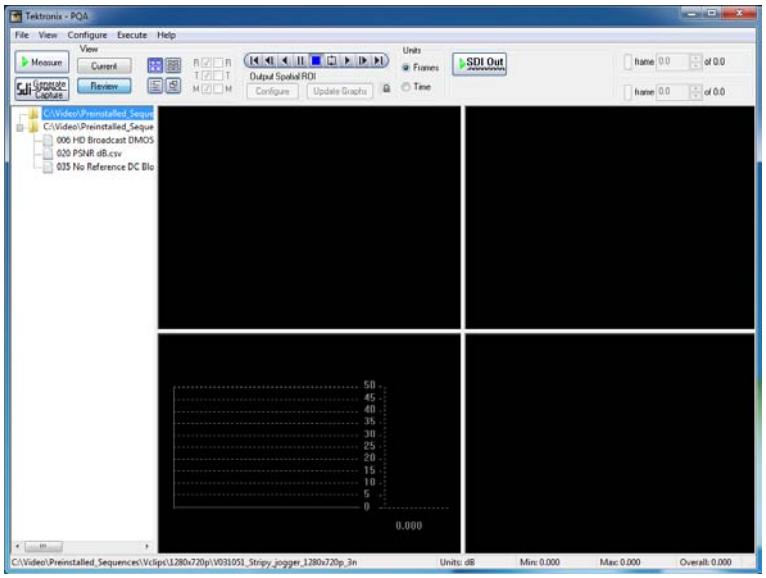


When the Edit Working Directories dialog is displayed, you can see the directory just added now appears in the list of Working Directories.

19. In the **Edit Working Directories** dialog box, click **OK**.



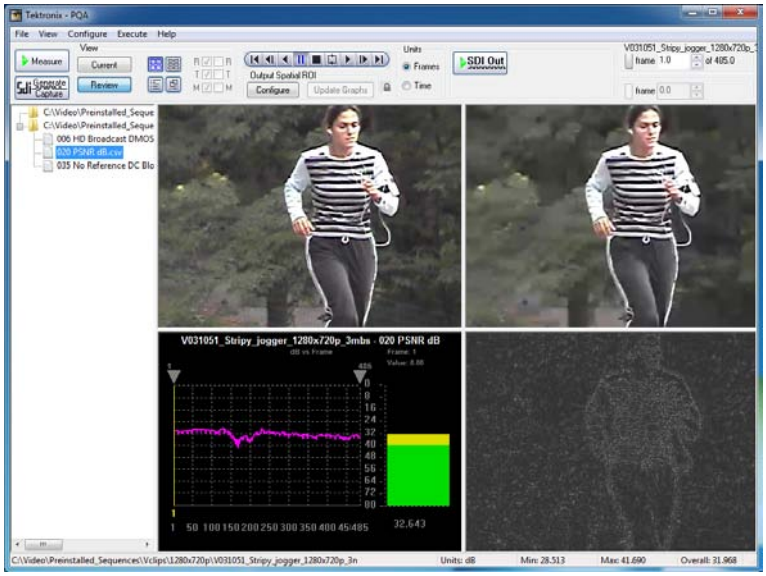
20. Click the **+** symbol next to the folder for the directory you just added to the working directory list.



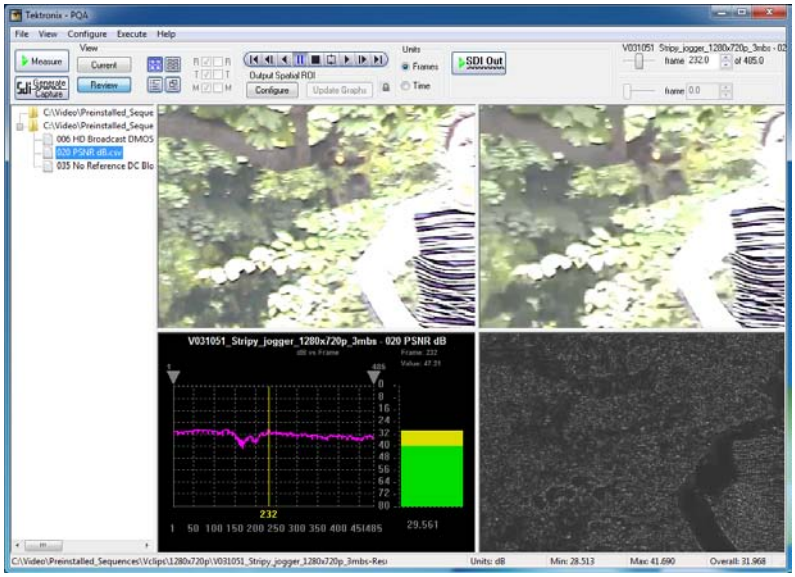
21. Click the **+** symbol next to the folder named after the test file you selected.

When the folder expands, you will see results files for all the tests you have run using the test video clip.

22. Select the results file labeled **020 PSNR dB.csv**.



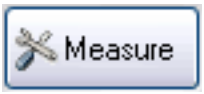
23. To review the results, adjust the slider bar to change the displayed frame. Note which frame has the worst value, and note the highlighted region on the map.



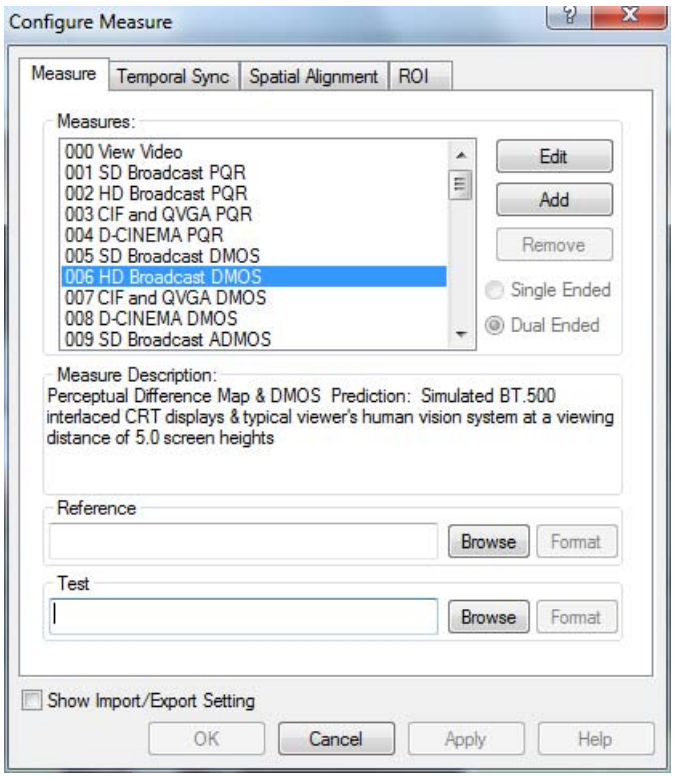
DMOS Measurement

The DMOS (Differential Mean Opinion Score) measurement shows the difference between the reference and test sequences taking the human vision model into consideration under ITU-R BT.500 conditions. This measurement predicts the degree to which viewers perceive the difference between reference and test sequences (under the ITU-R BT.500 conditions). This measurement is useful for evaluating the general performance of CODEC algorithms / instruments. The perceptual difference map shows the location in the sequence where there are differences that can be perceived by people. The DMOS measurement is useful for identifying what sequence and CODEC algorithm combination impacts picture quality.

1. Click the **Measure** button.

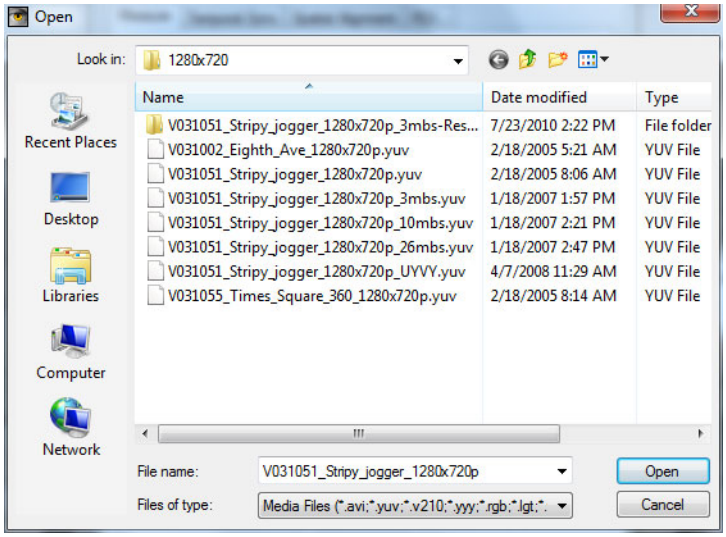


2. Select the **006 HD Broadcast DMOS** measurement from the **Configure Measure** window.
3. In the **Reference** box, click **Browse**.



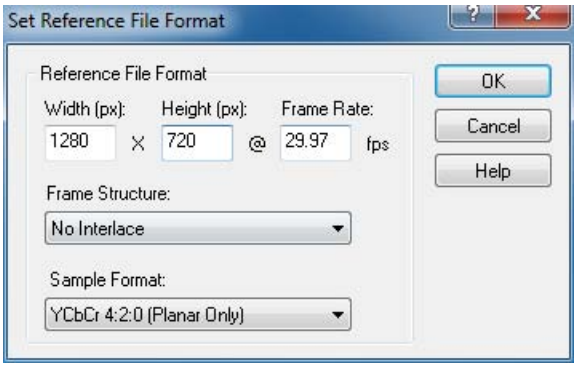
4. In the **Open** dialog box, browse to the directory: **C:\Video\PreInstalled_Sequence\Vclips\1280x720p**.

5. Select the file **V031051_Stripy_jogger_1280x720p.yuv** and click **Open**.

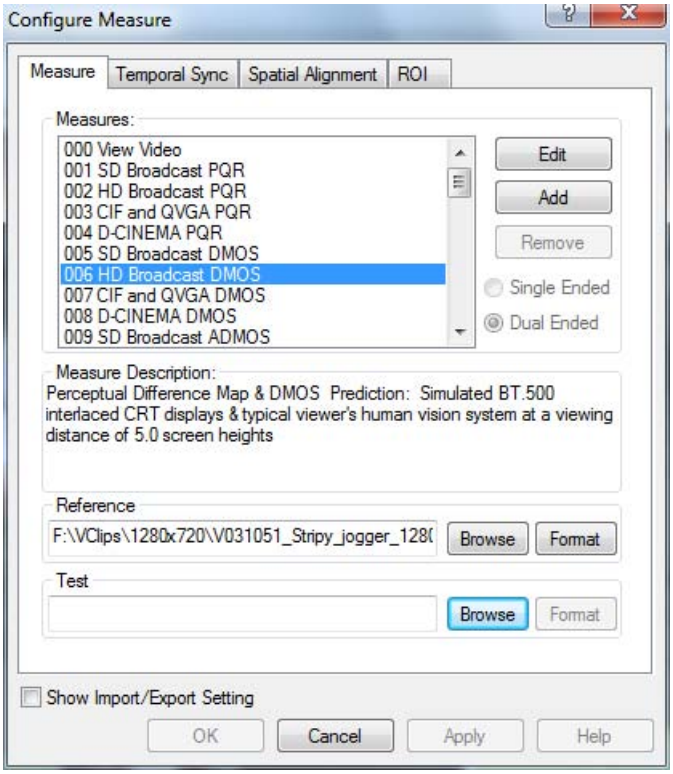


6. In the **Set Reference File Format** dialog, enter the following values:
   - Width: 1280
   - Height: 720
   - Frame Rate: 30
   - Sample Format: YCbCr 4:2:0 (Planar Only)

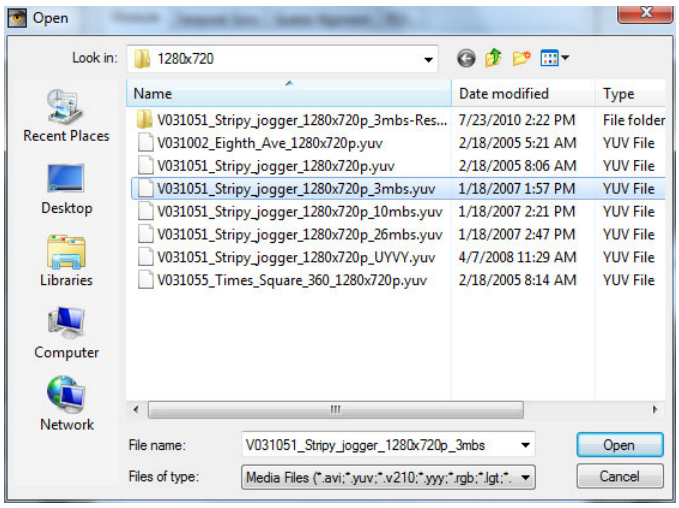
7. Click **OK**.



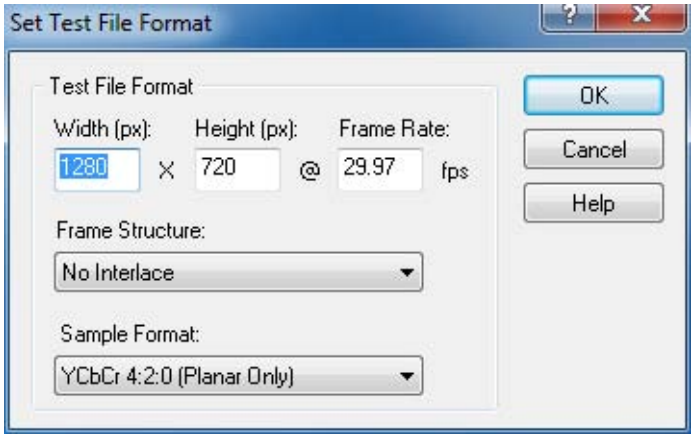
8. In the **Test** box, click **Browse**.



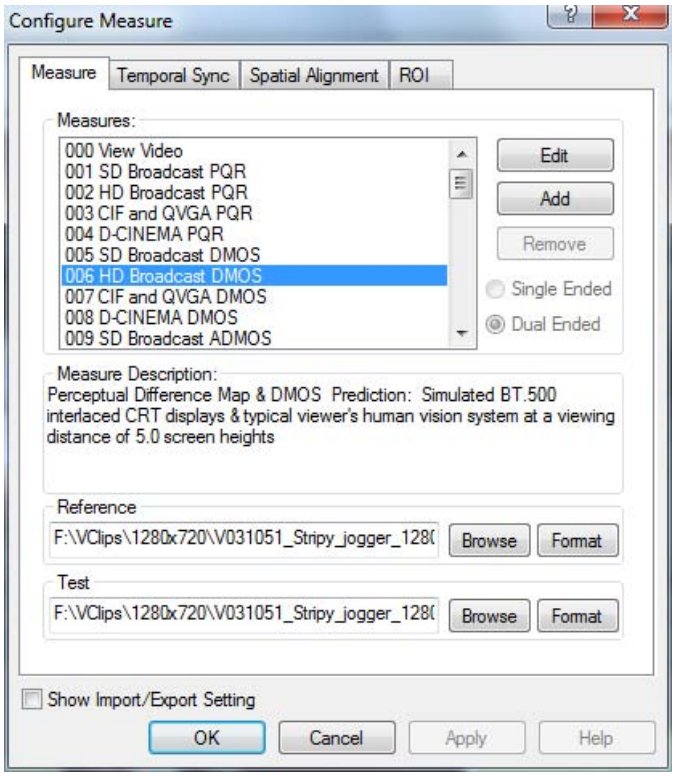
9. Select the file **V031051_Stripy_jogger_1280x720p_3mbs.yuv** and click **Open**.



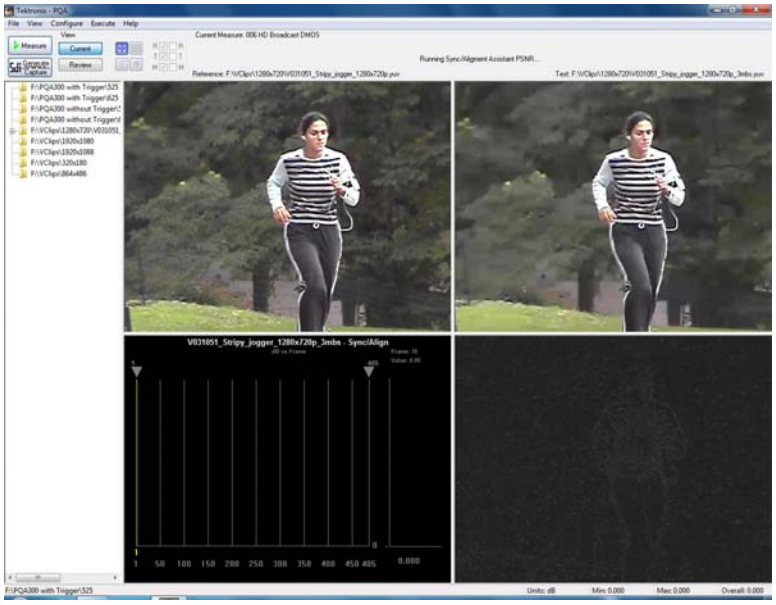
10. In the **Set Test File Format** dialog, enter the following values:
    - Width: 1280
    - Height: 720
    - Frame Rate: 30
    - Sample Format: YCbCr 4:2:0 (Planar Only)
11. Click **OK**.



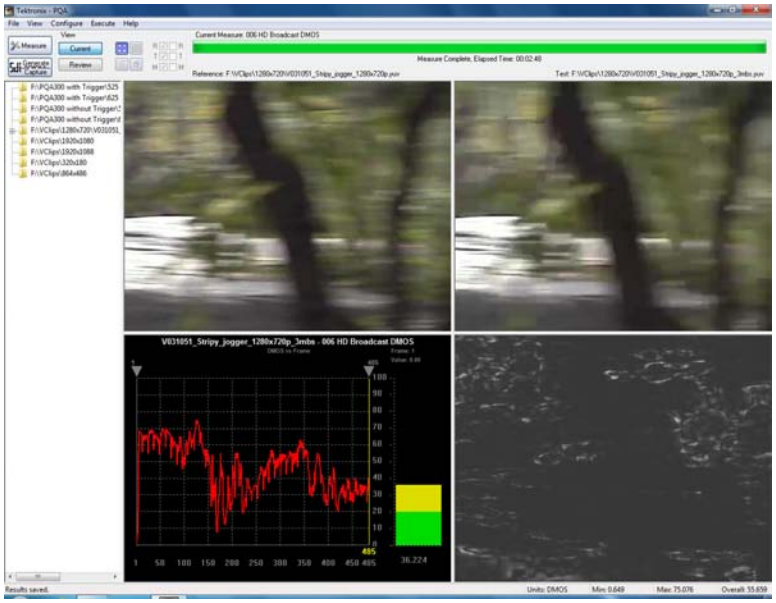
12. Click **OK** in the Configure Measure dialog box.



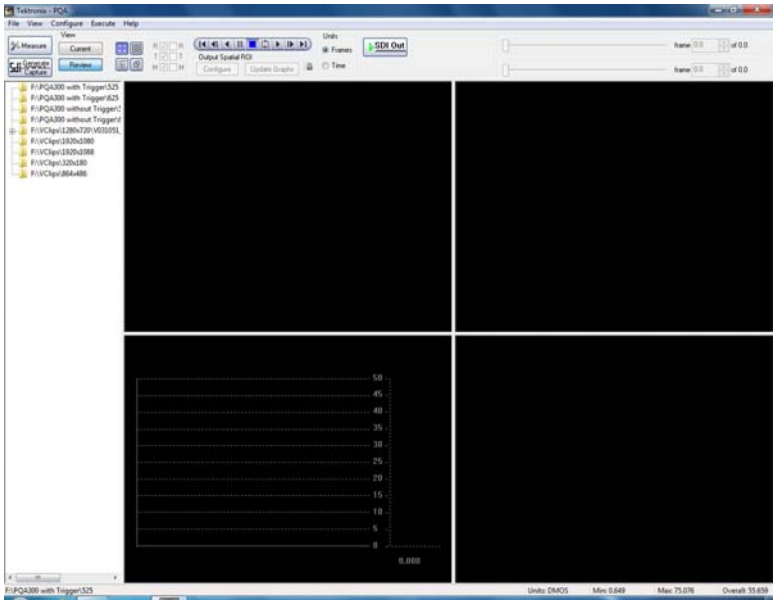
13. Click the **Measure** button to begin the measurement.



When the measurement is complete, the progress bar will display **Measure Complete** and display the elapsed time the measurement required.

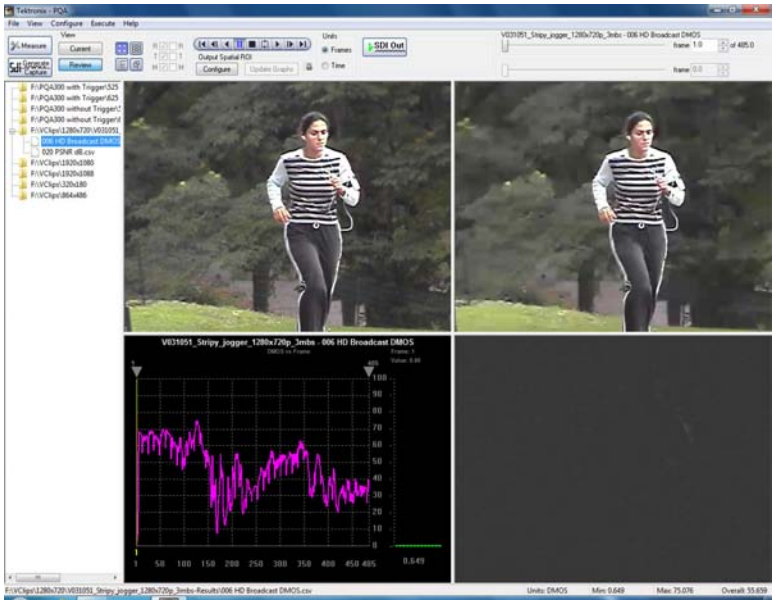


14. To view the results of the measurement, click the **Review** button.

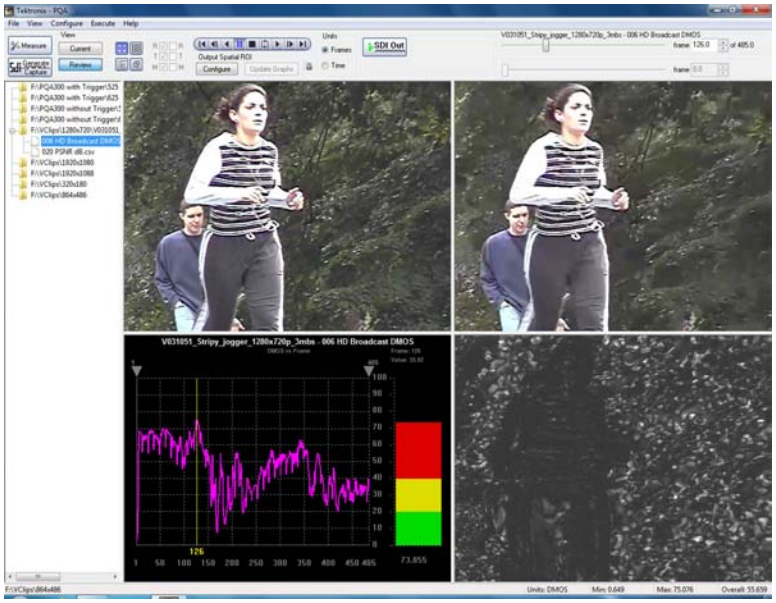


If you performed the previous application, PSNR Measurement, you will see that the results for this measurement now appear above the previous results. (If the results do not appear in the Navigation panel, select **File** > **Update Sequence List**.)

15. To review the measurement results, click the **006 HD Broadcast DMOS.csv** results file.



16. To review the results, adjust the slider bar to change the displayed frame. Note the different pattern in the results compared to the PSNR measurement.



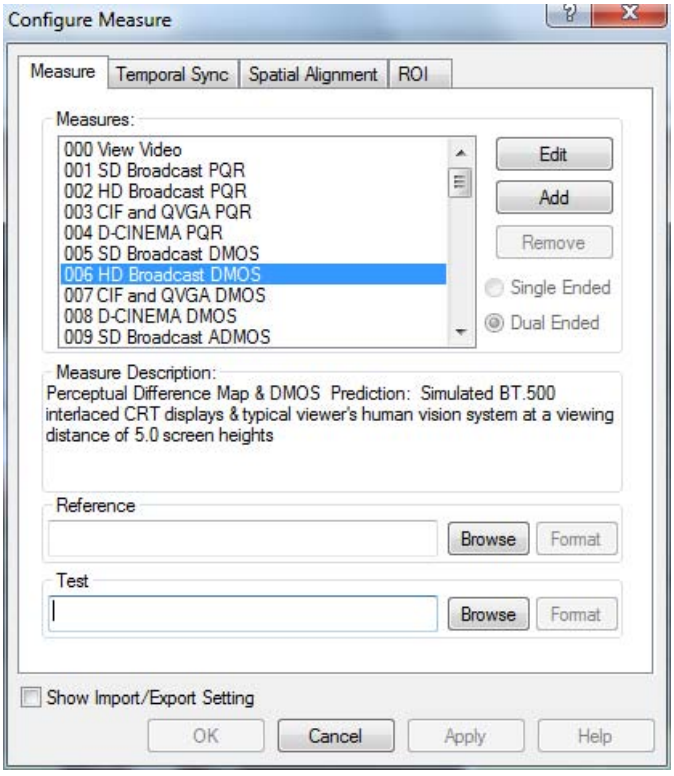
Artifact Weighted DMOS Measurement

Blurring, Ringing/Mosquito Noise, and Blockiness are well known artifacts caused by CODEC processing. It can be useful to a designer to know individual DMOS scores for each type of artifact. The artifact-weighted DMOS measurement provides the DMOS score for each artifact type and thus, indicating to the CODEC designer ways to optimize the algorithm.

For example, if the result from the DMOS score and the Blurring weighted DMOS score are similar, it means the DMOS result was mainly caused by Blurring.

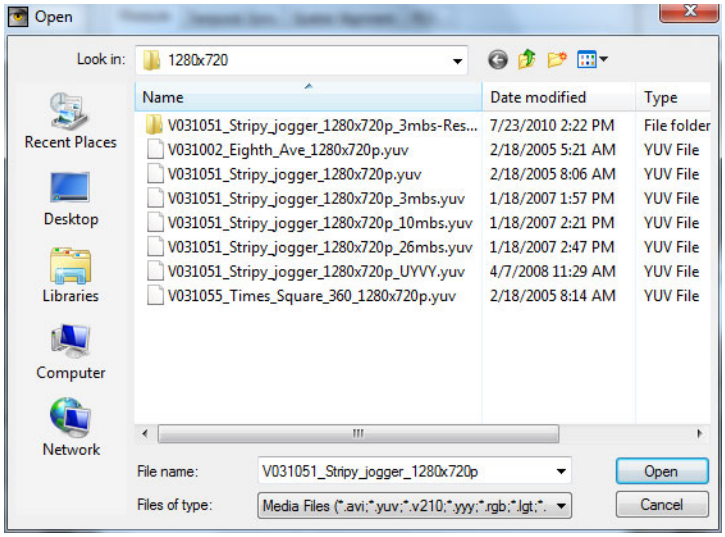
1. Click the **Measure** button.

2. Select the **006 HD Broadcast DMOS** measurement from the **Configure Measure** window.
3. In the **Reference** box, click **Browse**.



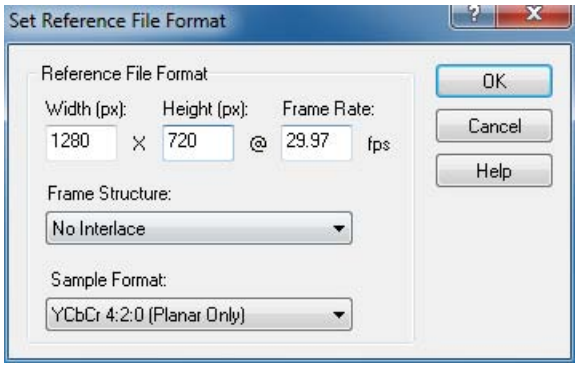
4. In the **Open** dialog box, browse to the directory: **C:\Video\PreInstalled_Sequence\Vclips\1280x720p**.

5. Select the file **V031051_Stripy_jogger_1280x720p.yuv** and click **Open**.

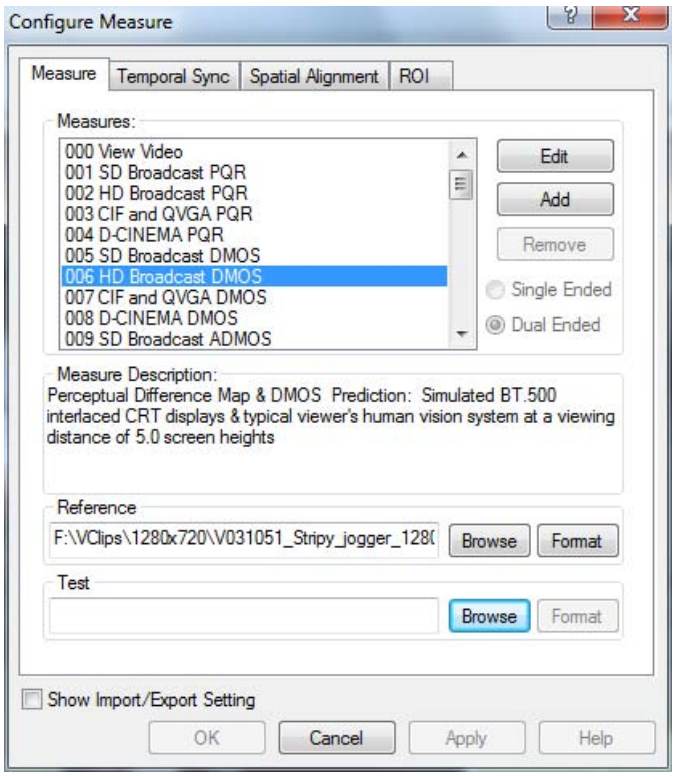


6. In the **Set Reference File Format** dialog, enter the following values:
   - Width: 1280
   - Height: 720
   - Frame Rate: 30
   - Sample Format: YCbCr 4:2:0 (Planar Only)

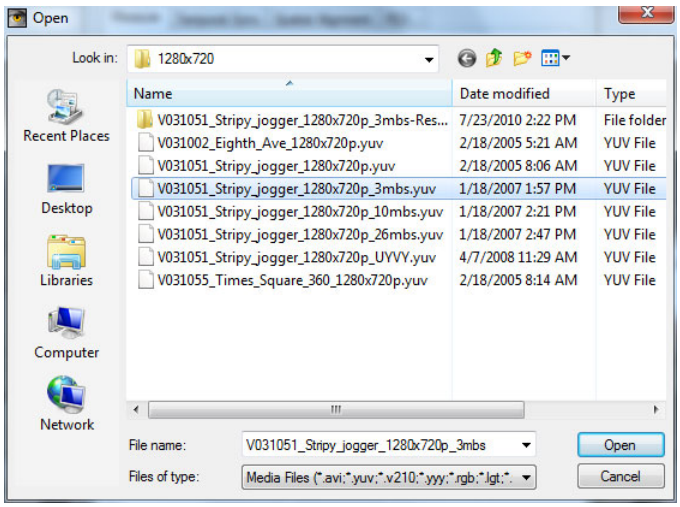
7. Click **OK**.



8. In the **Test** box, click **Browse**.



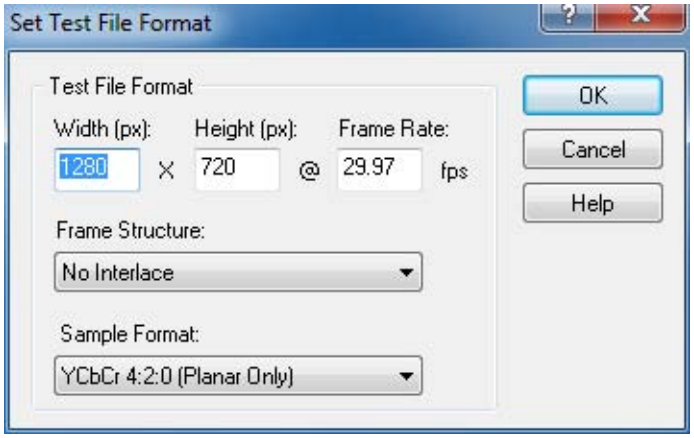
9. Select the file **V031051_Stripy_jogger_1280x720p_3mbs.yuv** and click **Open**.



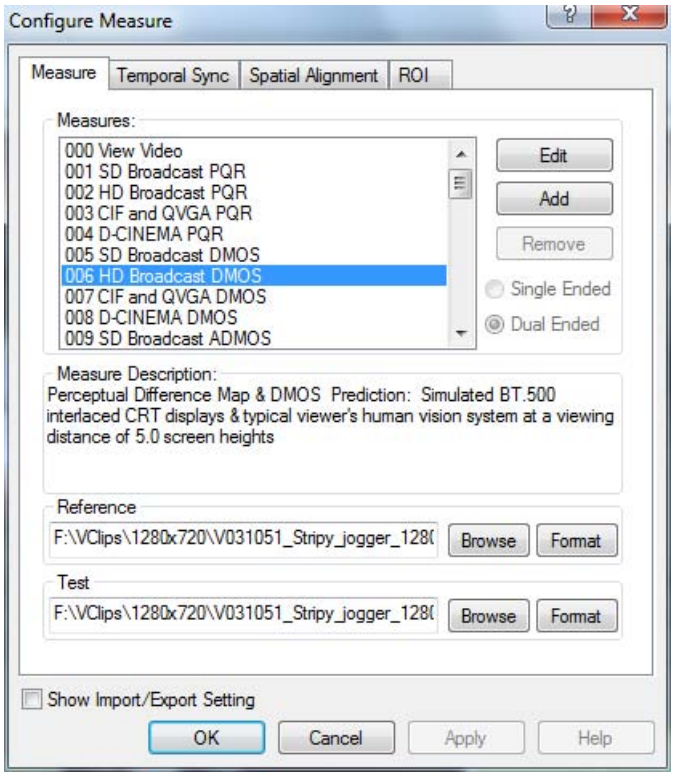
10. In the **Set Test File Format** dialog, enter the following values:

- Width: 1280
- Height: 720
- Frame Rate: 30
- Sample Format: YCbCr 4:2:0 (Planar Only)

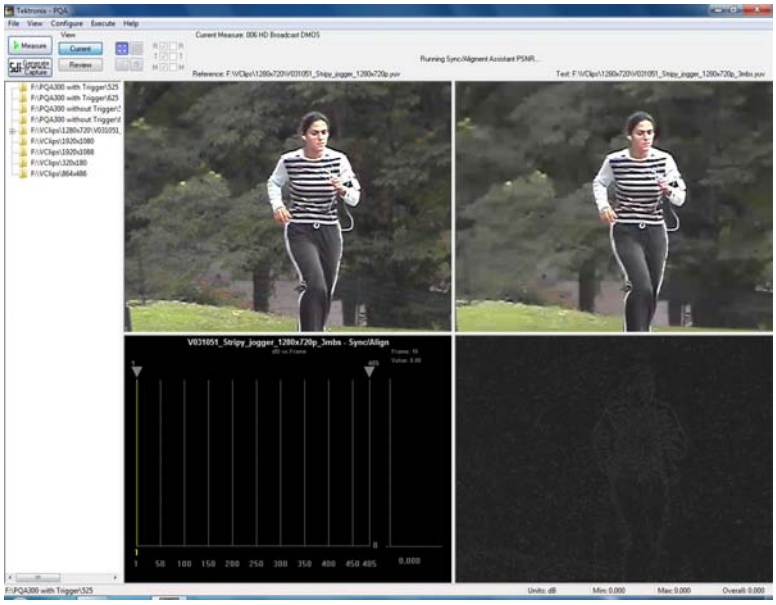
11. Click **OK**.



12. Click **OK** in the Configure Measure dialog box.

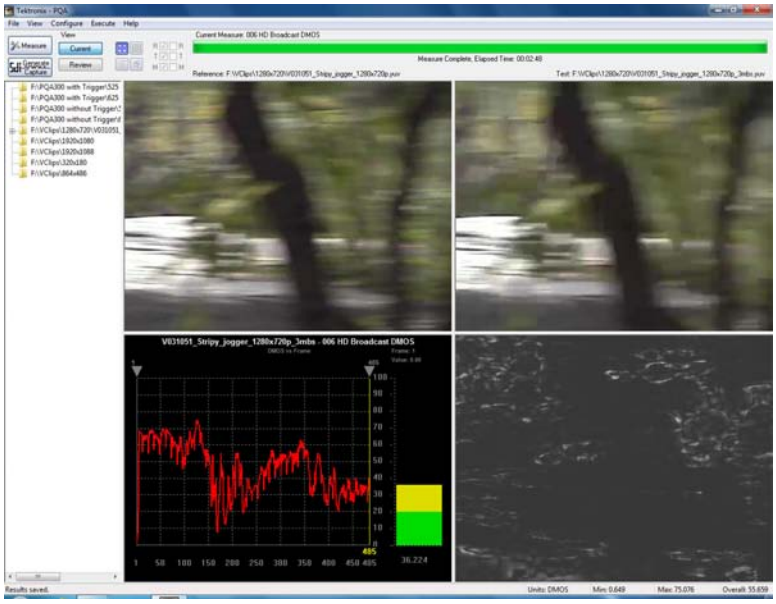


13. Click the **Measure** button to begin the measurement.



When the measurement is complete, the progress bar will display **Measure Complete** and display the elapsed time the measurement required.

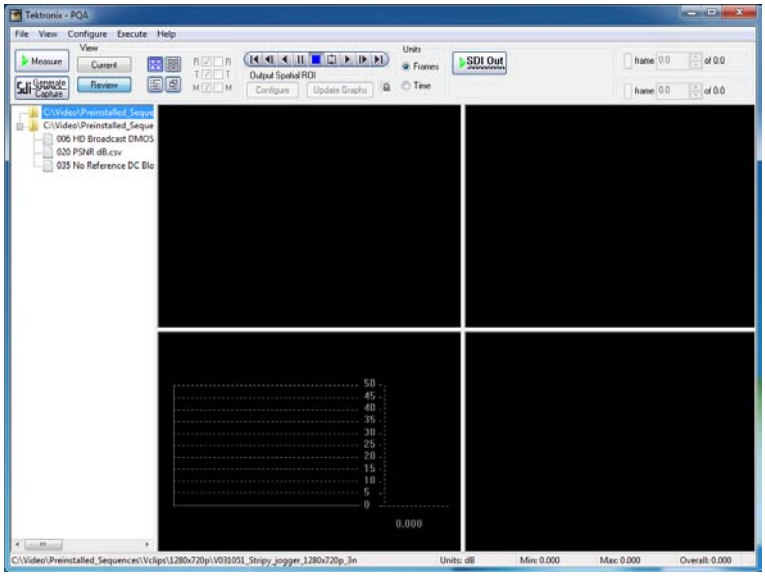
14. To view the results of the measurement, click the **Review** button.



15. In the main application window, click the **Review** button.

If you performed the one of the previous applications, you will see that the results for this measurement now appears with the previous results. (If the results do not appear in the Navigation panel, select **File** > **Update Sequence List**.)

If you have not performed any of the previous measurements, you will need to add the directory containing the measurement results to the Navigation pane. (See page 83, *Selecting Measurement Results for Display*.)

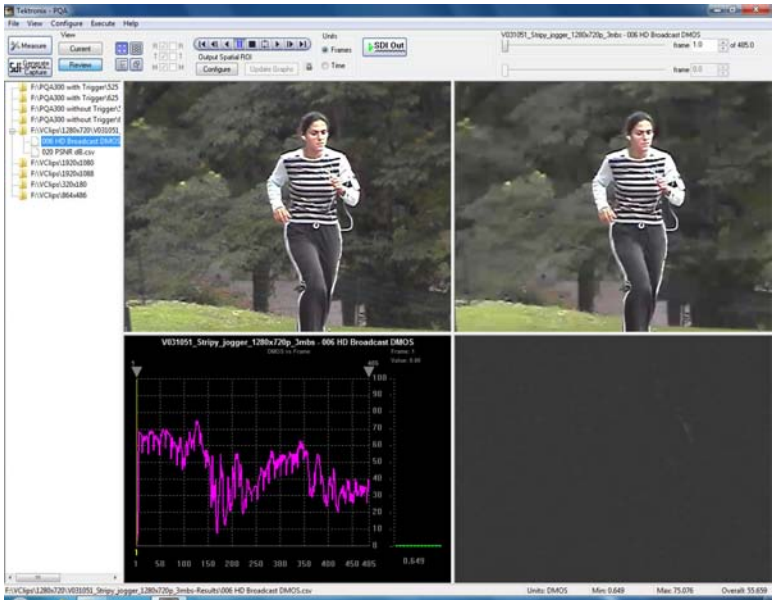


16. Click the **+** symbol next to the **F:\VClips\1280x720p** folder.

17. Click the **+** symbol next to the **V031051_Stripy_jogger_ 1280x720p_3mbs-Results**.

When the folder expands, you will see results files for all the tests you have run using the test video clip.

18. Click on the results file labeled **006 HD Broadcast DMOS.csv**.

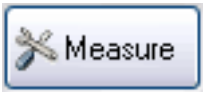


If you get a similar artifact DMOS result as you do with the DMOS measurement, it means that the majority of the DMOS result is due to artifacts measured by the artifact DMOS measurement. Thus, you might be able to improve the DMOS result by altering your algorithm to reduce the artifacts measured by the artifact DMOS measurement.

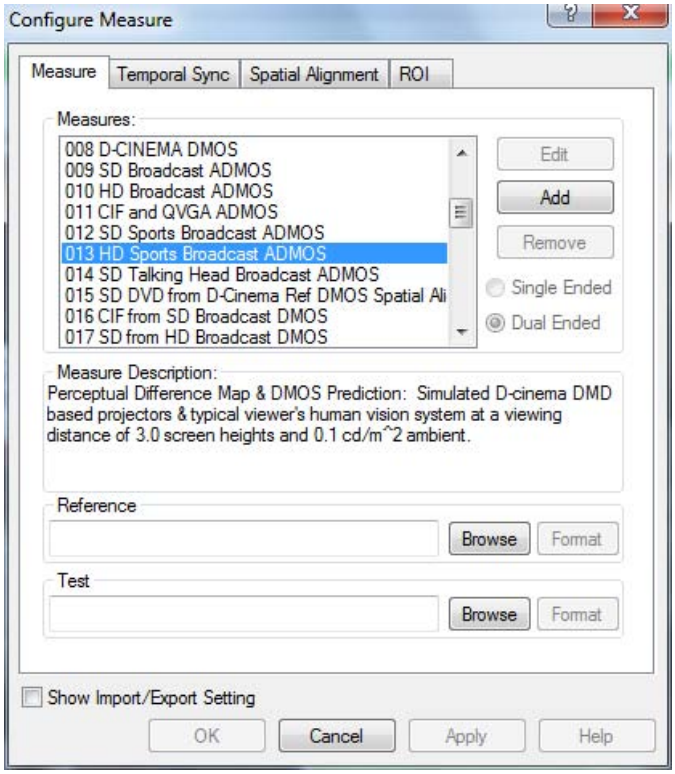
Attention Weighted DMOS Measurement

The attention weighted DMOS measurement provides a DMOS result with weighting apportioned by probable areas in the sequences on which the human eye is focusing. This measurement provides information that enables a designer to optimize a CODEC for a specific application, such as a Sports program. Knowing which areas of sequences get the most attention from viewers enables the designer allocate to bit resources for the more important objects in the scene.

1. Click the **Measure** button.

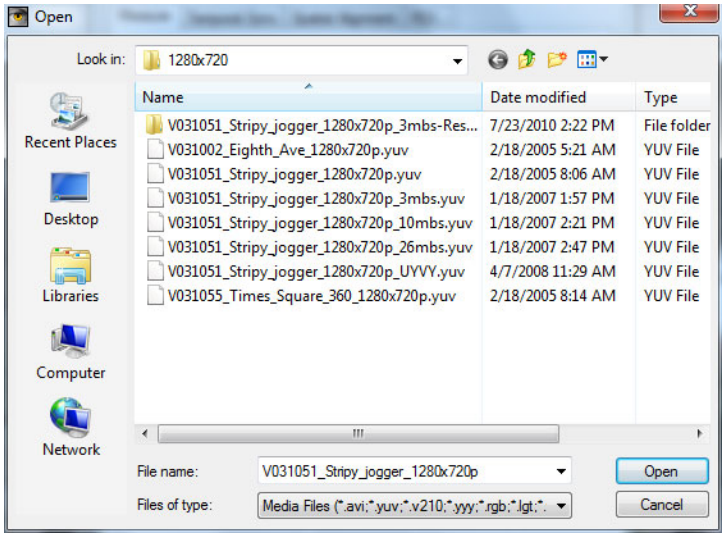


2. Select the **013 HD Sports Broadcast ADMOS** measurement from the **Configure Measure** window.
3. In the **Reference** box, click **Browse**.



4. In the **Open** dialog box, browse to the directory: **F:\VClips\1280x720p**.

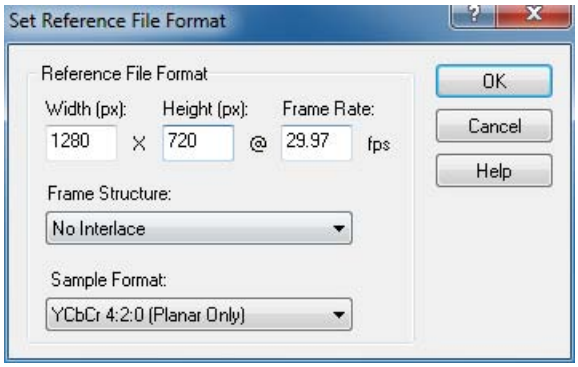
5. Select the file **V031051_Stripy_jogger_1280x720p.yuv** and click **Open**.



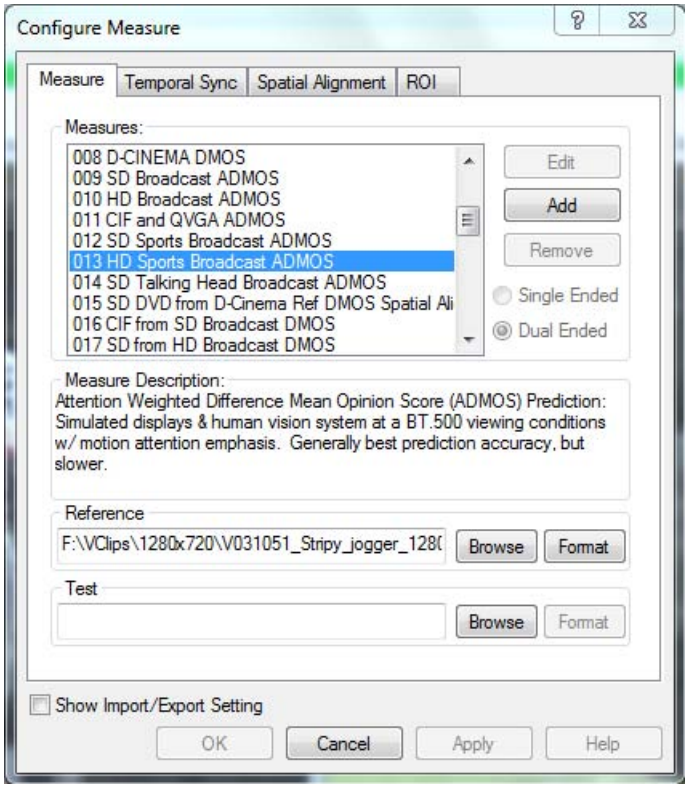
6. In the **Set Reference File Format** dialog, enter the following values:

   - Width: 1280
   - Height: 720
   - Frame Rate: 30
   - Sample Format: YCbCr 4:2:0 (Planar Only)

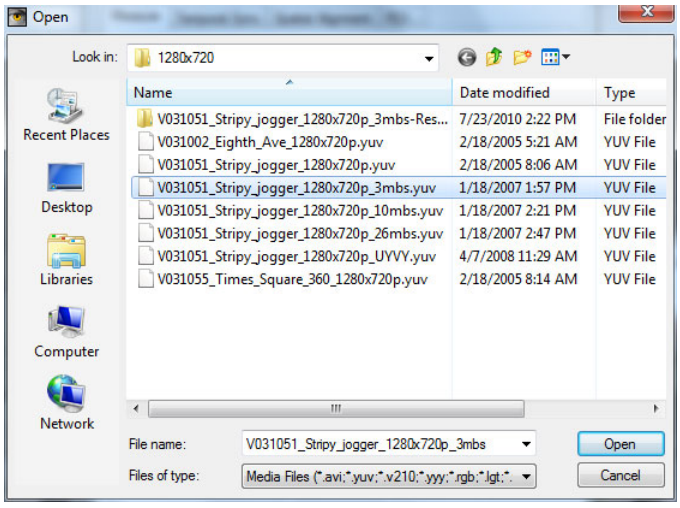
7. Click **OK**.



8. In the **Test** box, click **Browse**.



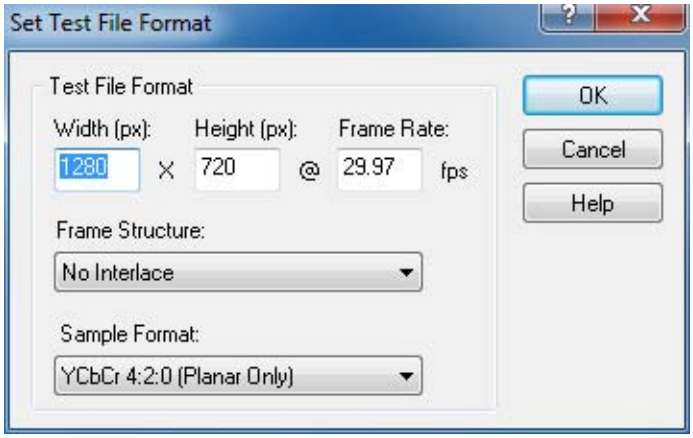
9. Select the file **V031051_Stripy_jogger_1280x720p_3mbs.yuv** and click **Open**.



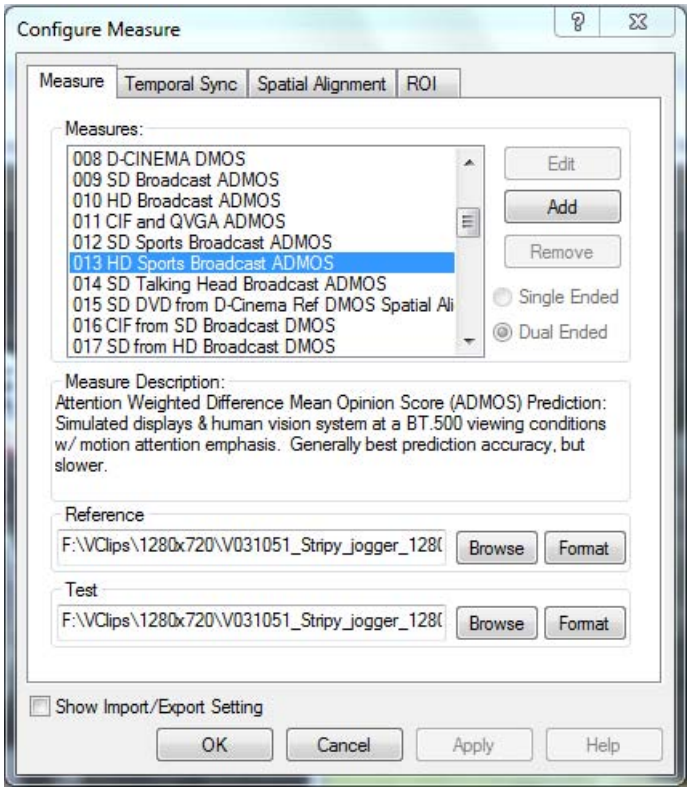
10. In the **Set Test File Format** dialog, enter the following values:

- Width: 1280
- Height: 720
- Frame Rate: 30
- Sample Format: YCbCr 4:2:0 (Planar Only)

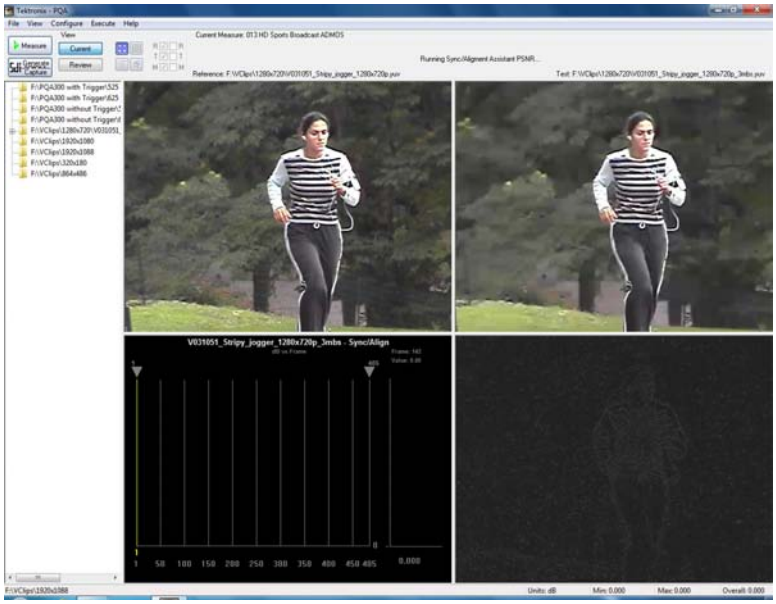
11. Click **OK**.



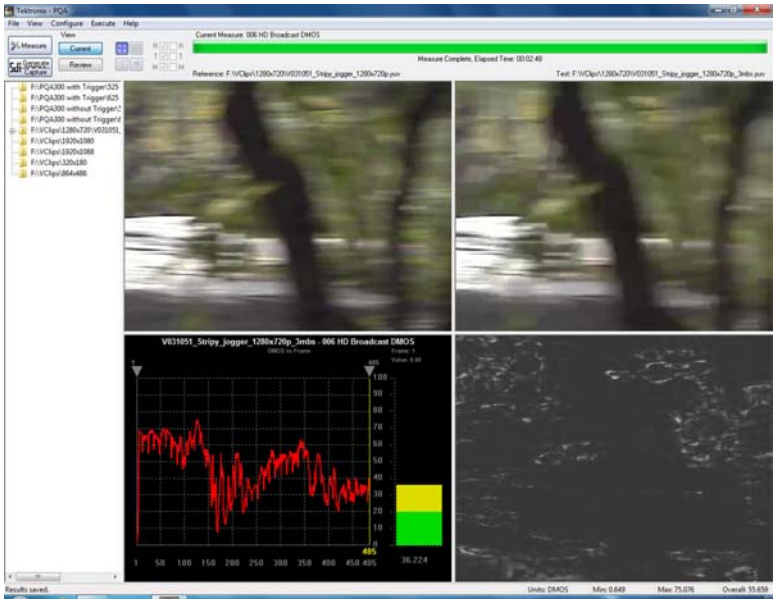
12. Click **OK** in the Configure Measure dialog box.



13. Click the **Measure** button to begin the measurement.



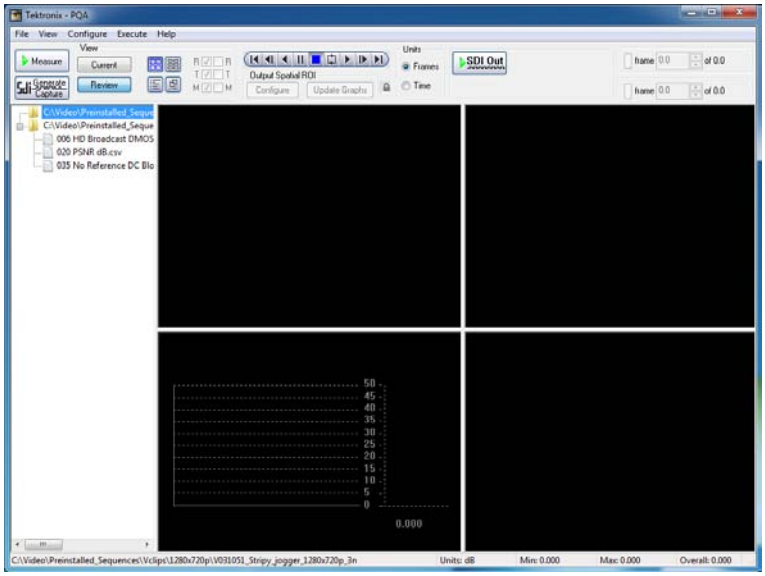
When the measurement is complete, the progress bar will display **Measure Complete** and display the elapsed time the measurement required.



14. In the main application window, click the **Review** button.

If you performed the one of the previous applications, you will see that the results for this measurement now appears with the previous results. (If the results do not appear in the Navigation panel, select **File** > **Update Sequence List**.)

If you have not performed any of the previous measurements, you will need to add the directory containing the measurement results to the Navigation pane. (See page 83, *Selecting Measurement Results for Display*.)

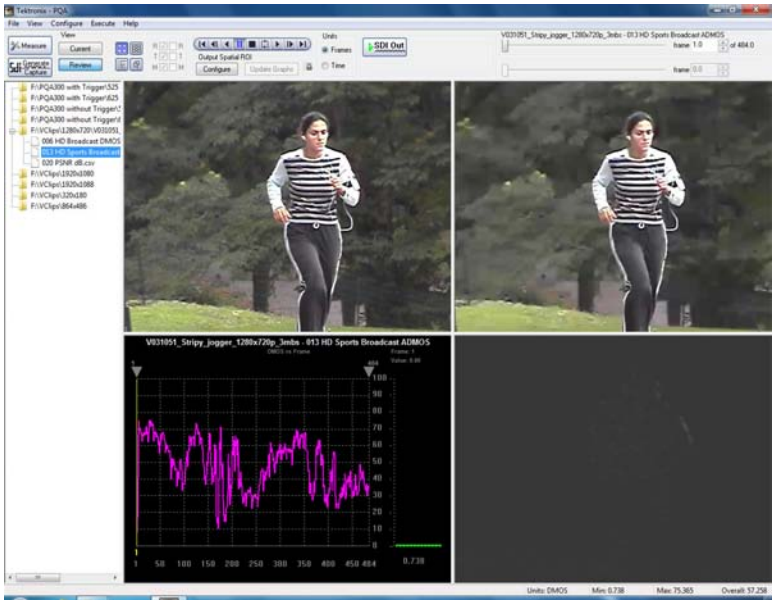


15. Click the **+** symbol next to the folder for the directory you just added to the working directory list.

16. Click the **+** symbol next to the folder named after the test file you selected.

When the folder expands, you will see results files for all the tests you have run using the test video clip.

17. Select the results file labeled **013 HD Sports Broadcast ADMOS.csv**.



If you see a different trend for the DMOS result, it means the contents contains an area which attracts higher attention from the viewer. You might consider optimizing the algorithm in ways to reduce human eye attention.

Artifacts Measurement with No Reference

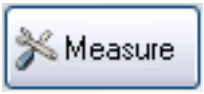
An artifacts measurement with reference provides a more accurate picture quality measurement (with respect to human perception) than an artifact measurement with no reference. The reason for this is that the measurement system cannot determine if the artifacts in the picture are caused intentionally by the creator or by unexpected system behavior. Nonetheless, an artifacts measurement with no reference is still a valuable measurement tool. An artifact measurement with no reference will measure well-known digital compression artifacts in a picture sequence. This measurement is useful for monitoring a broadcast system where there is no expectation of a reference sequence as there would be in a camera evaluation.

Artifact detection reports a variety of different changes to the edges of an image:

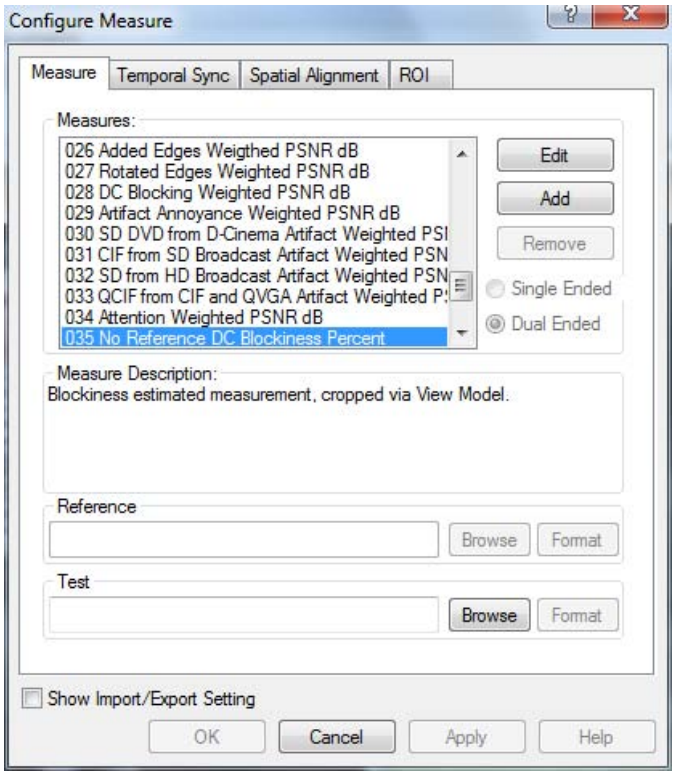
- Lost Edges or Blurring
- Added Edges or Ringing/Mosquito Noise
- Rotated Edges (Vertical and Horizontal) or Edge Blockiness
- Loss of Edges Within an Image Block or DC Blockiness

The No Reference DC Blockiness Percent measurement measures artifacts in a sequence and is used when there is no reference sequence. This measurement is useful for sample monitoring of a broadcast.

1. Click the **Measure** button.

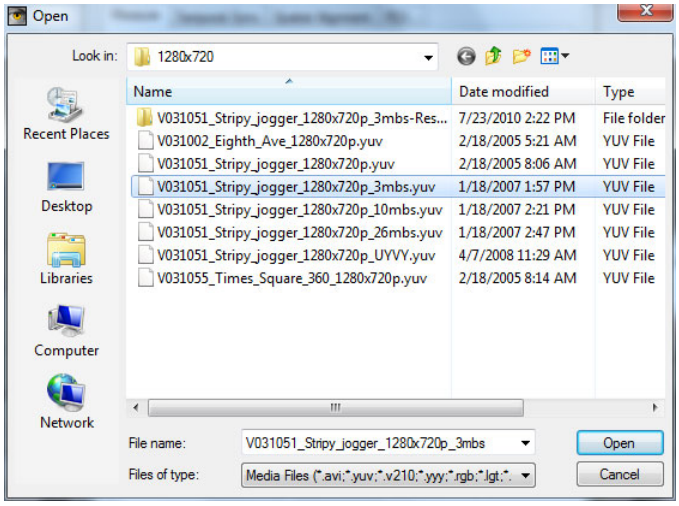


2. Select the **035 No Reference DC Blockiness Percent** measurement from the **Configure Measure** window.
3. In the **Test** box, click **Browse**.



4. In the **Open** dialog box, browse to the directory: **F:\Vclips\1280x720p**.

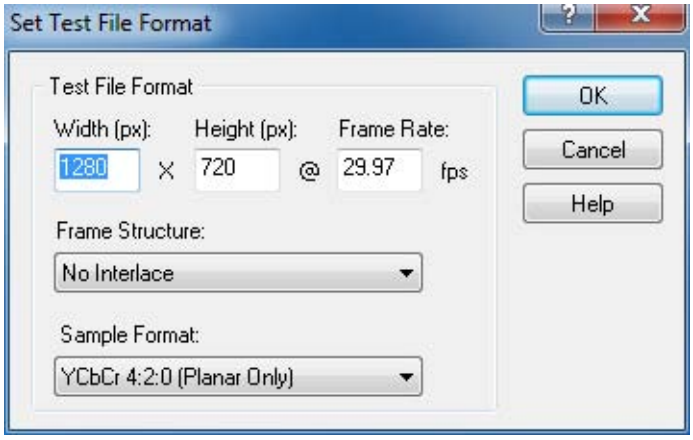
5. Select the file **V031051_Stripy_jogger_1280x720p_3mbs.yuv** and click **Open**.



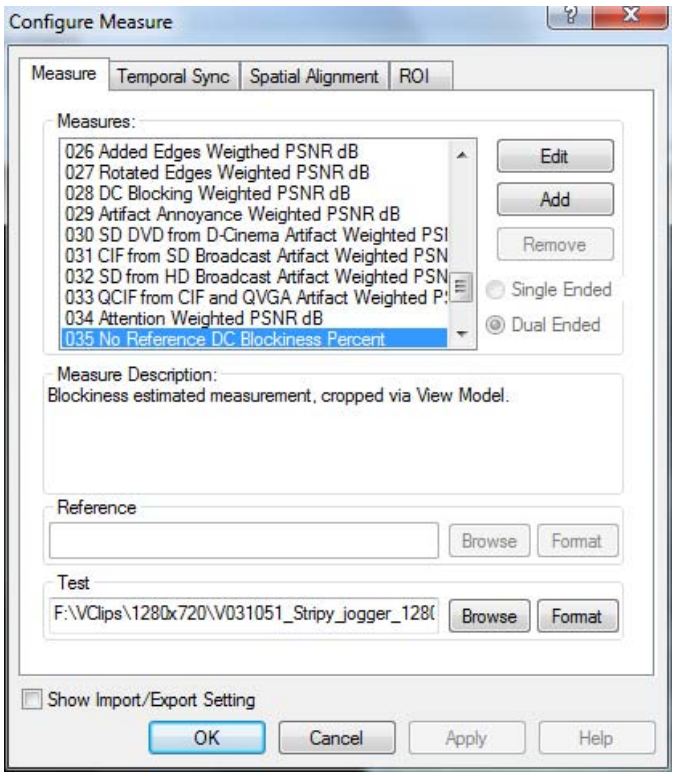
6. In the **Set Test File Format** dialog, enter the following values:

   - Width: 1280
   - Height: 720
   - Frame Rate: 30
   - Sample Format: YCbCr 4:2:0 (Planar Only)

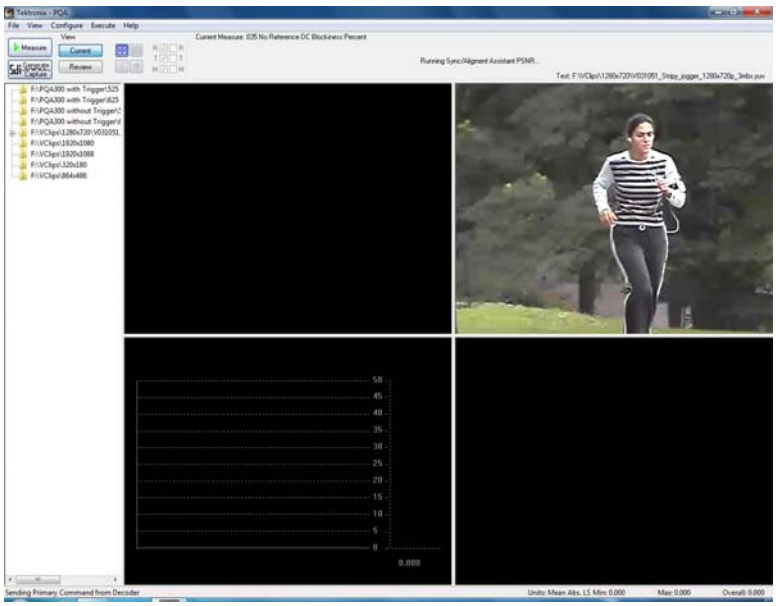
7. Click **OK**.



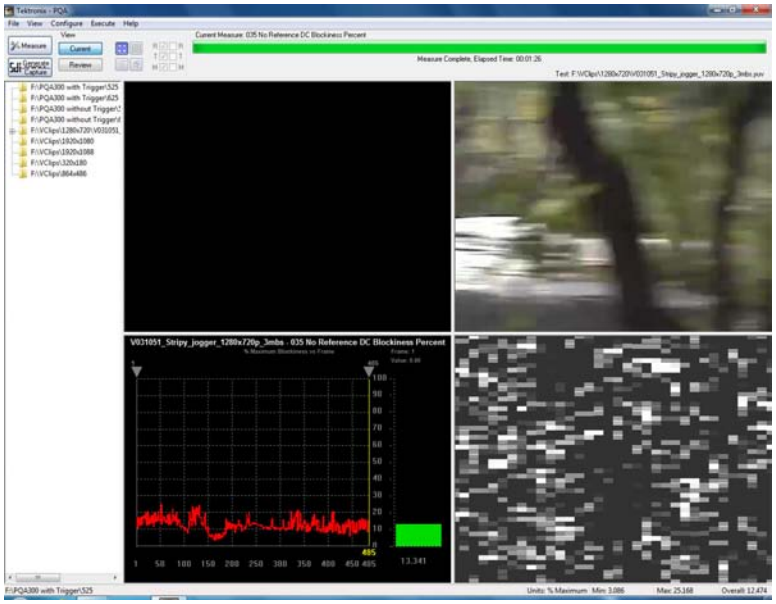
8. Click **OK** in the Configure Measure dialog box.



9. Click the **Measure** button to begin the measurement.



When the measurement is complete, the progress bar will display **Measure Complete** and display the elapsed time the measurement required.

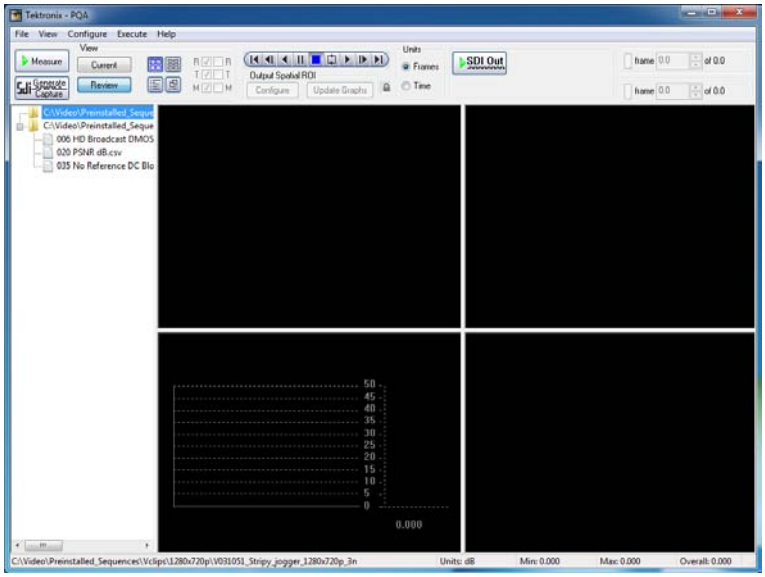


10. In the main application window, click the **Review** button.

    If you performed the one of the previous applications, you will see that the results for this measurement now appears with the previous results. (If the results do not appear in the Navigation panel, select **File** > **Update Sequence List**.)

    If you have not performed any of the previous measurements, you will need to add the directory containing the measurement results to the Navigation pane. (See page 83, *Selecting Measurement Results for Display*.)

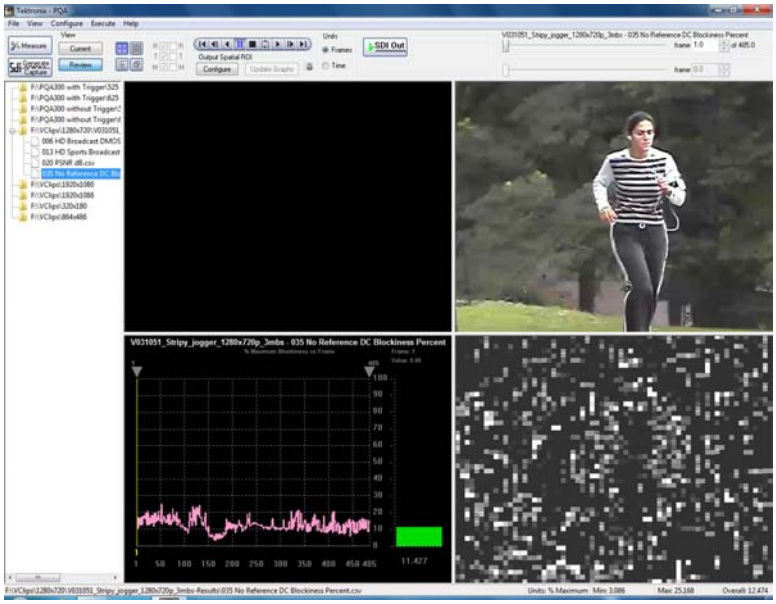
11. Click the **+** symbol next to the **F:\Vclips\1280x720p** folder.



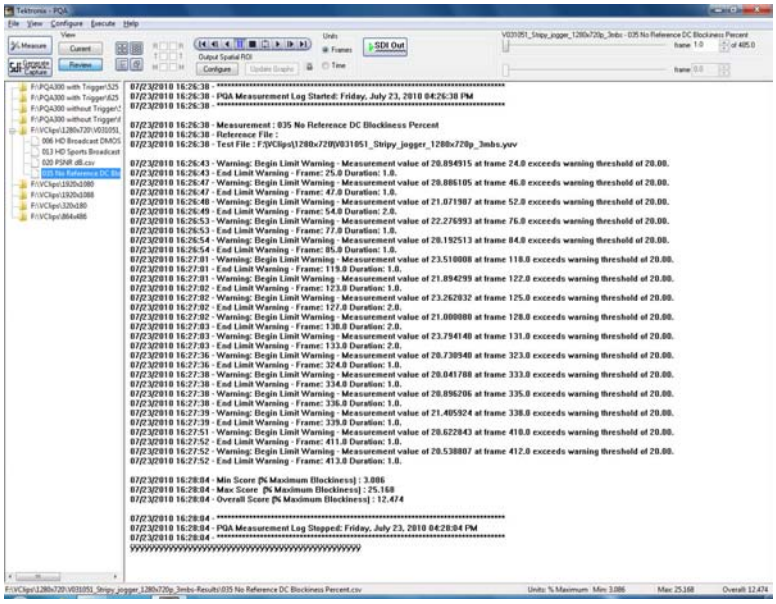
12. Click the **+** symbol next to the **V031051_Stripy_jogger_ 1280x720p_3mmbs-Results**.

When the folder expands, you will see results files for all the tests you have run using the test video clip.

13. Click on the results file labeled **035 No Reference DC Blockiness Percent.csv**.



14. To view the Event Log for the measurement, click on  (the Event Log button).



Automated Measurements Using XML Scripting

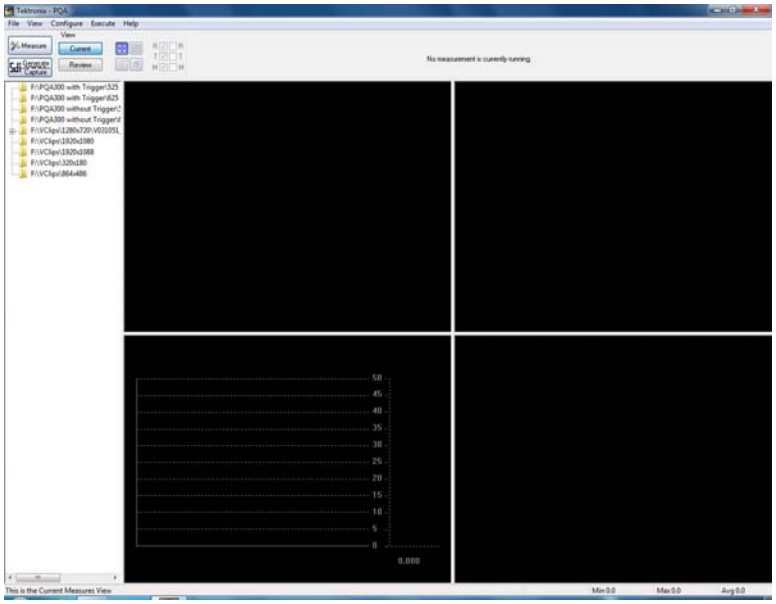
Using the PQA600 analyzer XML scripting capability, you can also run multiple measurement sequences simultaneously. You do this by running the software from a command line. When run in this way, the normal Windows application interface is not launched, but you will get a status readout in the command prompt while the measurement is running. Using the XML scripting capability maximizes system performance when you need to perform multiple measurements.

There are two ways to create an XML script. The simplest way is to export a measurement to a script from the Configure Measure window. Alternatively, you can edit an XML script file to specify the measurement to be made, the reference and test files, and any other parameters necessary to execute the test.

Exporting an XML Script

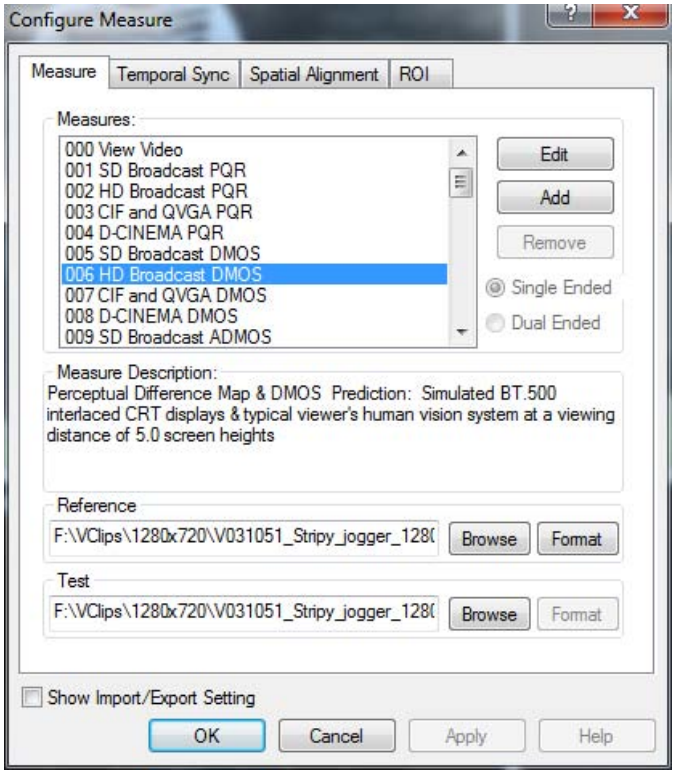
To export an XML script:

1. Click the Measure button.



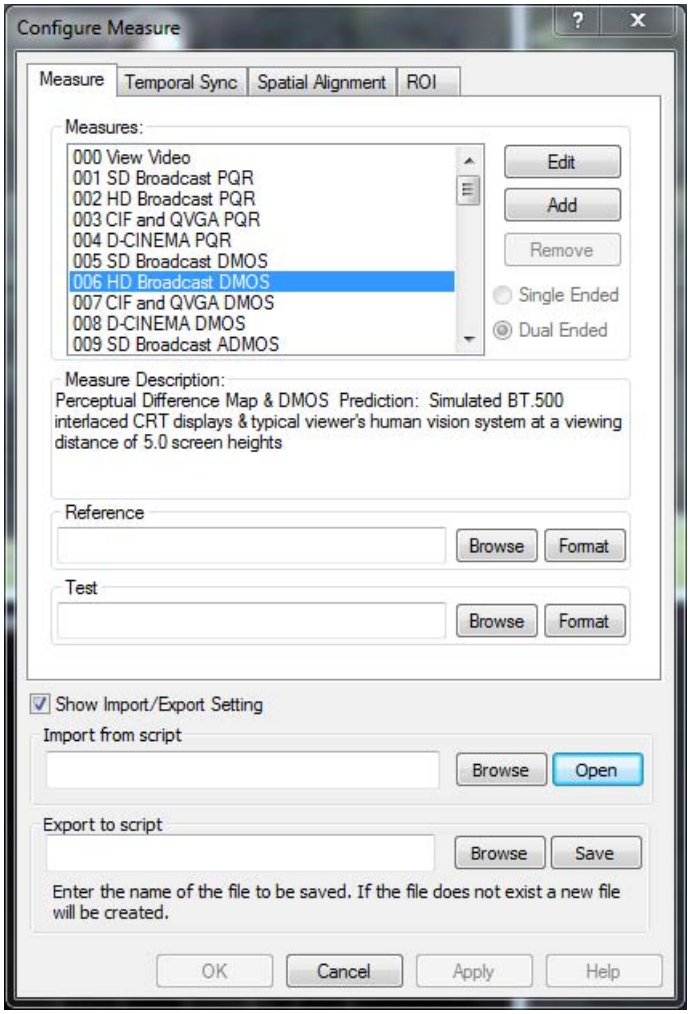
2. Configure a measure as you want to run it.

Select a measure and specify all measurement characteristics (when you are not using a predefined measure). Specify the Reference and Test files as required.

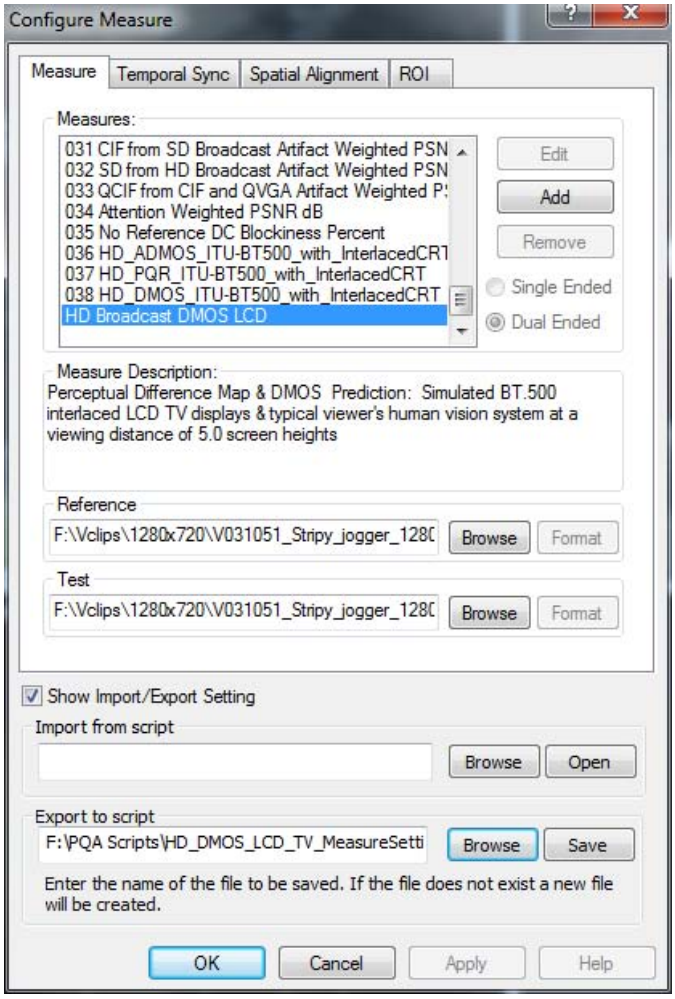


3. Select the **Show Import/Export Setting** check box.

   This displays two additional text entry boxes. One text entry box is used to specify a script to import and the other text entry box is used to specify the file name of an exported script.



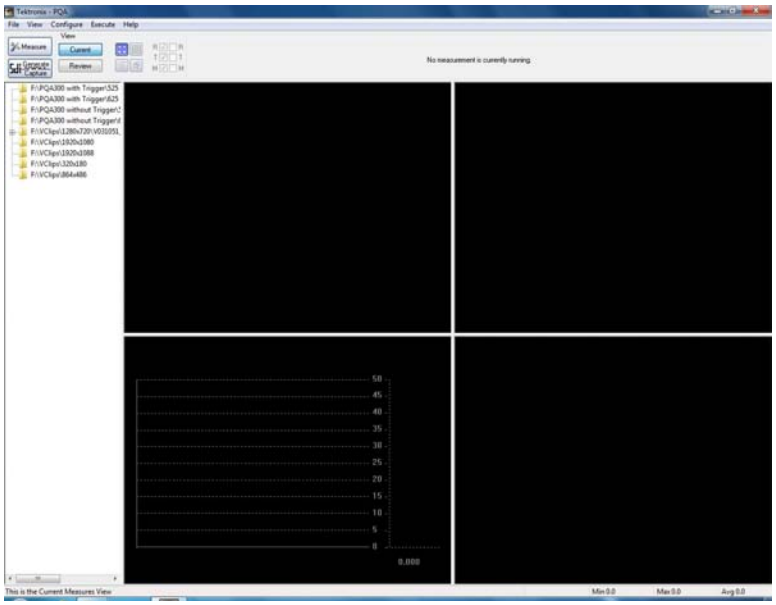
4. Type in a path and file name for your exported script or click the Browse button to specify where to save your script file.
5. Click Save to save the measure to the script file.



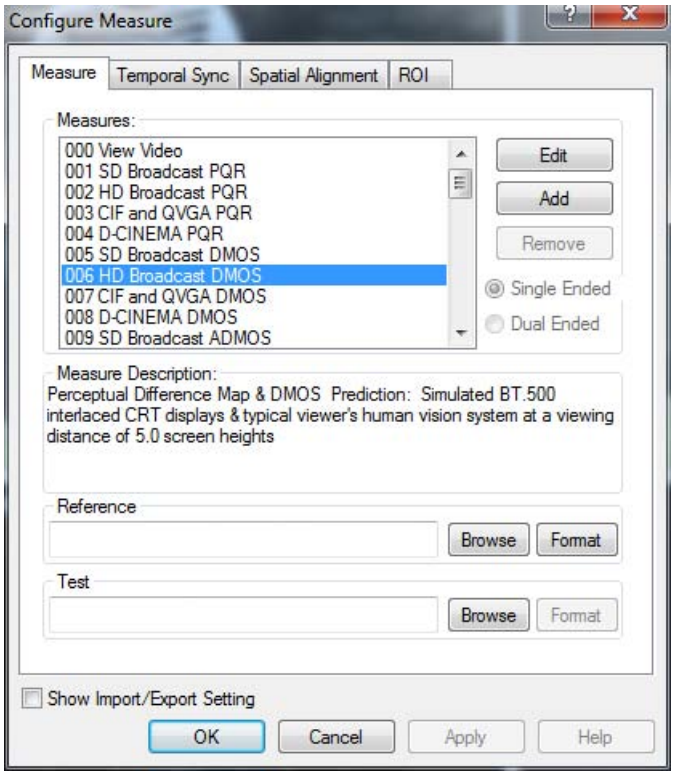
Importing an XML Script

To import an XML script:

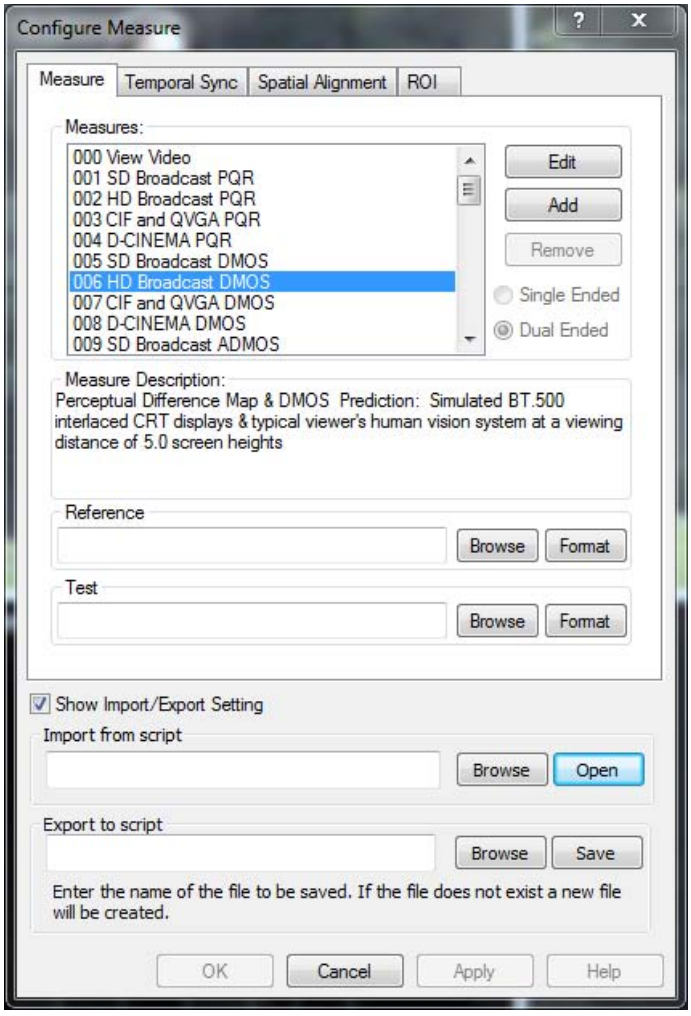
1. Click the Measure button.



2. Select the **Show Import/Export Setting** check box.



This displays two additional text entry boxes. One text entry box is used to specify a script to import and the other text entry box is used to specify the file name of an exported script.

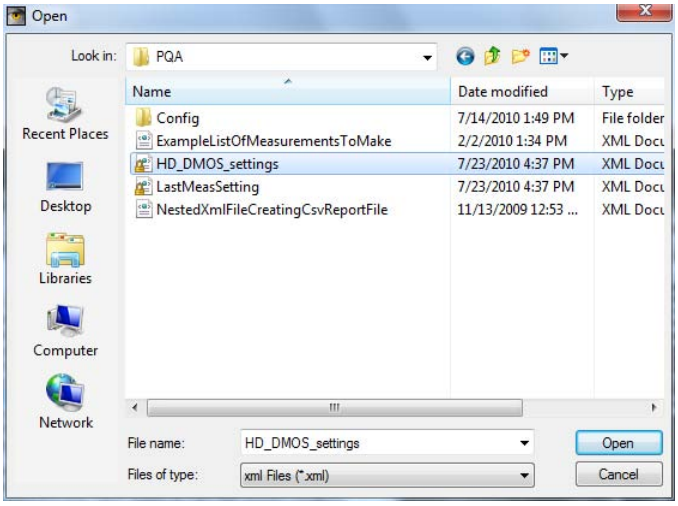


3. Type in a path and file name for your imported script or click the Browse button to use the Open dialog to select the script file to import.

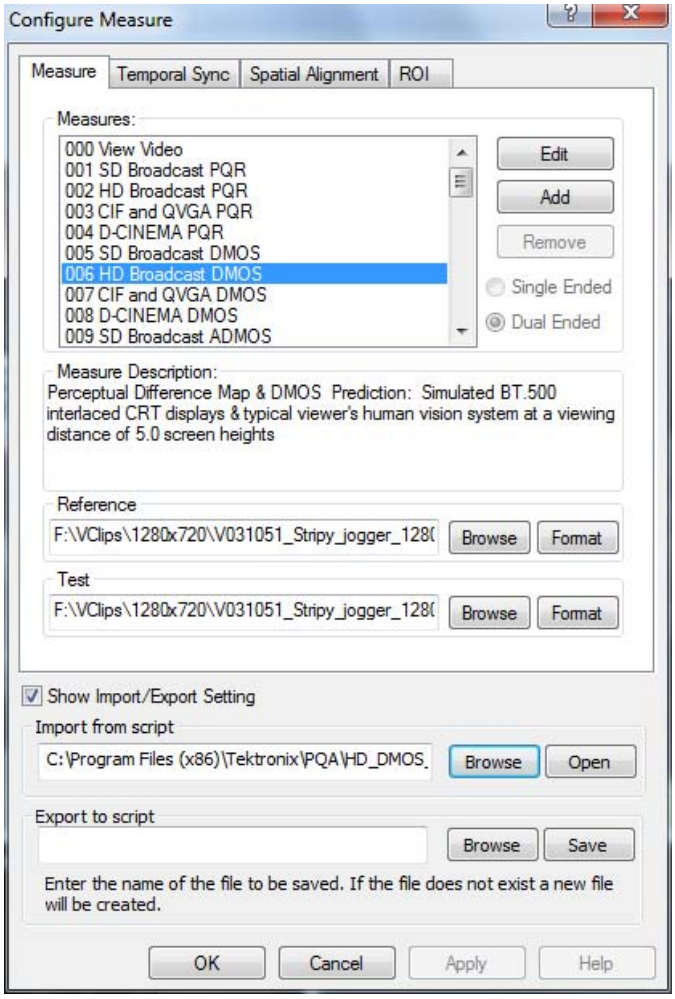
4. If you use the Browse button, click **Open** in the Open dialog box to open the selected script file.

   When you click Open, the PQA600 imports the script and configures the Measure as defined in the script file. This includes the selected measure, Temporal Sync tab settings, Spatial Alignment tab settings, ROI tab settings, and the reference and the test files.

5. If you typed in a path and file name for the script, click **Open** to import the script file.



6. Once the script is imported, click **OK** to accept the script settings.



Running a Script

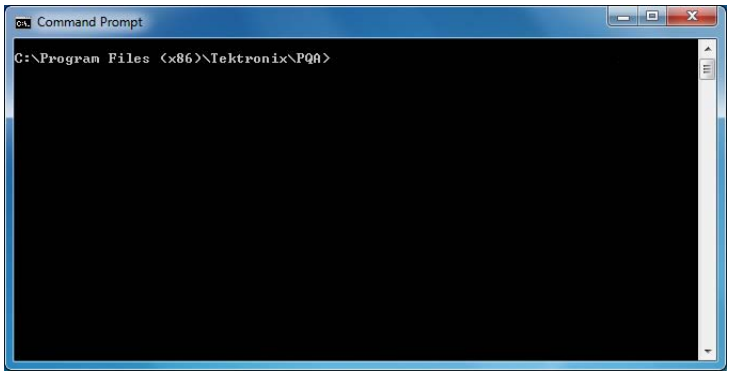
To run a script, open a command prompt window, change directories to the PQA600 application directory, and type “PQxml filename”. The measurement begins and the results are saved in the same location as they would be if the measurement were run through the regular PQA600 Windows application.

There are two sample XML script files installed with the PQA600 application (they are located in the PQA600 application folder). The sample scripts are NestedXmlFileCreatingCsvReportFile.xml and ExampleListOfMeasurementsToMake.xml.

To run an XML script:

1. Open a command prompt window by selecting **Start > All Programs > Accessories > Command Prompt**.
2. Change directories to the PQA600 application directory.

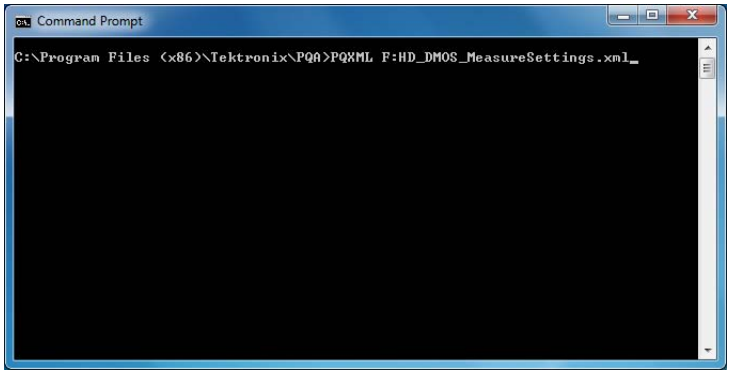
To execute a script file, you enter the name of the script application (PQXML) followed by the name of the script. Scripts can be located on other drives than the C: drive, as the following example shows.



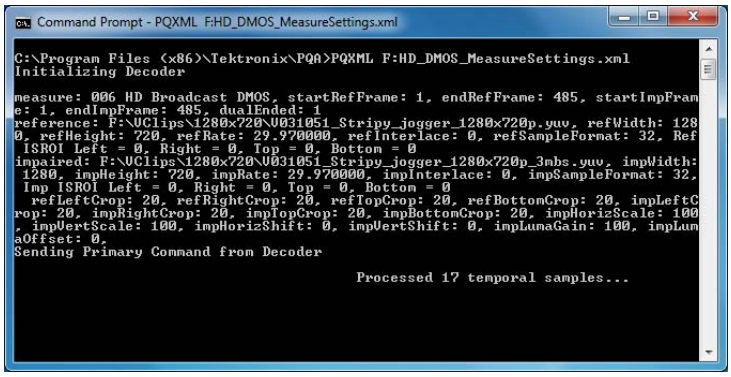
3. Type `PQXML` followed by the script name.

For example:

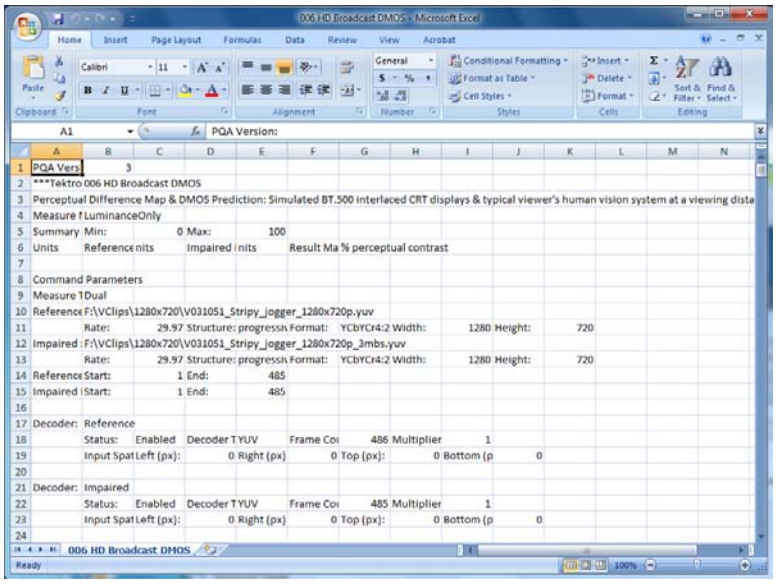
- `PQXML F:HD_DMOS_MeasurementSettlings.xml`



While the XML script is running, the application will display its progress.



4. When the measurement is complete, you can open the results file with the PQA600 application or with a spreadsheet.

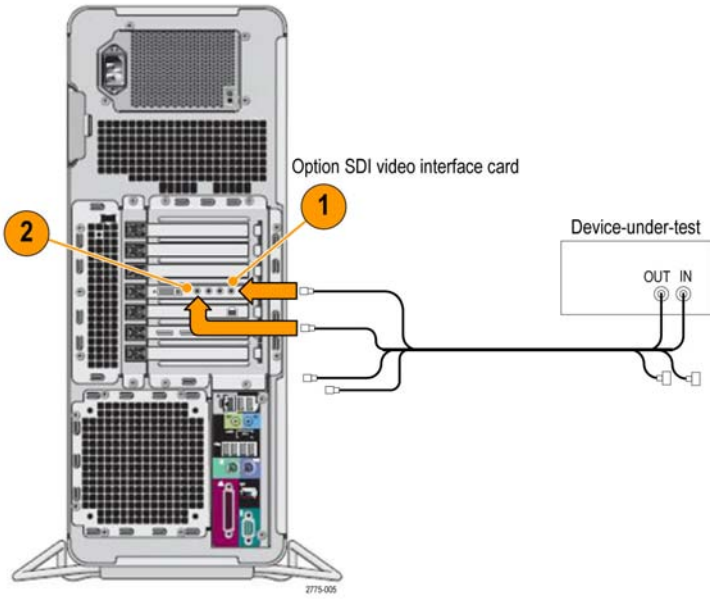


DMOS Measurement with SDI Generation, Capture, and Auto Temporal/Spatial Alignment

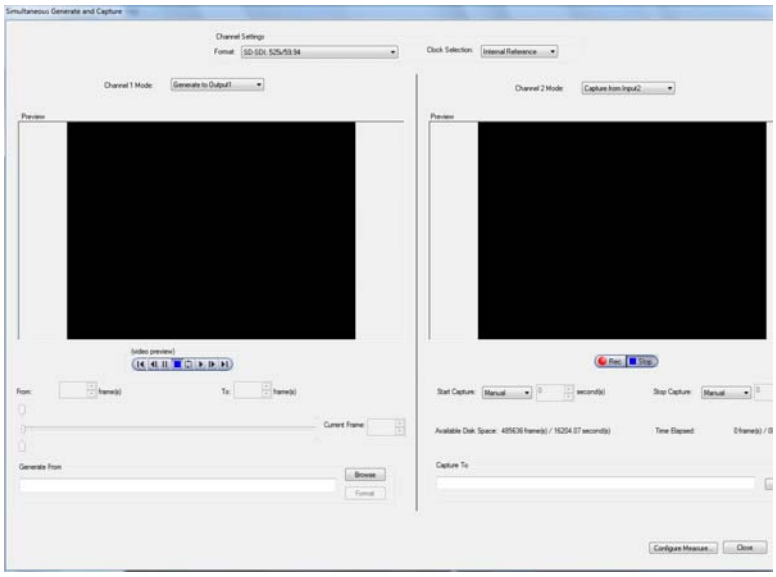
You can use the PQA600 with Option SDI to capture video for analysis. Furthermore, you can generate an SDI video signal to serve as the video source for a Device-Under-Test. You connect SD/HD SDI video output and input to the video interface card on the rear panel. Captured video files have a .vcap file extension. The following procedure demonstrates the process of generating and capturing video. This procedure demonstrates the whole process from selecting a file to use as a source for generating video, capturing the video from a device-under-test, to measuring the DMOS.

NOTE. *The PQA600 saves video capture files with a VCAP file extension.*

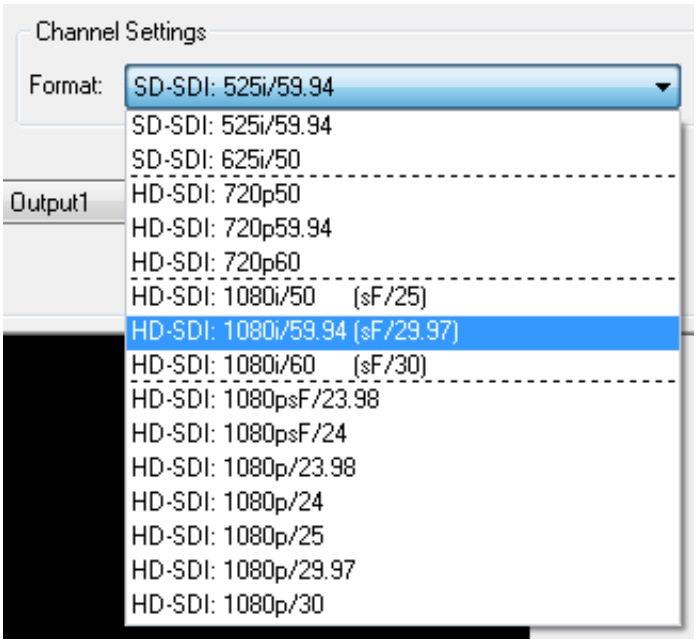
1. Connect the SDI interface card Out 2/B connector to the device-under-test input connector.
2. Connect the device-under-test output connector to the SDI interface card 1/A connector.



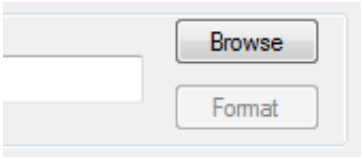
3. Click the **Sdi Generate / Capture** button. This displays the Simultaneous Generate and Capture window.



4. Set the format for the generated signal from the **Format** drop-down list. Select **HD-SDI: 1080i/59.94 (sF 29.97)**.

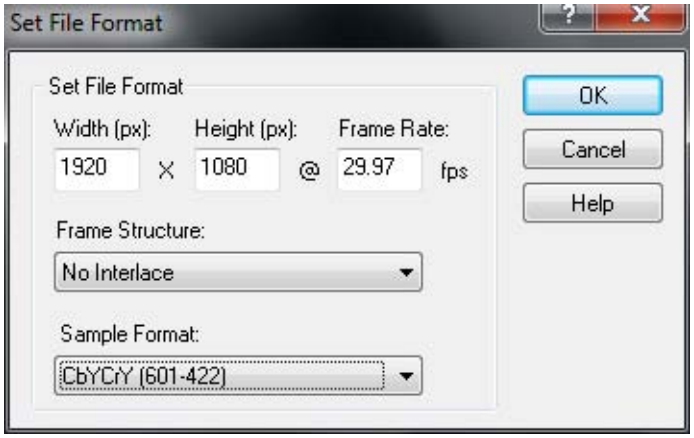


5. Click the **Browse** button. Navigate to F:\Preinstalled_Sequences\Vclips\1920x1080. Select the file V031051_Stripy_jogger_1920x1080i_UYVY.yuv and click **Open**.

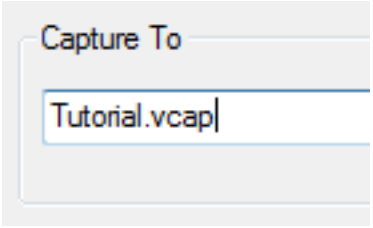


6. Set the file format as follows:

- Height: 1920
- Height: 1080
- Frame Rate: 29.97
- Frame Structure: No Interlace.
- Sample Format: CbYCrY (601–422)

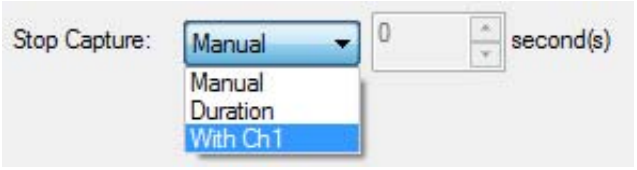


7. Specify the name of the file that the video should be captured to using the **Capture To** entry box. Use the **Browse** button to select a location from a dialog box. Set the capture file to F:\Tutorial and click **Save**. The file name appears in the **Capture To** box.



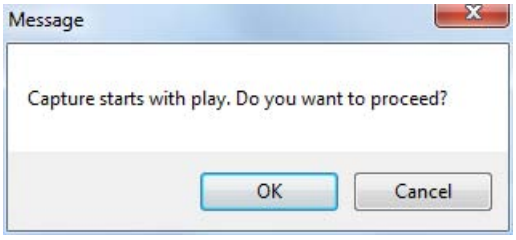
8. Set **Start Capture** to **With Ch1**.

9. Set **Stop Capture** to **With Ch1**.



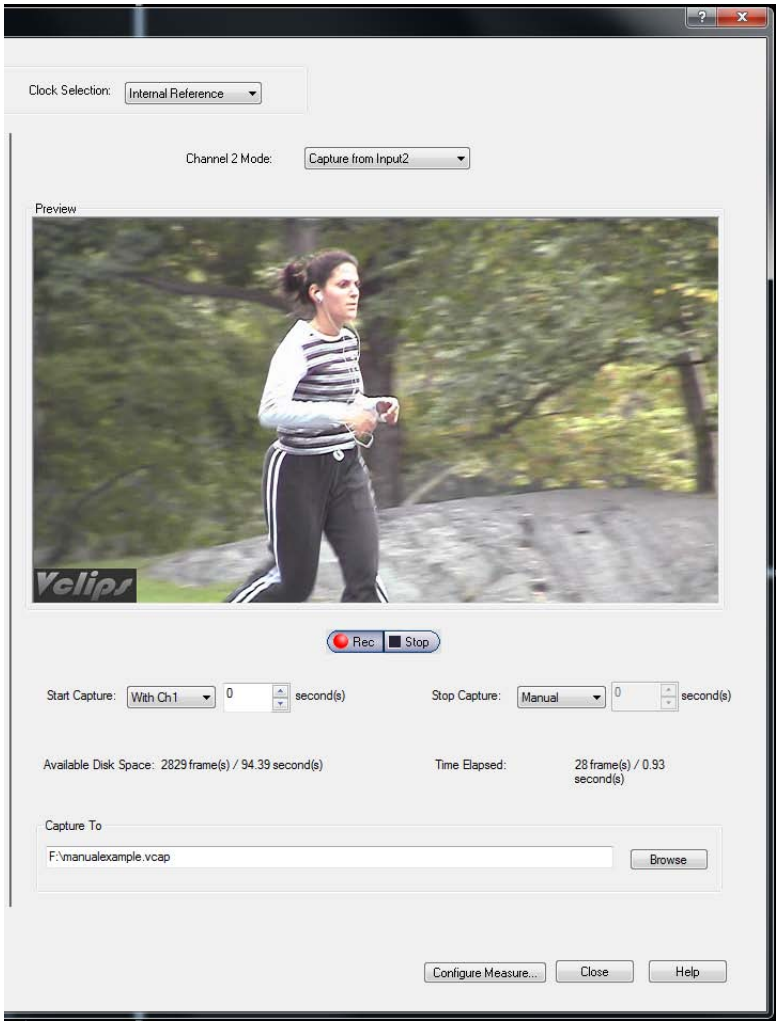
10. Click the play button to start generating a video signal and capturing the output of the device-under-test.

11. Because Start Capture is set to With Play, a dialog box will remind you that the instrument is set up to capture video when play begins. Click **OK** to continue.



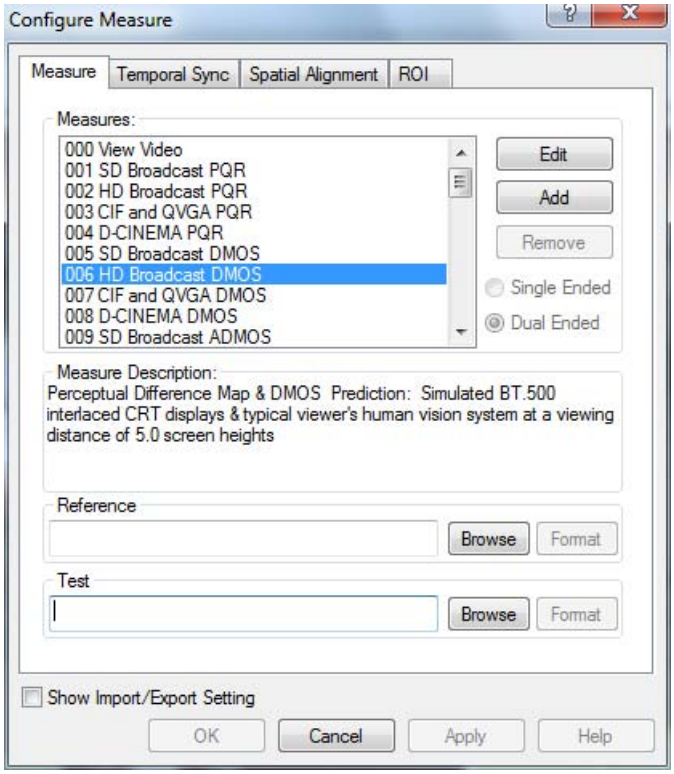
The figure at the right shows video capture in progress.

12. When the capture is completed, click **Close**.



13. Click the **Configure Measure** button at the bottom-right corner of the Simultaneous Generate and Capture window.

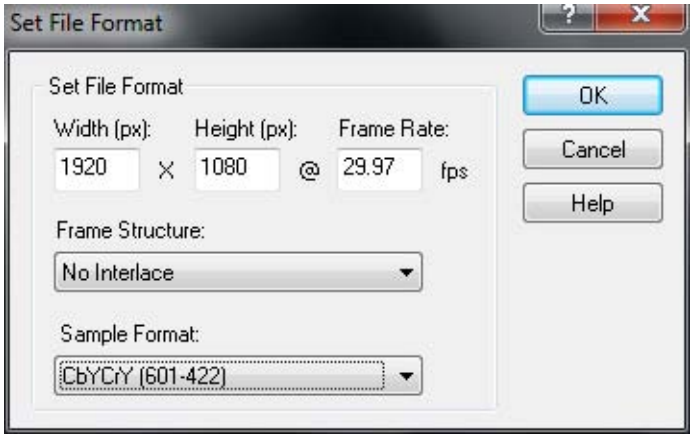
14. Select the **006 HD Broadcast DMOS** measure.



15. Click the Browse button for Reference and navigate to F:\Vclips\1920x1080. Select the file V031051_Stripy_jogger_1920x1080i_UYVY.yuv and click **Open**.

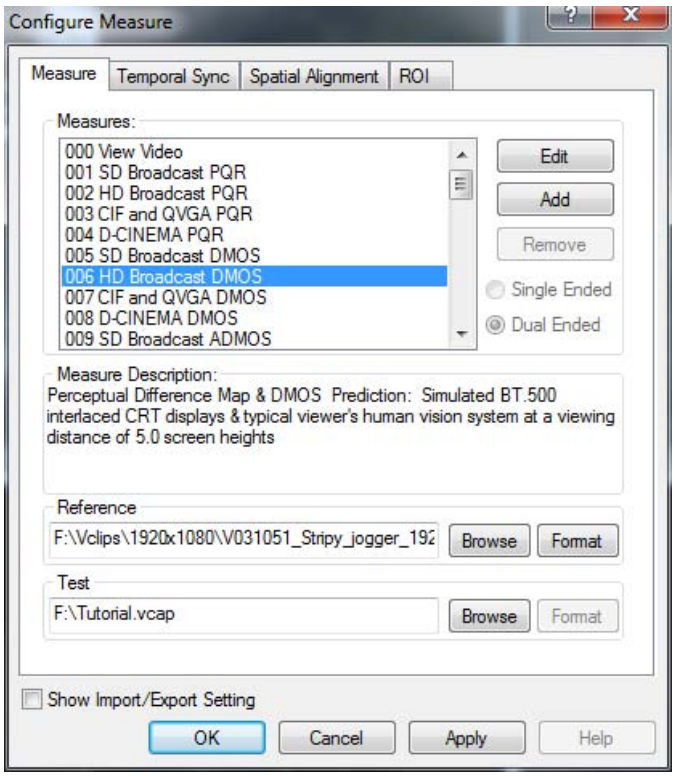
16. Set the file format as follows:

- Height: 1920
- Height: 1080
- Frame Rate: 29.97
- Frame Structure: No Interlace.
- Sample Format: CbYCrY (601–422)



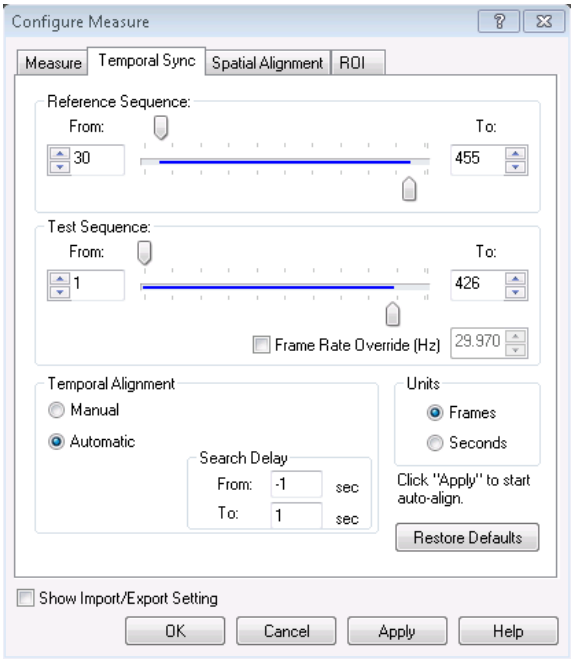
17. Click the **Browse** button for Test and navigate to F:\. Select the file **Tutorial.vcap** and click **Open**.

18. Click the **Temporal Sync** tab.

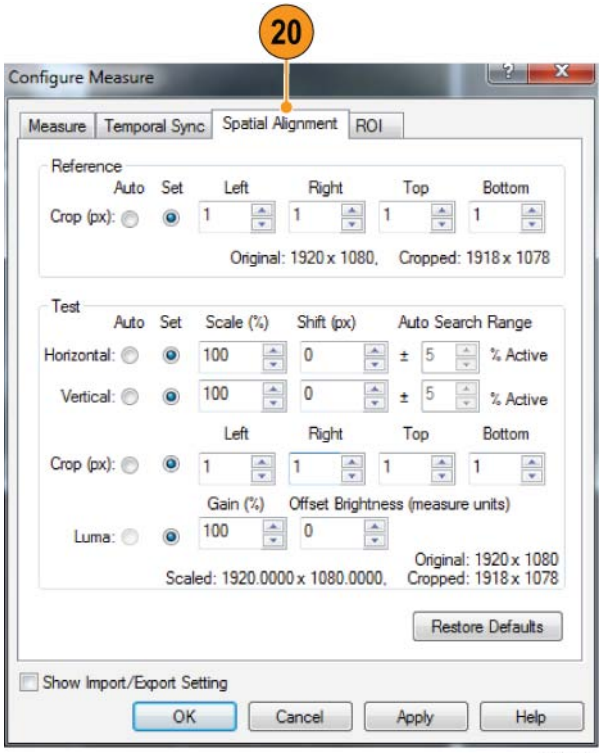


19. Click **Automatic** in the Temporal Alignment section, then click **Apply**.

Once you click Apply, the PQA600 attempts to align the video sequences automatically.

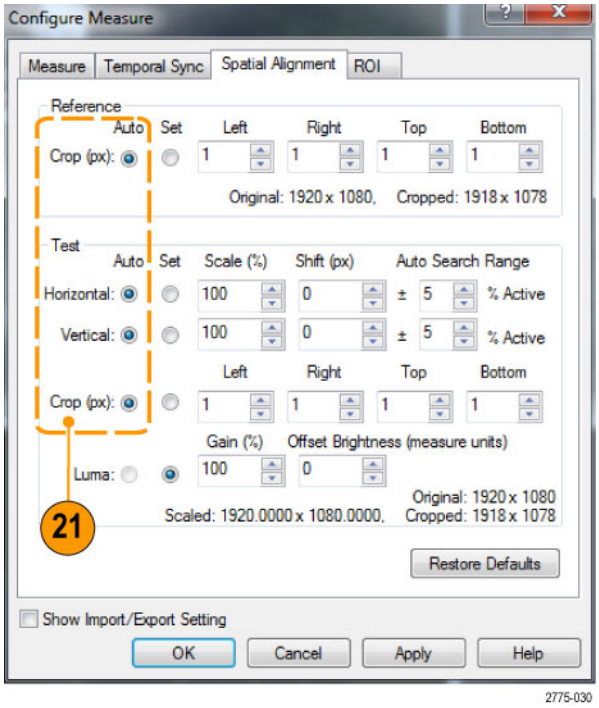


20. When the Temporal Alignment is complete, click the Spatial Alignment tab.



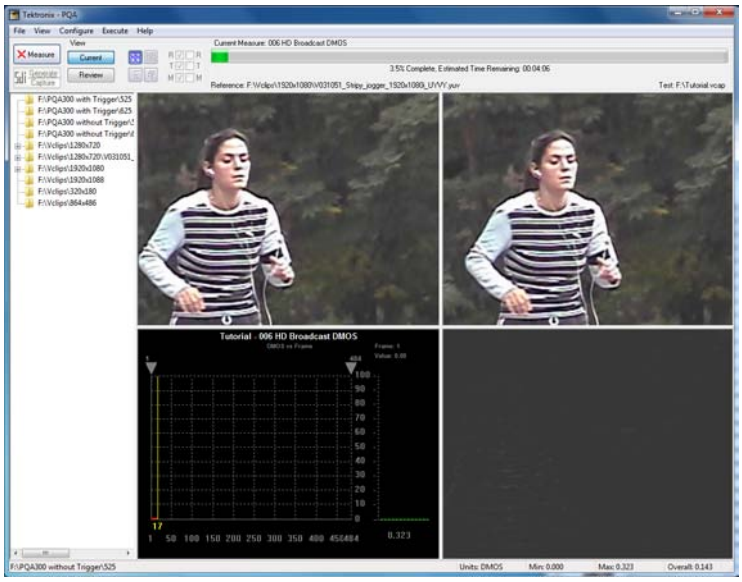
21. Select **Auto** on all parameters, Click **OK**.

22. Click **Measure**.



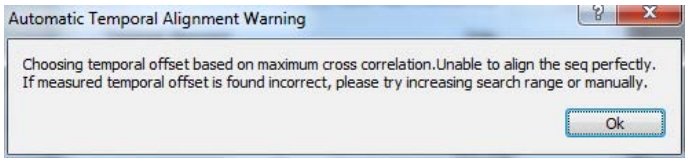
When the PQA600 first starts the measurement, it will first perform a spatial alignment if the settings are on Auto. While it does this, the panels in the Summary View will be black. The status of the alignment process is displayed in the status bar at the lower-left corner of the application window.

Once the alignment phase is complete, the measurement phase begins.



On occasion you might receive a Temporal Alignment Warning after the PQA600 attempts to align two video sequences.

This can occur for a number of reasons. A low correlation coefficient can occur because two sequences are out of the range of alignment, you are analyzing flat field sequences, or because of distortions in the test sequence.



If you receive this warning, you might be able to improve the correlation between the sequences by changing the temporal alignment settings (if the cause of the low correlation coefficient is poor alignment). For detailed information on adjusting the temporal alignment settings, see the *PQA600 Picture Quality Analysis System Measurement Technical Reference*, part number 071-2779-XX.

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