

**MTM400A, IPM400A, QAM400A, and RFM300
DTV Monitors
Technical Reference**



077-0175-04

Tektronix

MTM400A, IPM400A, QAM400A, and RFM300 DTV Monitors

Technical Reference

This document supports firmware version 4.6 and above.

Warning

The servicing instructions are for use by qualified personnel only. To avoid personal injury, do not perform any servicing unless you are qualified to do so. Refer to all safety summaries prior to performing service.

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077-0175-04

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[W9b – 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.

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.

Use Proper Fuse. Use only the fuse type and rating specified for this product.

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:



CAUTION
Refer to Manual



Protective Ground
(Earth) Terminal

Preface

This manual describes the MTM400A, IPM400A, QAM400A, and RFM300 DTV (Digital Television) Monitors, which provide a complete solution for transmission monitoring of MPEG transport streams over RF, IP, ASI and SMPTE interfaces. The monitors use a single transport stream processor platform packaged in a 1 RU rackmount chassis to provide monitoring of a transport stream at data rates up to 155 Mbps.

The information in this manual is applicable to firmware version 4.5 and later.

Related Products

MTM400A DTV Monitor

The MTM400A DTV Monitor provides a complete solution for multilayer, multichannel, remote monitoring to DVB, ATSC, DCII, and ISDB-T/Tb standards with content-checking support for MPEG-2 and H.264/AVC. Optional RF measurement interfaces provide a powerful and cost-effective solution for monitoring DVB-T transmitter sites or DVB-S/S2 uplinks and downlinks. An in-depth, real-time MPEG analysis option allows diagnostics to be performed on live broadcast signals without having to use deferred-time analysis of captured streams.

Refer to the *MTM400A DTV Monitor Quick Start User Manual*, Tektronix part number 071-2492-XX.

IPM400A DTV Monitor

The IPM400A DTV Monitor is powerful solution for remote monitoring of IP video national and regional headends. The IPM400A simultaneously verifies both IP and TS integrity on all IP Video flows (sessions) on a GbE link. It is ideal for monitoring networks which carry both Multi-Program Transport Streams (MPTS) or Single-Program Transport Streams (SPTS), at either constant bit rate (CBR) or variable bit rate (VBR). An in-depth, real-time MPEG analysis option allows diagnostics to be performed on live payload without having to use deferred-time analysis of captured streams.

Refer to the *IPM400A DTV Monitor Quick Start User Manual*, Tektronix part number 071-2698-XX.

QAM400A DTV Monitor

The QAM400A DTV Monitor provides a complete solution for remote real-time monitoring of cable broadcast signals. The comprehensive QAM RF and SI/PSI and PSIP confidence-monitoring capabilities provide a powerful and cost-effective solution for monitoring HFC (hybrid fibre-coaxial) cable headends. An in-depth, real-time MPEG analysis option allows diagnostics to be performed on live ATSC signals without having to use deferred-time analysis of captured streams.

Refer to the *QAM400A DTV Monitor Quick Start User Manual*, Tektronix part number 071-2784-XX.

RFM300 DTV Monitor

The RFM300 DTV Monitor provides a complete solution for remote real-time DTV monitoring of ATSC signals. The comprehensive 8VSB RF and PSIP confidence-monitoring capabilities provide a powerful and cost-effective solution for monitoring DTV transmitter sites, including contribution and distribution feeds at local and national operation centers for FCC compliance. An in-depth, real-time MPEG analysis option allows diagnostics to be performed on live ATSC signals without having to use deferred-time analysis of captured streams.

Refer to the *RFM300 DTV Monitor Quick Start User Manual*, Tektronix part number 071-2700-XX.

VQNet™ Element Management System

VQNet is a Tektronix Video Monitoring EMS that supports all Tektronix IP Video and DTV Monitor probe types to alert, locate and diagnose video network problems. It is a software product which will run on a server (not Tektronix supplied) to aggregate and report on the status of broadcast signals measured by up to 500 distributed probes across a video distribution network, providing alarms, logs, trending and reporting of key performance metrics.

For further information, refer to the *VQNet Quick Start User Manual*, Tektronix part number 071-2699-XX.

VQS1000 Video Quality Software

VQS1000 is a Video Quality Software application for single ended objective QoE analysis of video and audio content. It is designed for use with all current Tektronix IP Video and DTV Monitor probes using private backhaul video and audio. It can also be used standalone for file analysis. Combined with physical transport alarms from the Tektronix probes, operators can determine if the source of a problem is in the content (for example, over-compression) or in network distribution layers.

Refer to the *VQS1000 Video Quality Software Quick Start User Manual*, Tektronix part number 077-0489-XX.

Product Documentation

The following table lists the product documentation supporting the DTV monitors.

Table i: Product documentation

Item (Tektronix part number)	Purpose	Location
MTM400A DTV Monitor Quick Start User Manual (071-2492-XX English, 071-2493-XX Japanese, 071-2632-XX, German)	Provides installation and high-level operational overviews	 +  +  www.Tektronix.com
IPM400A DTV Monitor Quick Start User Manual (071-2698-XX English)	Provides installation and high-level operational overviews	 +  +  www.Tektronix.com
RFM300 DTV Monitor Quick Start User Manual (071-2700-XX English)	Provides installation and high-level operational overviews	 +  +  www.Tektronix.com
QAM400A DTV Monitor Quick Start User Manual (071-2784-XX English)	Provides installation and high-level operational overviews	 +  +  www.Tektronix.com
MTM400A, IPM400A, QAM400A, and RFM300 DTV Monitor Read This First (071-2654-XX)	Describes late breaking product information and operational issues	 +  www.Tektronix.com
MTM400A, IPM400A, QAM400A, and RFM300 DTV Monitor Technical Reference (077-0175-XX)	Provides in-depth operating information (this manual)	 +  www.Tektronix.com
MTM400A, IPM400A, QAM400A, and RFM300 DTV Monitor Specifications and Performance Verification Technical Reference (077-0176-XX)	Provides complete product specifications and a procedure for verifying the operation of the instrument	 +  www.Tektronix.com
MTM400 and MTM400A RUI v3.x Upgrade Technical Reference (077-0174-XX)	Describes the remote user interface (RUI) changes introduced with the MTM400A monitor	 www.Tektronix.com
MTM400A, IPM400A, QAM400A, and RFM300 DTV Monitor Test Parameter and Configuration File Technical Reference (077-0177-XX)	Provides information about using test parameters and configuration files	 www.Tektronix.com
MTM400A, IPM400A, QAM400A, and RFM300 DTV Monitor Programmer Manual (077-0178-XX)	Provides information about remote command syntax	 www.Tektronix.com

Table i: Product documentation (cont.)

Item (Tektronix part number)	Purpose	Location
MTM400A, IPM400A, QAM400A, and RFM300 DTV Monitor Declassification and Security Instructions (077-0179-XX)	Provides instructions for removing your proprietary information from the instrument	 www.Tektronix.com
MTM4UP Upgrade Instructions (075-0973-XX)	Provides instructions for installing software and hardware upgrades in the MTM400A	 +  www.Tektronix.com
IPM4UP Upgrade Instructions (075-0997-XX)	Provides instructions for installing software and hardware upgrades in the IPM400A	 +  www.Tektronix.com
RFM3UP Upgrade Instructions (075-0993-XX)	Provides instructions for installing software and hardware upgrades in the RFM300	 +  www.Tektronix.com
QAM4UP Upgrade Instructions (075-1012-XX)	Provides instructions for installing software and hardware upgrades in the QAM400A	 +  www.Tektronix.com

Remote User Interface Overview

Remote User Interface Overview

The DTV monitors are single-stream, extended-confidence, MPEG-2 protocol, monitoring devices. They are used to monitor a single transport stream in MPEG-2, DVB, ISDB and ATSC environments. DTV monitors must be operated in a standard equipment rack.

The basic DTV monitor provides confidence monitoring by making key measurements and comparing them with preset parameters; inconsistencies can be reported as varying levels of error. Integrated flexibility allows the software to be upgraded with diagnostic capabilities and to supply detailed information to enable fault identification and analysis. Unencrypted MPEG-2 video content can be monitored using the thumbnail feature.

The user interface is accessed through a Remote User Interface (RUI). The RUI allows the status of the DTV monitor to be determined from anywhere in the world and provides remote control of the measurements and configuration to the administrator. The RUI is accessed through Microsoft Internet Explorer (Version 6 SP 1 minimum).

Table 1-1: DTV Monitor interface options

Interface	MTM400A	IPM400A	RFM300	QAM400A
ASI (Asynchronous Serial Interface)	Standard	Standard	Standard	Standard
SMPTE 310M	Standard	Standard	Standard	Standard
QAM Annex A (Quadrature Amplitude Modulation)	Optional	–	–	Optional
QAM Annex B	Optional	–	–	Optional
QAM Annex C	Optional	–	–	Optional
COFDM (Coded Orthogonal Frequency Division Modulation)	Optional	–	–	–
QPSK (Quadrature Phase Shift Keying)	Optional	–	–	–
8PSK (Eight Level Phase Shift Keying)	Optional	–	–	–

Table 1-1: DTV Monitor interface options (cont.)

Interface	MTM400A	IPM400A	RFM300	QAM400A
8VSB (Eight level Vestigial Side Band)	Optional	-	Standard	-
DVB-S2	Optional	-	-	-
IP Video Gigabit Ethernet	Optional	Standard	-	-

RUI Components

The following figure shows the main components of the RUI. They are described in the following paragraphs.

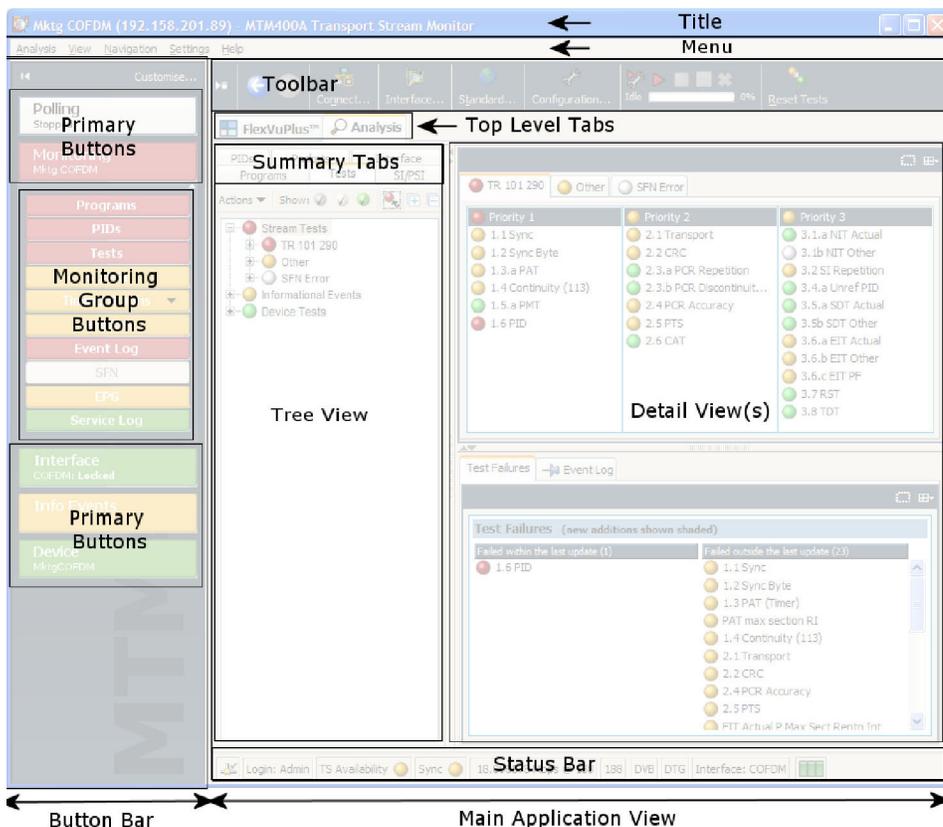


Figure 1-1: RUI components

Title Bar The title bar shows the stream name (defined in the Stream Configuration view), the IP address of the connected DTV monitor, and the product title, for example the MTM400A Transport Stream Monitor.

Menu Bar The menu bar provides access to a selection of major system options using drop-down menus. (See Table 1-2.)

Table 1-2: Menu options

Menu name	Command	Shortcut keys	Function
Analysis	Connect...	Alt + N	Connect to new DTV monitor.
	Exit	Alt + F4	Closes the remote user interface window and terminates the connection with the DTV monitor.
View	Show Main Window	-	Shows/hides the main window.
	Show Button Bar	-	Shows/hides the button bar.
	Show Toolbar	-	Shows/hides the toolbar.
	Show Status Bar	-	Shows/hides the status bar.
	Tear-Offs ►	-	Provides selection and control of tear-off windows.
Navigation	Back / Forward	Alt + Left / Alt + Right	Allows navigation backward and forward through view history.
	<i>FlexVuPlus</i>	-	Opens the <i>FlexVuPlus</i> display.
	Select Tree ►	-	Opens Analysis windows:
		1 Programs tree	Ctrl + 1
		2 Tests tree	Ctrl + 2
		3 SI/PSI tree	Ctrl + 3
		4 PIDs tree	Ctrl + 4
	5 Packets tree	Ctrl + 5	
	6 Interface tree	Ctrl + 6	
Settings	Configuration...	Alt + C	Opens the Configuration dialog box.
	Interface...	Alt + I	Opens the Interface Configuration dialog box.
	Standard...	Alt + T	Opens the DTV Standards Selection dialog box.
Help	About...	-	Displays application and system information.

Toolbar The toolbar controls are described and shown in the following figure. (See Table 1-3.)



Figure 1-2: Toolbar controls

Table 1-3: Toolbar controls

Item	Control name	Description
1	Hide/Show button bar	Hide or show the button bar.
2	Previous/Next	Move to the previous/next view in the viewing history.
3	Connect	Opens the Connect to MTM Device dialog box that you can use to reconnect to the current DTV monitor or to connect to a different DTV monitor (see the DTV Monitor Quick Start User Manual).
4	Interface	Opens the Interface dialog box. (See page 3-35.) You can set up the RF or IP interface.
5	Standard	Opens the Standard Selection dialog box. You can select the DTV standard and region: MPEG, DVB, ATSC, ISDB, Chinese, and DigiCipherII.
6	Configuration	Opens the Configuration dialog box. (See page 3-1.) You can configure stream and device functions.
7	Recording controls	Opens the Recording Settings dialog box. You can set up and initiate stream recording (See page 3-4.)
8	Reset Tests	Resets all tests, including Stream, Device, and Interface tests and Informational warnings.

- Button Bar** The button bar provides basic monitoring and shortcuts to the views in the application window. (See Figure 1-1.) (See Figure 1-3.) The buttons are divided into the following two groups:
- Primary buttons. The primary buttons include Polling, Monitoring, Interface, Info Events, and Device.
 - Monitoring buttons. All of the buttons associated with monitoring are grouped under the Monitoring primary button. You can hide or show the monitoring buttons by clicking on the ▲ or ▼ symbols.

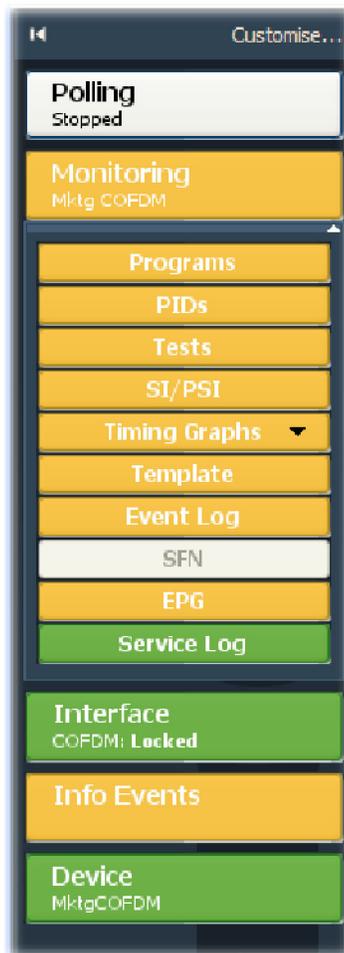


Figure 1-3: Button bar

Customizing the Button Bar. To customize the button bar for your monitoring requirements, select **Customize** from the top of the button bar or from the button bar context menu to open the Customize Button Bar dialog box (See Figure 1-4.)

The Device and Monitoring buttons are always shown. Other buttons can be permanently shown, permanently hidden, or automatically hidden when the function or feature is not available. Select the option from the drop-down list that is available when the button name is highlighted.

You can change the position of buttons in the Monitoring group by highlighting the button name and using the Move Up and Move Down buttons.

You can customize the display to show or hide the button bar depending on your monitoring needs. (See page 1-7.)

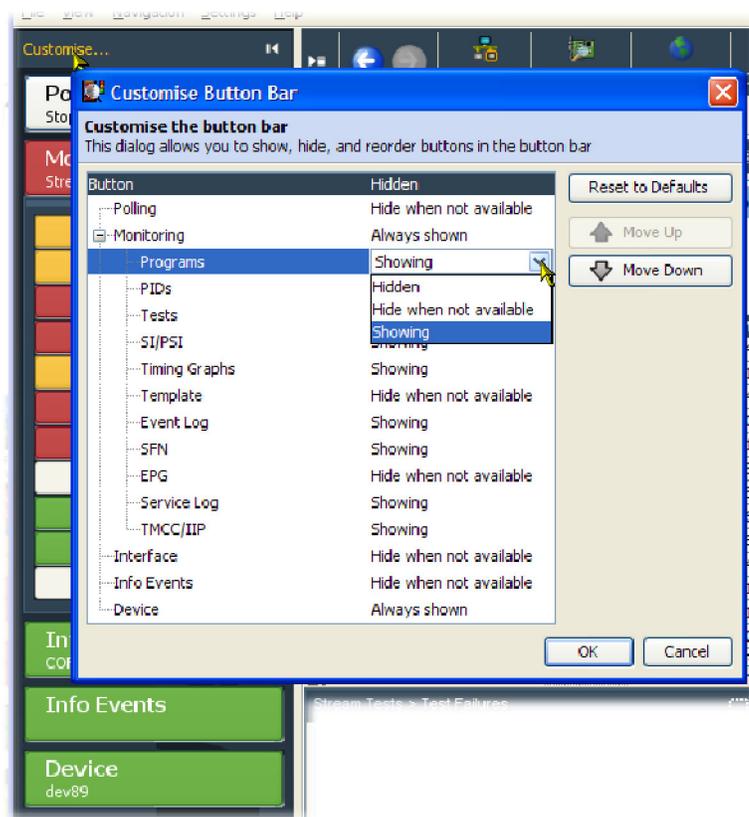
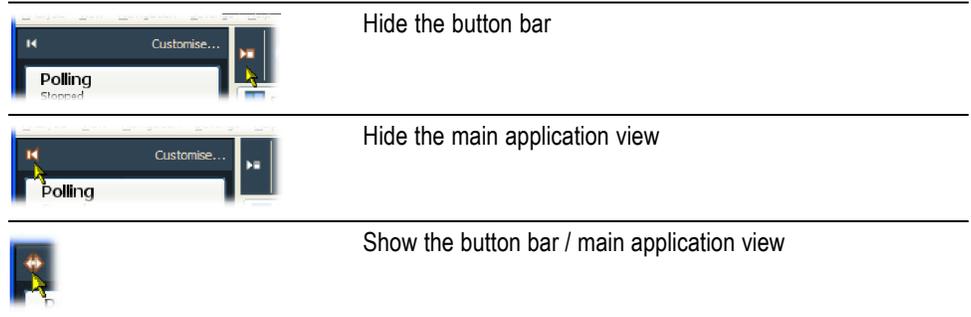


Figure 1-4: Customize Button Bar dialog box

Showing / Hiding the Button Bar and the Main Application View. By clicking on the appropriate button, you can hide the button bar, leaving only the main application window displayed, or you can hide the main application window, leaving only the button bar displayed.



Main Application View

The main application view contains the following display elements: (See Figure 1-1 on page 1-2.)

- Top-level tabs. The top-level tabs provide access to the *FlexVuPlus* display and the following Analysis views:
 - Programs view
 - Tests view
 - SI/PSI (Tables) view
 - PIDs view
 - Packets view
- Interface view (where an interface card is installed)
- Summary tabs. The Summary tabs provide access to the individual analysis views, which include the tree views and the detail views.
- Tree view. Each analysis view includes a tree view. This is a hierarchical view of the related analysis information.
- Detail view(s). The detail views vary depending on which node is highlighted in the tree view. Detail views include summary views, error logs, and thumbnail views.

Horizontal and Vertical Panel Slides. Using the horizontal and vertical panel controls, you can cause a single pane in the main application window to expand horizontally or vertically. (See Figure 1-5.) The controls are displayed on the divider bars that are between views and panels. The RUI window size and panel boundaries can be dragged in the conventional Windows manner to resize them.

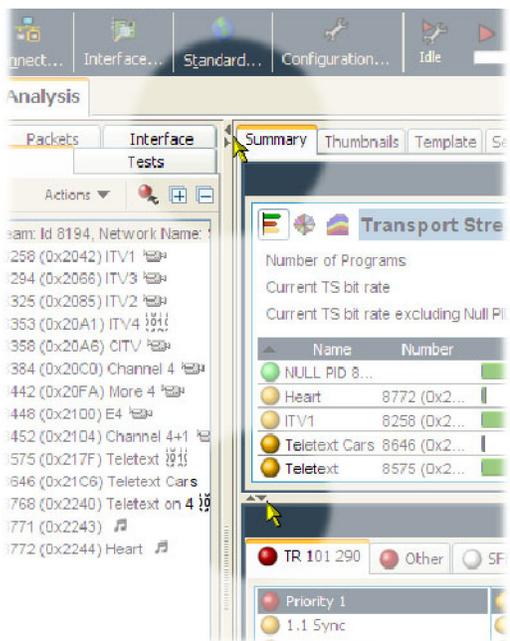


Figure 1-5: Panel slide controls

Tear-off Function. Click the tear-off icon to display a view in a window separate from the main application view. (See Figure 1-6.)

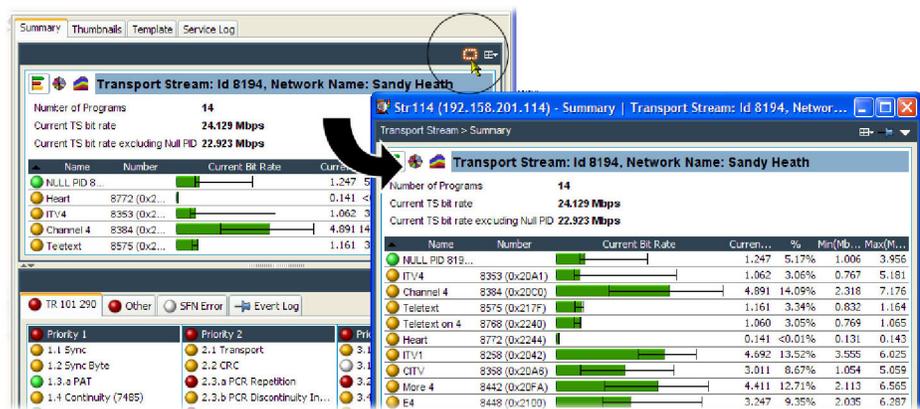


Figure 1-6: Tear-off view

Status Bar The Status bar messages are described and shown in the following figure. (See Table 1-4.)

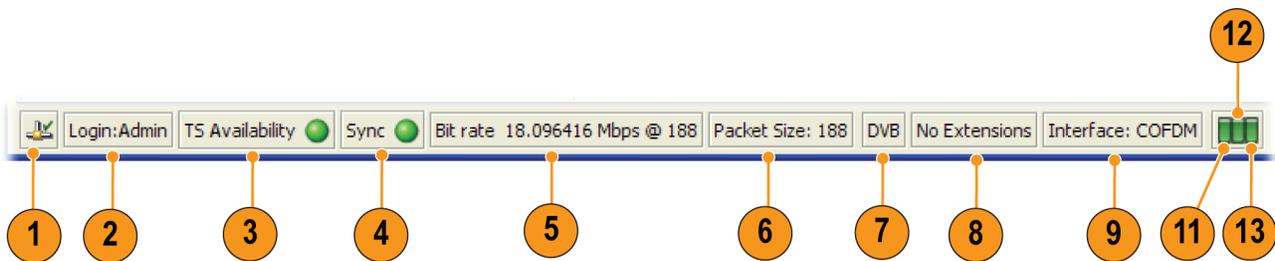


Figure 1-7: Status bar

Table 1-4: Status bar controls

Item	Icon function	Description
1	Connectivity	Shows the status of the network connection with the DTV monitor. If the network connection has failed, a red cross is superimposed on the icon.
2	Login	Shows the user name currently logged in: Administrator or User. (See page 3-23.)
3	TS availability	Indicates that either the stream bit rate has fallen below the minimum value or that synchronization has been lost (see item 4 in this table, <i>Sync</i>). The minimum stream bit rate is set using the "Min stream bit rate for processing" parameter. (See page 3-8, <i>Test Parameters</i> .)
4	Sync	Shows the status of the MPEG sync loss test. Loss of sync during analysis of a stream may mean that analysis of the complete stream was not possible.
5	Bit rate	Total bit rate of the transport stream.
6	Packet size	Packets in a stream can be either 188 or 204 bytes long. This is detected automatically.
7	Stream interpretation, base standard	This is the set of tests that is being used to analyze the stream.
8	Stream interpretation, region	This subset of tests modifies the base standard; it may add tests or modify existing ones.
9	Physical interface	The current interface for real-time analysis.
10	Partial reception	(Not shown - available only for ISDB-T streams.) This icon indicates the presence of partial reception data in the stream. The colors indicate the status as follows: <ul style="list-style-type: none"> ■ Gray: Partial reception availability is unknown ■ Green: Partial reception data is available ■ Gray + red cross: Partial reception data is not available
11	Processing status, Strained	Shows the "strained" processing status; that is whether throttling is being applied to cut down on the information being processed. ¹
12	Processing status, Overwhelmed	Shows the "overwhelmed" processor status; that is whether the processing engine is able to cope with the amount of information in the stream even after throttling. ¹

Table 1-4: Status bar controls (cont.)

Item	Icon function	Description
13	Processing status, SI throttle	Shows the SI throttle status; that is whether the processing engine is able to cope with the amount of SI tables in the stream, in particular EPG information, even after throttling. ¹
14	Stream learning mode	(Not shown) Shows that the stream learning mode is enabled. (See page 3-1, <i>Stream Configuration</i> .)

¹ Processing status colors:
 Green: OK
 Amber: Processing was strained/overwhelmed but is currently OK
 Red: Processing is currently strained/overwhelmed
 White: Processor state is unknown
 Gray: Test disabled

Context Menus Context menus (or right-click menus) are available throughout the DTV monitor RUI. The menu options are context sensitive. (See page 4-20, *Context Menus*.)

Tooltips Extensive tooltips are available. Hover the pointer over the button or item with which you need help.

Dialog Box Commands Command buttons in dialog boxes operate as follows:

- OK. Implements any changes made in the dialog box and closes the box.
- Apply. Applies any changes made in the dialog box, but does not close it.
- Cancel. Discards any changes made in the dialog box, but not already applied, and closes the box.

Navigation In addition to the Previous/Next controls in the toolbar, the *FlexVuPlus* and tear-off views display a breadcrumb trail to indicate their relative location in the RUI structure immediately beneath the title bar. (See Figure 1-2 on page 1-4.)(See Figure 1-8.) Click on an element of the breadcrumb trail to open the corresponding Analysis view.

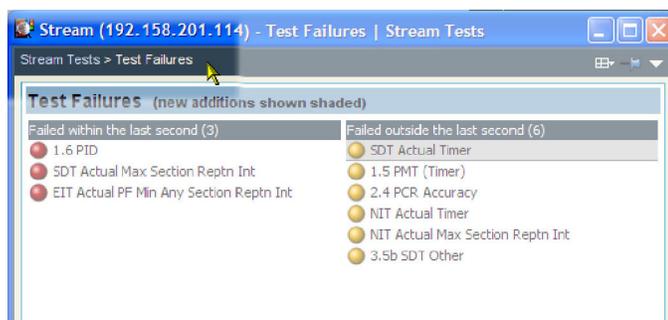


Figure 1-8: Breadcrumb trail

FlexVuPlus Display

The *FlexVuPlus* display enables the instrument to perform like a four-in-one monitor on a single incoming stream. (See Figure 1-9.) The display allows you to select up to four concurrent views of a monitored stream and provides the ability to configure each of the four views independently. Each of the *FlexVuPlus* views is selected from views available under the Analysis tab.

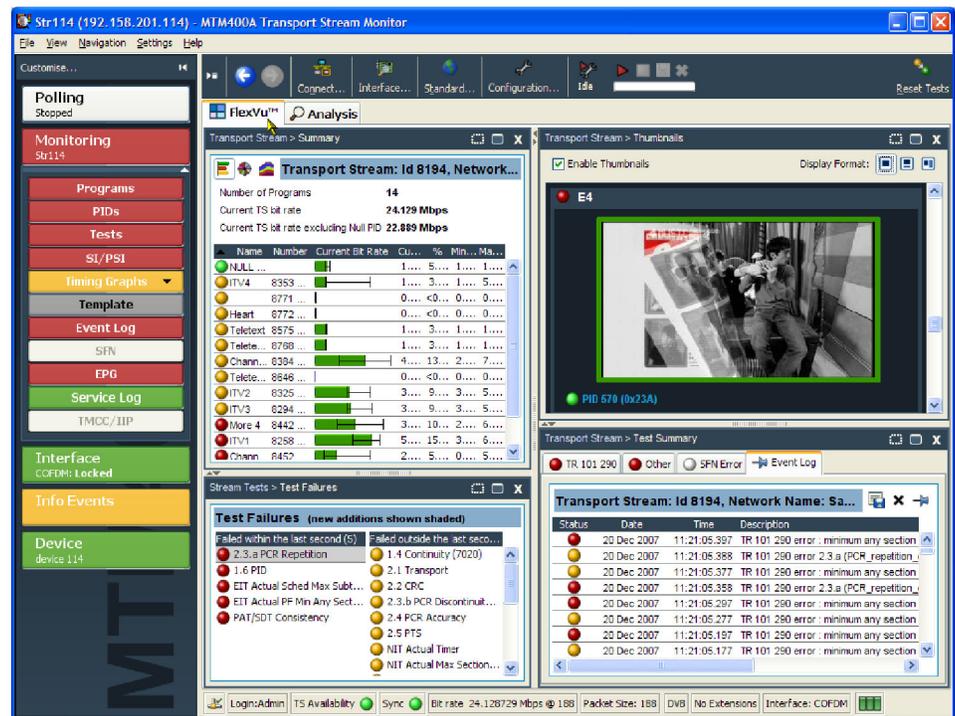


Figure 1-9: *FlexVuPlus* display

FlexVuPlus Display Selection

The *FlexViewPlus* select icon appears in the top-right corner of many main application detail views. (See Figure 1-10.) Use this icon to select views for simultaneous display in the *FlexVuPlus* window. When you click the icon, you can then select the *FlexVuPlus* panel in which the view will be displayed.

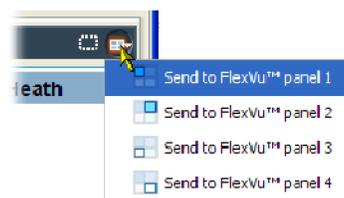


Figure 1-10: *FlexVuPlus* select icon

Analysis Views

Analysis Views

The analysis views provide a single main program summary window with different context sensitive views contained within tabbed frames. This view is intended to provide the maximum amount of useful information while keeping the screen from appearing cluttered. From the Analysis view window, you can access the following views:

- Programs
- Tests
- SI/PSI (Tables)
- PID
- Packets
- Interface

These views are described on the following pages.

Programs View

The Programs view is displayed when the Analysis > Programs tab is selected. The tree view initially displays the top node of the program tree, which represents the monitored stream from a program perspective.

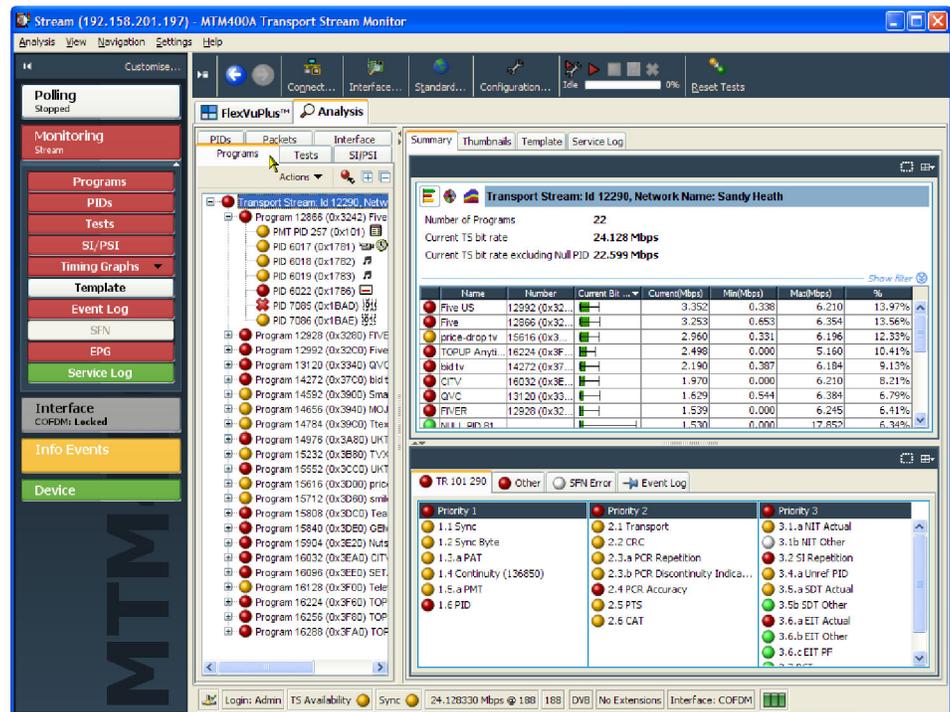


Figure 2-1: Analysis - Programs view

The detail view shows details of the node highlighted in the navigation view.

With the tree expanded, the navigation view shows the content of the stream. (See Figure 2-1.) The tree view consists of the transport stream, program, and elementary stream nodes (PIDs). The transport stream carries a number of programs and each program carries a number of elementary streams. Elementary streams are carried in packets that are identified by packets identifiers (PIDs).

Each node in the programs tree view displays a different range of detail views as in the following table.

Table 2-1: Programs view nodes

Detail tab	Transport stream node	Program node	Elementary stream node
Summary	✓	✓	-
Thumbnails	✓	✓	-
Template	✓	-	-
Event Log	✓	✓	✓
Service Log	✓	-	-
Test errors (TR 101 290; A78; other)	✓	-	-
Other errors	✓	-	-
SFN errors	✓	-	-
Program Tests	-	✓	-
Associated Tests	-	-	✓
Timing Graphs	-	-	✓
TMCC/IIP	✓	-	-

Error Location

Clicking the Next Error button  will highlight the next red LED in the current view. Only the lowest level nodes will be considered and highlighted in the search because the parent nodes simply reflect the state of the lowest level nodes.

Transport Stream Node

The transport stream node represents the entire transport stream in terms of the programs that it contains. The adjacent LED icon represents the status of the entire transport stream; any status error in the stream will be represented by this LED. When this node is selected, the detail view displays the transport stream summary.

The associated detail view provides a program-oriented overview of the transport stream, allowing you to see the relative data rates of all of the programs contained within the transport. A summary of the overall stream is also displayed. The information can be displayed as a bar chart, a pie chart, or a historical multiplex graph. (See page 4-5.)

The data rate of a program is the cumulative data rate of all the PIDs that are associated with that particular program, including PCR and ECM PIDs.

NOTE. *Components can be shared between programs, so the overall data rate of all of the programs can appear to be greater than the total data rate of the transport stream as shown in the status bar.*

Test Status Views

The lower detail view shows you a summary of the states of all the associated tests and an event log for the entire transport stream (an unfiltered event log). The available test tabs vary, depending on which interpretation standard you choose. For example, with the DVB interpretation standard, the available tabs are TR 101 209 and Other. Other interpretation standards will generate different tabs and different sets of tests. (See page 2-27, *SI/PSI (Tables) View*.)

You can use the context (right-click) menus to reset and disable tests to set alarms, recording triggers points, and to jump to associated tests.

Event Log

The Event Log displays the log entries for the whole transport stream. A detailed description of event log management is provided. (See page 4-1, *Event Log*.)

Thumbnails

This screen displays thumbnail views of the video channels being monitored.

Three modes of thumbnail display are available: Thumbnails only, Brief Details, and Full Summary. The Thumbnails only view provides a video view of each channel, including its service name and PID. The Brief Details and Full Summary views provide progressively more detailed information about each video channel. Selecting the thumbnail viewing size from the context menu affects all thumbnails.

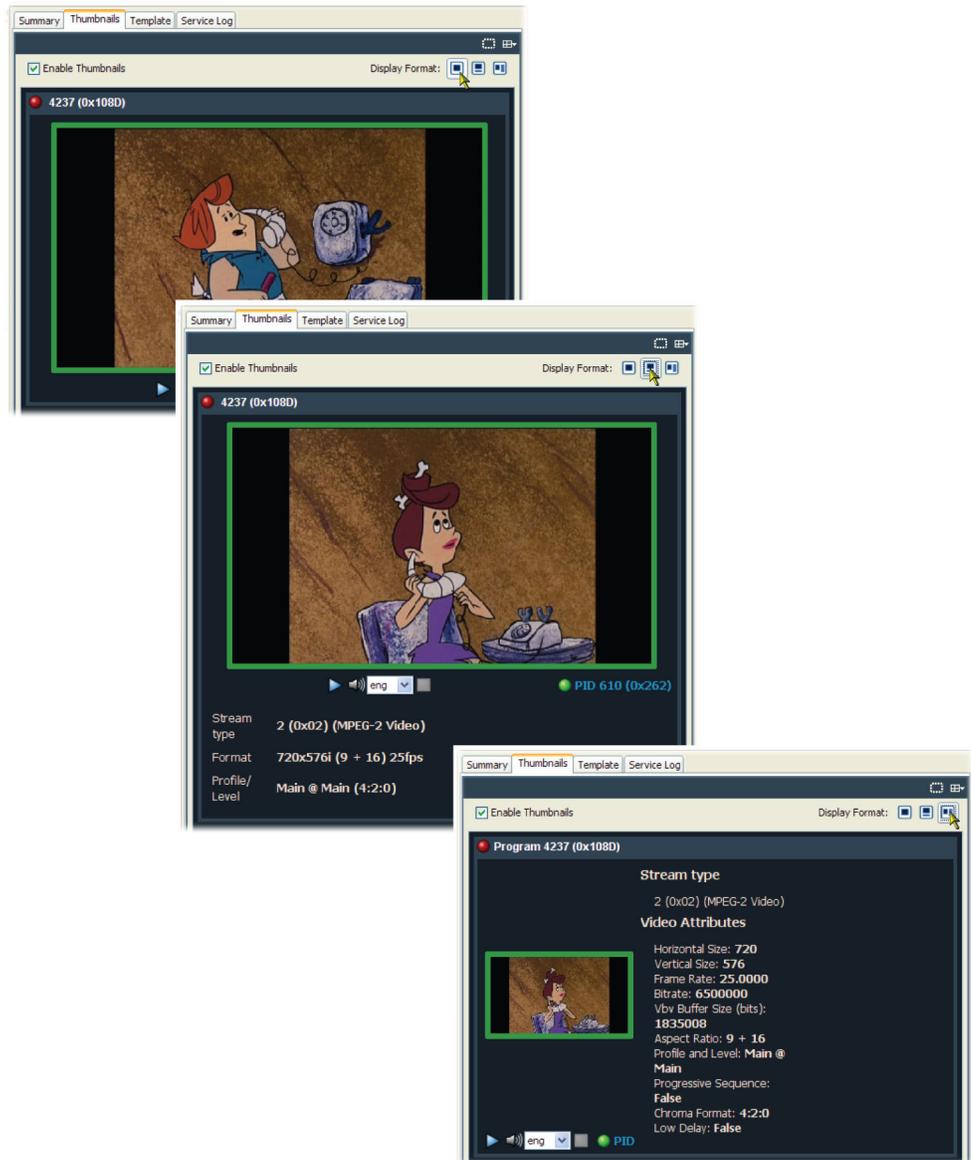


Figure 2-2: Thumbnail display

If the video channels being monitored are scrambled or undecodable, one of the following icons will be displayed:

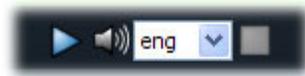
The following icons are used to indicate the state of thumbnails:

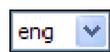
-  (Red) Error or no thumbnail
-  (Red, with padlock) Video - Scrambled
-  (Blue) Non-video / non-audio
-  (Blue) Audio
-  (Gray) Stream processing strained

The color of the thumbnail frame reflects the status of the PID carrying the displayed elementary stream. To view the PID in the PIDs view, either select the quick link from the context menu or double-click the thumbnail frame.

Video and Audio Backhaul

By streaming video and audio content, backhaul allows program content to be checked and verified. The backhaul control bar contains the following controls:



-  Start streaming video and audio content to the configured decoder.
-  Start streaming audio content to the configured decoder.
-  Select the audio content to be streamed. The available audio content will vary from stream to stream.
-  Stop the current streaming session.

Refer to the decode set up to configure the decoder to be used by backhaul. (See page 3-33.)

Template Monitoring the syntax of a transport stream according to the selected DTV standard (for example, TR 101 290) is not enough to guarantee that the correct information is being delivered to the viewers' receiver. Ensuring that the contents of the transport stream are correct requires the monitoring equipment to have prior knowledge of what the broadcaster plans to transmit. A template in which the operator enters the values expected to be present in a transport stream can be compared with a transport stream to verify its content, and made to indicate any discrepancy.

The composition of a transport stream may vary during the day as daytime programming is replaced by the evening primetime and then the late night programs. You can schedule template changes to coincide with changes in the program content.

Among the items that can be checked using a template are the following:

- Transport stream identifier
- Services - presence, name
- PIDs in services
- PID types and scrambling state
- Service regional ratings

The template feature allows you to create a template that can be applied to a stream (or streams) that is being monitored. If the stream does not conform to the template, the associated icon changes color (in the same way as the error icons) and an entry is made in the error log.

Initially, templates are stream specific; a template will be created and applied to a specific stream. However, a template can subsequently be uploaded to any device.

The presence of service 8258 in the transport stream is being checked. (See Figure 2-3.) In addition, details of the service and associated PIDs are checked.

Template	State	Expected Value	Actual Value
Services	●		null
Service 8258	●		null
Constraint	●	Present	Present
Service Type	●	1	1
Service Name	●	ITV1	ITV1
PCR PID	●	520	520
Other PIDs Allowed	●	0	0
PIDs	●		null
PID 520	●		null
Constraint	●	Present	Present
Stream Type	●	2	2
Conditional Access	●	0	0
Is PID Scrambled	●	0	0
PID 521	●		null
Constraint	●	Present	Present
Stream Type	●	3	3
Conditional Access	●	0	0
Is PID Scrambled	●	0	0
PID 522	●		null
Constraint	●	Present	Present
Stream Type	●	3	3
Conditional Access	●	0	0
Is PID Scrambled	●	0	0
PID 523	●		null
Constraint	●	Present	Present
Stream Type	●	6	6

Figure 2-3: Template view

The device and stream identities are shown in the title bar. The template currently in use is shown in the field at the top of the screen.

- The first column shows, in hierarchical and graphical form, the categories of template elements to be applied. Each category can be expanded by clicking the folder icon. (See page 2-11, *Template Manipulation*.)
- If the element conforms to the template setting, the State icon will be green. Failure to conform is indicated by a red icon. If any elements fail to conform, the Template button in the button bar will also be red.
- The Expected Value is the value provided in the template configuration file.
- The Actual Value is reported.

The template content is supplied in XML format as part of the configuration file. The template lists data whose presence and content is to be checked in the transport stream. The State icons indicate that an element listed in the template has conformed to the requirement.

The following template section of a configuration file resulted with the display. (See Figure 2-3.)

```

<?xml version = "1.0" encoding = "UTF-8" standalone = "yes"?>
<MTM400Configuration Name="AutoTemplate" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:noNamespaceSchemaLocation="config.xsd">
  <Streams>
    <Stream Number="1">
      <!-- This parameter contains a strict template for the current stream -->
      <PS56>
        <!-- Delete this entry if you do not wish to check the Transport ID -->
        <TransportStreamId>8194</TransportStreamId>
        <!-- Delete this entry if you do not wish to check the Network ID -->
        <NetworkId>12290</NetworkId>
        <!-- Delete this entry if you do not wish to check the Original Network ID -->
        <OriginalNetworkId>9018</OriginalNetworkId>
        <!-- Change to 1 to allow other services -->
        <OtherServicesAllowed>0</OtherServicesAllowed>
        <!-- The absolute attribute makes this set of services remove any existing tests -->
        <ServiceList Update="Absolute">
          <!-- The service ID is used as the key to tests -->
          <Service Number="8258">
            <!-- 0 says that this service must be present, 1 would make it optional, 2 would make it an error -->
            <Constraint>0</Constraint>
            <!-- The service type indicates radio, television etc. -->
            <ServiceType>1</ServiceType>
            <!-- The service name the user sees -->
            <ServiceName>ITV1</ServiceName>
            <PCRPID>520</PCRPID>
            <!-- Set to 1 is you wish to allow occasional PIDs to be added to this service -->
            <OtherPIDsAllowed>0</OtherPIDsAllowed>
            <PIDList Update="Absolute">
              <PID Number="520">
                <!-- 0 says that this service must be present, 1 would make it optional, 2 would make it an error -->
                <Constraint>0</Constraint>
                <StreamType>2</StreamType>
                <CADescriptorPresent>>false</CADescriptorPresent>
                <IsScrambled>>false</IsScrambled>
              </PID>
              <PID Number="521">
                <!-- 0 says that this service must be present, 1 would make it optional, 2 would make it an error -->
                <Constraint>0</Constraint>
                <StreamType>3</StreamType>
                <CADescriptorPresent>>false</CADescriptorPresent>
                <IsScrambled>>false</IsScrambled>
              </PID>
              <PID Number="522">
                <!-- 0 says that this service must be present, 1 would make it optional, 2 would make it an error -->
                <Constraint>0</Constraint>
                <StreamType>3</StreamType>
                <CADescriptorPresent>>false</CADescriptorPresent>
                <IsScrambled>>false</IsScrambled>
              </PID>
              <PID Number="523">
                <!-- 0 says that this service must be present, 1 would make it optional, 2 would make it an error -->
                <Constraint>0</Constraint>
                <StreamType>6</StreamType>
                <CADescriptorPresent>>false</CADescriptorPresent>
                <IsScrambled>>false</IsScrambled>
              </PID>
              <PID Number="2000">
                <!-- 0 says that this service must be present, 1 would make it optional, 2 would make it an error -->
                <Constraint>0</Constraint>
                <StreamType>11</StreamType>
                <CADescriptorPresent>>false</CADescriptorPresent>
                <IsScrambled>>false</IsScrambled>
              </PID>
              <PID Number="2001">
                <!-- 0 says that this service must be present, 1 would make it optional, 2 would make it an error -->
                <Constraint>0</Constraint>
                <StreamType>11</StreamType>
                <CADescriptorPresent>>false</CADescriptorPresent>
                <IsScrambled>>false</IsScrambled>
              </PID>
              <PID Number="2201">
                <!-- 0 says that this service must be present, 1 would make it optional, 2 would make it an error -->
                <Constraint>0</Constraint>
                <StreamType>11</StreamType>
                <CADescriptorPresent>>false</CADescriptorPresent>
                <IsScrambled>>false</IsScrambled>
              </PID>
              <PID Number="2202">
                <!-- 0 says that this service must be present, 1 would make it optional, 2 would make it an error -->
                <Constraint>0</Constraint>
                <StreamType>11</StreamType>
                <CADescriptorPresent>>false</CADescriptorPresent>
                <IsScrambled>>false</IsScrambled>
              </PID>
            </PIDList>
          </Service>
        </ServiceList>
      </PS56>
    </Stream>
  </Streams>
</MTM400Configuration>

```

Template Manipulation. The categories of template elements are interpreted in a tree format, the branches of which can be expanded and contracted if the file is viewed in an XML editor or Microsoft Internet Explorer.

Each category title is accompanied by a folder icon. Clicking a folder will expand that category. Expanding a category might reveal the basic components of the category or it might reveal further subcategories, which can also be expanded.

A bullet icon is displayed adjacent to basic components. Selecting the folder icon of an expanded category will collapse the category.

XML files can be edited with an XML editor or a text editor (for example, Microsoft Notepad).

The DTV monitor will automatically generate a template for you based on the stream being monitored. You can **Create and Apply** a template immediately or you can **Create and Download** a template for further modification or examination.

Template checking can be turned off by disabling the Template checking check box on this view or the Configuration > Stream page.

Template and Schedules. The use of templates can be enhanced by scheduling their application and use. In this way, a series of templates can be applied chronologically to a stream. (See page 3-16, *Schedule Management*.)

Service Log

Each program in a transport stream can contain one or more elementary streams (for example, video, audio and control). The content of each elementary stream is carried as packets of data; each elementary stream is assigned a Packet Identifier (PID). Service Logging allows packet counts for specified PIDs (range: 0 to 100) to be collected at a user-definable interval.

Typically this information can be used by network operators to bill customers for transferred data. Network operators may want to present an itemized bill for packets of data carried in each time period.

The data is stored as a grid. After each time period, all the counts move down one position and a new count is started in the top row. The grid is 64 rows (time periods) deep and 100 PIDs wide. So up to 100 PIDs may be monitored, with a common timing resolution.

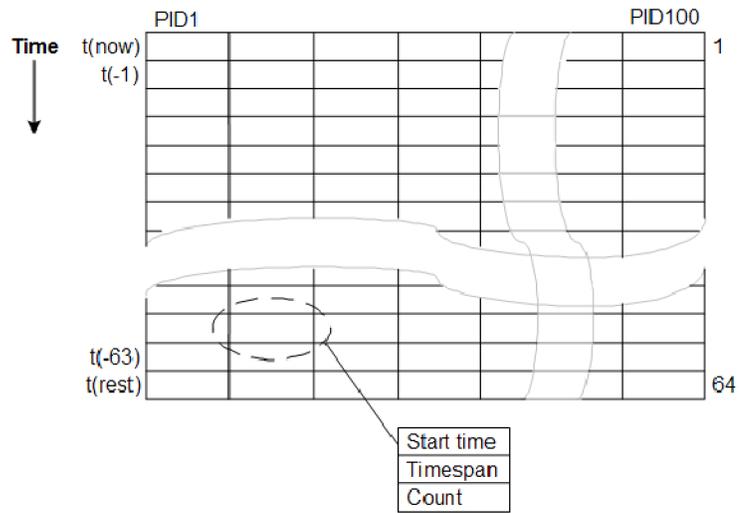


Figure 2-4: Service logging - Data storage

The timing resolution should not be set too fast or data may reach the bottom of the grid (t(rest)) before it can be read. If data does reach the bottom of the grid, it is not lost but it is accumulated in the final row. Accumulated data is added to the bottom row for up to three days. After this time the data is discarded and the PID is no longer monitored.

When a service log is being monitored from multiple locations, only one location should be selected to consume entries. This will allow all locations adequate time to view or log the entries.

The customer must balance the level of detail required (the timing resolution) with the infrastructure that is required to collect, store, and collate the information. Typically the timing resolution is set for 1000 ms; in this case the grid cell will contain a value approximating to packets per second; to improve accuracy each count has an associated duration.

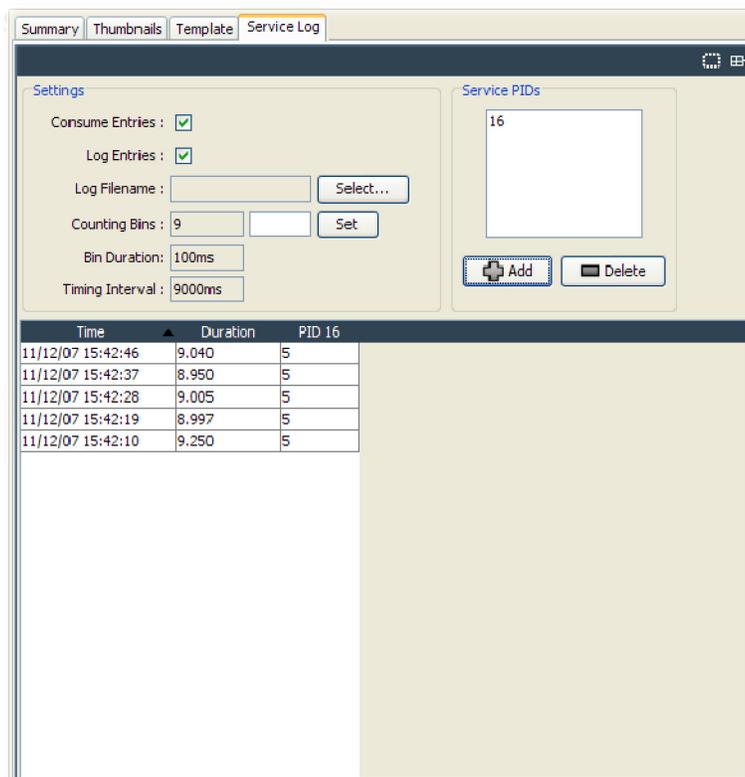


Figure 2-5: Stream view - Summary

The following settings are available:

Consume Entries. The data in the service log is not discarded once it is read; this means that more than one RUI may view the data. One RUI should be nominated to consume the entries. This RUI will then be guaranteed to get all of the data without another RUI consuming the data. Where the data is logged to disk, the logging RUI must be the consuming RUI.

Log Entries. Select this check box if entries are to be logged to a file.

Log Filename. Displays the log file name. A log file name can only be set when the Consume Entries check box is selected. The log file is written in CSV (comma separated values) format. In this format, it can be transferred to any suitable analysis program, for example, Microsoft Excel.

Max. List Entries. This value sets the number of entries that are displayed. It does not affect the actual logging of counts. Enter a value in the field and select Set.

Add / Delete. The Service PIDs text area lists the PIDs currently being logged. PIDs can be added and deleted.

The timing resolution of counts is controlled by configuration file parameter PS4 (Packet Counting Bin Duration) multiplied by PS6 (Number of Packet Counting Bins), typically $PS4 * PS6$ is set for 1000 ms.

PS4 is the t (tau) value for the PID occupancy bit rate measurement as defined in TR 101 290. This value affects many measurements; in this case it ensures that the timespan is a whole multiple of the bit rate counting interval and reduces sampling errors. PS6 (Counting Bins) should be set to give the required count duration - Timing Interval ($PS4 * PS6 * 10$).

Service Log Configuration. The Service Log parameters can also be set using the configuration file. The following example shows how to monitor four PIDs.

NOTE. *The PIDs may be specified as separate elements or as a space delimited list.*

```
<?xml version="1.0" encoding="UTF-8"?>
<MTM400Configuration Name="Service Log Config"
  xmlns:xsi="XMLSchema-instance"
  xsi:noNamespaceSchemaLocation="config.xsd">
  <Streams>
    <Stream Number="1">
      <PS6>10</PS6>
      <PS4>100</PS4>
      <ServiceLog>
        <PIDS>301</PIDS>
        <PIDS>302</PIDS>
        <PIDS>304 410</PIDS>
      </ServiceLog>
    </Stream>
  </Streams>
</MTM400Configuration>
```

This configuration can be embedded in a full configuration file, or just uploaded as an incremental change. (Refer to *Configuration File Structure* in the DTV Monitor Programmer Manual).

Program Node

Each of the program nodes in the transport stream represents a single program referenced within the stream. When a program node is selected in the navigation view, the detail pane displays the details of the program. The LED adjacent to the program node represents the status of its child nodes (elementary streams) and the related tests.

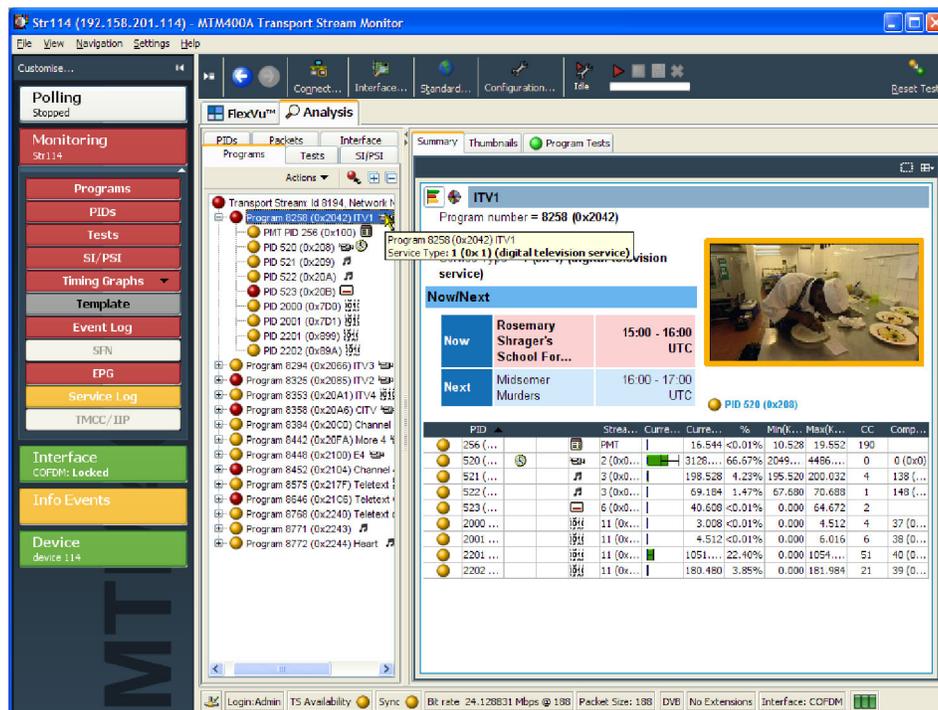


Figure 2-6: Program node

The program detail view provides you with an overview of the selected program, allowing you to see the relative data rates and stream types of all of the PIDs that are associated with the program (including PCR and ECM PIDs). If the program contains an MPEG2 video stream, it is decoded to produce a thumbnail picture of the content. Similarly, where EPG information is associated with the program, a summary (Now and Next program) is displayed. PID content is indicated using icons. Bar chart and pie chart views are available.

PID related information is available under the Summary view.

The Thumbnails view displays details of the streams and thumbnails for each of the programs (where available).

The Program Tests view shows tests related to the program.

The Event Log shows the errors for the highlighted program or test. When no tests are selected, the event log will show the events related to all tests associated with the elementary stream selected in the program tree. You can deselect a test in the detail view by clicking the Name column header.

Where parameters are associated with tests, parameters can be edited using the context menu. (See page 3-8, *Test Parameters*.)

Elementary Stream Node

Each of the elementary stream nodes in the program tree represents a single elementary stream referenced by the parent program. When this node is selected, the view pane displays the Associated Tests view. A tooltip is displayed giving stream type and description when the pointer is hovered over the node in the program tree view.

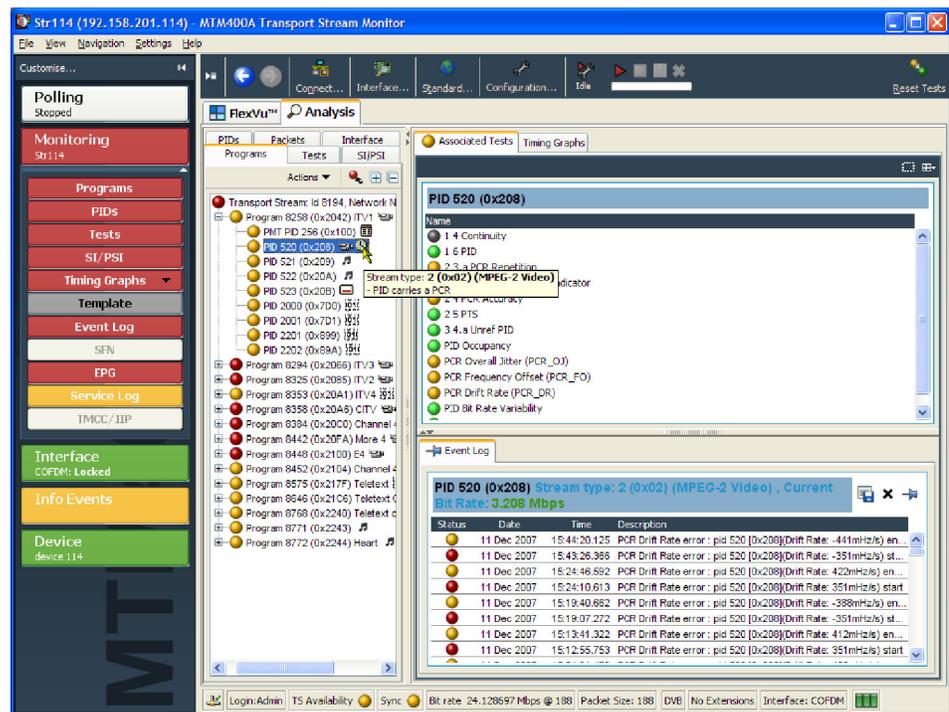


Figure 2-7: Elementary stream node

An LED associated with each elementary stream node indicates the status of the tests relating to the elementary stream.

When the selected elementary stream PID contains timing information, PCR trend analysis views are also available, allowing you to display graphs of PCR accuracy and PCR interval data. When the transport stream contains timestamped data, the PCR overall jitter, PCR frequency offset, PCR arrival time, and PCR drift rate graphs are also available. (See page 2-18, *Timing Graphs*.)

NOTE. *Graph management and timing graphs are described in more detail in the Graph Management. (See page 4-11.)*

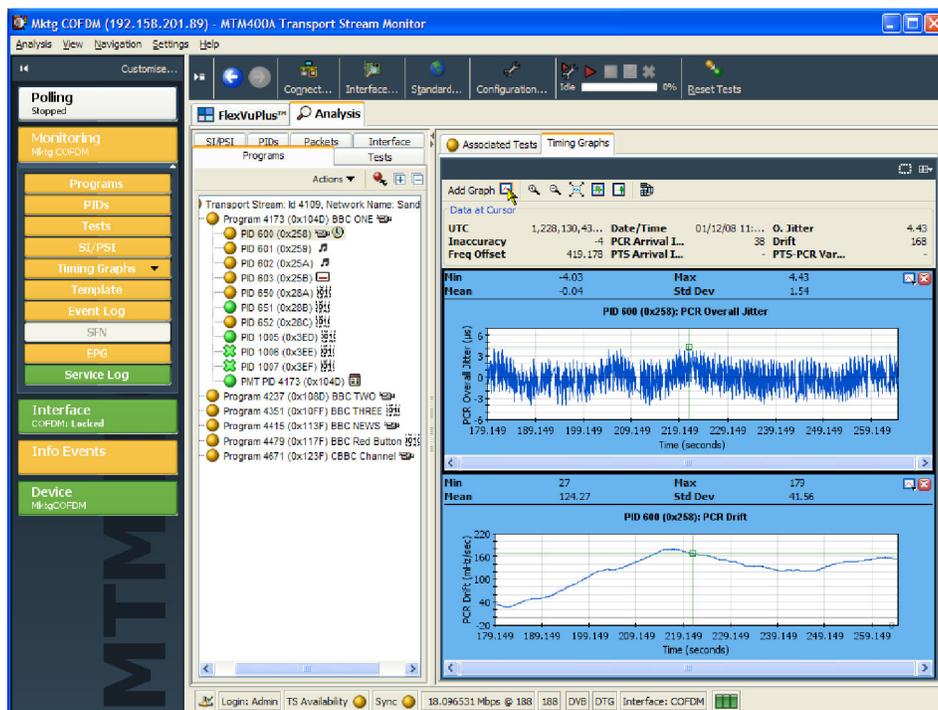


Figure 2-8: PCR Graphs view

The Associated Tests tab shows tests related to the elementary stream node.

Where parameters are associated with tests, parameters can be edited using the context menu. (See page 3-8, *Test Parameters*.)

Similarly, the Event Log shows the errors for the highlighted test. When no tests are selected, the event log will show the events related to all tests associated with the elementary stream selected in the program tree.

Timing Graphs The following table shows the timing graphs that are available for PIDs carrying PCR and PTSs.

Table 2-2: Timing measurement graphs

Graph Type	PID + PCR + Timestamps
PCR Inaccuracy	✓
PCR Arrival Interval	✓
PCR Drift Rate	✓
PCR Frequency Offset	✓
PCR Overall Jitter	✓
PTS Arrival Interval	✓
PTS-PCR Variation	✓

Descriptions follow of each of the measurements. Adjustments can be made to each of the measurement parameters.

If the interval exceeds the limits displayed on the screen, the scale is adjusted automatically as necessary to include the maximum displayed values.

NOTE. *As with other parameter value adjustments, it is important to note where the adjustment is being made from. If the adjustment is made with a test node highlighted, all PIDs will be measured against that value. If the adjustment is made with a PID highlighted, only that PID will be measured against the modified value.*

PCR Overall Jitter The Program Clock Arrival (PCR) Overall Jitter graph shows the time interval between the actual value of the PCR and its expected value based on its arrival time.

The Maximum PCR Accuracy Error limit can be adjusted by modifying the Max PCR overall jitter parameter.

PCR Inaccuracy The PCR Inaccuracy graph shows the difference between the actual and expected values for each PCR on the Y-axis. Expected PCR values are calculated from the byte index of the PCR.

The Maximum PCR Accuracy Error limit can be adjusted by modifying the Max PCR accuracy error.

- PCR Arrival Interval** The PCR Arrival Interval graph provides a display of the time interval between successive PCRs, during the last 256 PCRs. The interval is displayed on the Y-axis.
- The PCR Maximum Repetition Interval limit can be adjusted by modifying the PCR max repetition interval.
- PCR Drift** The Drift Rate graph shows the rate of change of PCR Frequency Offset, which is often very small. It is calculated using PCR Frequency Offset measurements.
- The maximum PCR Drift Rate limit can be adjusted by modifying the Max PCR frequency drift rate parameter.
- PCR Frequency Offset** The Frequency Offset graph shows the difference between the program clock frequency and the nominal clock frequency (measured against a reference that is not PCR or transport stream derived).
- PCR Frequency Offset is a measurement of the error in the PCR frequency from the specified 27 MHz; the MPEG specification sets the limits at ± 810 Hz.
- The Maximum PCR Frequency Offset limit can be adjusted by modifying the "Max PCR frequency offset" parameter.
- PTS Arrival Interval** Presentation Time Stamps (PTS) graph provides a display of the time interval between successive PTSs.
- PTS-PCR Variation** Significant variation between the PTS and PCR arrival intervals may indicate that there are timing problems in the monitored stream.

Tests View

The Tests view displays test information relevant to the transport stream being analyzed. The view is displayed when the Tests button is selected in the button bar or when the Tests tab is selected in the tree view. (See Figure 2-9.)

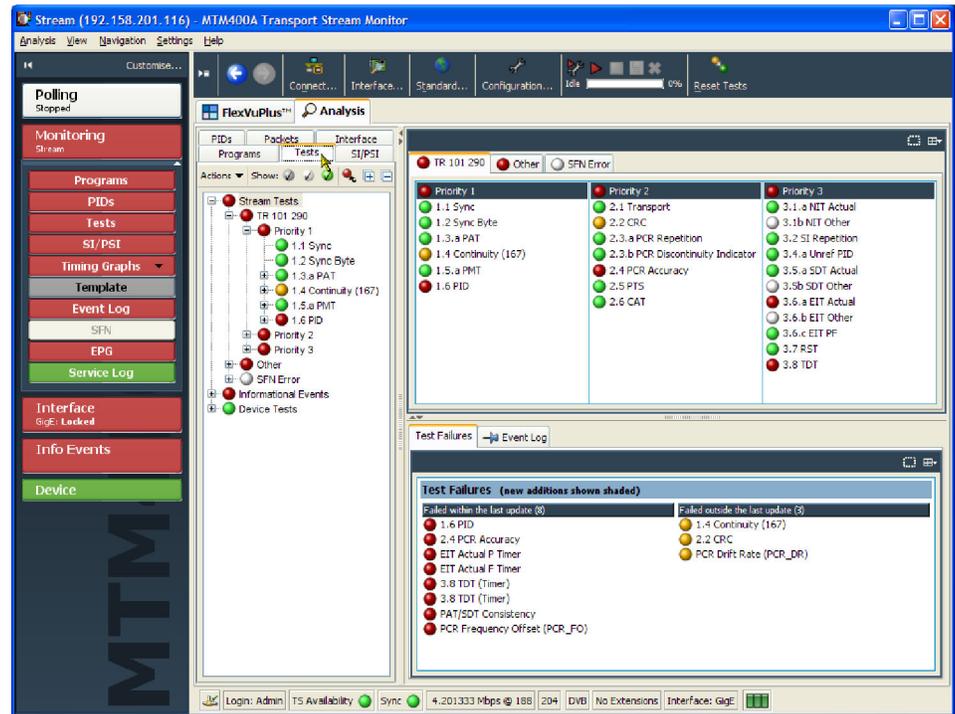


Figure 2-9: Tests view

The view displays a test tree that represents all the tests that have been applied to the analyzed transport stream. The nodes are available in the navigation view. (See Figure 2-10.)

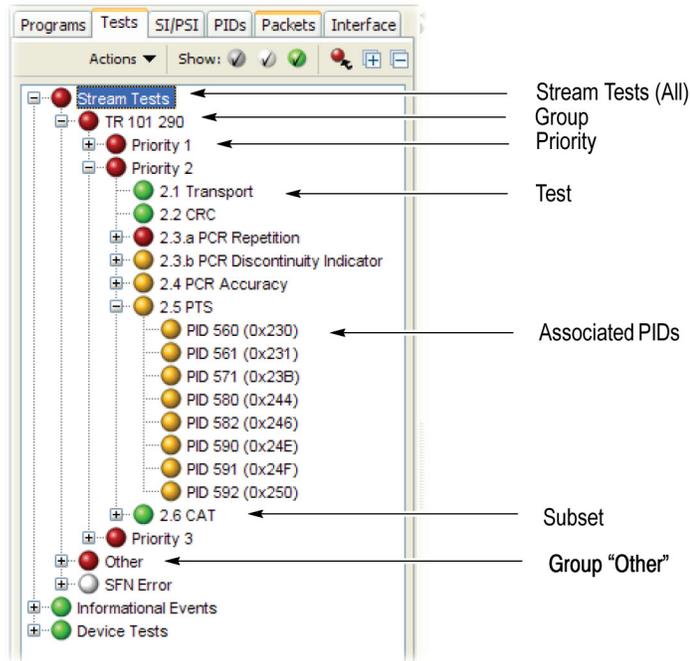


Figure 2-10: Test view nodes

Test Structure

The test tree structure represents all of the tests that can be applied to a transport stream complying with a particular digital video standard: MPEG, DVB, ATSC, ISDB-S, and ISDB-T. The standard must be selected before beginning analysis. The test tree contains nodes for each test that the analyzer can implement gathered under the stream tests primary node.

An example of a tree structure for a selected standard is the TR 101 290 group of tests for DVB transport streams. (See Figure 2-10.) The Group node is split into priority groups: First Priority, Second Priority, and Third Priority. Each of these priority groups contains a number of individual tests.

Test grouping differs between digital video standards. However, all of the currently implemented standards contain a subset of the relevant TR 101 290 tests. In standards other than DVB, the tests are not numbered.

Where relevant, PIDs will be associated with a test in the test tree when the test has either been disabled, or when it has failed.

Two other primary nodes are displayed, Informational Events and Device Tests.

Informational Events include stream events and messages that are logged but do not constitute a test failure; for example, a version change of a table carried in the SI/PSI is reported in the stream log but is not subject to a standard test. The only place that these stream events are recorded is in the stream logs. This screen collects these all in one place and allows their recording in the stream log to be enabled or disabled. This screen also shows errors that have been generated by all IP sessions when a Gigabit Ethernet interface is fitted. The messages to be displayed are set at the factory; interface cards can also generate messages.

Alarm and trigger actions can be set on all tests using the context menus. In addition to the alarms and triggers, message recording in the stream log can be enabled and disabled for stream related tests.

Error Color Coding

The color coding used for the error icons is shown in the following table.

Table 2-3: Color coding - Errors and Warnings

Icon	Color	Meaning
	Green	Idle - the event is not happening at this time.
	Red	Event detected and still present.
	Yellow	Transient event, which has now ended.
	Gray	The event has been disabled (or is unavailable). All buttons gray indicates that connection to a device has been lost.
	White	Test not applicable. For example, PCR tests when the program clock reference is not carried by any PIDs in the stream.
	Black	Maintenance mode.

Test Filtering

Interpreting the display of tests can be made easier using the three filter buttons at the top of the Tests navigation view.

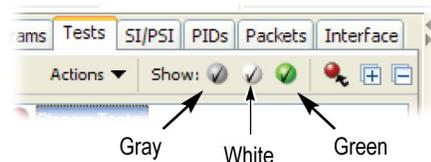


Figure 2-11: Test filtering buttons

Each button can be used to filter tests from the tree to reduce visual clutter.

- To show all tests (the default), all buttons must contain a tick.
- To hide tests that are currently disabled, that is, gray, click the gray button so that it shows a cross.
- To hide tests that are not applicable to the current standard or stream content, that is, white, click the white button so that it shows a cross.
- To remove all tests that are currently passing, that is, green, click the green button so that it shows a cross.

NOTE. *The tests will still be performed when hidden unless their state changes so that they are no longer filtered out - for instance a green test turning red.*

All Tests Node

A detailed view is displayed when the All Tests node is selected. (See Figure 2-9 on page 2-21.) In addition to a summary of all tests, the event log shows the most recent events that have occurred during analysis of the stream.

Test Failures View

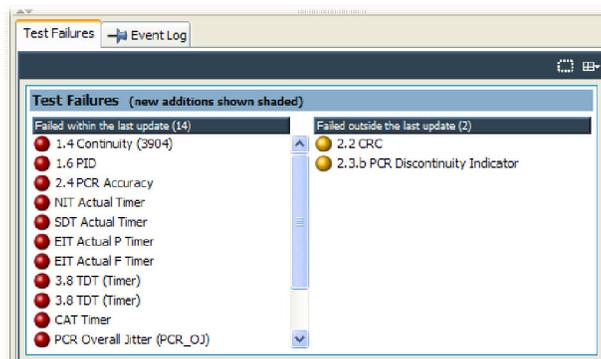


Figure 2-12: Test Failures view

The Test Failures view provides an overview of the tests that have failed during monitoring. The view is divided into two panes and is updated every second; longer under high load conditions.

- The left column lists all tests that are currently failing.
- The right column lists all tests that have failed at some point since monitoring began (or since the last reset), but are not currently failing.
- Any tests that were not present in a list in the previous update are shown shaded.

Test Nodes

When you select a test node, the Associated PIDs pane displays a summary of all of the PIDs and an event log listing all events that are associated with the test.

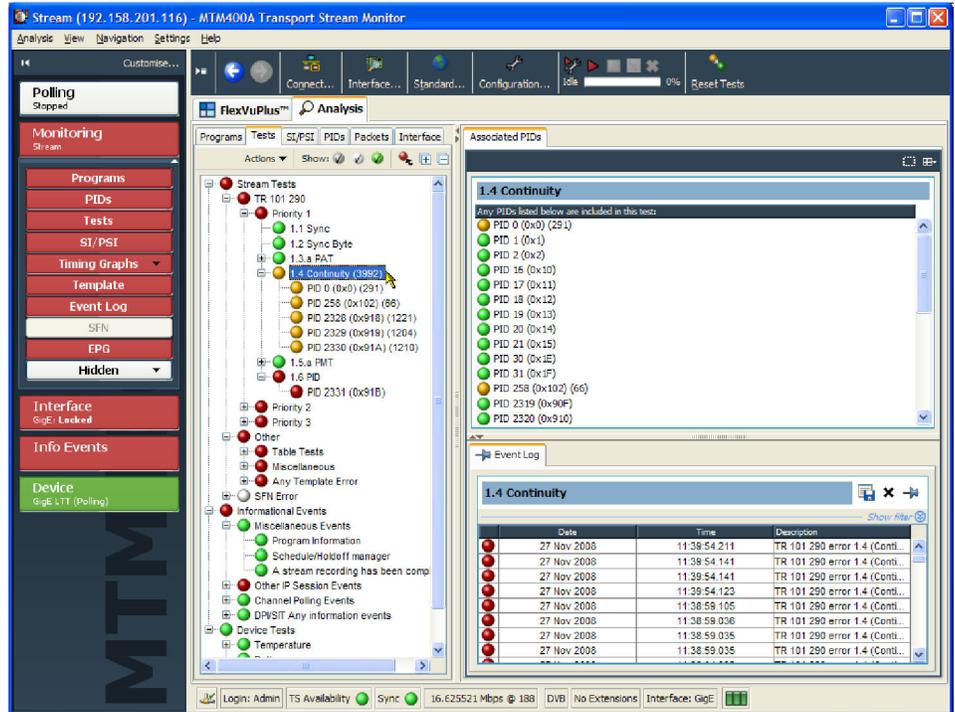


Figure 2-13: Tests view - test nodes

PID Nodes

Where tests have failed, the PIDs affected are listed under the test node in the Tests navigation view. Selecting a PID will display the Event Log for that PID.

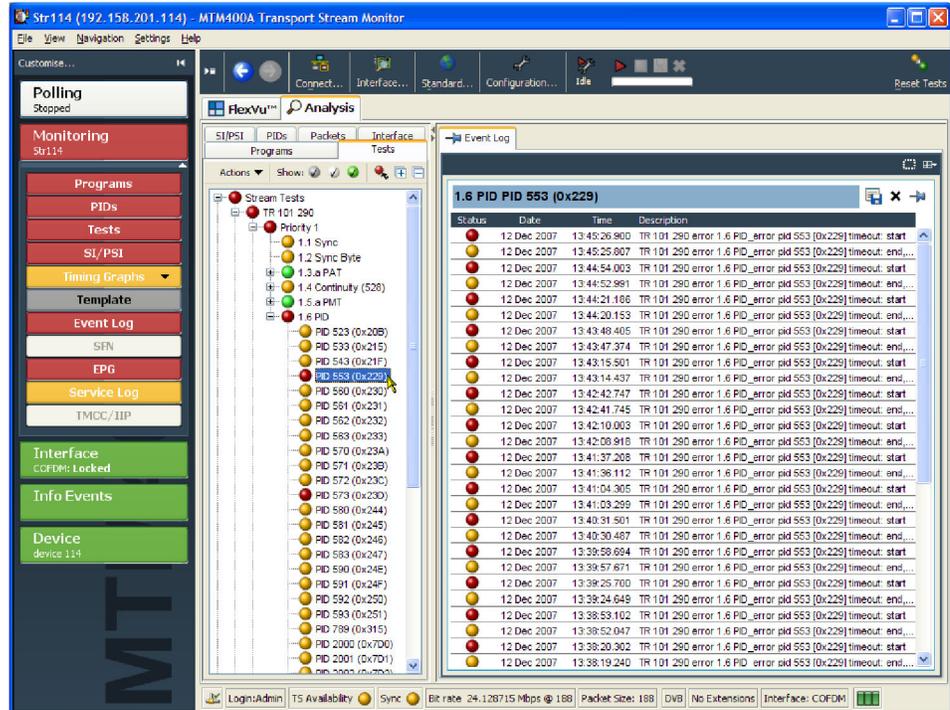


Figure 2-14: Test view - PID nodes

SI/PSI (Tables) View

The SI/PSI (tables) view displays service information in tree form, as in the other navigation views. The tree represents the service information tables that have occurred in the monitored stream and that comply with the selected digital video standard. This includes MPEG program specific information, DVB service information, ATSC and ISDB program information, and system information protocol. The tree contains nodes for each table found; tables/nodes are grouped together by functionality. The following figure shows an example of the Table navigation view with DVB stream interpretation selected.

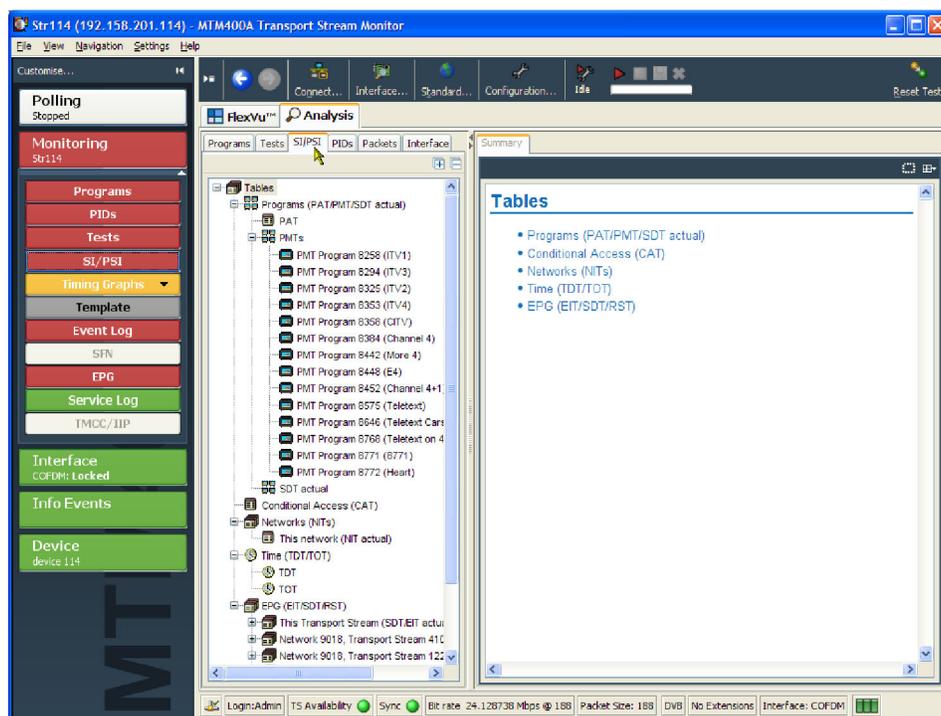


Figure 2-15: SI/PSI (tables) view

Every node within the service-information tree has a corresponding summary view. Nodes that represent tables will provide you with access to the table structure and hex data. (See page 2-29, *Section View*.) Nodes that represent tables will also provide you with the graphical displays of data rates and interval data. (See page 2-31, *SI Repetition Graphs View*.)

Some of the nodes that represent less common tables or table groups may not have specific summary views available in the analyzer. In these cases, a generic summary view is used.

Table Summary Pane

The Table Summary view provides a summary of the table related information for the monitored transport stream. There is a table summary view for every node of the service information. The content is dictated by the selected node.

All summary views for nodes that represent an individual table or subtable will display the table identity and version number of the table from which the information is extracted. Where relevant, links are provided to associated objects, for example, in the Programs Summary, links are provided to the individual program summary views. (See Figure 2-16.) Similarly, arrow icons provide links to the electronic program guide (EPG) tables. Where the section is carried on a PID, a link is also provided to the PIDs view.

The following figure shows an example of the summary pane with the PMT PIDs node selected in the navigation view.

The screenshot shows the MTM400A Transport Stream Monitor interface. The main window is titled 'Str114 (192.158.201.114) - MTM400A Transport Stream Monitor'. The interface includes a menu bar (File, View, Navigation, Settings, Help), a toolbar with buttons like 'Connect...', 'Interface...', 'Standard...', 'Configuration...', and 'Idle', and a 'Reset Tests' button. On the left, there is a 'Customise...' button and a 'Polling' status indicator (Stopped). Below that is a 'Monitoring' section for 'Str114' with a list of menu items: Programs, PIDs, Tests, SI/PSI, Timing Graphs, Template, Event Log, SFN, EPG, Service Log, TMCC/IIP, Interface (COFDM: Locked), Info Events, and Device (device 114). The main area is divided into two panes. The left pane, titled 'Tables', shows a tree view of the transport stream contents, with 'PMTs' selected. The right pane, titled 'Summary', shows the 'Programs' summary. It states 'This transport stream contains 14 programs:' and displays a table with the following data:

Program	PMT PID	Name	EPG
8258 (0x2042)	PID 256 (0x100)	ITV1	🔗
8284 (0x2066)	PID 260 (0x104)	ITV3	🔗
8325 (0x2085)	PID 258 (0x102)	ITV2	🔗
8353 (0x20A1)	PID 278 (0x116)	ITV4	🔗
8358 (0x20A6)	PID 262 (0x106)	CITV	🔗
8384 (0x20C0)	PID 300 (0x12C)	Channel 4	🔗
8442 (0x20FA)	PID 270 (0x10E)	More 4	🔗
8448 (0x2100)	PID 304 (0x130)	E4	🔗
8452 (0x2104)	PID 305 (0x131)	Channel 4+1	🔗
8575 (0x217F)	PID 272 (0x110)	Teletext	🔗
8646 (0x2106)	PID 274 (0x112)	Teletext Cars	🔗
8788 (0x2240)	PID 276 (0x114)	Teletext on 4	🔗
8771 (0x2243)	PID 282 (0x11A)	N/A	🔗

At the bottom of the interface, there is a status bar showing 'Login:Admin', 'TS Availability' (green), 'Sync' (green), 'Bit rate: 24.128731 Mbps @ 188', 'Packet Size: 188', 'DVB', 'No Extensions', and 'Interface: COFDM'.

Figure 2-16: SI/PSI (tables) view - Programs (example)

EPG Views

A specific departure from the Table Summary view is the EPG view that is displayed when a section of the EPG table is highlighted. (See page 2-31, *EPG Views*.)

Section View

The detailed section view is available when the selected node in the service information tree represents a table or subtable in the transport stream. (See Figure 2-17.) The subtable identity, version, and section are displayed at the top of the table pane.

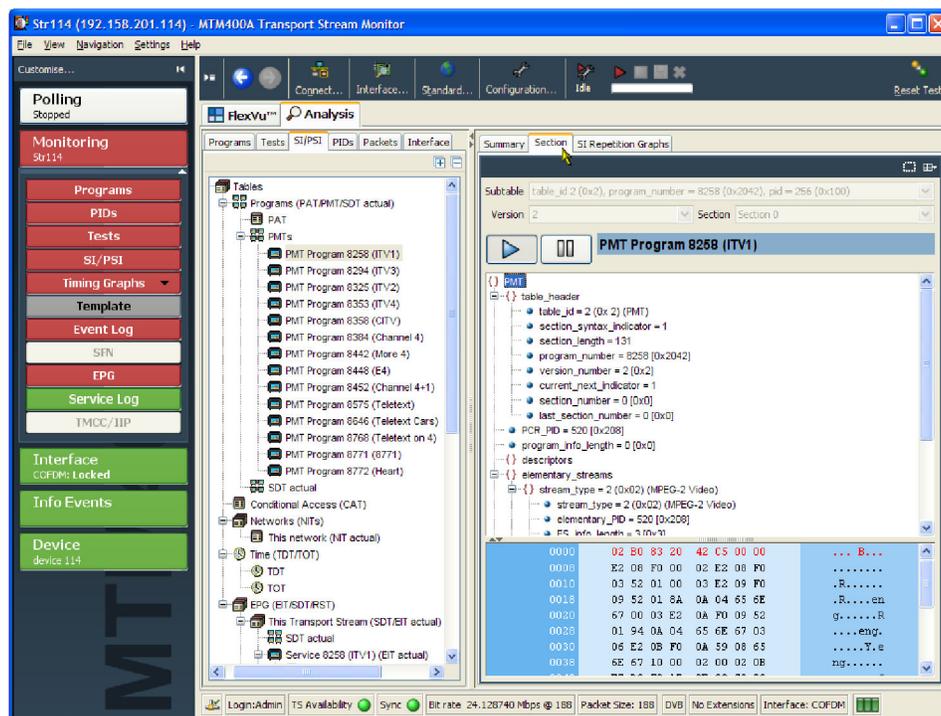


Figure 2-17: SI/PSI (tables) view - Section view

The table pane shows all fields that make up a section (for example, PMT). The fields are arranged in a hierarchical order. The presence of subordinate fields is indicated using { } bracket symbols adjacent to the container field. The container can be expanded or collapsed by clicking the + or - icon.

Below the table pane, the data source is displayed. The data pane shows the data bytes (in both hexadecimal number format and ASCII character format) for the selected table, version, and section. When a node is selected in the table pane, the bytes that make up the selected node (including the subordinate nodes) are highlighted in the hexadecimal data pane. (See Figure 2-18.)

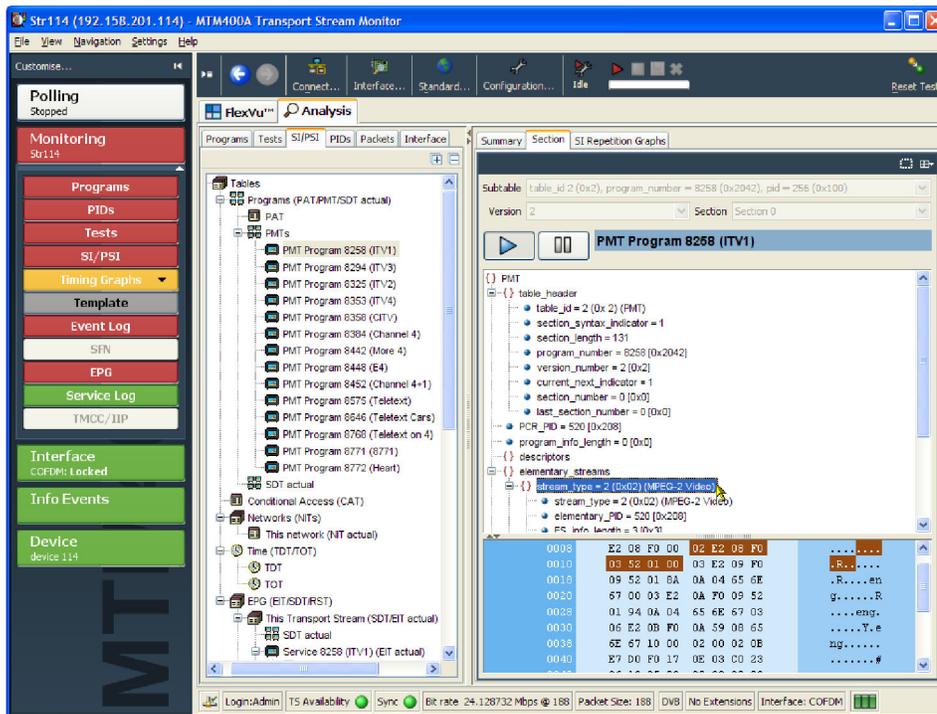


Figure 2-18: Section payload

If the section is corrupt or empty, the hexadecimal view background is red instead of blue. The view is continually updated. Updating can be paused, to allow you to examine specific details.



Pause table section updating



Resume table section updating

SI Repetition Graphs View

The section graph view will be available when the selected node in the service information tree represents a table or subtable in the transport stream. You can view graphs of the following data:

- Section repetition interval. This graph displays the interval between two sections of a table on a particular PID.
- Subtable intersection gap. This graph displays the interval between sections in a particular subtable.
- Subtable repetition interval. This graph displays the time between receiving one complete subtable and receiving the next complete subtable.

NOTE. *Not all of the above graph types are relevant to all table types. Graph Management is described in more detail in Graph Management. (See page 4-11.)*

EPG Views

An electronic program guide (EPG), where present, is a schedule of events, and programs, that are or will be available on each service. A short summary or commentary for each event may also be included. Events for services that are actually carried in the stream are referred to as "actual" and as "present" or as "following" (labeled as "EIT actual p/f" in the navigation view).

A transport stream may also carry EPG information for other network services, referred to as "other" (labeled as "EIT other p/f" in the navigation view).

NOTE. *The examples shown in the figures in this section are of DVB transport streams. The construction of SI and node names in ATSC and ISDB streams differ.*

The EPG node in the navigation view contains and displays all of the program information carried in the transport stream.

The content of the Detail view will depend on the currently highlighted EPG table node. Nodes representing an individual table or subtable will offer the usual Summary, Section, and SI Repetition graph detail views. However, the higher nodes will display the programming information graphically. (See Figure 2-19.)

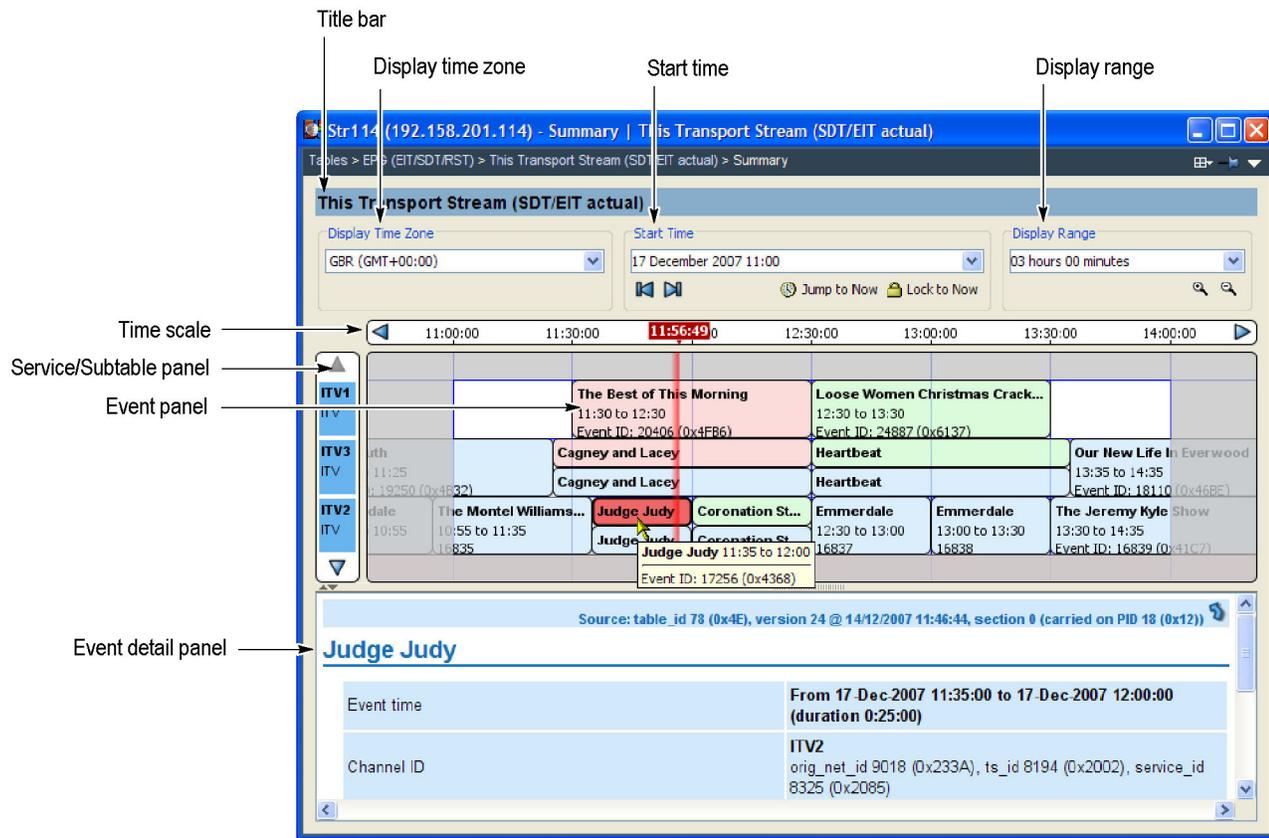


Figure 2-19: EPG Summary view (tear-off view)

EPG Summary View

The following screen elements are highlighted: (See Figure 2-19.)

Title Bar. Displays the title of the currently highlighted service or transport stream.

Displayed Time Zone. Select the required time zone from the drop-down list. The time scale will change accordingly. The time zone may be derived either from the transport stream, UTC (Coordinated Universal Time), or local time (as set on the host computer).

Start Time. Shows the event panel start time and date. Other dates can be selected from the drop-down calendar, and the display will scroll to the selected date.

The initial date and time will be dictated by the information found in the stream. This information is updated regularly.

Display Range. Shows the extent of the event panel. More detail can be displayed by choosing a shorter time period. Select the required range from the drop-down list. The adjacent zoom buttons select the next/previous range in the drop-down list.

Time Scale. Shows the start and end time of the current event panel. The range is dictated by the Display field selection.

Lock to Now. On the timescale, "Now" is marked. If past or present programs are being viewed, the Now marker can be off screen. The Lock to Now button brings the Now marker into view and keeps it in view. Scrolling the timescale deactivates the Lock to Now button.

Service/Subtable panel. When a transport stream EPG is selected, this panel shows the names of the services currently displayed in the event panel. The displayed services will vary depending on which node is selected in the navigation view.

Event Panel. This panel shows the events for one or more services, depending on the selected node. Individual events are color-coded and shown as blocks; each block (and its associated tooltip) displays event information that is extracted from the EIT. When a block is selected, the complete event information is shown in the event detail panel, including a link to the section carrying the information.

Events are color-coded as follows:

- Red: Present event
- Green: Following event
- Blue: Schedule event
- Yellow: (ISDB only) After event

Event Detail Panel. Shows details of the selected event. The details are contained in the EIT (event information table).

EPG Node Summary



Figure 2-20: EPG nodes

For each node type, the detail view shows the following information:

EPG Node. Links to the EPG information for all the transport streams described in this stream.

Transport Stream Summary Nodes. Graphical view of the events identified in the service(s) belonging to a specific transport stream.

SDT (Service Description Table) Nodes. Links to services identified in the SI for a specific transport stream.

Service Summary Nodes. Graphical view of the events identified in the service.

EIT Nodes. Detailed view of event information for a single EIT subtable.

Where appropriate, program content advisory information is displayed in abbreviated text form.

PIDs View

The PIDs view displays information about all of the PIDs found in the transport stream being monitored. (See Figure 2-21.) The tree view contains the PID tree structure representing all of the PIDs that have occurred within the transport stream.

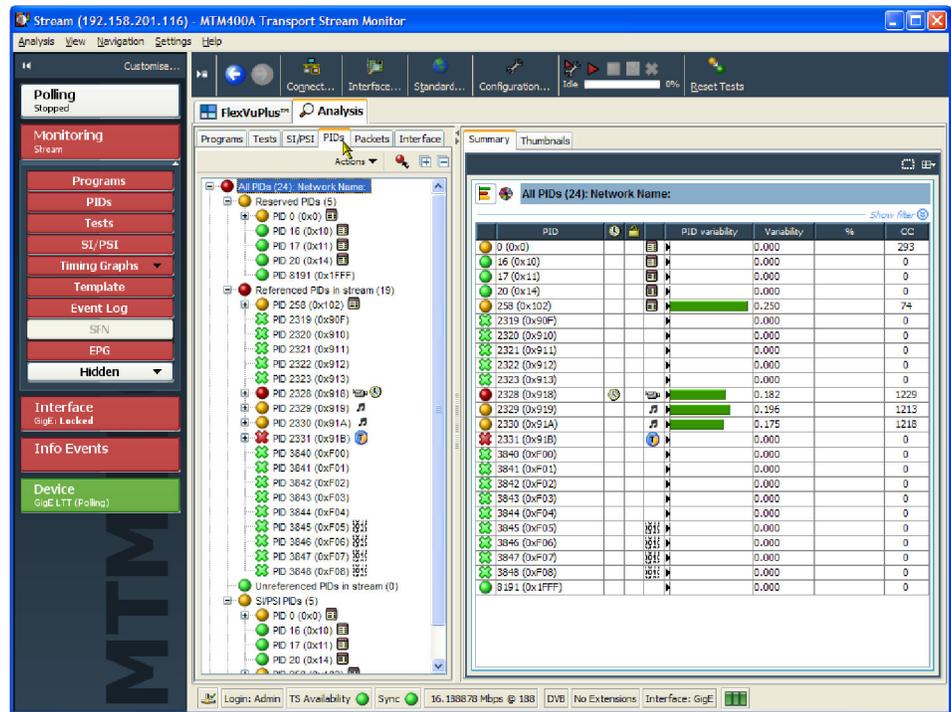


Figure 2-21: PIDs view

All PIDs Node

In the navigation view, PIDs are grouped under the following subordinate nodes:

- Reserved PIDs
- Referenced PIDs
- Unreferenced PIDs
- SI/PSI PIDs
- User PIDs

The number of PIDs in each group is shown adjacent to the node. The root node label shows the total number of PIDs found and the Network Name.

When highlighted, the All PIDs node displays in the detail pane all of the PIDs found in the analyzed stream.

Each of the subordinate nodes contains PIDs belonging to that group. PIDs are allocated during monitoring, and the number of PIDs is identified for each node. You can also allocate PID numbers to the User PID node, although User PIDs may not necessarily have been found in the stream. This feature allows you to compare the properties of one or more PIDs more easily.

The associated summary view provides a PID-oriented overview of the transport stream, allowing you to see the relative data rates of all of the PIDs contained within the transport stream. The information can be displayed as either a bar chart or as a pie chart. Columns in the summary views can be sorted in ascending or descending order by clicking the column header.

Each PID is associated with a number of tests. If one or more tests fail, they will be listed under the relevant PID node in the navigation view. Selecting the PID node will display a summary, in the detail view, of all associated tests that have been found. Selecting a specific test in the Associated Tests pane will display the Event Log and Parameters for only that test.

The Thumbnails tab displays views of the PIDs carrying video information. Three modes of thumbnail display are available: Thumbnails only, Brief Details, and Full Summary. (See page 2-6.)

Detail View (All PIDs and PID Group)

The All PIDs and PID Group detail view provides you with a PID-oriented overview of the transport stream. This view is displayed when any of the main nodes is selected in the tree pane: All PIDs, Referenced PIDs, Unreferenced PIDs, or User PIDs.

The view shows the relative data rates of all of the PIDs contained within the selected node. You can display the information in either a bar chart or a pie format. The associated test states are shown in all views.

In the pie chart view, double-clicking in the pie chart area toggles the segment labels. When no labels are displayed, click and hold a segment to display a single label.

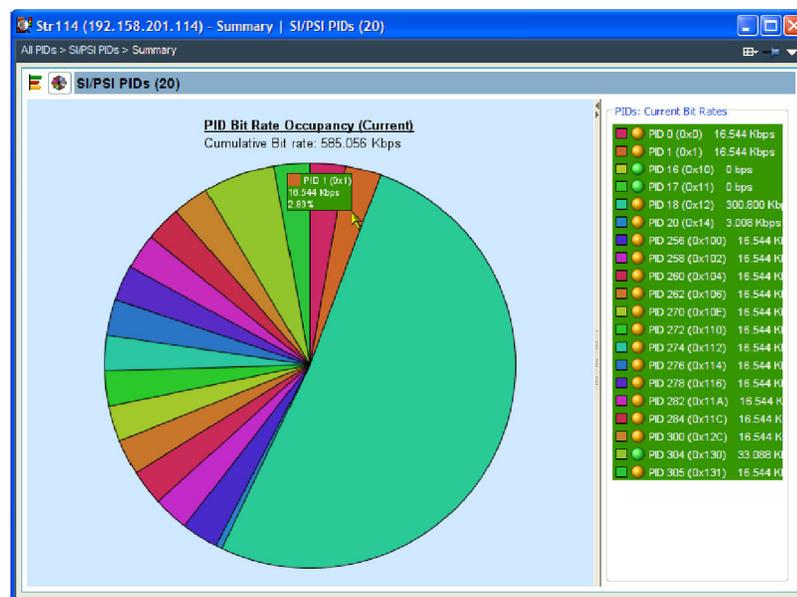


Figure 2-22: All PIDs Summary view (tear-off view)

The node summary views provide PID related information, for example, PID type stream type, scrambled status and the presence of PCRs. Layer information is also shown when analyzing ISDB streams. Icons provide an indication of the PID content. The combination and detail of the views vary depending on the selected PID type and node.

Detail View (PIDs)

The individual PID detail view provides you with information about the selected PID. This view will be visible when you select an individual PID node in the PID tree. Where a PID has failed a test, one or more test nodes are displayed as child nodes of the PID. The combination and detail of the views vary depending on the selected PID type and node.

Ordinary PID Selected

When a PID does not contain PCRs, the main view in the PID pane is the Associated Tests view. This view lists the tests associated with the selected PID. The status of the individual tests is indicated with LED icons. Also available are Timing Graphs, which show the bit rate of the selected PID in graphical form.

The Associated Tests event log shows all PID related events. If a test is selected in the PID panel, only the events associated with that test on that PID are shown. Similarly, when a test is selected, the Parameters option in the context menu shows the parameters associated with that test (when applicable). A test can be deselected by clicking the Name header in the PID panel.

PCR PID Selected

When the selected PID contains PCR information, the PCR timing graphs are made available. (See Figure 2-23.)

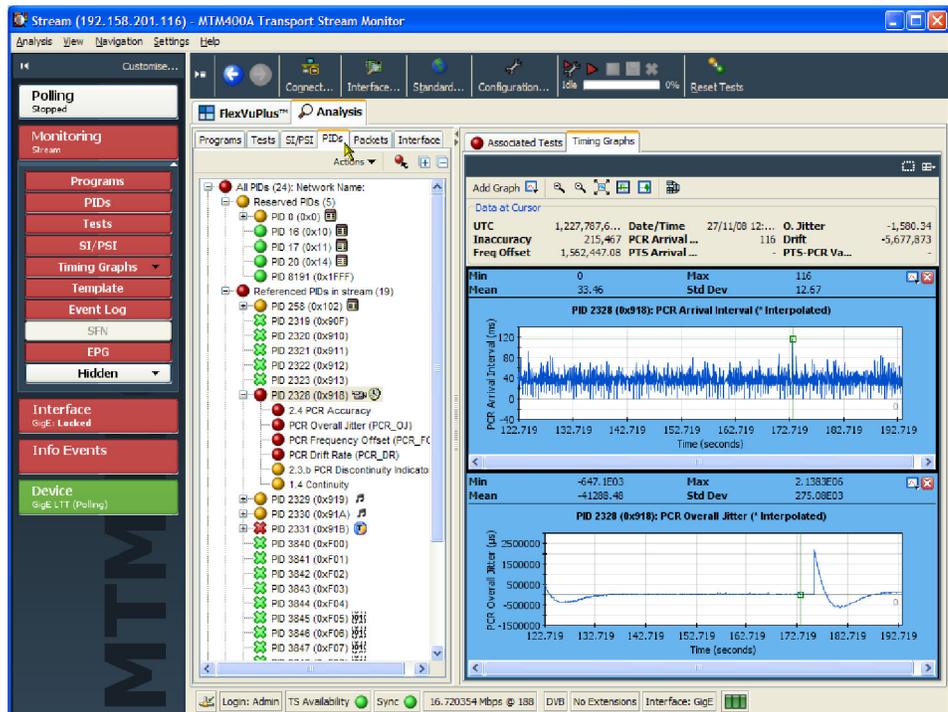


Figure 2-23: PID detail view - timing graphs

A Presentation Time Stamp (PTS) graph may also be available on PIDs carrying audio and video information. (See page 4-11, *Graph Management*.) (See page 2-18, *Timing Graphs*.)

Packets View

The Packets view displays SFN data when available in DVB mode, and information packets (IIPs) and TMCC data in ISDB-T mode.

The following figure shows an example of the IIP view in an ISDB-T transport stream.

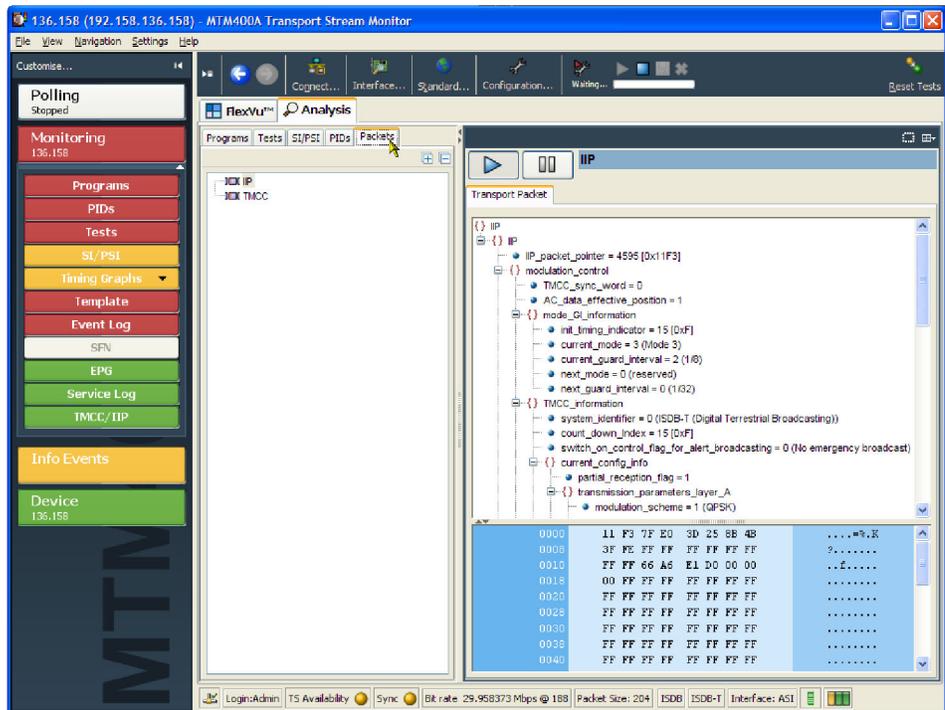


Figure 2-24: Packets view - ISDB-T, IIP detail example

Interface View

If any one of the interface cards is installed in the DTV monitor, the Interface tab and button are displayed. (See Figure 2-25.)

NOTE. Refer to *Interface Card Configuration* for information about configuring the optional interface cards. (See page 3-35.)

Two primary nodes are displayed in the tree view: IF Error Collection and IF Warning Collection. Each collection contains a range of tests.

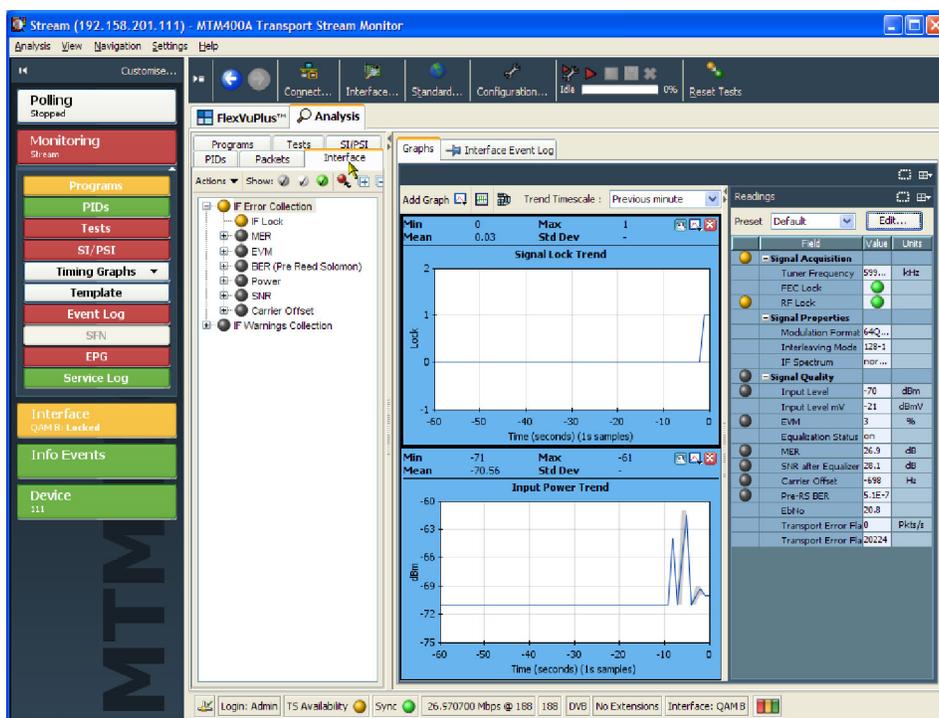


Figure 2-25: Interface view (typical)

The tabs displayed in the detail view will depend on which interface is installed. The RF card detail views contain two tabs: Graphs and Interface Event Log. The IP interface contains five tabs: IP Tables, Diagnostics, Graphs, Interface Event Log, and All Session Event Log. Also displayed are readings panels which display data derived from the installed interface card.

Interface related tabbed views and panels are described in the remainder of this section. Setting up the interface cards is described in *Interface Card Configuration*. (See page 3-35.)

In general, the graphs include instantaneous measurement graphs and trend graphs related to the installed interface. Graphs can be selected and displayed from the drop-down menu in the graph panel of the interface detail display. (See page 4-11.)

In the interface Readings panels, the LEDs on the left correspond to the tests in the IF Error collection tree. You can identify which test by selecting **View this test in the Interface tree** from the associated context menu; the test in the tree will be highlighted when the menu option is selected. The LEDs in the Value column correspond to errors reported by the interface card.

GbE Interface

The GbE Interface tree view contains two primary nodes: IF Error Collection and IF Warnings Collection. (See Figure 2-26.) The secondary nodes are specific to the GbE interface. The detail views are contained under five tabs: IP Tables, Diagnostics, Graphs, Interface Event Log, and All Session Event Log.

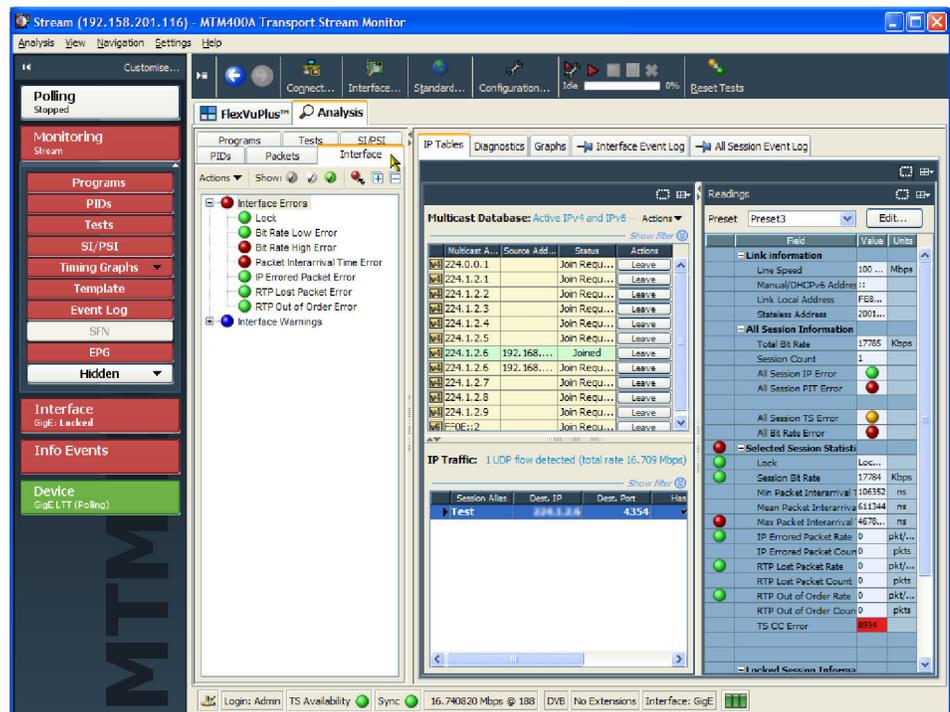


Figure 2-26: Interface view - GbE

IP Tables Tab The IP tables view contains the Multicast Database table, the IP Traffic table, and the IP card readings panel.

Multicast Database. This table shows the multicast addresses that have been added by the user. (See Figure 2-27.) This table will be shown only when multicast subscription mode has been selected.

The table shows the status of the current multicast sessions: Join Requested, Joined, Not Joined, Shadowed, Leave Pending, and Join Pending. Join Requested is displayed when Join has been clicked and a message has been transmitted on the network, but no traffic has yet been seen. As soon as traffic is detected, the status will be updated to Join.

IP Traffic. The Traffic view displays all traffic, including, for example, FTP (File Transfer Protocol) traffic and available IP sessions with rates higher than five network packets per second on the currently selected interface (copper or optical). (See Figure 2-27.) The currently selected traffic is highlighted in this table. You cannot select network streams that do not carry a transport stream. The column display can be shown/hidden by selecting/deselecting headings from the column heading context menu. (See Table 2-4 on page 2-44.) If a single subscription mode is selected, all sessions will be suspended except the one currently subscribed.

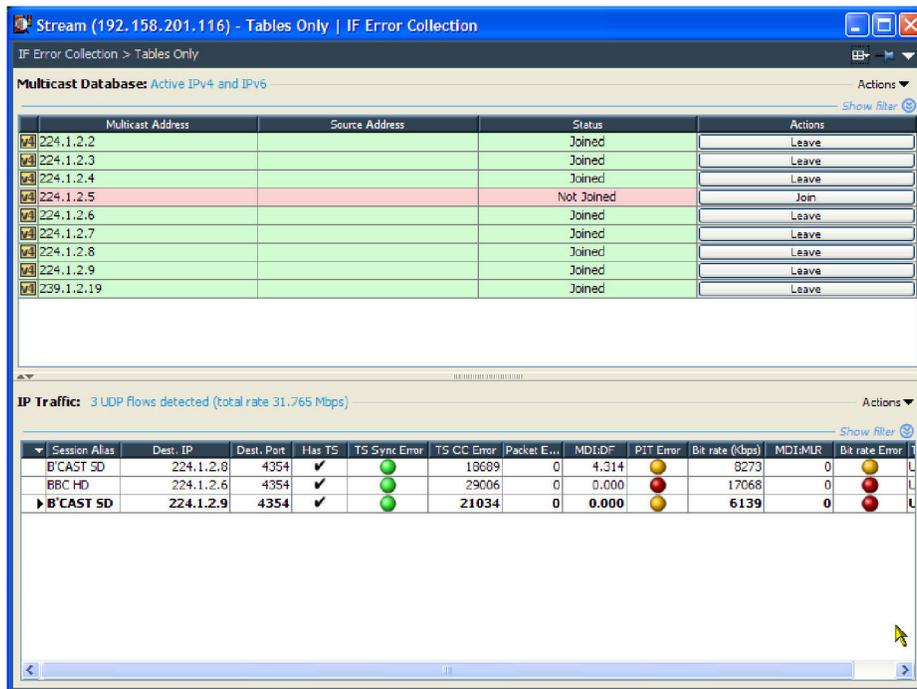


Figure 2-27: IP Traffic view (tear-off view)

Table 2-4: GbE IP Traffic view column descriptions

Column heading	Description
Active	Indicates the selected stream. The row is also bolded
Session Alias	User allocated name
Source MAC	Session source MAC address
Destination MAC	Session target MAC address
Source IP	Session source IP address
Destination IP	Session target IP address
Source Port	Session source IP port
Destination Port	Session target IP port
VLAN Tag	VLAN (Virtual Local Area Network) tag; "-" where not applicable. Includes all parts of the VLAN information not just the identity
Transport	RTP (Real Time Protocol) or UDP (User Datagram Protocol) (Others, such as FTP, are possible if there is a sustained flow of another kind on the network)
Has TS	Yes (check mark), if sync has been detected in this session. No, if sync has not been detected in this session
Multicast	Yes (check mark), if it is a multicast address
TTS	(Time Stamp Transport Stream) Yes (check mark), if the session is time-stamped.
TS Sync Error	Yes (green), if no sync byte or sync loss errors have been detected in the session since reset or startup
TS CC Errors	MPEG CC (continuity count) error count in each session since reset or startup
Pkt Error	Total count of IP corrupted, lost packets, and out-of-order packets in each session since reset or startup
PIT Error	Yes (green), if the PIT (packet inter-arrival time) in each session has not exceeded the user defined limit at any time since reset or startup
Bit Rate (Kbps)	Session bitrate (not the same as the stream bitrate, this includes IP wrappers)

At the top of each of the IP tables (Multicast Database and IP Traffic) is a **Show filter** option. (See page 4-17.)

GbE Readings. The readings described in a table are displayed in the GbE Readings panel of the following figure. (See Table 2-5.)

Previously configured setups are available in the **Preset** drop-down menu. Selecting from the drop-down menu is equivalent to applying a configuration in the Configure Interface dialog box. Use the **Edit** button to open the **Edit Interface Settings**. (See page 3-38.)

	Field	Value	Units
Link information			
	Line Speed	100 FDX	Mbps
	Manual/DHCPv6 Address	::	
	Link Local Address	FE80::A00:11FF:F...	
	Stateless Address	2001:205::A00:11F...	
All Session Information			
	Total Bit Rate	0	Mbps
	Session Count	0	
	All Session IP Error	●	
	All Session PIT Error	●	
	All Session TS Error	●	
	All Bit Rate Error	●	
Selected Session Statistics			
●	Lock	Not locked	
●	Session Bit Rate	0	Mbps
	Min Packet Interarrival Time	0	ms
	Mean Packet Interarrival Time	0	ms
	Max Packet Interarrival Time	0	ms
	IP Errored Packet Rate	0	pkt/min
	IP Errored Packet Count	0	pkts
	RTP Lost Packet Rate	0	pkt/min
	RTP Lost Packet Count	0	pkts
	RTP Out of Order Rate	0	pkt/min
	RTP Out of Order Count	0	pkts
	TS CC Error	0	
Locked Session Information			
	Source IP	0.0.0.0	
	Source Port	0	
	Destination IP	0.0.0.0	
	Destination Port	0	
	Type of Service	0	
	IP Datagram Size	0	bytes
	VLAN Tag	0x0	
	TS Packet Size	N/A	bytes

Figure 2-28: GbE interface Readings view (tear-off view)

Table 2-5: GbE interface readings

Field title	Description	Units
Link Information		
Line Speed	Shows the speed and type of the current physical connection to the network. Line speed; 10, 100, 1000, 1000 (Optical), N/A. FDX - Full-duplex; HDX - Half-duplex. <i>NOTE. The GbE interface card allows active network participation on half-duplex connections. However, if there are issues with active traffic, such as IGMP dropout, a full-duplex connection will be needed.</i>	Mbps
Manual/DHCPv6 Address	Manually entered address or address supplied by DHCPv6 server.	-
Local Link Address	The local link address is used for network address autoconfiguration where no external source of network addressing information is available.	-
Stateless Address	Unique IPv6 autoconfigured address.	-
All Session Information		
The All Session readings provide cumulative readings for the current multicast sessions.		
Total Bit Rate	Total bit rate on the currently selected copper/optical port including network headers.	Kbps
Session Count	The number of sessions present on the link.	-
All Session IP Error	Indicates the worst case packet error from all sessions. <i>NOTE. The All Session IP/PIT/TS error LEDs will turn red only when the related limits defined on the Information screen are exceeded.</i>	(Error LED)
All Session PIT Error	Indicates the worst case PIT Error from all sessions.	(Error LED)
All Session TS Error	Indicates compliance checking and sync errors for all sessions.	(Error LED)
All Bit Rate Error	Indicates bit rate errors for all sessions.	(Error LED)
Selected Session Statistics		
The Selected Session readings provide readings for the current session.		
Lock	The LED icon is green when the signal is in sync and is being received normally. When a signal is present but no lock is achieved, the indicator is red. When no signal is found, the indicator is gray.	(LED)
Session Bit Rate	Bit rate of currently selected stream including network headers.	Kbps
Min Packet Interarrival Time	Minimum packet interarrival time (PIT) of the currently selected stream.	ns
Mean Packet Interarrival Time	Mean packet interarrival time (PIT) of the currently selected stream.	ns
Max Packet Interarrival Time	Maximum packet interarrival time (PIT) of the currently selected stream.	ns
IP Errored Packet Rate	The calculation is maintained per session on the interface card. The field displays a red background if the rate is greater than zero.	pkt/min

Table 2-5: GbE interface readings (cont.)

Field title	Description	Units
IP Errored Packet Count	Total IP packet error count since the last reset. The count is maintained per session on the interface card, so that the count that is presented when a stream is selected is since reset or startup, not since the session was selected. The field displays a red background if the count is greater than zero.	pkts
RTP Lost Packet Rate	The calculation is maintained per session on the interface card. The field displays a red background if the rate is greater than zero. This field is not applicable (gray) if protocol is set to UDP.	pkt/min
RTP Lost Packet Count	Total lost RTP packets since the last reset. The count is maintained per session on the interface card, so the count that is presented when a stream is selected is since reset or startup, and not since the session was selected. The field displays a red background if the count is greater than zero. This field is not applicable (gray) if the protocol is set to UDP.	pkts
RTP Out of Order Rate	The calculation is maintained per session on the interface card. The field displays a red background if the rate is greater than zero. This field is not applicable (gray) if protocol is set to UDP.	pkt/min
RTP Out of Order Count	RTP out of order packet total count (since last reset). Count is maintained per session on the interface card, so the count that is presented when a stream is selected is since reset or startup, and not since the session was selected. The field displays a red background if the count is greater than zero. This field is not applicable (gray) if protocol is set to UDP.	pkts
TS CC Error	Total MPEG CC errors on this session since reset or startup. The field displays a red background if the count is greater than zero. NOTE. The TS CC Error count may not equal the count shown in the Analysis Tests view, for example TR 101 290, test 1.4, Continuity. The interface card starts counting before the DTV processor card, and will continue to count per session, while the DTV monitors other sessions.	-
Locked Session Information		
Source IP	IP address of the currently monitored transport stream.	-
Source Port	Port that is currently receiving the transport stream.	-
Destination IP	IP address to which the transport stream is being sent.	-
Destination Port	Port to which the transport stream is being sent.	-
Type of Service	Type of service field of the transport stream IP packets.	-
IP Datagram Size	Datagram size of the transport stream IP packets.	bytes
VLAN Tag	Virtual Local Area Network (VLAN) tag displayed in hex format. This is a two byte value containing priority bit, canonical format indicator (CFI), and VLAN ID (VID).	-

Diagnostics Tab

This tab displays ping results in the same format as the DOS ping program. The results include round trip time, TTL, and time-out messages. The results will be shown in this table after the Ping button is clicked. The address format, IPv4 or IPv6, should be selected in accord with the address format used.

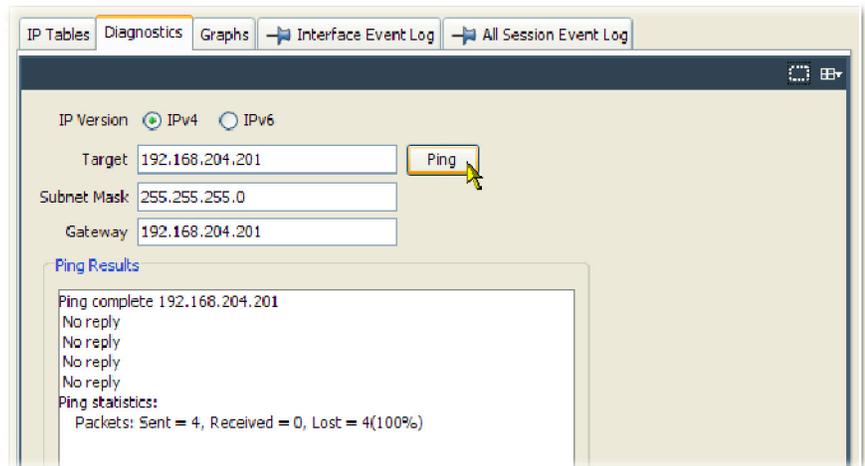


Figure 2-29: GbE interface - Diagnostics

Graphs Tab This tab allows a range of measurements to be displayed in graphical form. Readings are also displayed. (See page 2-46.)

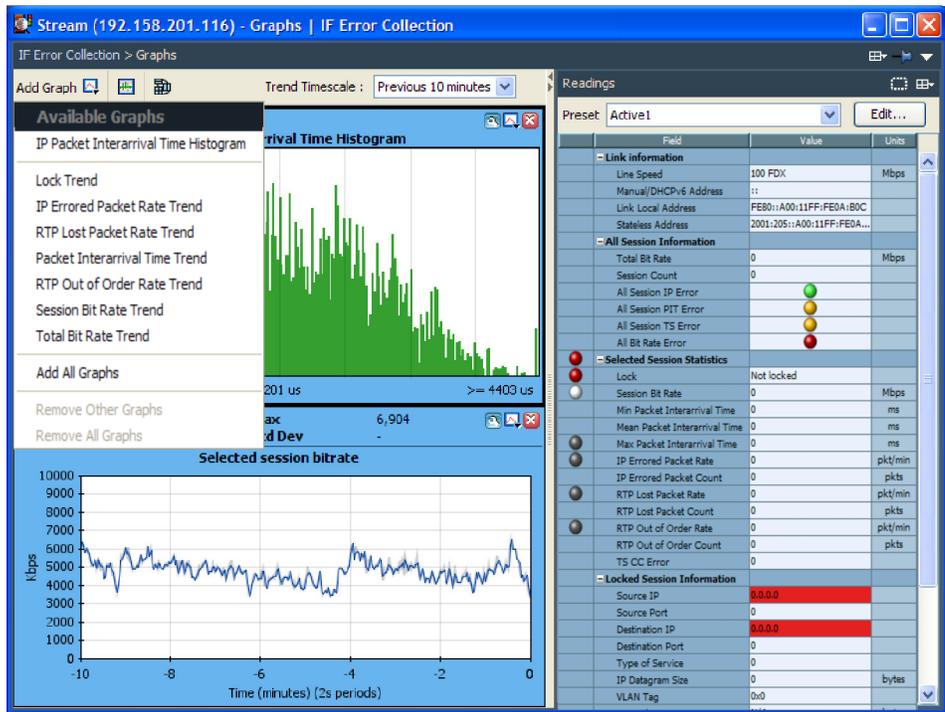


Figure 2-30: GbE interface graphs (tear-off view)

The following trend graphs are available: Lock, Corrupt Packet Rate, Dropped Packet Rate, Packet Inter-Arrival Time (Peak and Average), and Out-of-Order Packet Rate. The period over which the trend values are displayed can be selected from the Trend Timescale drop-down menu or from the graph context menus.

On some trend graphs, peak readings are shown in gray; the average readings are shown a single line.

Also available are graphs of the selected session bit rate and session cumulative bit rate (the sum of bit rates of all sessions).

Interface Event Log This log collects all of the interface errors in a single log file. The log can be saved for detailed examination and manipulation.

All Session Event Log This log collects all events. Apart from displaying all events, two other subsets of all events can be selected from a drop-down list and displayed, that is Selected Stream Events and All IP Session Events.

GbE Operation

The following notes are included to assist with the setup and operation of the GbE interface card. Click the Interface button in the toolbar to access the interface setup.

- Before connecting to the network under test, enter a valid Input Card IP address on the interface configuration dialog box, otherwise any router or switch that is connected may add an invalid IP address to its own ARP table (which may have a long time-out).
- If the Input Card IP is 0.0.0.0, you cannot be active on the network. Similarly, if the Input Card MAC is 00-00-00-00-00-00, you cannot be active on the network. In the latter case, the GbE card may have been incorrectly configured.
- A MAC address is allocated to the GbE interface card during manufacture. If required, you can change it using the Configure Interface dialog box.
- The MAC and IP addresses of the GbE interface card must be configured before any of the other GbE interface settings.
- The Network Interaction setting must be one of the active options when you are trying to send or receive pings on the network or when you are acting as an end point for unicast and multicast traffic.
- IGMP (Internet Group Management Protocol) join and ping commands cannot be sent when the Network Interaction mode is set to passive.
- An SFP (Small Format Pluggable) module is used to facilitate the Ethernet Optical interconnection feature. The GbE interface card has been tested with SFP module(s) ordered from Tektronix. SFP modules purchased from a supplier other than Tektronix are not warranted to work.
- Only optical SFPs are supported; copper SFPs are not supported.
- Only full duplex operation is supported by the GbE interface card.
- Traffic flows are displayed in the Traffic screen only if they have a total packet rate of > 5 network packets per second.
- The Traffic screen will show all traffic, for example, FTP. For non-transport streams, the DTV monitor will perform IP level tests only.
- Only transport streams can be selected for monitoring; transport streams are indicated by a check mark in the TS column.

COFDM Interface

COFDM (Coded Orthogonal Frequency Division Multiplexing).

Readings The following LED indicators are available on the Readings panel:

Overall RF Lock. All the lock indicators are showing "in lock", and the signal is being received normally.

TPS Lock. Transmission Parameter Lock, showing true if the ruggedly modulated TPS is being received.

AGC Lock. Automatic Gain Control lock, showing the received signal is within AGC control range.

SYR Lock. Symbol Recovery Lock, showing that the FFT symbol recovery system is in lock, allowing constellation data to be extracted.

FEC Lock. Showing the Reed Solomon Forward Error Correction system is in lock, and applying error correction to the received data.

Graphs The following graphs are available on the Graphs panel:

RF Constellation (all data carriers). When the receiver is in RF lock, the constellation points are displayed. According to ETR290, only the data pilots are used for MER and EVM calculation. The samples collected are not real time, so there is some dwell (delay) before a complete constellation is displayed. The persistence of the display can be varied using the Persist slider control at the bottom of the graph.

MER and EVM calculations are performed on the constellation data according to the formulae given in TR 101 290. This calculation specifically excludes the TPS carriers.

Overall SNR (all continuous pilots). A time line graph of measured Signal to Noise Ratio is displayed, over the preceding 255 seconds.

Overall SNR (all continuous pilots). A time line graph of measured Modulation Error Ratio is displayed, over the preceding 255 seconds.

Linear Amplitude response (selected carriers). A linear amplitude response is shown for the carriers selected using the carrier START and STOP controls. Allows you to view and zoom in on frequency dependent amplitude distortions.

Impulse Response. A channel response graph is shown, allowing time related distortions, particularly echoes, to be displayed relative to the main signal. Echoes occurring before and after the main signal are displayed. The graph is derived from the linear amplitude response, transformed into the time domain. The card settings can be used to extend the time range of the impulse graph.

NOTE. *The impulse graphs are indicative only; amplitudes farther away from the 0 dB peak tend to be reported low.*

8PSK Interface

PSK (Phase shift keying).

Readings The following LED indicators are available on the Readings panel:

RF Lock. Indicates when the RF receiver sections are in lock and receiving normally.

FEC Lock. Indicates when the Forward Error correction (DVB or turbo coded) is in lock and the data is being processed to give Transport Streams.

Graphs The constellation display is a representation of the digitally modulated carrier's instantaneous phase and amplitude for each transmitted symbol. A good constellation will have well-defined dot clusters in tight formations; each cluster should be centered in a grid overlay square. The overall shape of the dot clusters should form a square as represented by the outer edges of the grid.

The Persistence setting in the graph context menu sets the time in seconds that the dots persist on the graph.

DVB-S2 PSK Interface

DVB-S2 PSK (Phase shift keying).

Readings The following LED indicators are available on the Readings panel:

Signal Acquisition:

RF Lock. Indicates when the RF receiver sections are in lock and demodulating the input successfully.

Front End Lock. Indicates when the FEC (Forward Error Correction) is in lock.

Input Sync Active. Indicates that multiple stream frames are occurring within the received signal, and that the receiver has correctly locked on to the frame

boundaries. The synchronization function can be switched on and off in the Configure Interface dialog box. (See page 3-49.)

Graphs

Constellation. The constellation display is a representation of the digitally modulated carrier's instantaneous phase and amplitude for each transmitted symbol. For the DVB-S2 formats, a number of different constellations can be displayed, including QPSK, 8SPK, 16APSK, and 32APSK. QPSK and 8PSK constellation points lie on a single circle around the graph origin; two and three concentric circles of points form the 16APSK and 32APSK constellations. The APSK modes are used to carry higher bit rates, but at reduced resilience to noise and distortion in the transmission channel.

The Persistence setting in the graph context menu sets the time in seconds that the dots persist on the graph.

Also available are the following graphs, which display the trend of measurements over user-selected periods:

- **MER Ratio Trend.** (Modulation Error Ratio) Displays the received MER values over the selected period. Note that the MER is calculated after the receiver equalizer.
- **EVM Trend.** (Error Vector Magnitude) Closely related to, and can normally be calculated from, MER. It is a ratio of "errored signal vectors" to maximum signal amplitude expressed as a percentage (ref: TR 101 290 Annex).
- **Phase Noise Trend.** Displays embedded phase noise in the received signal, in degrees (rms) jitter, over the selected period.

Other trend graphs include Lock, Input Power, Carrier-to-Noise Ratio, and Pre Reed-Solomon/BCH BER (Bose, Chaudhuri, and Hocquenghen (BCH) bit error rate).

QPSK (L-Band) Interface

Readings

The following LED indicators are available on the Readings panel.

Lock If the interface is able to acquire full lock onto the channel and is receiving the signal correctly, the Lock indicator will light up green. Red indicates that lock cannot be achieved. Gray indicates that a signal is not present.

MER (dB). (Modulation Error Ratio) Provides a single "figure of merit" for received signal. It is the ratio of "ideal signal vectors" to "errored signal vectors" expressed in dB. MER is similar to a signal to noise measurement (ref: TR 101 290).

EVM (%). (Error Vector Magnitude) Closely related to, and can normally be calculated from, MER. It is a ratio of "errored signal vectors" to maximum signal amplitude expressed as a percentage (ref: TR 101 290 Annex).

BER. (Bit Error Rate) Provides an indication of the Forward Error Correction workload.

TEFs. (Transport Error Flag or TEI transport error indicator) Indicates the Forward Error Correction failure.

Graphs The constellation display is a representation of the digitally modulated carrier's instantaneous phase and amplitude for each transmitted symbol. A good constellation will have well-defined dot clusters in tight formations; each cluster should be centered in a grid overlay square. The overall shape of the dot clusters should form a square as represented by the outer edges of the grid.

The Persistence setting in the graph context menu sets the time in seconds that the dots persist on the graph.

QAM (Annex A and Annex C) Interface

Readings (See page 2-54, *QPSK (L-Band) Interface*.)

Graphs (See page 2-54, *QPSK (L-Band) Interface*.)

QAM (Annex B II) Interface

Readings The following LED indicators are available on the Readings panel.

Tuner Frequency. The center frequency of the received channel.

FEC Lock. Forward Error Correction Lock, which displays the status of the deinterleaver and Reed Solomon decoder.

RF Lock. If full lock onto the channel is acquired and it is receiving the signal correctly, the LED will light up green. When a signal is present but no lock is achieved, the indicator is red. When no signal is found, the indicator is gray.

Graphs The following graphs are available on the Graphs panel.

RF Constellation. I and Q data are collected from the QAM front end and displayed as a conventional constellation of 256 points by 256 points. The samples collected are not real time, so there is some dwell (delay) before a complete constellation is displayed. The persistence of the display can be varied using the Persistence option in the tools drop-down menu in the top right corner of the graph panel.

MER and EVM calculations are performed on the constellation data according to the formulas given in TR 101 290.

SNR after equalizer. This graph represents the signal-to-noise ratio over time, typically over 256 seconds. It is useful for examining signal-to-noise trends; for example, if an alarm condition has been breached, the graph can be used to examine trends in the signal-to-noise performance before the alarm occurred.

NOTE. *The Equalizer graph amplitude values are approximate.*

Equalizer. This graph shows the status of the equalizer taps, and gives an estimate of the channel state. If there are echoes or other time related distortions on the signal, the Equalizer display will display the amplitude of the corresponding tap correction values versus time.

MER. This graph gives a time record of MER over the last 255 seconds.

8VSB Interface

VSB (Vestigial sideband)

Readings The following LED indicators are available on the Readings panel:

Tuner Frequency. The center frequency of the received channel.

RF Lock. This indicates that all decoding systems are in lock and the signal is being decoded normally.

Graphs The following graphs are available on the Graphs panel.

Symbol Distribution. This graph shows the samples received over time in a falling vertical line display. In a noise free system, all samples would fall on one of the eight vertical lines. However, in normal systems the samples will be displayed distributed around the vertical lines. At the bottom of the graph display, the sample values are accumulated into a distribution histogram. The histogram can be displayed in a linear or logarithmic format.

Signal to Noise (SNR) (after equalizer). The SNR values are plotted in a pen-trace style, giving a brief history of the collected values.

Equivalent MER. An MER (Modulation Error Ratio) calculation is performed on the in-phase (I) data samples. The quadrature data samples are ignored in this calculation.

Equalizer. The equalizer coefficients are plotted across the graph display. The display illustrates the presence of multi-path echoes by indicating how the equalizer is adjusting to cancel them out.

NOTE. *The Equalizer graph amplitude values are approximate.*

Configuration

Stream Configuration

Configuration of the DTV monitor and the RUI are collected together in the Configuration dialog box, which can be accessed using the Configuration button on the toolbar. (See Figure 3-1.)

The left panel contains a tree view of the available configuration items under the primary nodes: Stream, Device, and Preferences. Individual nodes are described in the remainder of this section. When changes are made to the settings in individual nodes, the node name in the tree view is italicized and an edited indicator (*) is added to the name. The name and the indicator are reset when the change is applied and accepted. A brief explanation of the node is displayed at the top of the right pane; click the chevron button in the top right corner to hide the summary and increase available screen space.

The Stream configuration page can be accessed using **Configuration (toolbar) > Stream**. The Stream section of the configuration dialog box includes the following pages: Recording Settings, Test Parameters, PCR Filters, Slot Management, and Schedule Management. Each page can be accessed by selecting the relevant node in the tree view.

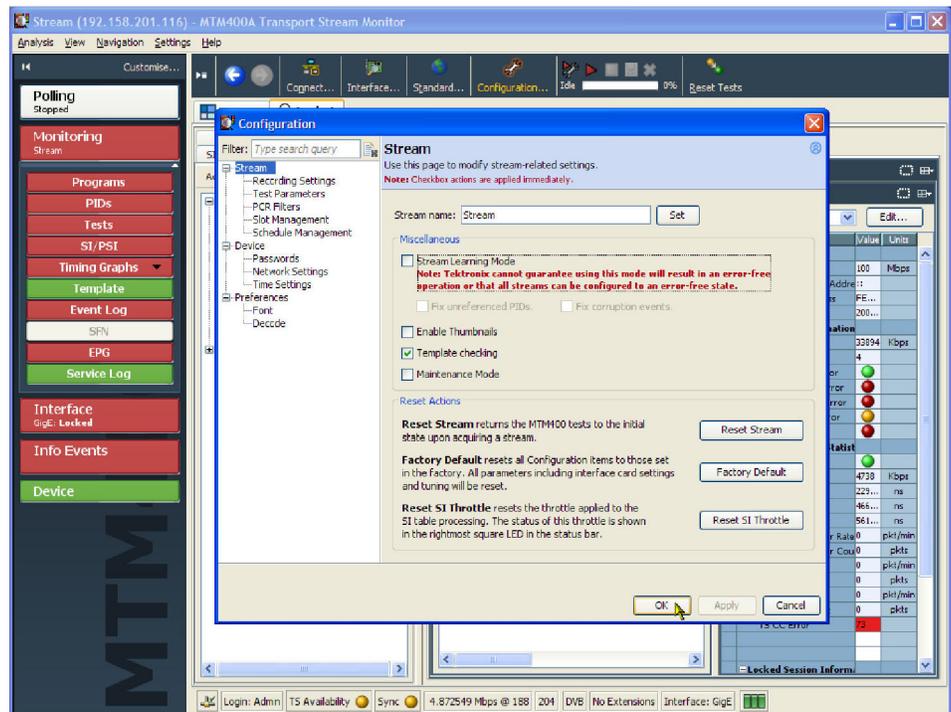


Figure 3-1: Configuration dialog box

Stream Global Settings

Select Stream in the tree view to access the Stream configuration global settings. (See Figure 3-2.)

NOTE. The changes made to the Miscellaneous check boxes are applied immediately.

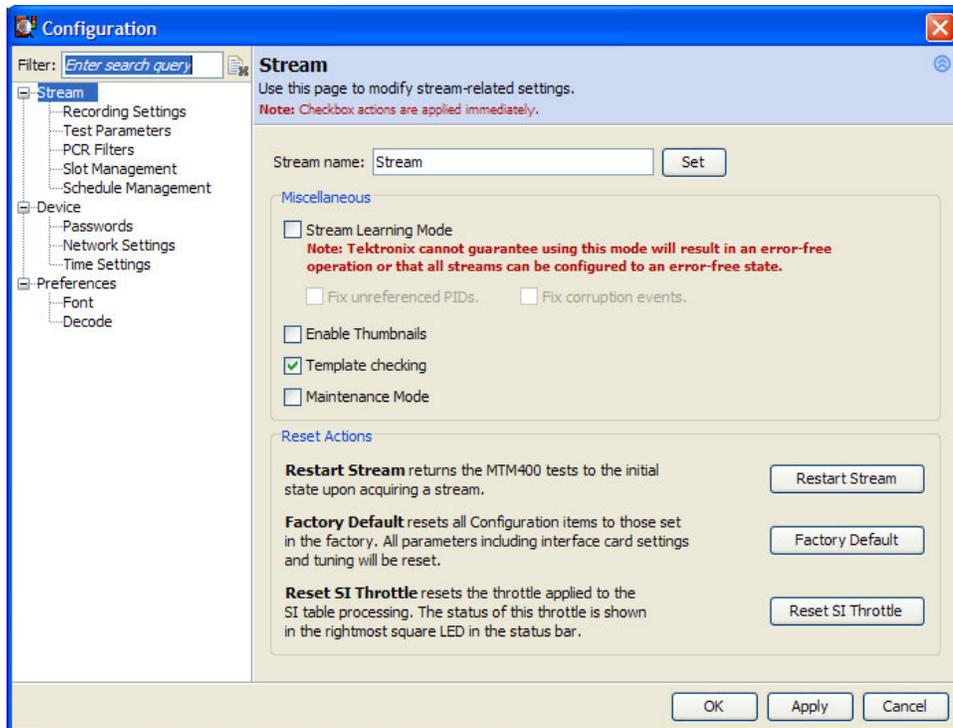


Figure 3-2: Stream global settings configuration page

Stream Name The stream name identifies the stream in the DTV monitor; the name must be 128 characters or less in length. The name is used in the RUI title bar and the Button bar.

Miscellaneous Settings **Stream Learning Mode.** Enables learning mode, in which the DTV monitor adjusts the analysis limits to match the presented data.

Few streams conform exactly to the interpretation standards. By adjusting parameters, learning mode ensures that "average" streams do not cause excessive errors. While learning mode is enabled, an icon is displayed in the RUI status bar.

Enable Thumbnails. Enables thumbnail generation for viewing in the RUI.

Thumbnail support must be installed on the RUI client PC if the DTV monitor RUI is to be used to view thumbnails. Instructions for installing the thumbnail support are included in the DTV Monitor Quick Start User Manual.

Template Checking. When enabled, applies the current template to the stream.

Maintenance Mode. When enabled, no alarms (TTL, relays or audible) will be raised for the stream. The DTV monitor will continue to monitor the stream and errors will be logged. The action of enabling and disabling maintenance mode is also recorded in the log. In this mode, all buttons are colored black.

Reset Actions **Restart Stream.** Returns the DTV monitor tests to the initial state upon acquiring a stream; all tests are reset and all SI information is flushed. This is useful if you make a seamless switch between nearly identical streams. If there is no change in the SI identity and/or versions to inform the DTV monitor that it is a new stream, you can reset the stream manually here.

Factory Default. Resets all configuration items, including interface card settings, to their factory defaults.

Reset SI Throttle. Resets the SI table processing throttle. The status of this throttle is shown graphically on the RUI status bar.

Recording Settings

To examine offline events that occur in a stream, recordings can be made whose start is triggered by an event, manually, an external TTL input, or by an alarm.

The recording is held in RAM and can be downloaded from the DTV monitor to the client PC for storage and further analysis. The file is stored as a valid MPEG file; however extra information is encoded in the file to allow Tektronix MPEG analysis products to reconstruct the real-time timing artifacts present at the time of recording.

The Recording Settings configuration page can be accessed using **Configuration** (toolbar) > **Stream** > **Recording Settings**. (See Figure 3-3.)

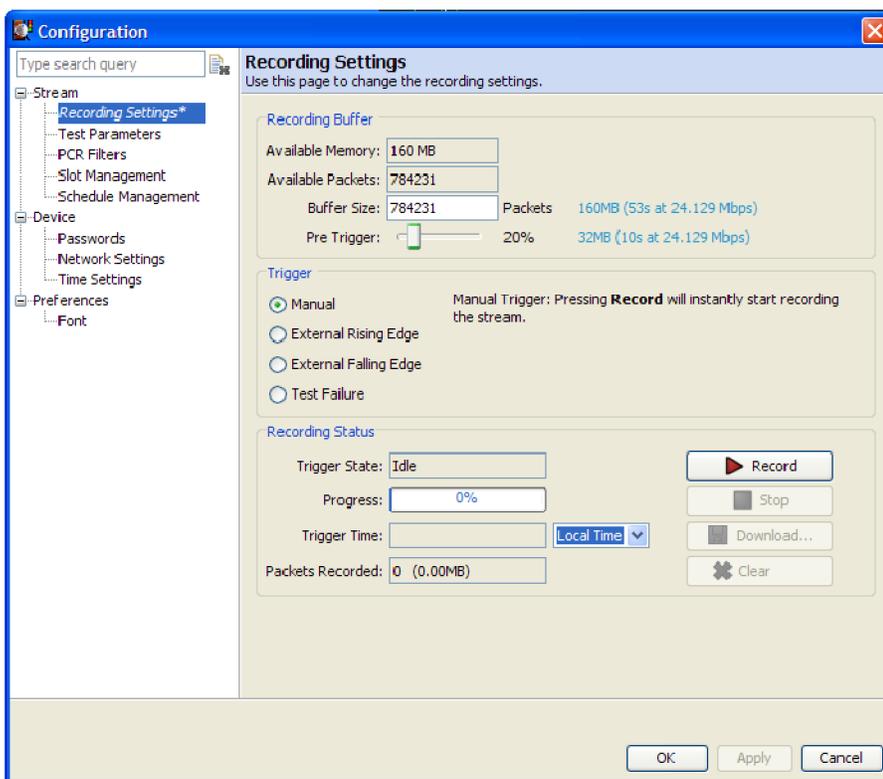


Figure 3-3: Recording Settings configuration page

Recording Buffer Settings

The recording buffer is the amount of memory available to store recordings.

Available Memory. The memory available for recording.

Available Packets. The maximum number of packets that can be recorded in the available memory.

Buffer Size. You can set the number of packets that are to be recorded.

Pre Trigger. You can set the percentage of a stream that will be recorded before a trigger event.

Pretrigger Recordings

A percentage of a stream can be recorded before a trigger event as specified by the pretrigger setting. The start of recording is dependent upon the selected trigger type. However, the stream is being recorded in memory at all times; the available memory is used as a circular buffer, in that it is filled and written over continuously until a trigger event occurs.

NOTE. *A circular buffer is an area of memory that stores a continuous stream of data by starting again at the beginning of the buffer after reaching the end.*

As soon as the trigger event occurs, recording will begin. Recording continues until the memory buffer is full. The recording will remain in memory until it is manually cleared, typically after it is uploaded to a client PC.

The pretrigger set up can be changed only when no recording activity is in progress.

The pretrigger setting allows the proportion of data saved before a trigger event to be specified as a percentage of the final recorded file. Set the percentage by dragging the Pre Trigger slider.

The proportion of pretrigger data might be less than specified if the trigger event occurred before enough packets were recorded in the circular buffer (particularly after clearing the buffer).

For example, if the available memory will hold a 20 second recording, with 25% pretrigger specified and an event-triggered recording starting five seconds or more into the run, the contents of the recorded file will be as illustrated in the following figure.

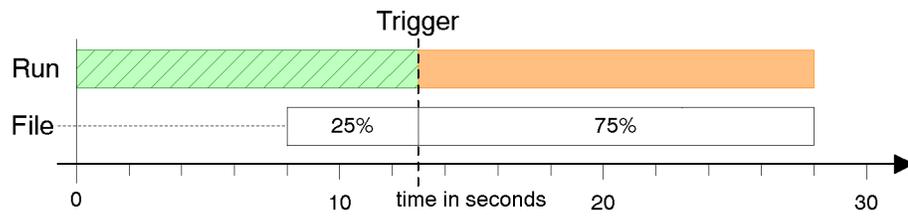


Figure 3-4: 25% pretrigger example

If the Trigger event was detected earlier than five seconds into the run, the 20 second file will contain all of the data up to the trigger. If recording was triggered at three seconds only the first 15% of the file would hold pretrigger data. The file contents would be as illustrated in the following figure.

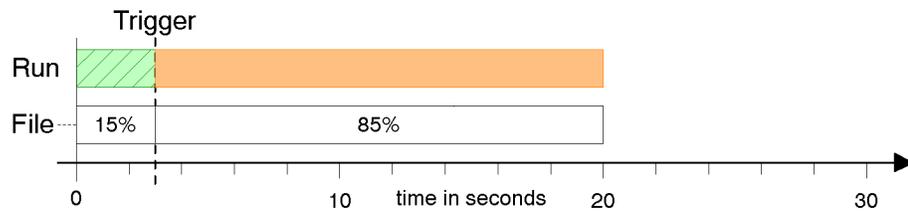


Figure 3-5: 15% pretrigger example

Trigger Types The event that triggers a recording can be one of four types:

Manual. You can start the recording at any time by clicking **Record**.

External Rising Edge / External Falling Edge. The trigger is set when **Arm** is selected. Recording will start when a rising / falling edge is detected at the TTL input on the TS Processor alarms connector. See the *MTM400A, IPM400A, QAM400A, and RFM300 DTV Monitor Specifications and Performance Verification Technical Reference* for a listing of the product specifications.

Test Failure. Tests can be associated with record trigger actions. (See Figure 3-6.) When a test with an associated record trigger action fails and Arm has been selected, recording starts.

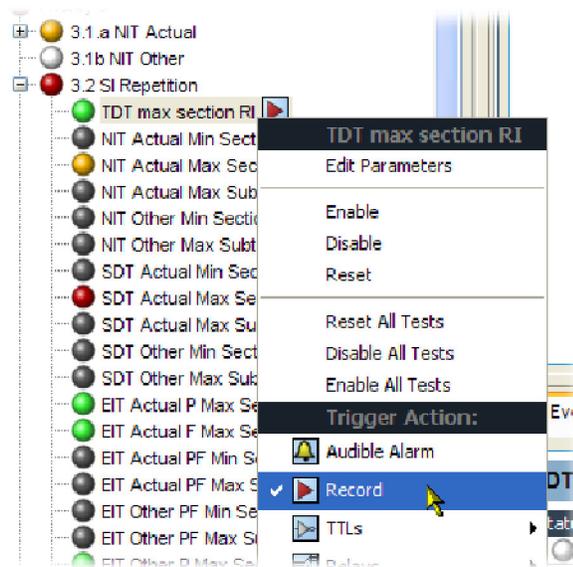


Figure 3-6: Record trigger set - example

Triggered Recording Operation

The Recording Status area of the Recording Settings page is used to set up and control the recording status.

Arm / Record. Arm the trigger (and wait for trigger event to occur) or start a manual recording. Arm starts recording in the pretrigger buffer, so that when the recording trigger is activated the pretrigger conditions are met. Trigger State shows the current state of the trigger: Idle, Waiting for trigger.

Trigger Time. Displays the time that the trigger event occurred. You can select the time zone in which trigger times are presented from the drop-down list:

- **Local.** The time local to the PC on which the DTV monitor RUI is currently running.
- **UTC.** Coordinated Universal Time.
- **Remote Time.** The time local to the device being monitored.

Packets Recorded. Displays the number of packets recorded and the amount of memory used.

Download. Enter the location to which the recorded stream is to be saved.

Clear. Clears the current recording. Background recording (for the pretrigger) will start again immediately.

Stop. Use this button to disarm the previously armed trigger or to stop the current recording. Any recording made up to the point when the button is pressed will be available for analysis.



The recording controls are also available in the toolbar:

Test Parameters

Many tests are associated with parameters recommended by the DTV standard (DVB, ATSC, ISDB) being applied to the stream. The parameters can be adjusted to suit local conditions (although the test result may then not conform to the standard).

The Test Parameters configuration page can be accessed using **Configuration** (toolbar) > **Stream** > **Test Parameters**. (See Figure 3-7.)

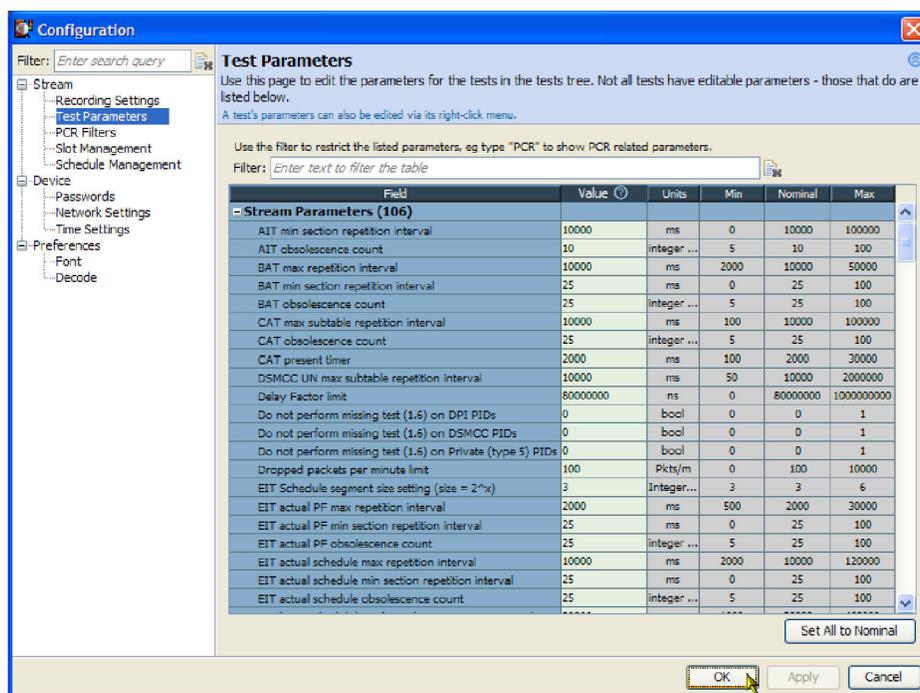


Figure 3-7: Test Parameters configuration page

Only administrators can set parameters, enable and disable tests, and set alarms.

On the Test Parameters page, the tests are grouped together as stream parameters, interface parameters, default PID group parameters, and default program parameters. You can search for a parameter by entering all or part of its name in the search box. Clear the search box to redisplay all of the parameters.

Each parameter lists the measurement units, the maximum and minimum values, and the nominal value recommended by the selected DTV standard. To change a value, place the cursor in the **Value** field, make the change and click **Apply**. To reset all parameters to their nominal values, click **Set All to Nominal**. Network traffic will dictate how quickly changes are implemented by the instrument.

You can access parameters associated with individual tests by selecting Edit Parameters from the context menu of a test. Not all tests have parameters that can be edited. All of the test parameters are described in the *MTM400A, IPM400A, QAM400A, and RFM300 DTV Monitor Test Parameter and Configuration File Technical Reference*, which can be downloaded from the Tektronix Web site (www.tektronix.com).

PCR Filters

The PCR measurements performed by the instrument are defined by TR 101 290. Appendix I of TR 101 290 describes the measurements in detail and introduces the concept of the "demarcation frequency" at which PCR errors are separated into drift errors or jitter errors. Errors below the demarcation frequency are measured as drift, while errors above that frequency are measured as jitter.

TR 101 290 also defines three standard demarcation frequencies, MGF1 (10 MHz), MGF2 (100 MHz), and MGF3 (1000 MHz), at which the PCR measurements can be made, and provides for a user-definable demarcation frequency, MGF4.

The PCR Filters page can be accessed using **Configuration** (toolbar) > **Stream** > **PCR Filters**. (See Figure 3-8.)

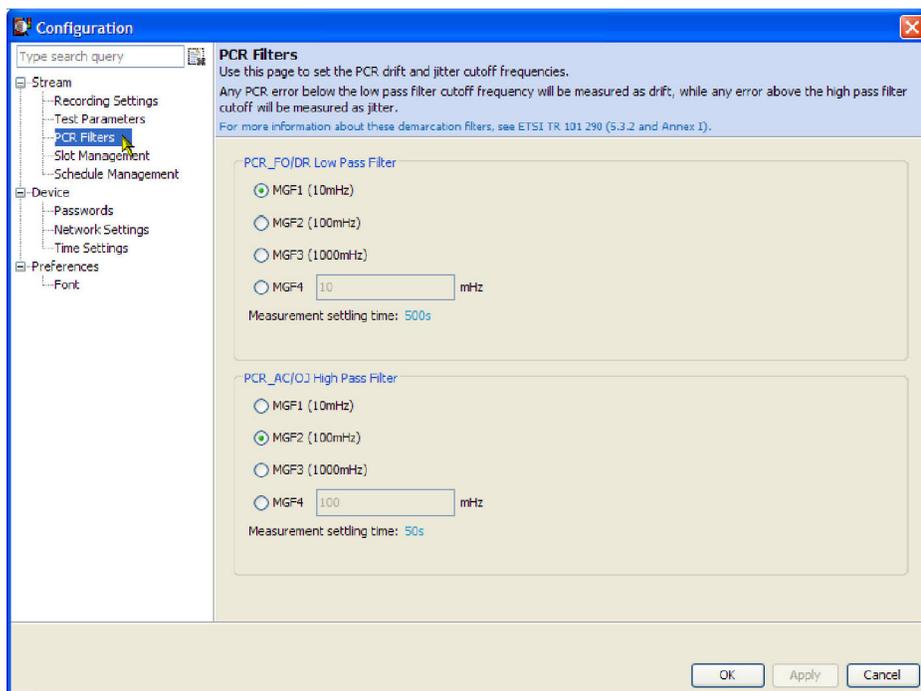


Figure 3-8: PCR Filters configuration page

Any PCR error below the low-pass filter cutoff frequency will be measured as drift; any error above the high-pass filter cutoff will be measured as jitter.

The filters can be set to any of the standard MGF profiles, or a user desired cut-off frequency, by selecting MGF4 and entering a value between 1 MHz and 10000 MHz (10 Hz). Alternatively, these filter values can be changed in the Test Parameters page. Search for "PCR_" to find the high- and low-pass filter parameters.

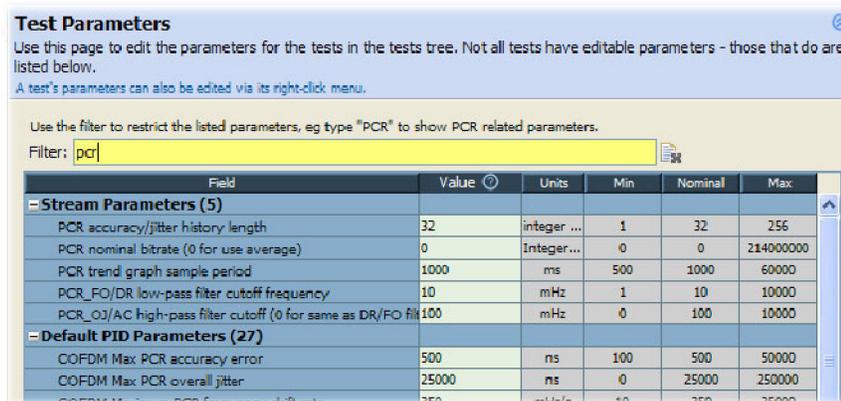


Figure 3-9: PCR Filter parameters

The TR 101 290 drift limit of ± 75 MHz/s is only defined at a demarcation frequency of 10 MHz. As the low-pass filter frequency is increased above that value, more of the PCR jitter will be measured as drift, and so the measured drift values will increase. If you are attempting to check that your source PCR clock is compliant with the TR 101 290 limits, the low-pass filter cut-off frequency should be set to 10 MHz.

Settling Time. All of the PCR measurements that depend on demarcation filters have a settling time. (See Table 3-1.) The measurements will not return valid values before this time elapses. The settling time is indicated on the PCR graphs.

This settling time is inversely proportional to the cut-off frequency of the demarcation filter. This means that there is a trade-off between reducing the filter frequency to improve drift measurement accuracy and increasing the time it takes to obtain any drift measurements at all.

For more information about PCR measurements, read the *PCR Measurements Primer*, available on the Tektronix Web site (www.tektronix.com).

Table 3-1: PCR settling times

Filter cut-off	Settling time	TR 101 290	Comments
10 MHz	500 s	MGF1	TSCA default for PCR_FO/DR low-pass filter cut-off; drift limit of ± 75 MHz/s is only applicable at this level
100 MHz	50 s	MGF2	TSCA default for PCR_OJ/AC high-pass filter cut-off.
1000 MHz (1 Hz)	5 s	MGF3	-
1 MHz - 10,000 MHz	5000 s - 0.5 s	MGF4	User-defined profile

Slot Management

Configuration files provide a means of supplying and storing all stream-related, user-definable parameters that are active in a DTV monitor. Configuration files may be complete, containing all parameters, or partial, containing only those parameters that require changing. The files are composed in XML (eXtensible Markup Language) format and can contain sections relating to all aspects of configuration; template information can also be included. The files can be viewed in Internet Explorer or they can be viewed and edited in a text editor, for example, Microsoft Notepad. For more information, see the *MTM400A, IPM400A, QAM400A, and RFM300 DTV Monitor Test Parameter and Configuration File Technical Reference*, which can be downloaded from the Tektronix Web site (www.tektronix.com).

The configuration slot management page can be accessed using **Configuration** (toolbar) > **Stream** > **Slot Management**. (See Figure 3-10.)

The concept of configuration files allows uniformity in setup to be achieved at a range of locations (DTV monitors), especially where scheduling is supported. An additional facility allows weekly schedules to be written for each stream, which instructs the DTV monitor to load configuration slots at specific times and days during the week. (See page 3-16, *Schedule Management*.)

In DTV monitors, configuration settings are held in storage slots. (See Figure 3-11.) Eight storage slots are available for each stream. The contents of a storage slot must be applied to the active area (active configuration) before it is implemented.

The **Allow Users to load...** check box is available to Administrators only. Select the check box to allow Users to upload configurations predefined by the Administrator.

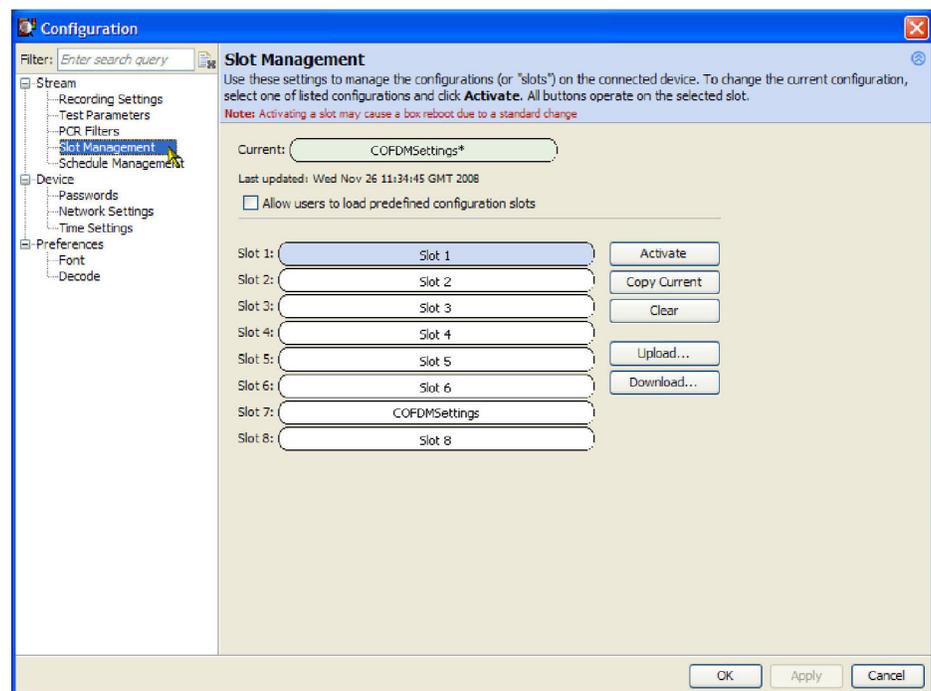


Figure 3-10: Configuration - Slot Management page

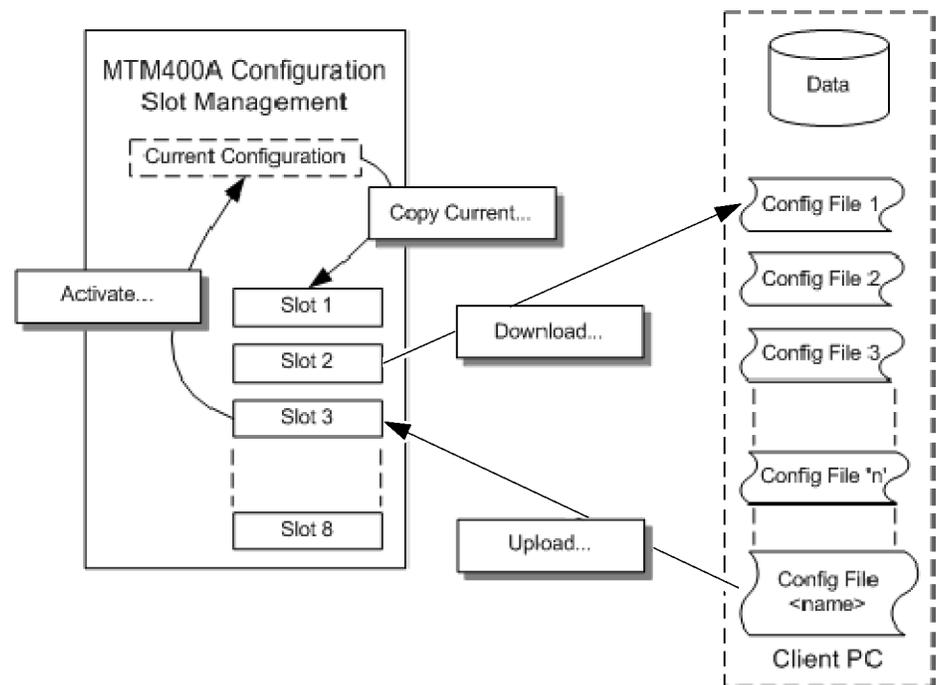


Figure 3-11: Configuration file handling

You can modify the active parameters during normal operation; these changes will only affect the active configuration. The active configuration is saved in non-volatile RAM as operational changes are made and will be recovered after the unit is reset or powered off.

The active configuration settings can also be saved to any of the storage slots. The contents of a storage slot can subsequently be downloaded to a file on a remote, networked PC. Similarly, a correctly configured file (or portion of a file) can be uploaded into any slot. A file portion can be a correctly configured XML file that specifies a subset of the total configuration file.

The default names allotted to the slots are Slot 1 to Slot 8; they are always displayed in the same order. When a configuration file occupies the slot, the name is changed to that in the configuration file header; however, the position of the slot in the list remains the same. For the configuration file structure, refer to the *MTM400A, IPM400A, QAM400A, and RFM300 DTV Monitor Test Parameter and Configuration File Technical Reference*.

Activating a Slot

For the settings stored in a slot to become active, the contents of a storage slot must be transferred to the active configuration.

On the Slot Management page, highlight the slot to activate and click **Activate**. The settings stored in the selected slot will be copied to the active configuration and implemented.

Storing Active Settings to a Slot

The settings currently held in the active configuration can be copied to any storage slot.

On the Slot Management page, highlight the slot to receive the active configuration and click **Copy Current**. The active configuration settings will be stored in the selected slot.

Downloading from a Storage Slot

The settings currently held in a storage slot can be copied to a file on the Client PC, for example, for modification.

1. On the Slot Management page, highlight the slot containing the configuration to be downloaded and click **Download**.
2. In the Save dialog box, locate and select a file name to be overwritten or type in a new name; use the extension .xml.
3. Select **Save** to download the configuration file from the selected slot.

Uploading to a Slot

Correctly prepared configuration files can be uploaded to a slot.

1. On the Slot Management page, highlight the slot to receive the uploaded configuration file and click **Upload**.
2. In the Open dialog box, locate and select the configuration file to be uploaded or type in the path and name (*.xml).
3. Select **Open** to upload the configuration file into the selected slot.

If the file is incorrectly formatted, the operation will fail and a message will be displayed.

Clearing a Slot

Slots can be cleared as follows:

1. From the Configuration view, select **Clear Slot**.
2. From the list, highlight the slot to be deleted.
3. Select **OK**. The slot name is deleted from the dialog box and replaced with the slot number.
4. Select **Start** to upload the configuration setting into the selected slot.

Renaming a Slot

The only way of changing the name displayed in a slot is by modifying the associated configuration file header. The upload and download file names will not be used. Only names present in the file header will be used as slot names.

1. If necessary, download the slot file to your PC (see **Downloading from a Storage Slot** above).
2. Using a text editor, for example, Notepad, open the configuration file.
3. In the file header (<MTM400Configuration...>), enter the file name required within the Name field quotation marks. For example, in the following example, the name New Configuration has been entered.

```
<xml version="1.0" encoding="UTF-8">
<MTM400Configuration Name = "New Configuration"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:noNamespaceSchemaLocation="config.xsd"> <Device>...
```

4. Save the file, ensuring that the file name extension is xml.
5. Upload the file to a slot as required.

NOTE. *The file name in the header is used as the slot name.*

Schedule Management

Configuration schedules allow information held in configuration slots to be activated at specified times and days of the week. (See page 3-12.) Schedules operate on a weekly basis. A schedule includes the following information:

- A schedule name. When the schedule is uploaded to the DTV monitor, the schedule name will be displayed in the Current Schedule field in the Configuration dialog box.
- UTC Offset. (See page 3-20, *Scheduling and Time Zones*.)

The schedule file can be uploaded to DTV monitors in many time zones, ensuring that the configuration files will be activated at the same moment on each device. The schedule file contains a number of schedule items, such as:

- Configuration Slot - the number of the stored slot (1 to 8) to copy to the active slot.
- Load Time - time configuration slot should be copied in the specified schedule time zone (HH:MM:SS)
- The days of the week when this is to be applied. This can be a single day, or a list of days (Mon | Tue | Wed | Thu | Fri | Sat | Sun).
- Start Error Reporting Holdoff Period (seconds)
- Stop Error Reporting Holdoff Period (seconds)
- Start Error Logging Holdoff Period (seconds)
- Stop Error Logging Holdoff Period (seconds)

Changing configurations can cause an excessive number of spurious errors to be generated. The Error Logging and Reporting Hold-Off Periods are provided so that logging and reporting of errors can be suspended before, during, and after the changeover, if required.

One schedule item must be specified as the baseline (the first item to be loaded). This allows the DTV monitor to synchronize, for example, if the instrument is switched on in the middle of a weekly schedule.

The schedule will be specified in a text file using XML. The following is an example of the schedule file format:

```

<Schedule Name="<name>" UTCOffset="<offset>">
<!--where <offset> = Local, or an offset from UTC time e.g. -60 -->
  <BaseScheduleItem>
    <!--Defines the base schedule item - there should only be one of these -->
    <ConfigurationSlot>1</ConfigurationSlot>
    <LoadTime>16:34:30</LoadTime> <!-- Load time specified in HH:MM:SS -->
    <LoadDay>Mon</LoadDay> <!-- Mon, Tue, Wed, Thu, Fri, Sat or Sun>
    <HoldOffPeriods>
      <StartErrorReporting>5</StartErrorReporting> <!-- Optional -->
      <StopErrorReporting>5</StopErrorReporting> <!-- Optional -->
      <StartErrorLogging>5</StartErrorLogging> <!-- Optional -->
      <StopErrorLogging>5</StopErrorLogging> <!-- Optional -->
    </HoldOffPeriods>
  </BaseScheduleItem>
  <ScheduleItem>
    <ConfigurationSlot>2</ConfigurationSlot>
    <LoadTime>15:00:00</LoadTime> <!-- Load time specified in HH:MM:SS -->
    <LoadDays>Mon | Tue | Wed</LoadDays>
    <!-- any combination of Mon, Tue, Wed, Thu, Fri, Sat, Sun>
    <HoldOffPeriods>
      <StartErrorReporting>5</StartErrorReporting> <!-- Optional -->
      <StopErrorReporting>5</StopErrorReporting> <!-- Optional -->
      <StartErrorLogging>5</StartErrorLogging> <!-- Optional -->
      <StopErrorLogging>5</StopErrorLogging> <!-- Optional -->
    </HoldOffPeriods>
  </ScheduleItem>
</Schedule>

```

In this example, both the BaseScheduleItem and the ScheduleItem have LoadDays entries; remember, if you copy and paste between the two sections, the BaseSchedule section entry is singular (LoadDay) and the ScheduleItem section entry is plural (LoadDays).

NOTE. *There should be only a single day listed in the LoadDay entry in the BaseScheduleItem section; there can be multiple days listed in the LoadDays entry in the ScheduleItem section.*

Scheduling

The Schedule Management page can be accessed using Configuration (toolbar) > Stream > Schedule Management. (See Figure 3-12.)

NOTE. *If any changes are made to the configuration from the user interface, a warning message is displayed seeking confirmation of the action. Changes can affect the configuration that is currently loaded by the scheduler. They can also affect or be affected by future scheduled configurations.*

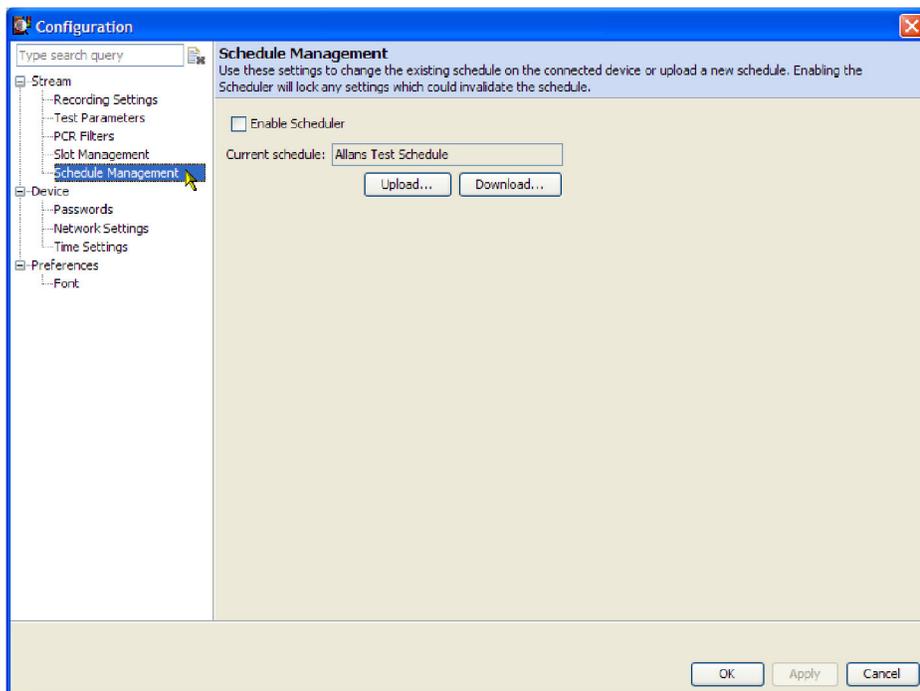


Figure 3-12: Schedule Management configuration page

With a prepared schedule file available, you can upload, download, and enable scheduling from the stream Configuration dialog box.

Uploading a Schedule. A schedule file is uploaded from either the client PC or a network location:

1. Click **Upload** on the Schedule Management page.
2. In the **Open** dialog box, enter or browse to the filename of the schedule file to be uploaded to the DTV monitor and click **Open**.
3. Select **Close** when the upload has finished or to terminate the process early.

The schedule name will be displayed in the Current Schedule field in the Configuration dialog box.

If the uploaded schedule is replacing a currently running schedule, the **Enable Scheduler** check box on the Schedule Management page should be cleared and then checked to allow the new schedule to take effect.

Downloading a Schedule. A schedule file is downloaded from the DTV monitor to either the client PC or to a network location:

1. Click **Download** on the Schedule Management page.
2. In the **Save** dialog box, enter or browse to the filename of the schedule file to be downloaded from the DTV monitor and click **Save**.
3. Select **Close** when the download has finished or to terminate the process early.

Enabling Scheduling. Scheduling will not be enabled until the Enable Scheduler check box is selected. When scheduling is enabled, all configuration editors, for example, the Parameters page, are locked; no changes can be made until scheduling is disabled. A message is displayed in the Configuration dialog box status bar.

If an uploaded schedule is replacing a running schedule, the Enable Scheduler check box on the Schedule Management page should be cleared and then checked to allow the new schedule to take effect.

Scheduling and Time Zones. A schedule consists of a list of schedule items that specify the times when specific configuration slots should be loaded. The UTC Offset schedule attribute allows the times to be interpreted in different ways:

- **Local.** If you set the UTC Offset attribute to Local, then the schedule times represent the local times on the DTV monitor. For example, if the UTC to Time Zone Offset of the device is -360 minutes (6 hours behind UTC) and a schedule load time is specified as 13:00, then the appropriate configuration will be loaded at 13:00 in the local time zone of the DTV monitor, which is $13:00 + 360 \text{ minutes} = 19:00 \text{ UTC}$.

(UTC to Time Zone Offset is set through **Configuration > Device > Time Settings**). (See page 3-26.)

Setting the UTC Offset attribute to Local is useful where it is easier for the user to calculate times in the time zone where the DTV monitor is installed. It is also useful where there are multiple DTV monitors situated in different time zones, and configurations should be loaded in the local time of each DTV monitor.

The configuration time are loaded for a schedule with the UTC Offset attribute set to Local containing a load time of 13:00 that are used by DTV monitors in several different time zones. (See Figure 3-13.)

- **User-Defined Offset.** You can also set the UTC Offset attribute to a numeric value specifying the time zone in which the schedule is written, and independent of the DTV monitor. UTC Offset represents the difference in minutes between the time zone that the schedule times are written in and the UTC. In other words, subtract the number of minutes from the times specified in the schedule to obtain UTC time.

For example, if UTC Offset is set to 60, the schedule times defined are one hour ahead of UTC. This means that if a schedule time of 11:00 is specified, the appropriate configuration should be loaded at $11:00 - 60 \text{ minutes} = 10:00 \text{ UTC}$. This method of operation is useful where there are multiple DTV monitors monitoring a transmission chain that spans several time zones, and

configurations that check features of the transport stream have to be loaded by each DTV monitor at the same instant in time.

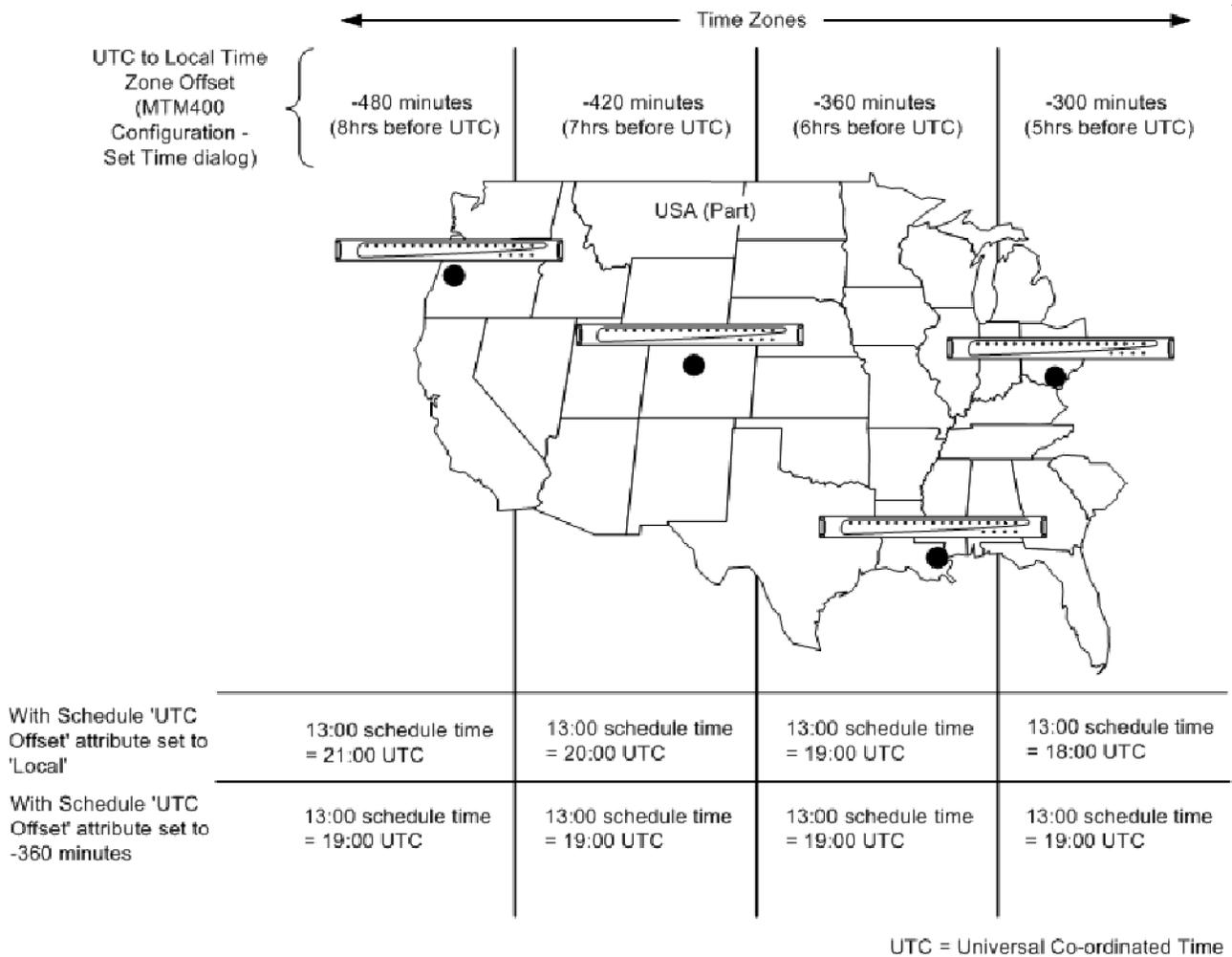


Figure 3-13: Scheduling and time zones

Device Configuration

The Device section of the Configuration dialog box includes the following pages: Passwords, Network Settings, and Time Settings. Each page can be accessed by selecting the relevant node in the tree view.

The Device configuration page can be accessed using **Configuration** (toolbar) > **Device**. (See Figure 3-14.)

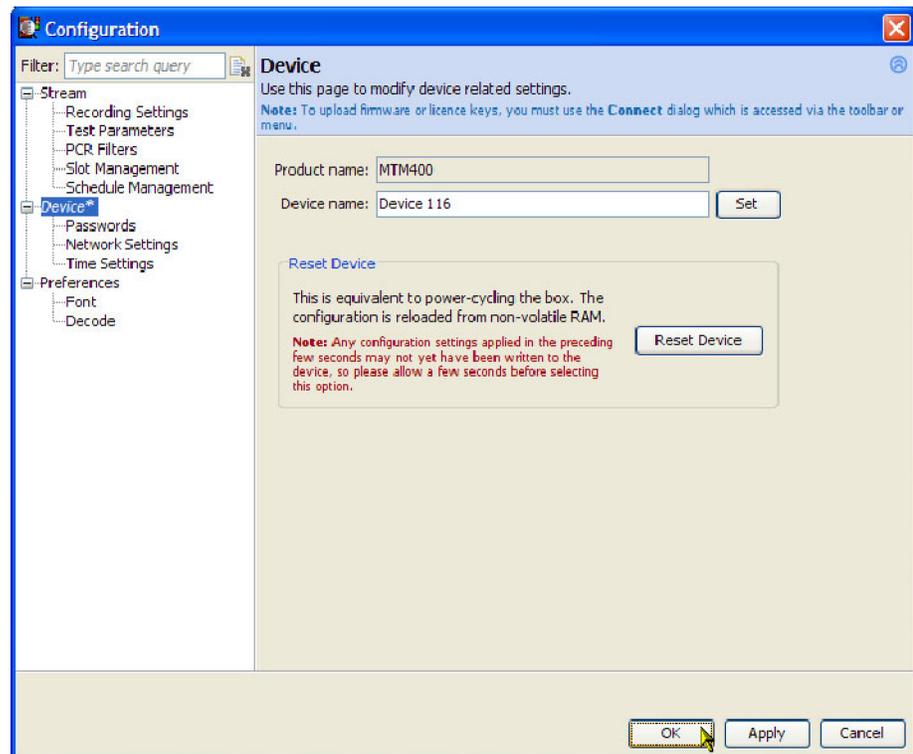


Figure 3-14: Device global configuration page

Device Global Settings

Select Device in the tree view to access the Device configuration global settings.

Product Name The product name is identified as DTV monitor.

Device Name The device name identifies the DTV monitor. The name is used in the Device button. Use the Set button to apply the name.

Reset Device Resets the DTV monitor; it is equivalent to power-cycling the box. The configuration is reloaded from non-volatile RAM. Any configuration settings applied in the preceding few seconds may not be saved. If you have just changed any settings, wait a few seconds before resetting the device.

Passwords Settings

Use the Passwords configuration page to change the current password. This is the password that will be required when you access the device through the RUI. The password file created is stored on the DTV monitor.

The passwords are associated with the two available user names: Administrator and User.

- Administrator. Gives full read/write access to all views and settings, including options where installed.
- User. Gives read only access to all views and settings, including options where installed. You can also reset alarms.

The Passwords configuration page can be accessed using **Configuration** (toolbar) > **Device** > **Passwords**. (See Figure 3-15.)

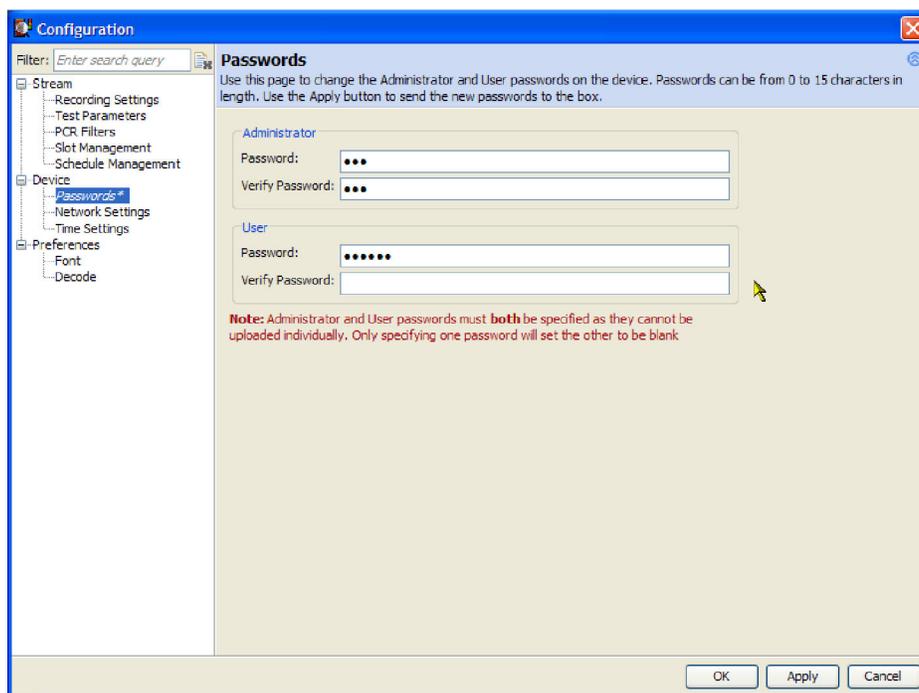


Figure 3-15: Passwords configuration page

Use the following procedure to change passwords:

NOTE. *You must log in to the DTV monitor as an administrator; only users with administrator access can change the passwords.*

The Administrator and User passwords must both be specified when either is changed. If only one password is specified, the other will be set to blank.

1. Enter the password in the Administrator **Password** field.
2. Reenter the password in the Administrator **Verify Password** field.
3. Repeat steps 1 and 2 for the User password fields.
4. Click **Apply** to confirm the passwords.

Network Settings

Use the Network Settings configuration page to change the network attributes for the DTV monitor. Although the DTV monitor network identity is initially set up during installation, it can be changed subsequently through this configuration page. SNMP community strings can also be set using the Network Settings dialog box.

The Network Settings page can be accessed using **Configuration** (toolbar) > **Device** > **Network Settings**. (See Figure 3-16.)

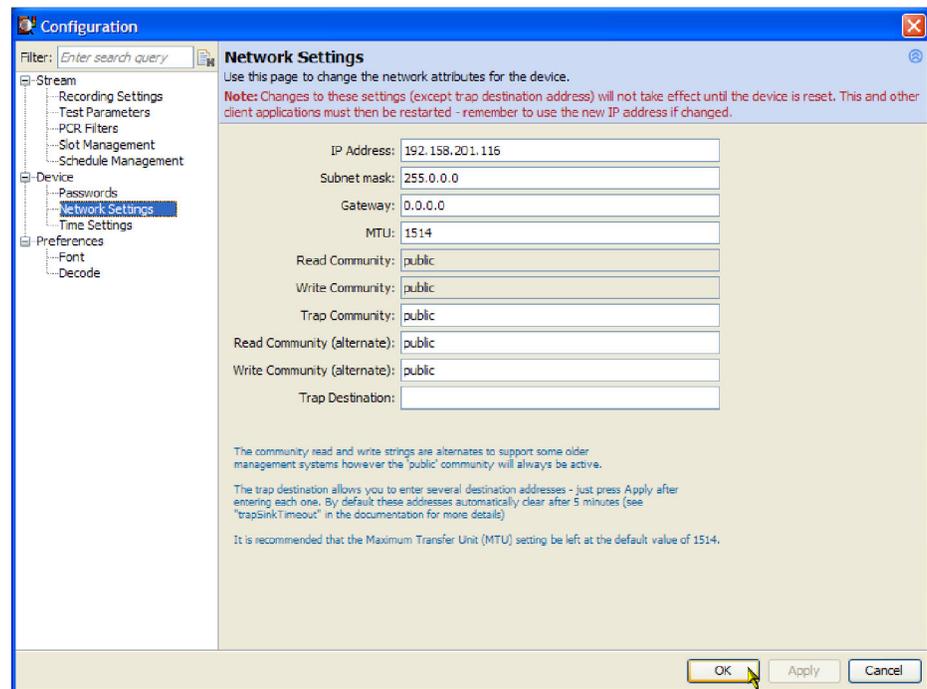


Figure 3-16: Network Settings configuration page

For changes to the network settings to take effect, click **Apply** to restart the device. Click **Cancel** if a restart is not required. The new settings will not take effect until the device is restarted.

If necessary, obtain the IP Address, Gateway and Subnet Mask values from the Network Administrator.

NOTE. *If the Network Settings are changed and the DTV monitor is restarted, the PC that is running the RUI will be unable to communicate with the instrument, since the browser is trying to communicate with the previous network identity. It will be necessary to close the RUI (File > Exit) and restart it using the new network identity.*

Maximum Transfer Unit (MTU) refers to the size (in bytes) of the largest packet that the DTV instrument will send to the control network. It is recommended that the MTU setting be left at the default value of 1514.

The community strings, **Read Community (alternate)** and **Write Community (alternate)**, are provided to support some older management systems.

The trap destination field allows you to enter several addresses to which SNMP traps should be sent. This may limit the effects of multiple traps messages overwhelming the management system.

Time Settings

From the Time Settings configuration page, you can coordinate the time used by the DTV monitor and/or the remote user interface.

Time Zones

A consequence of allowing the DTV monitor user interface to be accessed across networks is the crossing of time zones and allowing for DST (Daylight Saving Time) variations. Various features of the user interface use timing information, including the Log files. You need to know the time source being used to record events. Also, when scheduling the loading of configuration files, time zones must be taken into account. (See page 3-16, *Schedule Management*.)

The following figure shows a typical setup in which a DTV monitor is located in Denver, CO and is monitored from Portland, OR. In local time, Portland is one hour behind Denver. In this example, the UTC is 10 p.m. Therefore the local times in Portland and Denver are 2 p.m. and 3 p.m. respectively.

The user interface allows you to coordinate times of the system elements and to choose the local reference time zone; UTC, local time at the client PC, or local time at the DTV monitor. All times are calculated with respect to UTC.

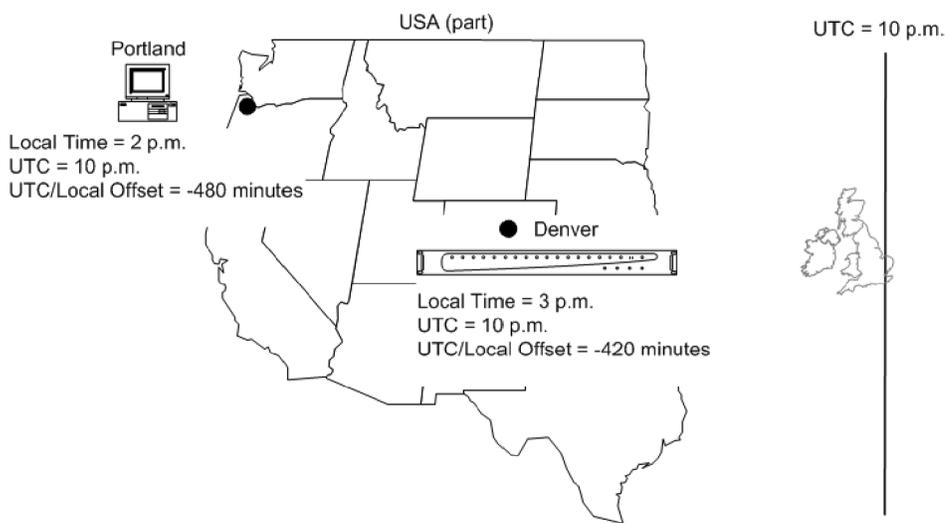


Figure 3-17: Time zones example

Time Settings The Time Settings configuration page can be accessed using **Configuration (toolbar) > Device > Time Settings**. (See Figure 3-18.)

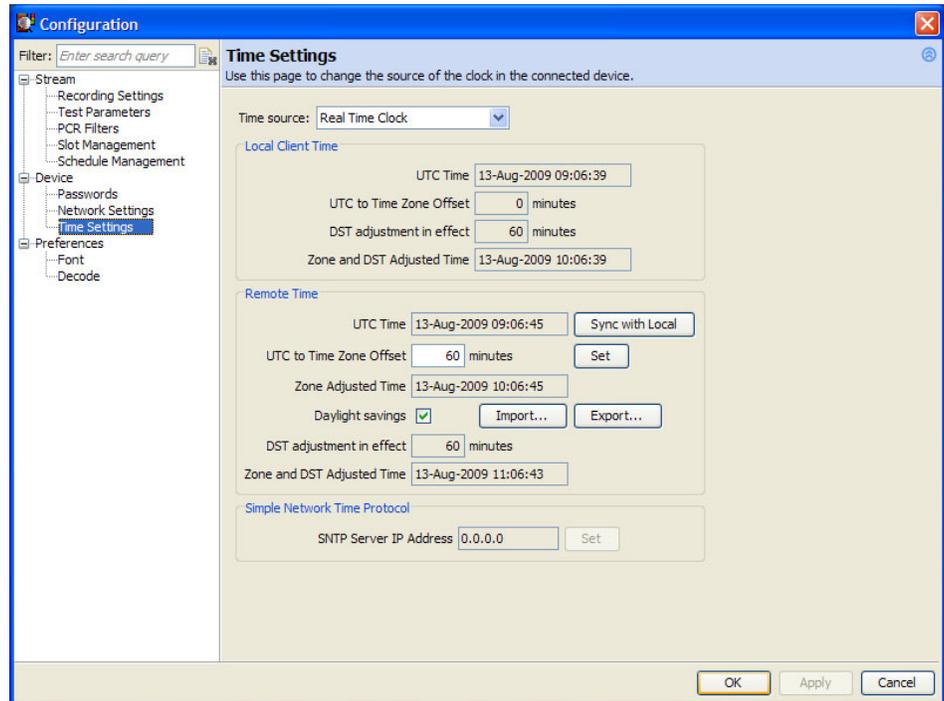


Figure 3-18: Time Settings configuration page

The Time Settings page has three panels:

- **Local Client Time:** This panel refers to the local time, at the RUI client.
- **Remote Time:** This panel refers to the time at the currently connected remote monitor.
- **Simple Network Time Protocol:** (See page 3-28.)

Three time sources are available to the DTV monitor from the Time Source drop-down menu:

- **Real Time Clock.** The DTV monitor internal clock.
- **Longitudinal Time Clock.** An analog-format time clock often available from a centralized source.
- **Simple Network Time Protocol.** A UTC-synchronized time clock available over the internet. The appropriate IP addresses of time servers should be available from the System Administrator.

When Real Time Clock is selected from the Time Source drop-down list, the DTV monitor can be synchronized to local PC time by clicking **Sync with Local**. Any offset required (for a different time zone) is entered in the UTC to Time Zone Offset field in minutes (range: ± 12 hours) and activated using Set.

NOTE. *There may be a slight delay between the DTV monitor time displayed and the actual time on the device due to network delays incurred in retrieving the time. This is most likely to be seen if you apply Sync with Local and observe that the Local and DTV monitor times are slightly out of step.*

When either Longitudinal Time Code or Simple Network Time Protocol selected from the Time Source drop-down list, the DTV monitor takes its time from the respective input. Any offset required (for a different time zone) is entered in the UTC to Time Zone Offset field (in minutes) and activated using Set.

Local Client Time Configuration. Local time is the time being used by the remote user interface; it is the local PC time. It is referenced to UTC and will show any offsets applied that allow for local time variations, for example, time zone offsets and any automatically applied allowance for Daylight Saving Time (DST). The adjusted times are displayed. Local time corresponds with the current Windows clock and time zone parameters.

Remote Time Configuration. The Remote Time panel shows the time being used by the DTV monitor; this can be in a completely different time zone. It is referenced to UTC and can be offset to allow for local time variations, for example, time zone offset and DST. The adjusted times are displayed.

Simple Network Time Protocol Server Setting. To use a remote time server, Simple Network Time Protocol should be selected from the Time Source drop-down list, and the IP address of a suitable SNTP server entered in the SNTP Server field.

The network Gateway and Subnet Mask must be set up for the remote server to be able to communicate. (See page 3-24, *Network Settings*.)

DST Settings

The DST adjustments are supplied by an XML file, which, when imported, is becomes part of the overall configuration file. For more detailed configuration file information, refer to the *MTM400A*, *IPM400A*, *QAM400A*, and *RFM300 DTV Monitor Test Parameter and Configuration File Technical Reference*.

To apply a DST offset, select the Daylight savings check box. The check box will only be enabled if a DST configuration file has been imported. Any offset to be applied will be displayed in the various time zone fields in the Time Settings panel.

Exporting a DST configuration file. The Export button will be enabled only where DST information is already contained in the configuration file. The exported file will contain only DST related data.

- In the **Configuration > Device > Time Settings** panel, select **Export**.
- In the Save dialog box, select a location where the file should be saved and select **Save**.
- If the file is to be edited, locate and open it using a suitable editor, Notepad or a dedicated XML editor.

Importing a DST configuration file.

1. In the **Configuration > Device > Time Settings** panel, select **Import**.
2. In the Open dialog box, locate the DST configuration file and select **Open**.
3. The file is uploaded.
 - a. If no file has been previously uploaded, the Daylight savings check box is activated.
 - b. If daylight saving is already in force, any new settings will take effect at the next DST update.

You can find a description of the DST configuration file in this manual. (See page 4-18, *Daylight Saving Time Configuration File*.)

Preferences Configuration

The Preferences section of the Configuration dialog box includes the following pages: Fonts and Decode. The page can be accessed by selecting the relevant node in the tree view.

The Preferences configuration page can be accessed using **Configuration** (toolbar) > **Preferences**. (See Figure 3-19.)

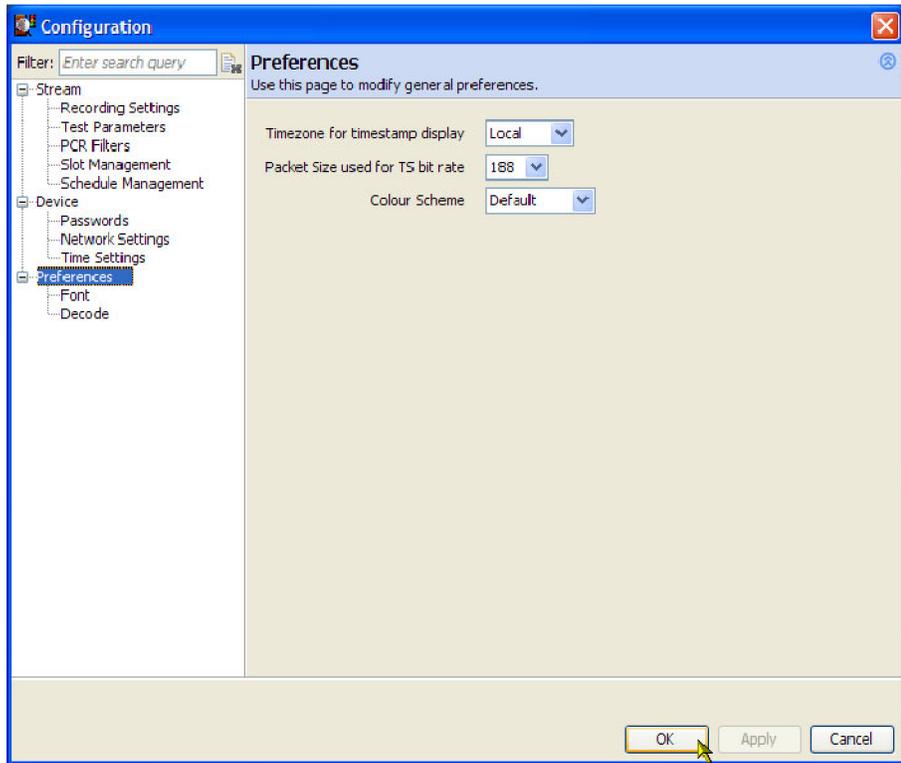


Figure 3-19: Preferences configuration page

Preferences Global Settings

Select **Preferences** in the tree view to access the Preferences configuration global settings.

Timezone for Timestamp Display

This setting affects the display of timestamps in the Event Log. Use the drop-down list to select one of the following timezone settings:

- Local. The time set on the PC running the RUI.
- UTC. Coordinated Universal Time.
- Core. The timezone set on the DTV monitor.

Packet Size Used for TS Bit Rate

Use the drop-down list to select the packet size to use when calculating the bit rate of the transport stream.

Color Scheme

Use the drop-down list to select the graph background colors.

- Default. This color scheme is based around a light background.
- Instrument. This color scheme is based around a dark background.

Font Settings

The Font configuration page is accessed using **Configuration** (toolbar) > **Preferences** > **Font**. (See Figure 3-20.)

How the DTV monitor displays entries in the Event Log is dictated by the Log Entries setting in the Font configuration page along with the language and fonts used by a local computer. For example, if the default language of the computer hosting the RUI is Japanese, the event log will be displayed in Japanese characters. You must choose a suitable font for the characters to display correctly.

How the DTV monitor displays the text strings carried in a stream is dictated by the Stream Content setting in the Font configuration page and by the interpretation standard used.

The Standard setting controls the font used in buttons, menus, and other textual components, excluding log entries and stream content.

The font and size of all of the font settings can be reset to Locale Default Font and the normal size using the Set to Default button.

The Log Entries and Stream Content fonts can be set to the same as the Standard font and size using the Copy Standard button.

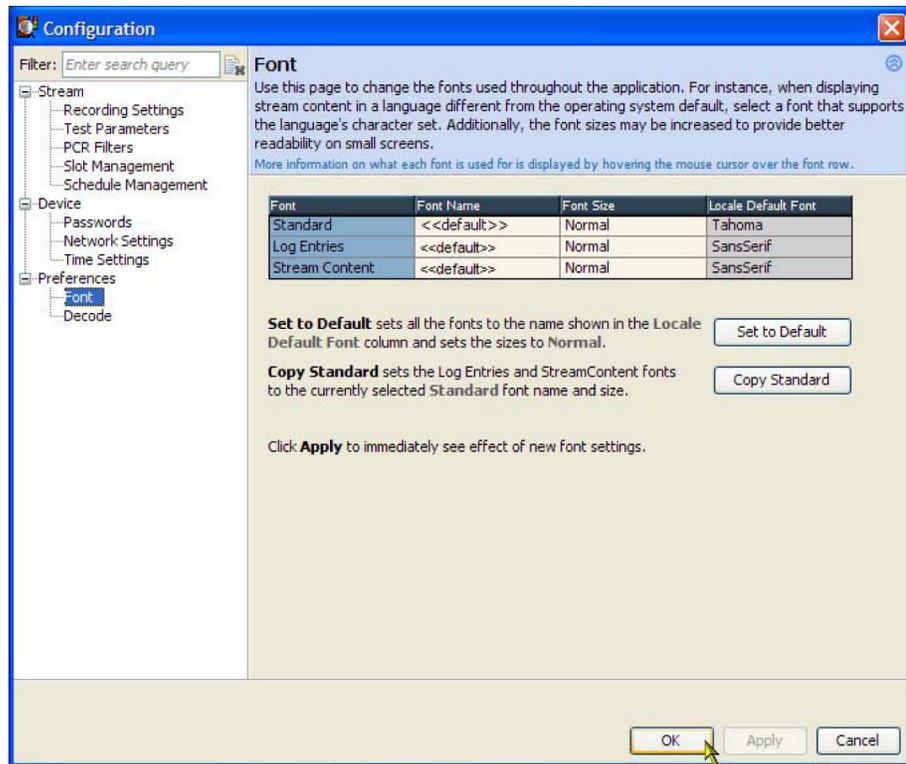


Figure 3-20: Configuration - Font page

Setting the Display Fonts

Select the font name and font size required from the drop-down lists in each row. Click Apply to implement the changes.

Installing a Custom Font Extension

The ARIB specifications for the ISDB standards make use of private extensions to the standard Unicode character set [0xE000-0xF8FF]. These extensions allow you to add additional characters and nonstandard proprietary characters to an existing font, or as a system-wide default. The extension sets are provided as TrueType Extension files (*.tte). Any extension sets should be installed using the Private Character Editor which is supplied as part of the standard Microsoft Windows installation.

The DTV monitor RUI is capable of displaying these private character extensions, but the operating system must be correctly configured. The instructions for installing custom font extensions are located in the related Quick Start User Manual.

Decode

The Decode configuration page is accessed using **Configuration** (toolbar) > **Preferences** > **Decode**. (See Figure 3-20.)

Use this page to designate and set up the video decoder software to be used. The supported decoders are listed and should be installed on the client PC. The selected decoder is activated when the play/listen buttons are selected in the Program or PIDs thumbnails views. (See page 2-6, *Thumbnails*.) (See page 2-7, *Video and Audio Backhaul*.)

The decoders currently available are as follows:

- The VideoLAN VLC player facilitates the video and audio backhaul feature. (See page 2-7.)
- The Tektronix VQS1000 Video Quality Software facilitates QoE analysis of video and audio content. (See *VQS1000 Quick Start User Manual*, Tektronix part number 077-0489-XX.)

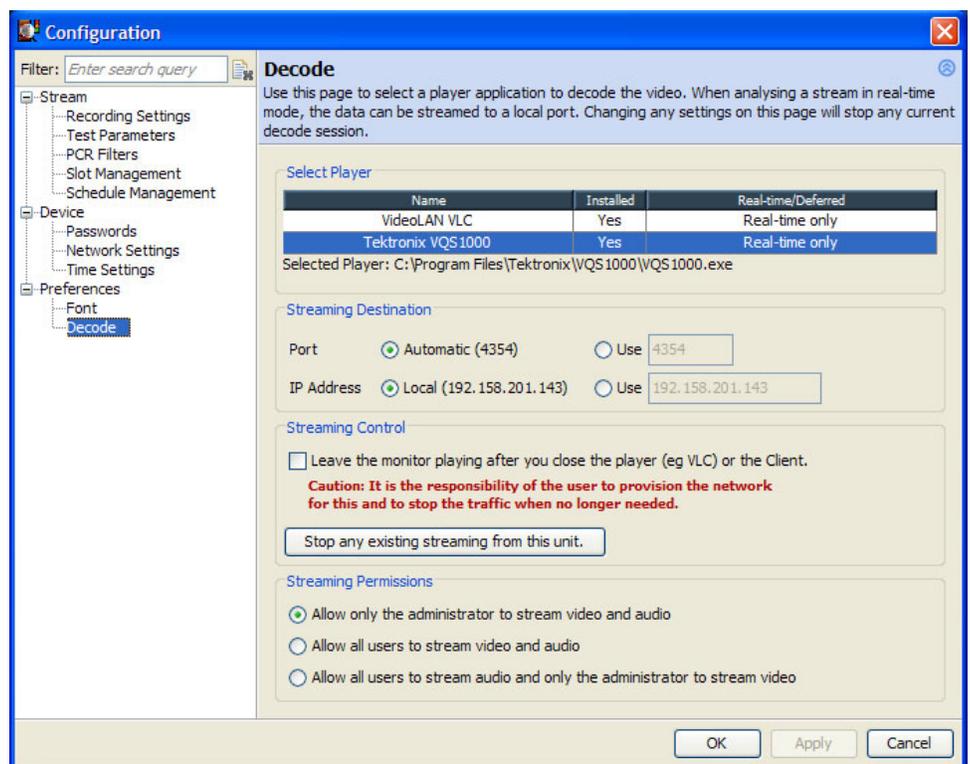


Figure 3-21: Configuration - Decode page

Select Player pane

The Select Player fields show the location and setting of the players available on the PC displaying the RUI.

**Streaming Destination
pane**

This pane sets up the destination and control of the video and audio stream to the VLC player. The Automatic Port setting and the Local IP Setting are set automatically for the RUI PC. You can set them manually by selecting Use and entering the required values.

NOTE. *The manual settings do not necessarily need to correspond to the PC displaying the RUI, if there is a VLC player installed at the location identified.*

Streaming Control pane

If the Leave the MTM400A... check box is selected, and if the VLC player or the RUI is closed, any stream that is playing will continue to be played out of the DTV instrument. It is your responsibility to stop the traffic when it is no longer needed.

Select the **Stop any existing streaming...** button to stop any streams being played out to a VLC player from the connected DTV instrument.

**Streaming Permissions
pane**

You can designate who is able to play out streams by selecting one of the following buttons:

- Allow only the administrator to stream video and audio
- Allow all users to stream video and audio
- Allow all users to stream audio and only the administrator to stream video

Interface Card Configuration

This section describes how to configure the optional interface cards that can be installed in the DTV monitor. Only one interface card can be installed at a time.

The following interface cards are available:

- Gigabit Ethernet (GbE)
- QAM (Annex A)
- QAM (Annex B2)
- QAM (Annex C)
- COFDM (Coded Orthogonal Frequency Division Multiplexing)
- 8PSK (Phase Shift Keying) / QPSK (L-Band)
- DVB-S2 PSK (Phase Shift Keying)
- 8VSB (Vestigial Side Band)

NOTE. *The following older-version interface cards were available with the MTM400 monitor. These interface cards will operate properly if they are installed in the MTM400A monitor.*

QPSK (L-Band)

You can configure your interface card using the Interface dialog box. You can also save more than one configuration for future use. Each configuration setup can be allocated a preset name.

The test results and readings displayed in the Interface view for each of the interface cards are described. (See page 2-41.)

Configuring an Interface Card

To configure an interface card and to store the settings as a preset, perform the following steps:

NOTE. *The following procedure uses a COFDM interface card as an example. The process for configuring all interface cards is similar.*

1. Click **Interface** in the toolbar to open the Configure Interface dialog box. (See Figure 3-22.)

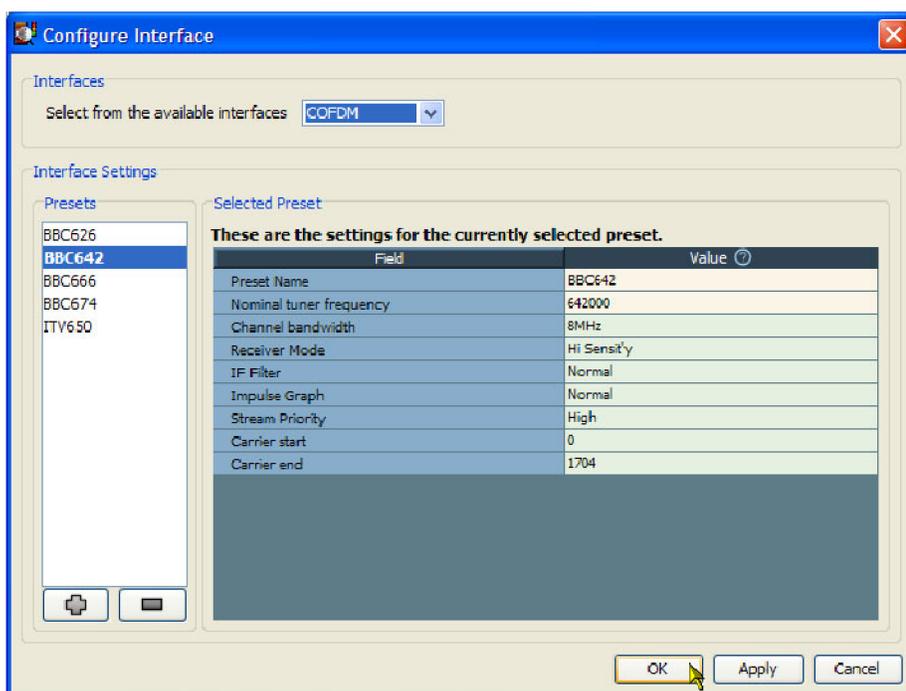


Figure 3-22: Typical Interface dialog box

2. Ensure that the interface card is active by selecting the name from the **Interfaces** drop-down list, for example, **COFDM**.
3. Create a new preset configuration by clicking the + (plus) button. This will duplicate the currently active (bolded) configuration and allocate a name beginning with the word "Preset".

4. If required, modify the allocated name in the **Preset Name Value** field of the **Selected Preset** area.

NOTE. *The background color of Value fields indicates the status of the field, refer to the associated tooltip for more information.*

Press Esc on the keyboard to discard configuration changes.

5. Modify the remaining fields as required. The configuration fields for each of the interface cards is described later in this section.
6. Click **Apply** to confirm the setting changes.

NOTE. *Unless you want the new preset to become active immediately, do not click Apply a second time.*

7. To close the dialog box and make the highlighted Preset active, click **OK**. To close the dialog box without changing the currently active Preset, click **Cancel**. Any applied preset value changes will be retained.

Using a Preset Configuration

To activate a preset configuration for an interface card, perform the following steps:

1. Click **Interface** in the toolbar to open the Interface dialog box. (See Figure 3-22.)
2. Ensure that the interface card is active by selecting the name from the **Interfaces** drop-down list, for example, **COFDM**.
3. Highlight the required preset name in the **Presets** panel.
4. Click **Apply** to activate the highlighted preset. If you click **OK**, the highlighted preset will be activated and the dialog box will close.
5. Click **OK** to close the dialog box.

IP Interface Configuration

The following configuration settings are available for the GbE interface card. (See Figure 3-23.)

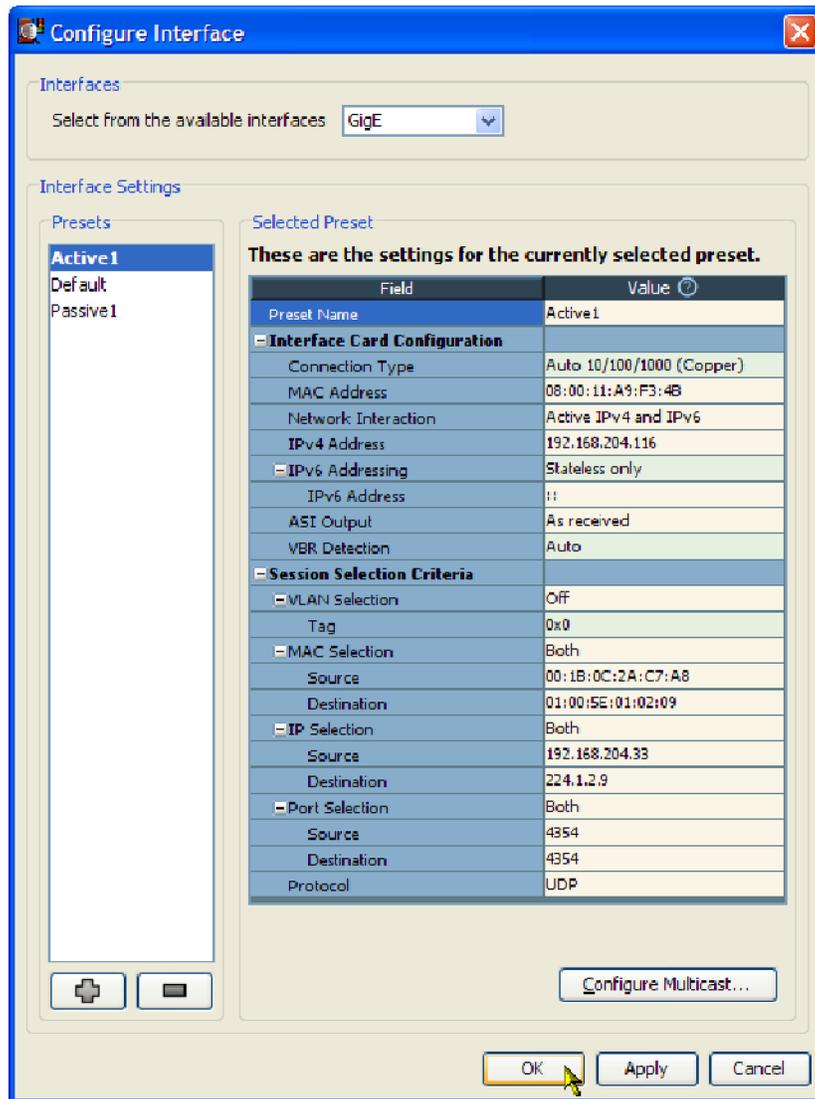


Figure 3-23: GbE Configure Interface dialog box

Preset Name The name allocated to a preset interface configuration setup.

Interface Card Configuration

These settings deal with the physical and network settings.

- **Connection Type:** Select the line speed and type of the physical connection from the drop-down list: Force 10 (Copper), Force 100 (Copper), Force 1000 (Copper), Force 1000 (Optical), Force 1000 (Optical Rx), Auto 10/100/1000 (Copper), and Auto 1000 (Optical).

The term Force means that the GbE card will not negotiate a line speed; the linked device will have to be set in the specified forced speed mode for this to work. For the Auto 10/100/1000 (Copper) mode, the GbE card will attempt to negotiate with the linked device for the fastest available speed denoted by the number following the word Auto.

NOTE. *The GbE interface card does not support hubs under any speed setting; connecting to a hub can cause undesired effects.*

Two types of interface are available on the GbE card: copper and optical. The copper interface supports speed settings at 10 Mbps, 100 Mbps, and 1000 Mbps. The optical interface supports 1000 Mbps only.

The Force 1000 (Optical Rx) mode is a special mode that can work in conjunction with a network splitter. In this mode, the receive laser needs to be connected into a valid optical link between two other devices using an optical splitter. This enables the GbE card to monitor the communication between other devices.

- **MAC Address:** Enter the MAC address of the GbE card, for example, 01-0a-02-0b-03-0c-04. The card is set with a unique MAC address in the factory; do not change this. The MAC address of your instrument can be found on a label affixed to the cover of the instrument.
- **Network Interaction:** Select the way that the instrument interacts with the connected network: Passive is equivalent to listening, where no interaction with the network is required. If you require interaction with the network to receive traffic, such as identifying specific sources or pinging other instrument, select Active. Selecting IPv4 and/or IPv6 in active mode will depend on your intended data sources.

The following selections are available:

- Passive (IPv4 and IPv6) - If you select this option, IPv6 Addressing fields are not used.
 - Active IPv4 only - If you select this option, complete only the IPv4 Address field.
 - Active IPv6 only - If you select this option, complete only the IPv6 Addressing fields.
 - Active (IPv4 and IPv6) - If you select this option, complete all of the IPv4 Address and IPv6 Addressing fields.
- **IPv4 Address:** Enter the IP address of the GbE card. This address will be allocated by your network administrator. The null value is 0.0.0.0.

IPv4 addresses are normally written as four octets in decimal separated by periods, for example, 192.0.2.235.

- **IPv6 Addressing:** If you have selected the active IPv6 network administration, use this field to select the means by which the IP address of the instrument can be discovered by the network.
 - Stateless only - The interface card will use its MAC address and an address prefix used in periodic advertisement messages generated by the local router to automatically calculate an IPv6 address (RFC 4862).
 - Manual - Enter an address which has been assigned by your network administrator in the IPv6 Address field.
 - DHCPv6 (Dynamic Host Configuration Protocol version 6) - The interface card will attempt to contact a DHCPv6 server on the network, which will supply an IPv6 address for the card (RFC 3315).

If you selected manual IPv6 addressing, enter the address in the **IPv6 Address** field.

IPv6 addresses are normally written as eight groups of four hexadecimal digits, where each group is separated by a colon (:). For example, 2001:0db8:85a3:0000:0000:8a2e:0370:7334. To shorten the writing and presentation of addresses, several simplifications to the notation are permitted. Your network administrator will be able to advise you.

A Link Local address is automatically assigned to allow your instrument to communicate with the nearest network router or switch.

- **ASI Output:** Set the output format:
 - As Received - The IP data is supplied in bursts as they are received directly to the ASI output port. The data can then be looped to the processor card for analysis.
 - Smoothed - The incoming IP data is buffered in an attempt to smooth the bit rate before supplying it to the ASI output port.
 - VBR to CBR (Variable bit rate to Constant bit rate) - The incoming IP data is received at a varying bit rate. Null packets are inserted into the stream to achieve a constant bit rate output. The result can be recorded and played back with the timing preserved.
- **VBR Detection:** Enhances VBR detection.

Session Selection Criteria

These settings target which stream is sent for analysis. Typically these settings are extracted from the session selected in the IP traffic screen. Not all fields need be completed; just enough to uniquely identify a session.

- **VLAN Selection:** (Virtual Local Area Network) A logical grouping of two or more network nodes, which are not necessarily on the same physical network segment, but which share the same network number. With the VLAN Selection turned on, if the packet carrying the transport stream contains a VLAN identity, the system will attempt to extract the transport stream from the first IP stream that fits the current control settings.
 - **Tag:** The desired VLAN ID in hex number format.

NOTE. *There may be more than one network session on the monitored networks. Using the following MAC, IP, and Port selections, a single session can be identified. If all selections are set to Off, no stream will be received.*

- **MAC Selection:** Select the MAC Selection filter: None, Source, Destination, or All. When a value other than None is selected, the system will extract the transport stream from the first IP stream that fits the Source and/or Destination settings.
 - **Source:** Enter the source MAC address to filter.
 - **Destination:** Enter the destination MAC address to filter.
Example MAC address: 01-0a-02-0b-03-0c-04.
- **IP Selection:**
 - **Source:** Enter the source IP address to filter.
 - **Destination:** Enter the destination IP address to filter.
Example IP address: 128.181.39.3.
- **Port Selection:**
 - **Source:** Enter the source port address to filter.
 - **Destination:** Enter the destination port address to filter.
Input port number in integers between 0 and 65535.
- **Protocol:** Select the session protocol: Don't Care, UDP (User Datagram Protocol), or RTP (Real time Transport Protocol).

Multicast Configuration

Multicasting allows you to subscribe to and monitor single or multiple streams on the network. To configure the use of multicasting, click the Configure Multicast button on the Configure Interface dialog box. The content and layout of the Configure Multicast dialog box will depend on the multicast subscription mode selected. The subscription mode also affects the layout of the IP Tables tab of the interface analysis view. The three modes are Off, Single, and Multicast Database:

- **Subscription Mode - Off.** No subscription information will be used for the current preset.
- **Subscription Mode - Single.** The single subscription mode allows you to enter a single subscription for the current preset. The subscription's multicast address and optional source address is displayed along with an Edit button. Clicking the edit button will display the Edit Current Subscription dialog.
- **Subscription Mode - Multicast Database.** The multicast subscription mode allows entry and management of multiple subscriptions. The subscriptions are displayed in the form of a table - the Multicast Database. This allows you to add, remove, join and leave multicasts as well as import and export subscriptions. This database is common to all presets but each preset can choose whether to use it for GbE traffic or use Single or Off.

In all modes the IP Traffic table will be displayed showing all the traffic visible to the network card.

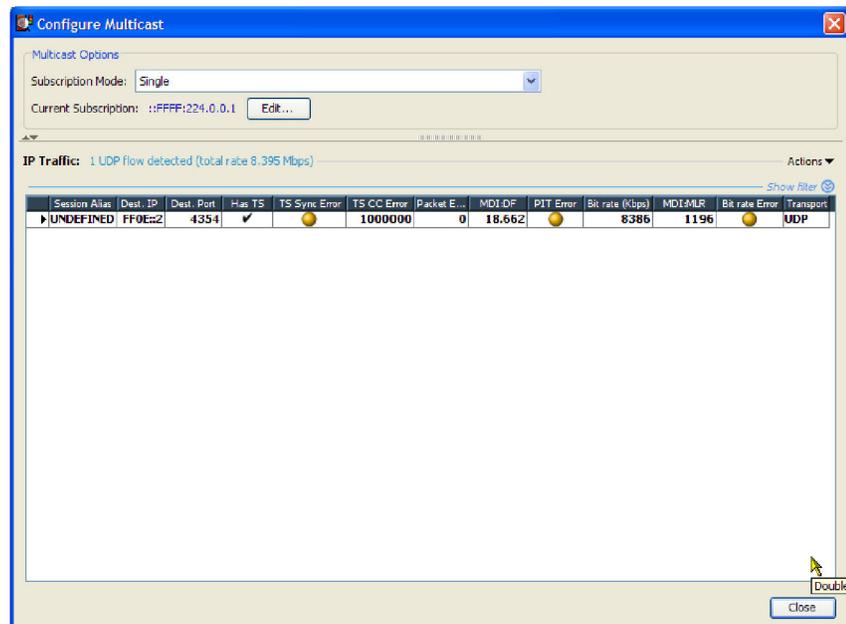


Figure 3-24: Single subscription mode

Selecting the single subscription option, displays the Edit Current Subscription edit button. Use the settings in the Edit Current Subscription dialog box to identify the multicast protocol to be used, IGMP (IPv4) (Internet Group Management Protocol) or MLD (IPv6) (Multicast Listener Discovery), and the specific multicast source address required.

Use the Set Supported Protocols button to select the multicast protocol version that is to be supported. The version labelled as auto-fallback allows the card to automatically switch to the version actually detected on the network.

Subscription Mode - Multicast. The multicast subscription mode displays all of the multicast subscriptions current added to the multicast database and allows you to add, remove, join and leave multicasts.

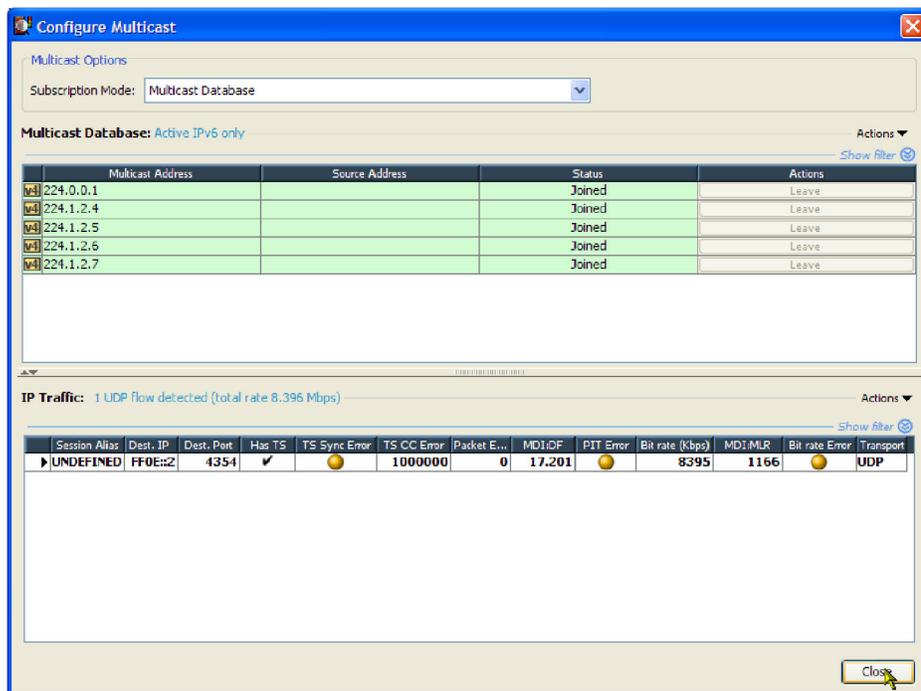


Figure 3-25: Multicast subscription mode

If the multicast database subscription mode is selected, two tables are displayed: Multicast Database and IP Traffic.

The multicast database lists the sources of traffic sessions that are available on the network.

The IP traffic table lists the sessions available from the sources that have been joined.

Edit Current Subscription

The Edit Current Subscription dialog box allows editing of the subscription used in Single Subscription mode. The parameters for a subscription are its multicast protocol (IGMP or MLD), its multicast address and its optional source specific address if using Source Specific Mode. To automatically join the subscription on closure of the dialog, enable the Join this multicast check box. Also accessible on this dialog box is the Set Supported Protocols button, which allows the supported protocol version to be changed for either MLD or IGMP. Usually these can be left at the default auto-fallback setting, but there may be times when you want to force the use of a particular version.

Multicast Database Table. The Multicast Database Table displays the contents of the multicast database stored in the DTV monitor. The entries in the database are color-coded according to the state of the subscription; the states are as follows:

State	Description
Not Joined	No request to join this subscription has been sent, or a Leave request has been sent for a previously joined subscription.
Processing	The Join or Leave request is currently being sent to the network.
Join Requested	A Join request has been sent out on the network but no matching traffic has been detected.
Joined	Traffic matching the subscription has been detected on the network.

NOTE. A session will only cause a match if the destination IP address is the same as the subscription's multicast address. If the subscription also specifies a Source Specific address, this must match the session's source IP address.

The Actions button on the right of the Multicast Database table, lists all the available actions. These include joining, leaving, subscription management and setting the supported protocols. It is also possible to populate the database automatically according to the detected traffic using the Mimic Current Sessions option; this will not overwrite the current subscriptions but will add to them. Additionally, the context menu for the table includes the option to copy the table or selected row contents in CSV format to the clipboard. Double-clicking a row in the table is equivalent to clicking its Join/Leave button. Double-clicking on the empty space at the bottom of the table will open the Add Subscription dialog box.

The current Network Interaction setting is displayed above the table. This setting dictates whether the network card will send outgoing traffic, for example, IGMP Join messages. Consequently if IPv4 (or IPv6) is set to passive, no IGMP (or MLD) or Ping messages will be sent by the interface card, and actions that would produce outgoing traffic will be disabled on the context menus.

In Multicast Database mode, editing an existing subscription is not supported. The Add Current Subscription dialog box must be used to create a new subscription; this can then be edited. The Add dialog box is identical in contents to the Edit Current Subscription dialog box.

IP Traffic Table. This table shows the sessions or "flows" detected by the network card. The number of sessions and the total bitrate are displayed above the table. The currently selected session being routed for deeper analysis is shown highlighted (and is marked in the Active column, if visible). Additionally, the context menu for the traffic table includes the option to copy the table or row contents in CSV format to the clipboard.

Double clicking on a row in the table is the equivalent of selecting that session for deeper analysis. Double clicking on the empty space at the bottom of the table will open the Add/Update Session Alias dialog box.

NOTE. *Selecting a session will automatically set the Session Selection Criteria parameters on the Configure Interface dialog box.*

Aliases. To better distinguish the sessions in the traffic table, it is possible to create a list of "aliases" which are names up to 32 characters in length. An alias will be assigned to a session if it matches the specified destination address, the optional destination port and the optional source address. Aliases will be displayed in the Session Alias column. For adding multiple aliases it is recommended to download the Session Aliases list for manual editing in a text or XML editor. This can then be uploaded to overwrite the previous list.

RF Interface Configuration

This section describes the configuration settings of the following RF interface cards:

- COFDM (See page 3-47.)
- 8PSK (See page 3-48.)
- DVB-S2 PSK (See page 3-49.)
- QPSK (L-band) (See page 3-50.)
- QAM (Annex A and C) (See page 3-51.)
- QAM (Annex B2) (See page 3-52.)
- 8VSB (See page 3-53.)

COFDM Interface Settings

The following configuration settings are available for the COFDM interface card:

Preset Name. The name allocated to a preset interface configuration setup.

Nominal Tuner Frequency. This value, set in kHz units, is the center channel frequency of the DVB-T channel to be received. For example, to receive channel E21, set this value to 474000 kHz. Any frequency can be entered. There is no need to follow a channel plan. The frequency resolution is determined by the tuner step size.

Channel Bandwidth. The COFDM interface card supports operation in 8 MHz, 7 MHz, and 6 MHz channels. Select the desired channel bandwidth from the drop-down menu.

Receiver Mode. To achieve high accuracy measurements, particularly for MER and SNR measurements, the COFDM IF card supports two modes of operation.

For conventional COFDM reception, a relatively low ultimate SNR is acceptable. For example, at 64 QAM, an ultimate receiver SNR of 30 dB can result in a reduction in system performance of only 0.5 dB. However, for more detailed analysis of COFDM constellations, a much higher ultimate SNR is required, preferably in excess of 40 dB. For this reason, two modes of COFDM operation are provided.

High Sensitivity mode gives the full dynamic range of a conventional COFDM receiver, but at the expense of ultimate SNR. The High Resolution mode modifies the signal path to dramatically reduce the noise generated in the receiver, giving a much higher ultimate SNR, but at the expense of receiver sensitivity. So for general purpose monitoring where the input signal may vary over a wide range, typically -75 dBm and lower, high sensitivity mode is preferred.

If the signal is consistently greater than -50 dB, high resolution mode provides better RF measurement performance.

IF Filter. The COFDM receiver incorporates two stages of selectivity. One of these can be bypassed in WIDE mode to give a more accurate representation of the input spectrum flatness (at the expense of overall selectivity).

Impulse Graph. Sets impulse response graph display range. Normal shows close echoes, Wide shows more distant echoes. Echoes are attenuated as the time delay increases; their amplitude should be regarded as indicative only.

Stream Priority. When hierarchical modulation is present, the transport stream priority, HIGH or LOW, can be selected for analysis by the MPEG analyzer tools. When no hierarchy is present, this defaults to HIGH priority.

Carrier Start. When observing carrier amplitudes ahead of the channel equalizer, this value sets the numerical value of the first carrier to be displayed, and defaults to zero.

Carrier End. When observing carrier amplitudes ahead of the channel equalizer, this value sets the numerical value of the last carrier to be displayed, and defaults to the maximum carrier number in the COFDM signal (1704 for 2K, 6816 for 8K modes).

8PSK Interface Settings

The following configuration settings are available for the 8PSK interface card:

Preset Name. The name allocated to a preset interface configuration setup.

Tuner Frequency (kHz). This value is the center frequency of the IF channel to be received (that is, after downconversion in the LNB where applicable). Any frequency can be entered; there is no need to follow a channel plan. The frequency resolution is determined by the tuner step size of 1 MHz.

Symbol Rate (kBaud). This value is the symbol frequency (Baud rate) of the signal to be received, over a range of 1 to 30 MBaud. You need to enter the symbol rate to a typical accuracy of 1000 ppm to ensure successful lock.

Modulation Format. The card supports a number of modulation formats: **Turbo FEC 8PSK**, **Turbo FEC QPSK**, **DVB QPSK** and **Digicipher™II**. Enter the

appropriate format and puncture rate (also known as the code rate) into the modulation drop-down dialog box. A Scan function is also provided, allowing automatic acquisition if the precise code rate is not known.

LNB Power. The 8PSK/QPSK interface card incorporates a regulated power supply for control of a LNB (Low Noise Block) or similar equipment. The supply voltage, using the drop-down dialog box, can be set to Off (default), 13 V, or 18 V. The output current is limited to 200 mA maximum, and is foldback limited to a low value in the event of an overload.

LNB 22kHz Tone. A 22 kHz tone is provided for control of an LNB (Low Noise Block) or similar equipment. The tone, using the drop-down dialog box, is selectable between Off (default) or On.

DVB-S2 PSK Interface Settings

The following configuration settings are available for the DVB-S2 PSK interface card:

Preset Name. The name allocated to a preset interface configuration setup.

Frequency. (GHz) This value is the center frequency of the IF channel to be received (that is, after down conversion in the LNB where applicable). Any frequency can be entered; there is no need to follow a channel plan. The frequency resolution is determined by the tuner step size of 1 MHz.

Use LNB Frequency. Enables/disables the LNB frequency selection.

- **LNB Frequency (tone off):** (GHz) LNB mixer frequency when the LNB 22kHz tone is switched off.
- **LNB Frequency (tone on):** (GHz) LNB mixer frequency when the LNB 22kHz tone is switched on.

LNB Power. The interface card incorporates a regulated power supply for control of a LNB (Low Noise Block) or similar equipment. The supply voltage, using the drop-down dialog box, can be set to Off (default), 13 V, or 18 V.

LNB 22kHz Tone. A 22 kHz tone is provided for control of an LNB (Low Noise Block) or similar equipment. The tone, using the drop-down dialog box, is selectable between Off (default) or On.

S2 Stream Filter. When enabled, you can select one stream from multiple stream that may be encoded in the RF signals using the input stream identity (Input Stream ID).

S2 Input Sync. For slow RF signals carrying multiple streams, this setting enables a stream synchronization and smoothing function.

PL Scrambling ID. Physical layer scrambling is used to spread the spectrum of the transmitted signal to reduce interference. You can select a specific Gold code to descramble the RF signal or Auto to cycle around up to 10 possible codes. Individual codes can be selected; these will act as a conditional access system or, in auto mode, increase priority.

QPSK (L-Band) Settings

The following configuration settings are available for the QPSK (L-Band) interface card:

Preset Name. The name allocated to a preset interface configuration setup.

Local Oscillator Frequency (GHz). The Local Oscillator (LO) frequency of the Low Noise Block (LNB) is dependent on the transponder frequency and must be such that the difference falls within the input range of the receiver. Typically, these values are 10.6 GHz (Hi-Band) and 9.75 GHz (Lo-Band) when converting from KU band. The values are 5.7 GHz (Hi-Band) and 5.15 GHz (Lo-Band) respectively when converting from C-Band. This information should be confirmed for the specific type of LNBS used.

Transponder Frequency (GHz). The IF frequency that is used to initialize the L-Band Interface card is calculated as follows:

$\text{Transponder_Frequency} - \text{LO_Frequency}$.

If you want to specify the IF frequency rather than the individual LO and Transponder frequencies, set the Local Oscillator Frequency to a value of 0 (zero) and specify the required IF frequency under this parameter. If the IF frequency is specified, it must be in the range 0.950 GHz to 2.150 GHz; the tuning increment is 125 kHz.

Polarization (Volts). This parameter selects the polarization by applying 13 V (vertical) or 18 V (horizontal) to the LNB (Low Noise Block). A value of 0 can be used if no voltage is to be applied from this card; for example, if the polarization voltage is being supplied from an external source.

Viterbi Rate. Select the code rate from the drop-down list: 1/2; 2/3; 3/4; 5/6; 6/7; 7/8. It might be overwritten if the Viterbi Rate Auto selection is enabled.

Symbol Rate (MS/s). Symbol rate value in mega symbols per second.

Viterbi Rate Auto. When enabled, the L-Band adapter automatically establishes the Viterbi Rate when acquiring Front End Lock.

NOTE. *The Viterbi Rate Auto option will not work correctly if the Viterbi rate is 5/6. If this rate (5/6) is known, or suspected, then the Auto option should not be used.*

22 KHz Tone. The Local Oscillator Frequency is selected by applying a 22 kHz tone.

Invert Spectrum. The sense of modulation might be inverted due to the number of mixing stages in the installation. Enabling the Invert Spectrum check box will invert the L-Band output.

QAM (Annex A and C) Settings

The following configuration settings are available for the QAM (Annex A and C) interface cards:

Preset Name. The name allocated to a preset interface configuration setup.

Rx Frequency (MHz). Receive frequency.

Symbol Rate (MS/s). Symbol rate value.

Constellation. Provides the option to set the modulation scheme: 4 QAM, 16 QAM, 64 QAM or 256 QAM.

Inversion. The sense of modulation may be inverted due to the number of mixing stages in the installation. Enabling the Inversion check box will allow the demodulator to lock onto a received signal with an inverted spectrum.

PLL Bandwidth. This control modifies the bandwidth of the carrier phase recovery loop, which is responsible for de-rotating the incoming symbols to establish a steady constellation. Two settings are available: **Normal** and **Wide**. In Normal mode, the loop bandwidth is approximately 3 kHz, which gives optimum immunity to noise in the channel for most applications.

In some cases, the loop bandwidth might be too narrow to follow the jittered signal, in which case the Wide bandwidth setting should be selected. This increases the loop bandwidth to about 10 kHz, which enables the DTV monitor to more easily acquire and track a jittered constellation, but makes the demodulator more susceptible to thermal noise. Normal is the default setting and is recommended for most applications.

AFC Range. Two carrier recovery ranges are available: **Normal** and **Wide**. In Normal mode, the range is approximately 150 kHz. In Wide mode, the range is

increased to 500 kHz. Normal setting is the default setting and is recommended for most applications.

Analysis Mode. Two settings are available: **MPEG mode** and **QAM mode**. In MPEG mode, the lock condition is declared as "No Lock" if a valid transport stream cannot be detected. This prevents spurious streams from being fed to the MPEG processor for analysis.

In QAM mode, the validity of the MPEG stream is ignored, possibly resulting in spurious MPEG analysis, but allowing lock to be asserted if the QAM receiver front end sees a valid QAM signal. This allows the display of RF data and constellations even if the MPEG data is not valid. In QAM mode, the DTV monitor behaves more like a conventional QAM analyzer.

MPEG mode is the default setting and is recommended for most applications. The range controls, PLL bandwidth and AFC range, are operable in both MPEG and QAM analysis modes.

QAM (Annex B2) Settings

The following configuration settings are available for the QAM (Annex B2) interface card:

Preset Name. The name allocated to a preset interface configuration setup.

Tuner Frequency (kHz). This value, set in kHz units, is the center frequency of the channel to be received. Any frequency can be entered. There is no need to follow a channel plan. The frequency resolution is determined by the tuner step size of 62.5 kHz.

Modulation Format. This drop-down list allows 64 QAM or 256 QAM operation to be selected. SCTE07 and ITU-Tj83 Annex B specify exact symbol rates for the two modulation formats, so there is no dialog box to enter the symbol rate separately.

Interleaving Mode. Interleaving assists in the correction of burst noise induced errors. All interleaving modes mentioned in SCTE 07 are supported, including all Level II modes up to $I = 128$ $J = 6$.

Carrier Lock. This allows the carrier lock range to be increased from the normal "150 kHz to approximately "500 kHz. This is useful if you are attempting to lock on to badly mistuned or wandering carriers.

Tuner Phase Noise. This control modifies the carrier loop bandwidth to allow the acquisition of noisy carriers. Normal mode is recommended for general use.

Equalization Range. The channel equalizer can be configured to give a long equalization range, at the expense of equalizer resolution, or, in normal mode,

optimized for typical cable environments. Normal mode is recommended for general use.

8VSB Settings

The following configuration settings are available for the 8VSB interface card:

Preset Name. The name allocated to a preset interface configuration setup.

Tuner Frequency (kHz). Enter the required tuned (channel) frequency. Remember to enter the center channel frequency, not the "pilot" frequency.

IF Spectrum. This can be set to **Normal** or **Inverse**, to allow for frequency conversions in the signal chain. Conversions that use difference frequencies invert the spectrum; additive conversions do not.

Channel State. Available options are **auto**, **static**, **dynamic** and **fast dynamic**. Using these options, you can match the receiver equalizer to the expected channel conditions. The recommended default setting is **auto**.

NTSC Rejection Filter. This setting gives you control over the integrated cochannel NTSC reject filter. Options are **on**, **off**, and **auto**. The recommended default setting is **auto**.

Carrier Lock. This setting allows you to control the carrier lock range. The **Normal** setting allows lock over a 150 kHz range; **Wide** extends the range to 500 kHz. The recommended default setting is **Normal**.

Tuner Phase Noise. Normal and High. This control modifies the carrier loop bandwidth to allow the acquisition of noisy carriers. Normal mode is recommended for general use.

Signal Detection. NTSC (National Television Standards Committee) and **VSB** (Vestigial Side Band).

Channel Polling

Channel polling allows multiple channels to be polled sequentially. This option will work with any of the interface cards. Figure (See Figure 3-26.) and Figure (See Figure 3-27.) provide overviews of the channel polling using an RF interface card and a GbE interface card respectively.

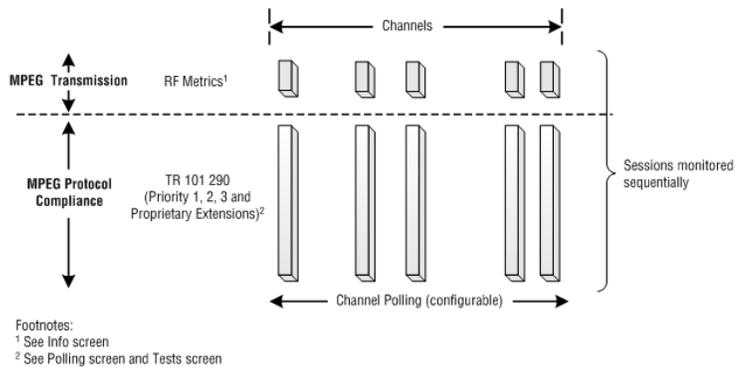


Figure 3-26: RF interface card channel polling overview

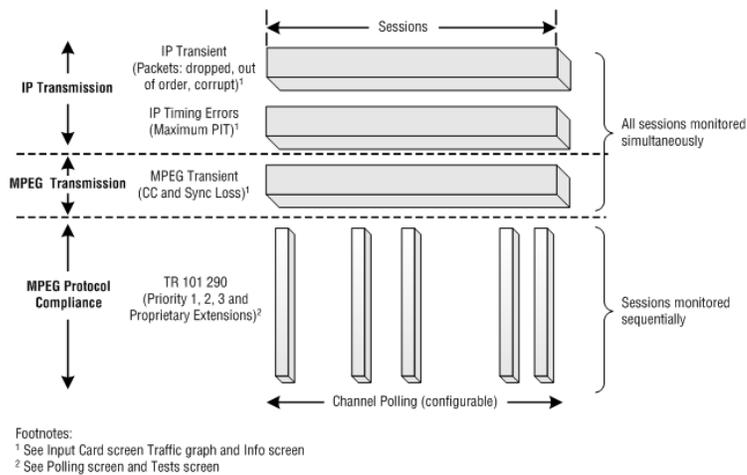


Figure 3-27: GbE interface card channel polling overview

The results of the simultaneously monitored session tests are displayed in the Information screen. The results of the user-defined sequential tests are displayed in the Polling screen.

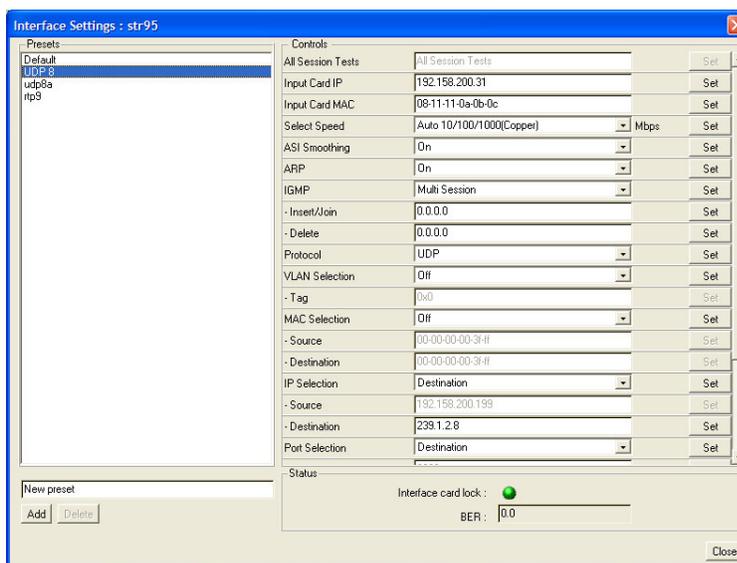
Polling Setup

Setting up channel polling is described in the following paragraphs:

- Set up the preset configurations
- Generate the polling script
- Observe the polling process

Set up the Preset Configurations

1. Select **Settings > Interface** to open the Configure Interface dialog box.



All defined preset configurations will be automatically added to the list displayed in the polling screen. Note that configurations with duplicated settings will not be accepted.

2. In the Presets text field, enter the new name.
3. Click **Add** to display the new name in the Preset list.
4. Select and highlight the new name in the Preset list.
5. Modify the interface settings, remembering to click **Set** to confirm each change.

The Interface Card Lock (or Front End Lock) LED should be green when the settings are successful.

6. Close the Interface Settings dialog box.

NOTE. *The Interface Settings dialog box is modal. You cannot open any other windows while it is open.*

GbE Interface Card Setup

An alternative method, useful for setting up preset configurations on a GbE interface card, is as follows:

1. In the GbE interface card Interface Settings dialog box, add a new name to the list of presets.
2. Close the Interface Settings dialog box.
3. Open the Input Card screen.
4. In the Controls area, select the new preset name from the Preset drop-down list.
5. Select the Traffic table and select a session from the displayed list.

The session values are displayed in the Controls area. These values are now associated with the selected preset configuration.

Generate the Polling Script

1. Click Polling to open the Polling Overview screen.

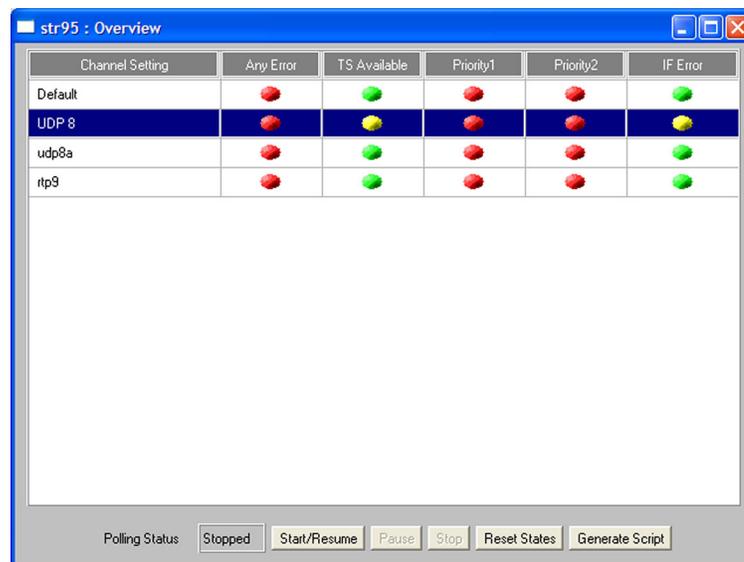


Figure 3-28: Polling Overview screen (example)

The preset configurations previously set up are listed in this screen, including deleted configurations (until the script is regenerated).

2. Before polling can be started, you must generate a configuration script. This is done automatically by clicking the Generate Script button.

This action will delete any redundant entries. A new script must be generated each time that a configuration is defined or deleted (in the Interface Setting dialog box).

When the Generate Script button is clicked, the Generate Polling Script dialog box is displayed. Set the Dwell time and the Acquire time and click **OK**.

3. Click the **Start/Resume** button to start polling.

Observe the Polling Process

The Polling screen and controls are described on the following pages. (See page 3-57, *Polling Screen*.)

Polling Screen

Polling Screen Channel Polling allows multiple user-defined channels to be polled sequentially. The channels polled correspond to the preset configurations selected in the Configuration screen. Setting up the preset configurations and the sessions to be polled and monitored are described in Channel Polling,

Channels to be polled can also be defined as part of the configuration file, see *MTM400A, IPM400A, QAM400A, and RFM300 DTV Monitor Test Parameter and Configuration File Technical Reference*.

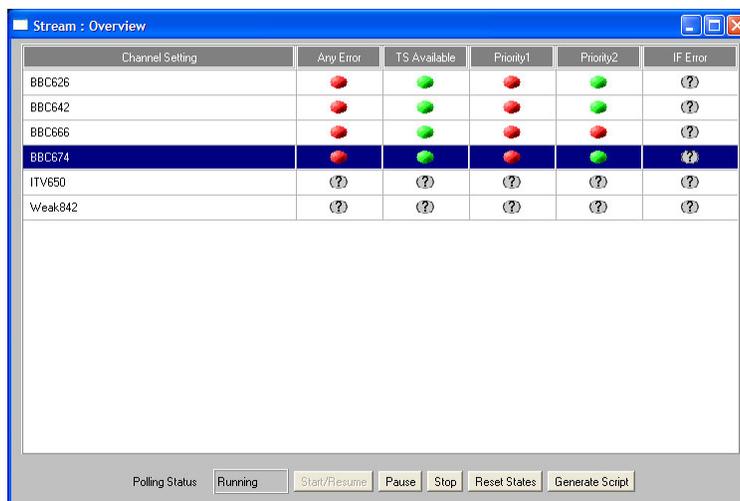


Figure 3-29: Stream view - Polling screen

Error states are maintained (remembered), even when another channel is being polled. So, a red state will be remembered until the next poll, even though the error might have cleared in the interim. When next polled, it would turn yellow to indicate that an error has occurred but has cleared.

Note that when a new configuration file is selected and made active, polling is stopped and the polling error states are reset. Polling must be restarted.

Columns.

Channel Setting	The name allocated in the configuration file. This name can correspond to either an elementary stream in a transport stream (where a CIP interface card is fitted) or a session in an IP stream (where a GbE card is fitted).
Any Error and TS Available	Corresponds directly with tests (which can also be viewed on the Tests screen).
Priority 1, Priority 2 and Priority 3	An error on one of these tests corresponds to any error in a Priority 1, Priority 2, or Priority 3 category (which can also be viewed on the Tests screen).
IF Error	Corresponds to an error on any of the tests listed under Interface Card errors, which can also be viewed on the Tests screen.

Channel Setting. The name allocated in the configuration file. This name can correspond to either an elementary stream in a transport stream (where a CIP interface card is fitted) or a session in an IP stream (where a GbE card is fitted).

Any Error and TS Available. Corresponds directly with tests (which can also be viewed on the Tests screen).

Priority 1, Priority 2 and Priority 3. An error on one of these tests corresponds to any error in a Priority 1, Priority 2, or Priority 3 category (which can also be viewed on the Tests screen).

IF Error. Corresponds to an error on any of the tests listed under Interface Card errors, which can also be viewed on the Tests screen.

Buttons

Polling can be started (or restarted) by selecting the Start/Resume button. The current status is shown in the adjacent Polling Status field. The Pause and the Stop buttons are used to pause and stop polling respectively.

The Reset Status button resets the error status of all polled streams. It is advisable to reset the status after pausing and stopping polling to ensure an error-free restart.

Generate Script

Selecting the Generate Script button automatically generates a polling script and merges it into the current configuration.

The generated polling script accounts for the interface card that is present and all the currently defined preset card configurations. The script defaults to spending 60 seconds interrogating each preset and allowing 15 seconds settling time at the start of each channel change.

Reference

Event Log

The event log displays a history of events related to a selected item. When no log is available, the message "No log entries were found" is displayed. In a log, events are placed in chronological order (with the most recent at the top).

Event log displays are context-dependent; the view and object that is currently selected will dictate the content of the associated log. For example, with the transport stream node selected in the Programs navigation view, the associated event log displays all events. Similarly, with a single PID selected, the associated event log only displays events relevant to that PID. Exported logs are similarly context-dependent; only currently displayed events will be exported.

Event Log Control

The event log will normally display the most recent event at the top of the log. Past events will be scrolled down the screen; not all of these event entries can be viewed on a single screen, even in a maximized or tearoff Log View window.

If events are constantly being generated, an event entry may pass out of view before you have a chance to examine it.

However, if you scroll down to view a past event, the viewing window will remain fixed on that entry, even though events entries are still being added at the top of the log view. This is evident by the scroll box continuing to advance towards the bottom of the screen.

The event entry being viewed will eventually move to the bottom of the event log and subsequently be deleted. At this point the entry will be lost, the view will return to the most recent entries at the top of the screen, and automatic scrolling will start again.

Pinning the Event Log

Another way of viewing a single event in a stream of log events is by pinning the log. By pinning the log, you are taking a snapshot of the log at a particular moment in time; you can then move up and down within the pinned log as required. Newly generated events will continue to be generated but will not be displayed until the log is unpinned.

You can pin the log by selecting the Pin icon or Pin Log from the context menu.



Shows that the log is not pinned
Select to pin the log



Shows that the log is pinned
Select to unpin the log

When the log is pinned, it is displayed against a blue background and the pin icon is changed.

Pinning the log may take a few seconds. The whole log is saved, up to 10000 entries.

The log will remain pinned until you select the Pin icon or display another view.

Copying the Event Log

It is possible to copy one row or the whole log to the Clipboard in CSV format using the Copy Row to Clipboard and Copy Table to Clipboard commands on the log context menu. As the log is constantly changing, to copy the entire event log it must be pinned first.

Exporting the Event Log

You can export the log (pinned or unpinned) in either XML or CSV format.



Export the log by selecting the Export icon or Export Log from the context menu.

Select the format in which the log file is to be saved, either xml or csv, and a location for the file.

Color Coding Events

Specific event types can be color-coded in the display to allow them to be identified more easily. (See Figure 4-1.) Color-coding can be done from any event log display. The color-coding dialog box is available from the event log context menu.

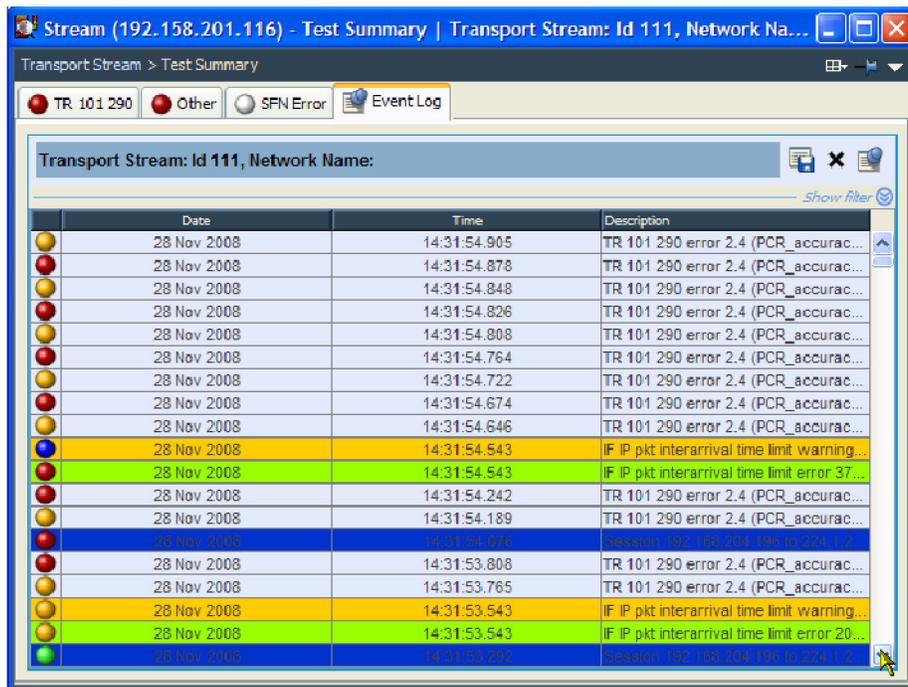


Figure 4-1: Event log color coding

To assign colors to specific events, perform the following steps:

1. Highlight the event type and select **Color** from the context menu. The Color dialog box is shown in a figure. (See Figure 4-2.)
2. Select the primary display color.

The color can be specified from the Swatches tab. It can also be specified in HSB (Hue, Saturation, Brightness) or RGB (Red, Green, Blue) terms by selecting the appropriate tab and entering the required values.
3. Select **OK**. All events of the same type are now highlighted in the selected color.

The color-coding on a single event type can be removed by selecting Reset Color from the Event Log context menu. Color-coding can be removed from all event types by selecting Reset All Colors from the context menu.

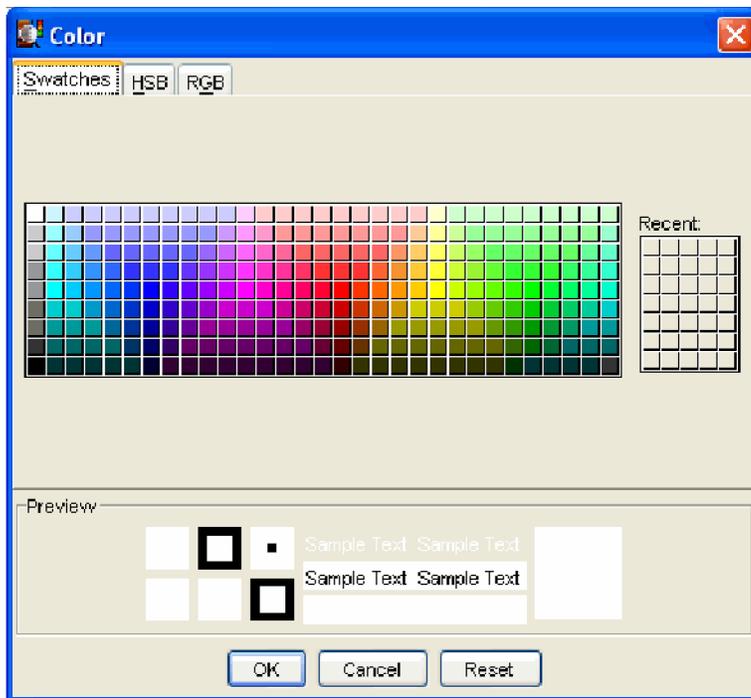


Figure 4-2: Event log - Color dialog box

Chart Views and Bit Rates

The multiple programs or PIDs in the Programs and the PIDs analysis summary views can be viewed as bar charts or pie charts. Additionally a historical multiplex graph can be viewed for the programs contained by the transport stream node in the Programs view.

In a stream, bit rates are calculated and displayed for the following:

- Transport stream
- Programs
- PIDs

The display choices (bar chart or pie chart) and management of the display are similar for each type. Select the appropriate icon to switch charts:



Figure 4-3: Chart view icons

Bar Charts

The following information is included with the bit rate bar charts: (See Figure 4-4.)

- Error status (LED)
- Object name (Program or PID name)
- Stream type (PIDs only)
- Bit rate bar including change bars and limit markers, where relevant
- Bit rate statistics (including the current bit rate, the bit rate expressed as a percentage of the overall bit rate, and the maximum and minimum values reached during analysis).

The bit rate bars are scaled so that all bars are displayed relative to the one with the highest bit rate.

Column widths can be adjusted by dragging the line dividing the column headers to the left or right.

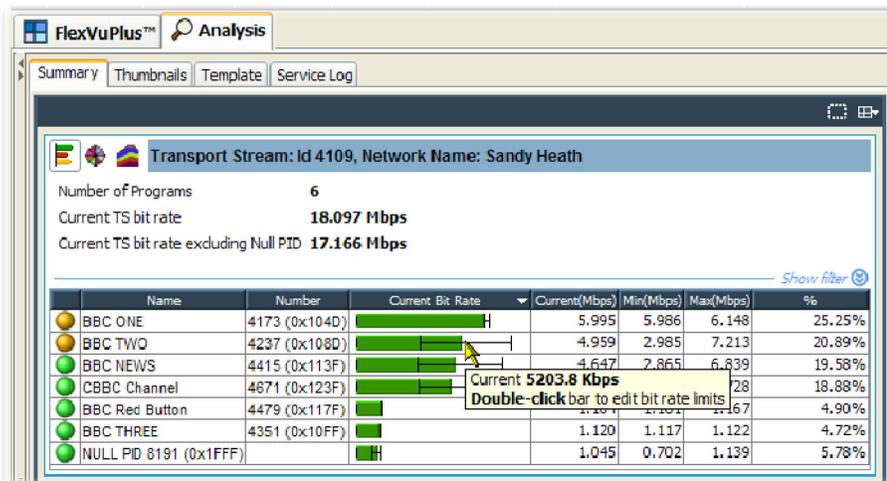


Figure 4-4: Bar chart

Error Status

Two levels of error status are displayed in each row. The error status LED shows the test status of the element, for example, a program. The color of the bit rate bar indicates the bit rate status and whether the rate has exceeded the limits set.

Bit Rate Range Bar

A range bar indicates the variation of bit rate in each program or PID. (See Figure 4-5.) The ends of the bar show the maximum and minimum values of the bit rate since monitoring started.

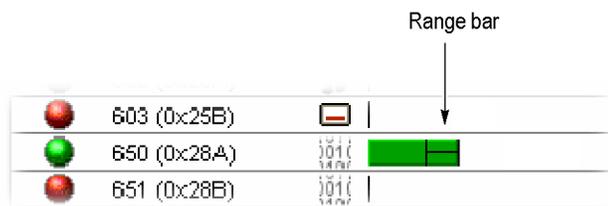


Figure 4-5: Bar chart range bar

Bit Rate Limits

Bit rate limits can be set on a program or PID bar. An error will be indicated when the bit rate exceeds the limits set. You can highlight the program or PID and then select **Set Bit Rate Limits...** from the context menu and to open the dialog box. (See Figure 4-6.) (See Figure 4-7.)

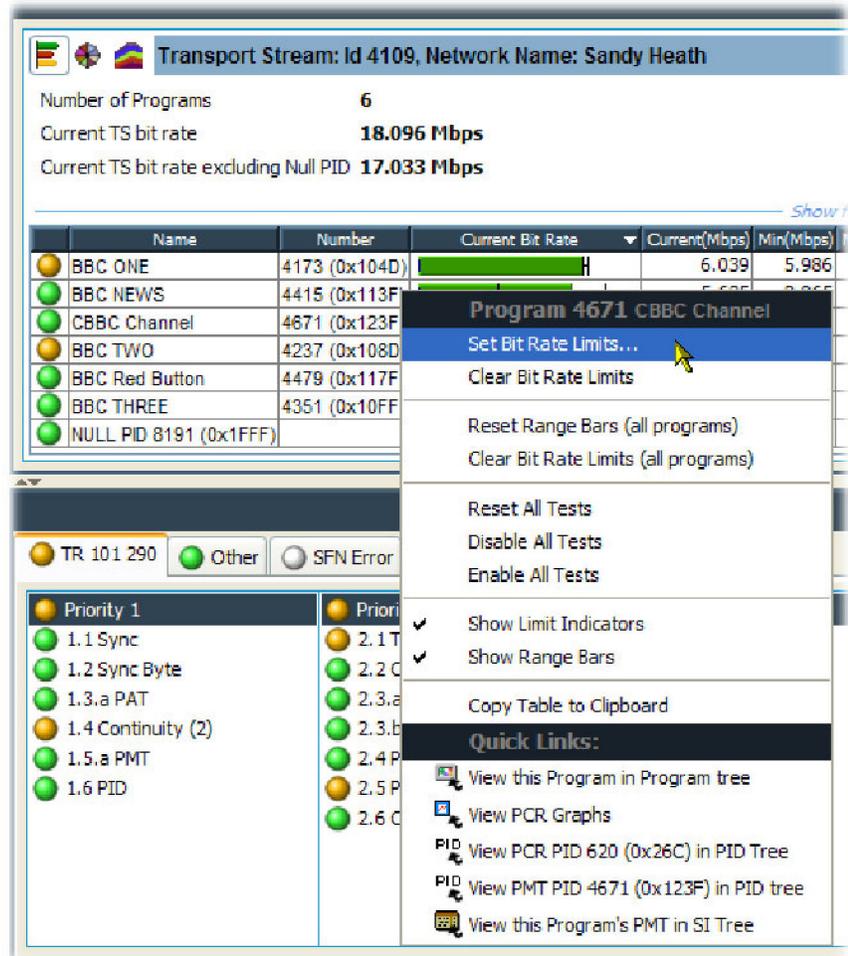


Figure 4-6: Set Bit Rate Limits context menu

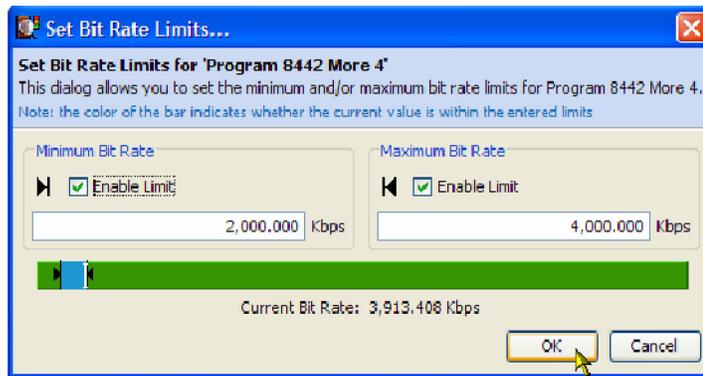


Figure 4-7: Set Bit Rate Limits dialog box

You can enable the limits by selecting the Enable Limits check box and enter the required values. The cursor in the bar indicates the current bit rate. The limits can also be changed by dragging the limit icons in the dialog box to the required positions. The color of the overall bar in the limits dialog box indicates whether the current bit rate is within the proposed limits. Select OK to close the dialog box. The limit icons will now be displayed on the bit rate bar. The scaling of all bars is recalculated to ensure that the maximum limit is displayed.

Limits set for specific PIDs will be applied (to a PID with the same number) irrespective of the stream being monitored.

Setting (and resetting) the bit rate limits for programs and PIDs will automatically update the Program Occupancy and PID Occupancy tests. To change the transport stream bit rate limits, the parameters must be altered directly in the Transport Stream Occupancy test. This can be found under the Other tab in the Tests view.

The Bit Rate Limits of *all* programs in a stream can be disabled and reset by selecting the Clear Bit Rate Limits (All PIDs) from the context menu.

Pie Charts

The pie chart shows similar information as the bar chart.

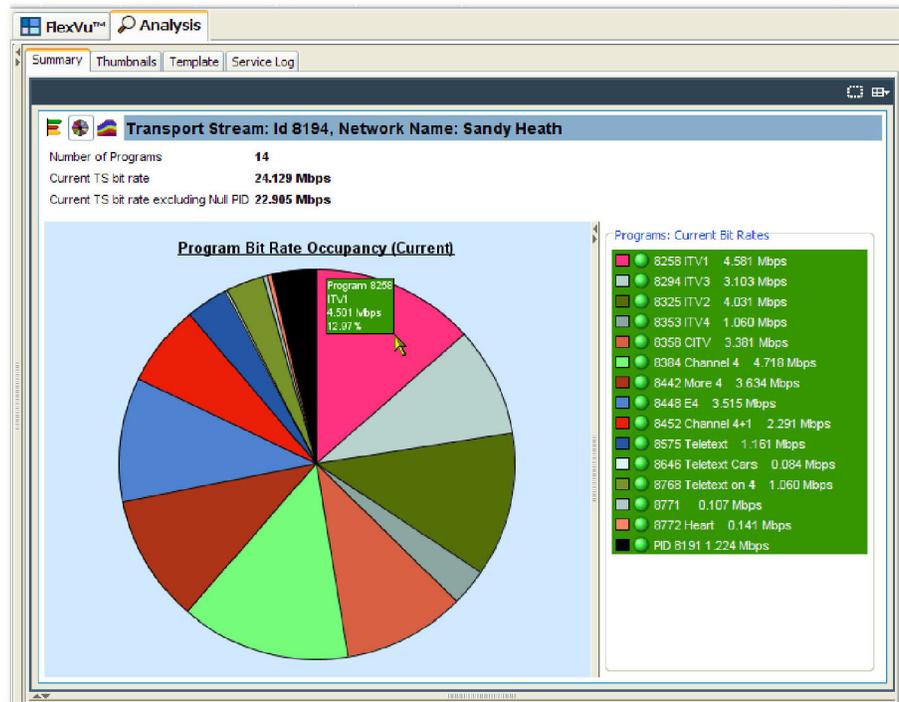


Figure 4-8: Pie chart

The pie chart view is divided into two panes. The left pane shows the pie chart, and the right pane provides a list of the component programs. Each program is color-coded. Related information given includes the overall program status (icon), the program name and number, and the bit rate (bps). The bit rate expressed as a percentage of the overall bit rate is displayed in the segment labels. The maximum and minimum values are not shown.

If a segment label is hidden at the edge of the window, click on a segment to display the label in full.

Historical Multiplex Graph

You can display trend graphs of the programs in the transport stream using the historical multiplex icon.

This graph displays stacked program bit rates over a period that you have selected from the Time period drop-down list.

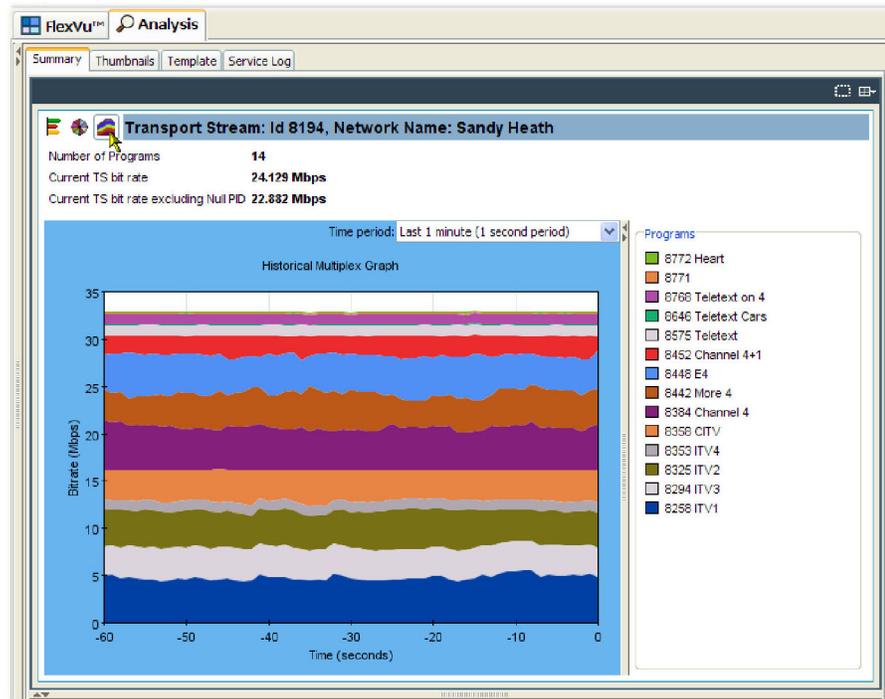


Figure 4-9: Historical multiplex graph

Graph Management

A number of screens displaying graphs are available in the RUI. The graphs are described in the relevant sections of this manual. This section describes the management of the graphs user interface.

Four categories of graph are available: those relating to PCR measurements, section timing, bit rates, and PTS (Presentation Time Stamps).

PCR measurement graphs include:

- PCR Drift
- PCR Inaccuracy
- PCR Arrival Interval
- PCR Frequency Offset
- PCR Jitter

Section timing graphs include:

- Section Repetition Interval
- Subtable Inter Section Gap
- Subtable Repetition Interval

The graphs that can be displayed depend on the selection made in the main application tree view. However, the menus and options for the graphs are similar and are described in the following pages.

Measurement Background

Measurement points (2048 maximum) are held in a circular buffer.

NOTE. *A circular buffer is an area of memory used to store a continuous stream of data by starting again at the beginning of the buffer after reaching the end.*

A graph set for full display will show the current measurement points. The graph is constantly being filled (from the right to left); measurements moving off the left side of the display are lost. The time scale (Y-axis) is started from zero each time that the node is accessed.

For some of the graphs, sufficient data must be gathered before meaningful results can be displayed. The phrase "Settling Time" will be displayed briefly in the graph area while the necessary data is gathered. Graphs may occasionally display discontinuities; however, the underlying testing process is continuous.

The following figure shows a typical timing graph display. In this example, a PID carrying PCR has been selected, and two graphs are displayed: PTS Arrival Interval and PCR Arrival Interval. Within the category, the X axis is common to the all graphs. A horizontal scroll bar allows you to select an area for inspection when the graph extends beyond the display area.

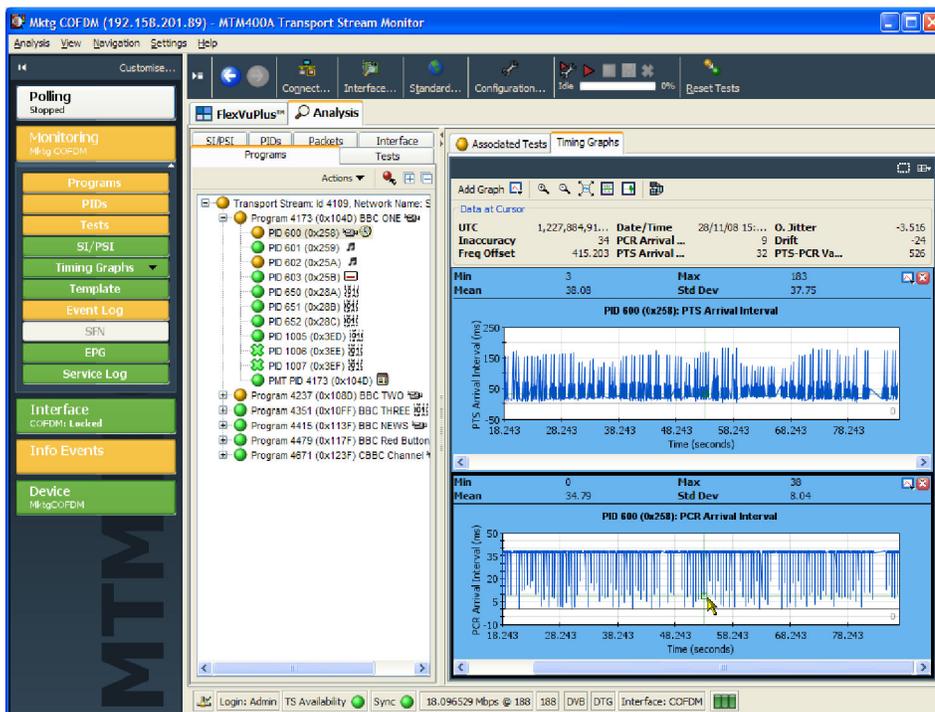


Figure 4-10: Typical timing graph display

Cursor Data and Control

You can display a cursor on the timing graphs allowing you to see accurate measurements in the adjacent data panel. (See Figure 4-11.) You can position the cursor by clicking any data point on one of the graphs. The cursor is displayed at the same point on all of the visible PCR graphs. A tooltip is displayed when a point is selected, providing the X and Y coordinates of the point; the values will vary depending on the graph. To move the cursor, click a new position on the graph or use the left or right controls on the keyboard.

Selecting a point on a graph will display a crosshair and small square centered on the point. If this point has a point at exactly the same timestamp, a square and crosshair will also be displayed. If no data point has a matching timestamp, only a vertical line will be drawn on the additional graphs.

The values displayed above the graphs (maximum, minimum, mean and standard deviation) are calculated for all of the data that is received while the node is highlighted. Data for the selected cursor position is displayed in the Data at Cursor panel.

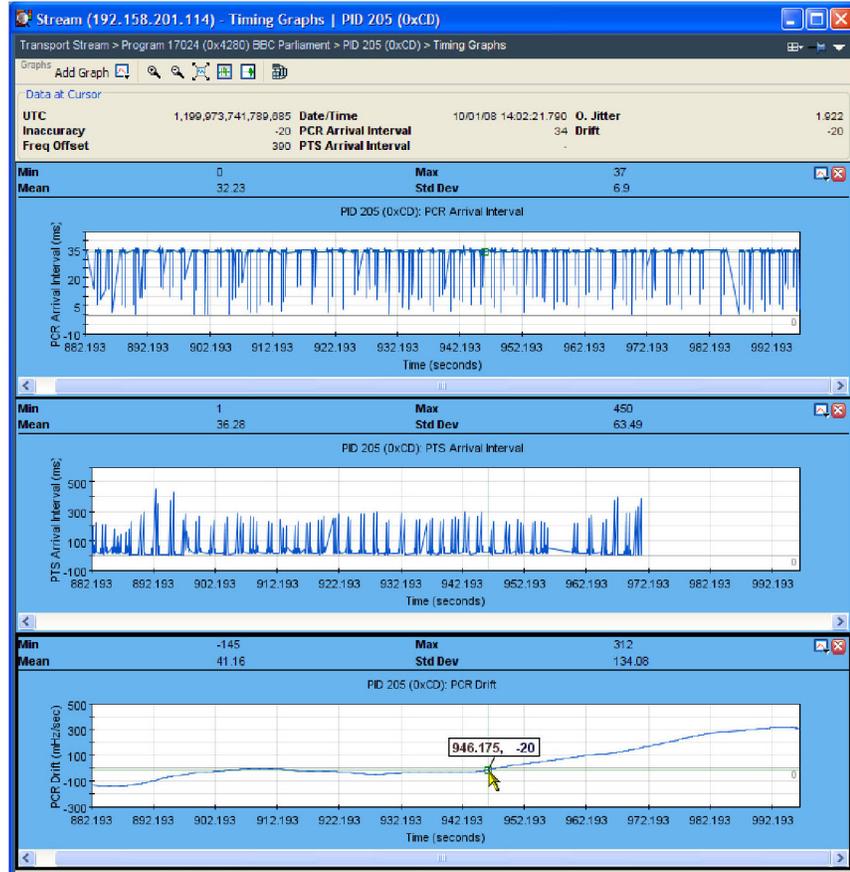


Figure 4-11: Graph cursors

Graph Menu and Toolbar

The Graph Toolbar allows you to select and control the available graphs. (See Figure 4-12.)

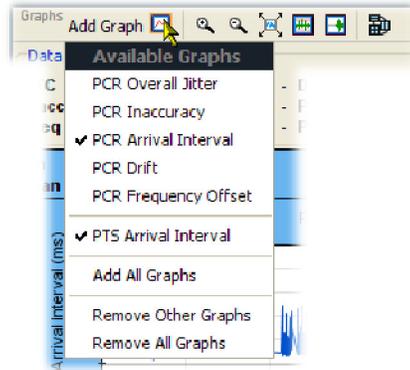


Figure 4-12: Graph toolbar

A drop-down menu allows you to select which graphs are to be displayed. Only graphs for which data is available are listed. (See page 2-18, *Timing Graphs*.) The remaining graph controls are as follows:

Icon	Description
	Zoom in
	Zoom out
	Return graphs to full scale display. (All graphs can be returned to full display by double-clicking anywhere in the graph display area.)
	Hide/show out-of-range indicators
	Hide/show settling time
	Rotate graph layout

The graph context menu can be displayed by right-clicking anywhere in a graph display area. The options on the menu are applicable to all graphs.

Adding and Removing Graphs

Graphs can be added by selecting them from the context menu or from the drop-down menu either in the graph toolbar or from the top right corner of any displayed graph. All graphs can be opened by selecting Add All Graphs from the same menu. Each graph type can only be displayed once.

Graphs can be removed by clearing them from the context menu or by clicking the close icon in the top right corner of the graph to be closed.

Out of Range Indicators

Each graphed measurement has limits set either by default (derived from the stream interpretation standard) or as modified by the user. (See Figure 3-7.) If the limit is exceeded, an error is flagged.

Limits imposed by the test parameters can be displayed on a graph by clicking the Out of Range indicator icon. (See page 4-14.)

Settling Time

Some of the graphs in the TSCA require a number of samples to be available before meaningful results can be displayed. The period during which sufficient samples are being gathered is referred to as the settling time. During this settling time, the graph is grayed out and displays the phrase "Settling Time".

Zooming Graphs

You can zoom graphs in and out using the controls on the menu bar or from the Graph Menu. An area of a graph can also be expanded by holding the right mouse button and dragging a rectangle around the area of interest.

Zooming (in or out) is centered on the middle point of the graph, irrespective of the cursor position. Both axes are expanded/contracted to accommodate the revised display. The graph is expanded or contracted by 25% of the displayed area each time that the control is used. Double-clicking on a graph rescales the axes to show the complete plotted data set.

If you hold the shift key when the zoom control is clicked, the Y axis is locked while the X axis is expanded or contracted. If you hold the control key when the zoom control is clicked, the X axis is locked while the Y axis is expanded or contracted. When a graph is zoomed in, its axes will not change as new data is collected. Eventually when the displayed data is overwritten in the MTM, the points will be removed from the graph.

Graph Controls

Right-clicking in a graph displays a context menu that allows you to control the appearance of the graph. The controls that appear vary depending on the type of graph selected.

Average. This setting applies to 8VSB interfaces only. This setting changes the contribution made by any historical points to the summary bars. A low setting allows historical points make less of a contribution (the graphs will be more dynamic). A high setting allows historical points to make more of a contribution (the graph will eventually settle to a less dynamic shape).

You can select from the following values (seconds): 15, 30, 60, 120, or Indefinite. When you select Indefinite, all historical points have equal contribution to the average.

MER Circles. Toggles whether or not MER circles are drawn on the RF Constellation graph.

MER Lines. Toggles whether or not MER lines are drawn on the 8VSB Symbol Distribution graph.

Persistence. Changes the length of time plots take to disappear from the RF Constellation graph. You can select from the following values (seconds): 15, 30, 60, 120, or Indefinite. When you select Indefinite, plots are not removed over time.

Time Period. Changes the timescale for all trend graphs displayed on the Graphs tab. You can select from the following values: Previous minute, Previous 10 minutes, Previous hour, Previous day, or Previous week.

Uses a logarithmic scale for the summary bars. This setting applies to 8VSB interfaces only. Toggles the use of a logarithmic scale for the summary bars shown at the bottom of the 8VSB Symbol Distribution graph.

Miscellaneous

Table Filtering

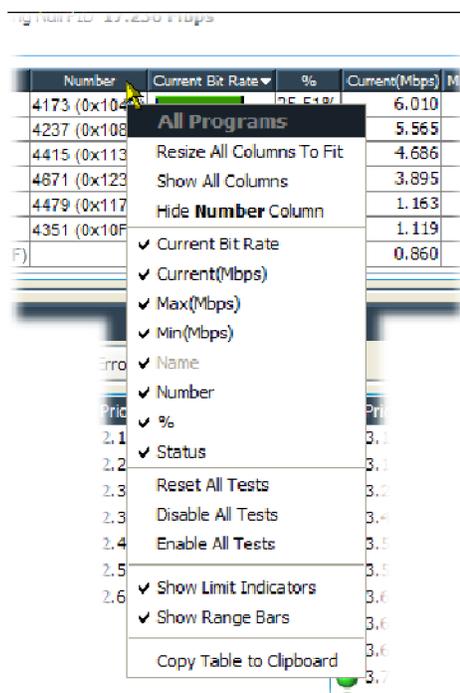
Table Filtering provides a powerful way of reducing the information shown in a table to that matching a specific search term. At the top of most table displays is a Show filter option, which, when pressed, will reveal an input field with a drop-down list containing a number of preset search terms; you can also enter your own terms. Each cell in a row will be queried for a match; only if the term is found is the row displayed.

Some tables allow the column header to be included in the search term to further restrict the results, for example, for the GbE traffic table, entering "multicast=yes" will display only rows with a tick in the multicast column.

When a filter is being applied, the background of the filter field will be yellow. The filter text can be cleared using the clear filter button adjacent to the filter field; when cleared, the whole table will be shown.

Table Column Configuration

Most of the views in tabular form allow you to configure the column layout. The layout will be remembered between sessions.



By right-clicking on a table column header, a context menu will be shown allowing column visibility and width to be changed. Columns which cannot be hidden are grayed out in the context menu column list. You can display all columns by selecting **Show All Columns**. Columns will be added to the table immediately after the column whose header was right-clicked. As well as using the context menu, columns can also be hidden by clicking their header with the middle or wheel mouse button (if available).

The width of selected columns can be adjusted automatically to fit the cell contents by selecting **Resize All Columns To Fit** from the table header context menu. In the case of there being extra space available after all columns have been resized, it will be allocated to the column whose header was right-clicked. Individual column widths can also be adjusted by dragging the separator between column headers.

Daylight Saving Time Configuration File

(See page 3-28, *DST Settings*.)

An example of a DST configuration file is shown in the following illustration:

```
<?xml version="1.0" encoding="UTF-8"?>
<DaylightSavingsDB xmlns="http://tek.com/vbu/mpeg/core/cgi-bin/dnloaddst">
  <DSToffsets Update="Absolute" Active="1">
    <DSToffset TrigYear="2000" TrigDay="1" TrigHour="0" TrigMin="0" AdjMins="0"/>
    <DSToffset TrigYear="2009" TrigDay="88" TrigHour="1" TrigMin="0" AdjMins="60"/>
    <DSToffset TrigYear="2009" TrigDay="298" TrigHour="0" TrigMin="0" AdjMins="0"/>
    <DSToffset TrigYear="2010" TrigDay="87" TrigHour="1" TrigMin="0" AdjMins="60"/>
    <DSToffset TrigYear="2010" TrigDay="304" TrigHour="0" TrigMin="0" AdjMins="0"/>
    <DSToffset TrigYear="2011" TrigDay="86" TrigHour="1" TrigMin="0" AdjMins="60"/>
    <DSToffset TrigYear="2011" TrigDay="303" TrigHour="0" TrigMin="0" AdjMins="0"/>
  </DSToffsets>
</DaylightSavingsDB>
```

The file can be modified using Notepad or a similar editor.

The fields are as follows:

TrigYear. The year in which the DST event will occur.

TrigDay. The day on which the DST event will occur; counted from January 1st.

TrigHour and TrigMin. The hour (24 hour clock) and minute when the event will occur.

AdjMins. The required offset, in minutes, from UTC. This can be a positive or negative value.

Icons

Icons are used in the DTV monitors to convey information about a node or function. The following table shows all of the icons used with a brief description of each.

NOTE. *The display of all icons is context-dependent. Not all icons will be visible in all views.*

Table 4-1: Icons

Icon	Description
	Audio
	Conditional access PID
	Data stream
	Stream scrambled
	PCR
	SI table
	Video
	Teletext
	Zoom in
	Zoom out
	Programs
	Program (single)
	Closed caption - CC-EIA608
	Closed caption - CC-EIA708

Where appropriate, program content advisory information is displayed in abbreviated text form.

Context Menus

Context menus are accessed by highlighting a user interface item and right-clicking. The following table lists in alphabetical order the menu options from all of the context menus. Some menu options appear in many context menus, and other options appear in only one context menu.

Table 4-2: Context menus

Context menu option	Description
Add as User PID	Adds the selected PID to the User PID list if it is not already a user PID
Add PID Group	Allows a new PID Group to be created and added
Add PID(s)	Allows addition of PIDs to the PID Group
Add Subscription	(GbE interface only) Add a subscription to the multicast database.
Add User PID	Allows one or more PIDs to be added as User PIDs
Add/Remove Graph	Allows one of the supported graphs to be added to the graph layout
Add/Update Session Aliases	(GbE interface only) Add/update session names, up to 32 characters
Audible	Toggles the activation of the Audible trigger
Average	Changes the contribution made by any historical points to the summary bars
Change Layout	Changes the graph layout. This increases the number of columns used to arrange the graphs
Clear All Bit Rate Limits	Removes the bit rate limits set for all PID Groups
Clear All Trigger Actions	Clears all triggers activated for this test
Clear Bit Rate Limits	Removes the bit rate limits set for the selected program, PID, or PID Group
Clear Bit Rate Limits (all PIDs)	Removes any bit rate limits set on all PIDs
Clear Bit Rate Limits (all programs)	Removes any bit rate limits set on any programs
Clear Log	Clears the event log contents; this does not affect a pinned log
Collapse all nodes	Collapses every node in the tree except the topmost node
Color	Allows a color to be associated with the selected event
Copy Row to Clipboard	Copies row, in CSV format, to clipboard
Copy Table to Clipboard	Copies table, in CSV format, to clipboard
Disable	Disables the selected test and all its subtests
Disable All Tests	Disables all the tests in the Tests tree
Disable Associated Tests	Disables only the tests associated with this PID
Disable Listed Tests	Disables only the tests in the list
Disable Occupancy Test	Disables the PID Group Occupancy Test
Download Session Aliases	(GbE interface only) Download session alias file
Edit Parameters	Allows editing of the selected Test or Test Group's parameters
Enable	Enables the selected test and all of its subtests
Enable All Tests	Enables all the tests in the Tests tree
Enable Listed Tests	Enables only the tests in the list

Table 4-2: Context menus (cont.)

Context menu option	Description
Enable Occupancy Test	Enables the PID Group Occupancy Test
Enable Associated Tests	Enables only the tests associated with this PID
Expand all nodes	Expands every node in the tree
Export as XML	Exports the section data in XML format along with a style sheet
Export data	Exports the section data in raw binary format
Export Log	Exports the displayed log table to a file in CSV or XML format
Export Multicast Subscriptions	(GbE interface only) Export current subscriptions to a file
Go to next red LED in current tree	Traverses the current tree, selecting the next failing test (showing a red LED)
Hide Settling Time	Toggles the visibility of the markers showing the settling time for the plotted data
Hide xxx column	Hide the selected (named) column
Import Multicast Subscriptions	(GbE interface only) Import subscriptions from a file
Interface	Shows the Interface dialog to allow configuration of the interface card
Join All	(GbE interface only) Send join request to network for all sessions in multicast database
Join Selected	(GbE interface only) Send join request to network for selected sessions in multicast database
Leave All	(GbE interface only) Leave all sessions in multicast database
Leave Selected	(GbE interface only) Leave selected sessions in multicast database
MER Circles	Toggles whether or not MER circles are drawn on the RF Constellation graph
MER Lines	Toggles whether or not MER lines are drawn on the 8VSB Symbol Distribution graph
Mimic Current Sessions	(GbE interface only) Add subscription for each multicast found
Persistence	Changes the length of time plots take to disappear from the RF Constellation graph
Pin Log	Stops the displayed event log table from being updated (for instance, for closer inspection or saving)
Record	Toggles the activation of the Record trigger
Relays	Toggles the activation of the Relay triggers (numbered 1-5)
Remove All PID Groups	Deletes all existing PID Groups
Remove from Group x	Removes this PID from the PID group x
Remove from User PIDs	Removes this PID from the User PID list
Remove PID	Allows removal of a PID from the group
Remove PID Group	Removes the PID Group from the list of PID Groups
Remove Subscription	(GbE interface only) Remove a subscription from the multicast database
Rename PID Group	Allows the PID Group name to be changed
Reset	Resets the selected test and all its subtests to green if it is currently amber
Reset All Colors	Removes the colors associated with all events in the Event Log
Reset All Range Bars	Resets the minimum and maximum range indicators (Range Bars) shown on the PID Group Summary Table for each PID Group
Reset All Tests	Resets all previously failed tests (amber) to green

Table 4-2: Context menus (cont.)

Context menu option	Description
Reset Associated Tests	Resets only the amber tests associated with this PID back to green. These tests are listed in the Associated Tests panel
Reset Color	Removes the color from the selected event
Reset Listed Tests	Resets only the amber tests in the list back to green
Reset Occupancy Test	Resets the PID Group Occupancy Test to green if currently amber
Reset Range Bars (all PIDs)	Resets the minimum and maximum range indicators (Range Bars) shown on the PID Summary Table (Histogram View) for each PID
Reset Range Bars (all programs)	Resets the minimum and maximum range indicators (Range Bars) shown on the Transport Stream Summary Table (Histogram View) for each program
Resize All Columns To Fit	Attempts to resize the columns so no text is clipped - if the horizontal width is small, this is not possible
Set Bit Rate Limits	Allows the bit rate limits for the PID, Program, or PID Group to be set
Set Supported Protocols	(GbE interface only) Set IGMP or MLD protocols
Show all Columns	Shows all columns in the associated table
Show Date	Toggles the display of the Date column in the Event Log table
Show hidden fields	Shows fields that are not editable such as those reserved for future use
Show Limit Indicators	Toggles the visibility of the bit rate limit markers
Show Limits	Toggles the visibility of the limits for the plotted data. The limits are extracted from the parameters for a related test
Show PID Variability	Toggles PID rate variability display
Show Range Bars	Toggles the visibility of the range bar markers
Show Time	Toggles the display of the Time column in the Event Log table
Thumbnail Size	Allows the size of the thumbnail to be changed
Time Period	Changes the timescale for all trend graphs displayed on the Graphs tab
Traps	Toggles the activation of the Trap triggers. This can either send a trap on test failure, or when the test stops failing
TTLs	Toggles the activation of the TTLs triggers (1-3)
Upload Session Aliases	(GbE interface only) Upload session alias file
Uses a logarithmic scale for the summary bars	Toggles the use of a logarithmic scale for the summary bars shown at the bottom of the 8VSB Symbol Distribution graph
View Occupancy Test in Tests Tree	Switches to the Tests tab and selects the PID Group Occupancy Test in the Tests tree
View PCR Graphs	Switches to the Programs tab and selects this program in the program tree and selects the Timing Graphs tab
View PCR PID x in PID tree	Switches to the PIDs tab and selects the Program's PCR PID in the PIDs tree (but does not switch to Timing Graphs tab)
View PID x in PIDs tree	Switches to the PIDs tab and selects PID x in the PIDs tree
View PMT PID x in PID tree	Switches to the PIDs tab and selects the Program's PMT PID in the PIDs tree
View Program's PMT in SI Tree	Switches to the SI/PSI tab and selects the Program's PMT Table node in the Tables tree
View this PID in PIDs tree	Switches to the PIDs tab and selects this PID in the PIDs tree

Table 4-2: Context menus (cont.)

Context menu option	Description
View this Program in Program Tree	Switches to the Programs tab and selects this program in the program tree
View this Test in the Interface tree	Switches to the Interface tab and selects this Test in the Tests tree
View this Test in the Tests tree	Switches to the Tests tab and selects this Test in the Tests tree
View this Warning in the Interface tree	Switches to the Interface tab and selects the Warning associated with this Test in the Tests tree
Zoom In	Zooms into the graph by 25%. Holding down the Shift key locks the Y axis, holding down the Ctrl key locks the X axis
Zoom Out	Zooms out of the graph by 25%

Maintenance

Maintenance

This appendix describes some general care and service procedures for the DTV monitor.

Preventative Maintenance

Protect the unit from adverse weather conditions. The unit is not waterproof.



CAUTION. *To avoid damage to the instrument, do not expose it to sprays, liquids or solvents.*

Do not use chemical cleaning agents; they may damage the instrument. Avoid chemicals that contain benzene, toluene, xylene, acetone or similar solvents.

Preventive maintenance mainly consists of periodic cleaning. The unit should be cleaned as needed based on the operating environment.

Cleaning the Exterior



WARNING. *To avoid personal injury or damage to the instrument, do not allow moisture inside it. Use only enough cleaning solution to dampen your cloth or swab.*

Clean the exterior surfaces of the instrument with a dry, lint-free cloth or a soft-bristle brush. If dirt remains, use a cloth or swab dampened with a 75% isopropyl alcohol solution. To rinse, repeat the same process using a cloth dampened with deionized water. A swab is useful for cleaning in narrow spaces around the connectors. Do not use abrasive compounds on any part of the unit.

Removing or Replacing an Interface Card

The procedure in this section describes how to remove or replace an interface card.

NOTE. *There are older version interface cards that were available with the MTM400 monitor; those interface cards will operate properly if they are installed in the MTM400A monitor. The following procedure includes instructions for removing or replacing those older version interface cards.*

The steps involved to remove or replace one of the optional interface cards are similar between the various cards; any differences are indicated in the procedure.



WARNING. *To prevent serious injury or death from electrical shock, do not operate the instrument with the cover or panels removed. Disconnect power from the instrument before removing the covers or panels.*



CAUTION. *Only qualified personnel should perform this procedure. Read the Service Safety Summary and the General Safety Summary at the front of this manual before performing this procedure.*

The following tools are recommended for removing or replacing an interface card:

- An anti-static wrist-strap for safe handling of components containing static sensitive devices. It is recommended that you wear the wrist-strap for all maintenance activity.
- A screwdriver with T10, T15, and T20 TORX tips to remove the instrument cover and the module mounting screws

Do not use unnecessary force to disconnect or insert connectors.

Accessing the Components

To access the interface card, the DTV monitor should be removed from the instrument rack, be disconnected from any power and signal sources, and be moved to a suitable static-free working environment.

Remove the Instrument Cover

1. Remove the 21 cover retaining screws and set them aside. (See Figure 5-1.)
2. Lift the cover clear of the instrument.

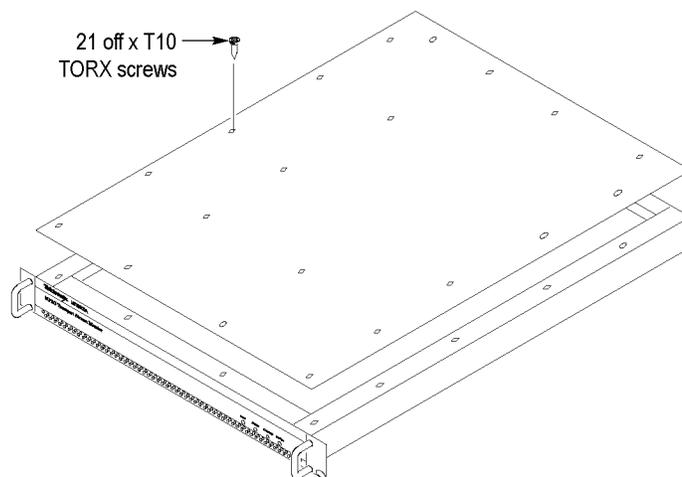


Figure 5-1: Removing the instrument cover

Remove the Installed Interface Card

3. Locate the interface card in your instrument. (See Figure 5-2 on page 5-5.) (See Figure 5-3 on page 5-6.) The interface card is mounted on the right side of the instrument as viewed from the rear.
4. If your instrument does not have an interface card already installed, proceed to step 11. (See page 5-10.)
5. If your instrument has an interface card already installed, use the following figures to determine which type of interface card is installed. (See Figure 5-2.) (See Figure 5-3.) (See Figure 5-4.)



CAUTION. To avoid incorrectly installing the interface card, be sure to follow the removal directions for the type of interface card that is installed in your instrument. There are three types of interface cards. (See Figure 5-2 on page 5-5.) (See Figure 5-3.) (See Figure 5-4 on page 5-6.) Each card type has different cable connections.

6. If a QAM (Annex A), QAM (Annex B1), QAM (Annex C), or QPSK (L-Band, old version) interface card is currently installed, perform the

following steps. The cable connections to these interface cards are also described. (See Table 5-2.) Otherwise, proceed to step 7.

- a. Disconnect the two coaxial cables from the SMB connectors labeled I/P and O/P. (See Figure 5-2.) These are push-fit connectors.
- b. If you are going to install a QAM (Annex B2), 8PSK/QPSK, DVB-S2, 8VSB, or COFDM interface card, completely remove the two coaxial cables by removing them from the connectors labeled I/P A and O/P A on the TS Processor card.

NOTE. *Leave the two coaxial cables connected to the TS Processor card if you are going to install a QAM (Annex A), QAM (Annex B1), QAM (Annex C), or QPSK (L-Band, old version) interface card.*

- c. Disconnect the eight-wire power cable from the connector labeled J7 on the interface card.
- d. Proceed to step 9.

Table 5-1: QAM (Annex A), QAM (Annex B1), QAM (Annex C), and QPSK (L-Band, old version) card connectors

Interface card connection	Cable type	Connects to location	Function
P1	Eight wires	J7 on Power Distribution card	Power
O/P	Miniature coaxial	I/P A on TS Processor card	Data and control (serializer)
I/P	Miniature coaxial	O/P A on TS Processor card	Data and control (serializer)

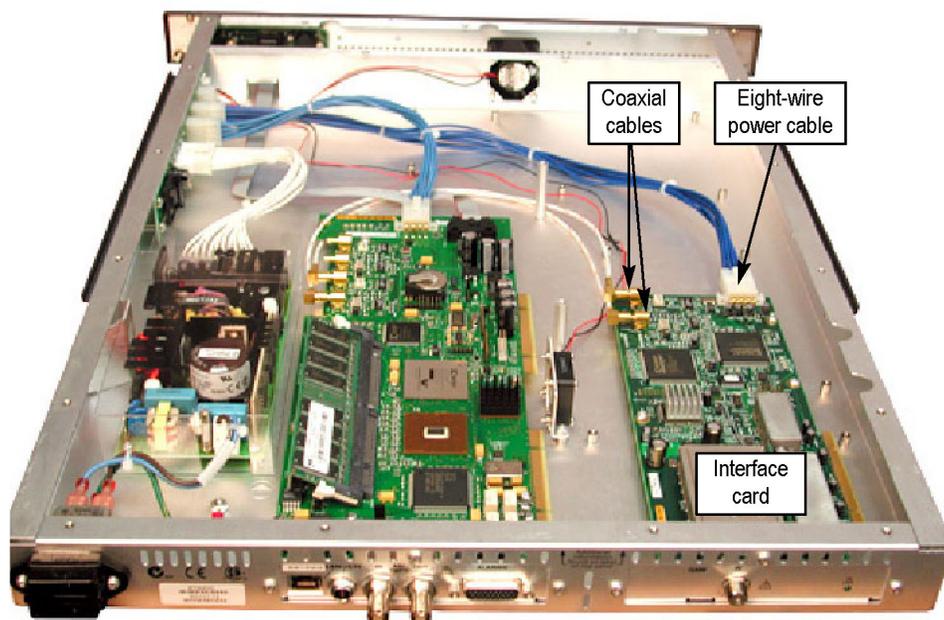


Figure 5-2: QAM (Annex A), QAM (Annex B1), QAM (Annex C), and QPSK (L-Band, old version) interface card location

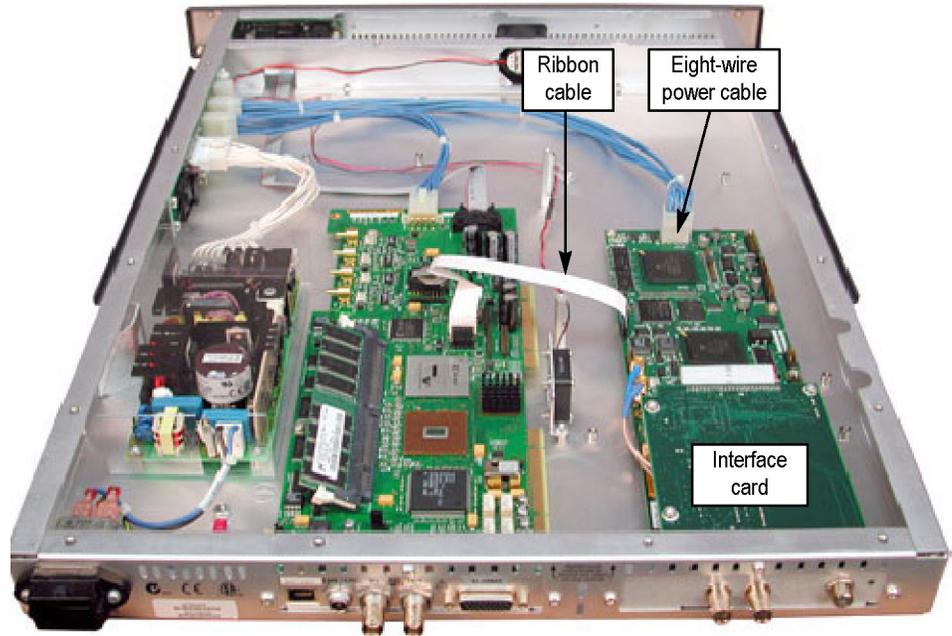


Figure 5-3: (See Figure 5-2.)QAM (Annex B2), 8PSK/QPSK, DVB-S2, 8VSB, and COFDM interface card location

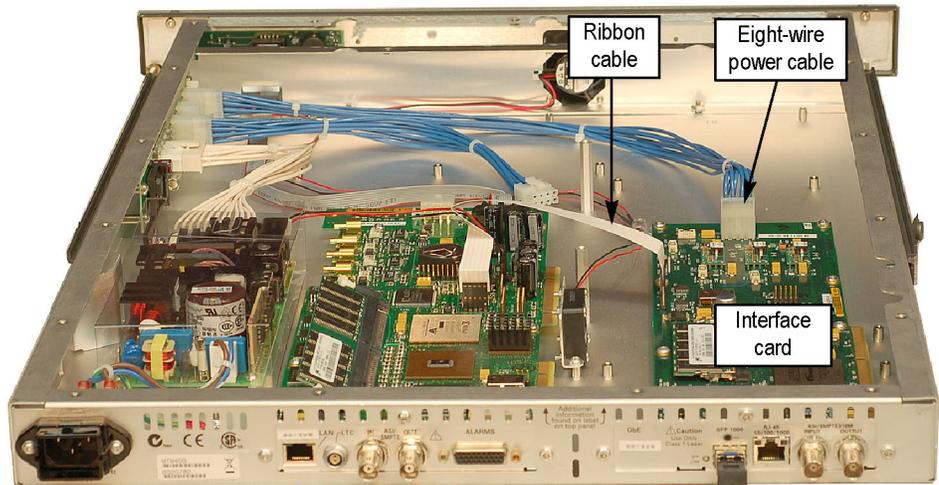


Figure 5-4: GbE interface card installation

7. If a QAM (Annex B2), 8PSK/QPSK, DVB-S2, 8VSB, or COFDM interface card is currently installed, perform the following steps. The cable connections to these interface cards are also described. (See Table 5-2.)
 - a. Disconnect the ribbon cable from the connector labeled J14 on the interface card. (See Figure 5-3.)
 - b. If you are going to install a QAM (Annex A), QAM (Annex B1), QAM (Annex C), or QPSK (L-Band, old version) interface card, completely remove the ribbon cable by removing it from the connector labeled J750 on the TS Processor card.

NOTE. Leave the ribbon cable connected to the TS Processor card if you are going to install a QAM (Annex B2), 8PSK/QPSK, DVB-S2, 8VSB, or COFDM interface card.

- c. Disconnect the eight-wire power cable from the connector labeled JR1 on the interface card.
- d. Proceed to step 9.

Table 5-2: QAM (Annex B2), 8PSK/QPSK, DVB-S2, 8VSB, and COFDM interface card connectors

Interface card connection (See Figure 5-3.)	Cable type	Connects to location	Function
JR1	Eight wires	J7 on Power Distribution card	Power
J14	Ribbon	J750 on TS Processor card	Data and control

8. If a GbE interface card is currently installed, perform the following steps. The cable connections to this interface card are also described. (See Table 5-3.)
 - a. Disconnect the ribbon cable from the connector labeled J10 on the interface card. (See Figure 5-4.)
 - b. If you are going to install a QAM (Annex A), QAM (Annex B1), QAM (Annex C), or QPSK (L-Band, old version) interface card, completely remove the ribbon cable by removing it from the connector labeled J750 on the TS Processor card.

NOTE. Leave the ribbon cable connected to the TS Processor card if you are going to install a QAM (Annex B2), 8PSK/QPSK, DVB-S2, 8VSB, or COFDM interface card.

- c. Disconnect the eight-wire power cable from the connector labeled J8 on the interface card.

Table 5-3: GbE interface card connectors

Interface card connection	Cable type	Connects to location	Function
J8	Eight wires	J7 on Power Distribution card	Power
J10	Ribbon	J750 on TS Processor card	Control data

9. Remove the retaining screws from the interface card as described below:
 - a. For QAM (Annex A), QAM (Annex B1), QAM (Annex C), and QPSK (L-Band, old version) interface cards, remove the four retaining screws from the card and remove the three retaining screws from the rear panel. (See Figure 5-5.)
 - b. For QAM (Annex B2), 8PSK/QPSK, DVB-S2, 8VSB, and COFDM interface cards, remove the six retaining screws from the card and remove the three retaining screws from the rear panel. (See Figure 5-6.)
 - c. For GbE interface cards, remove the six retaining screws from the card and remove the three retaining screws from the rear panel. (See Figure 5-7.)

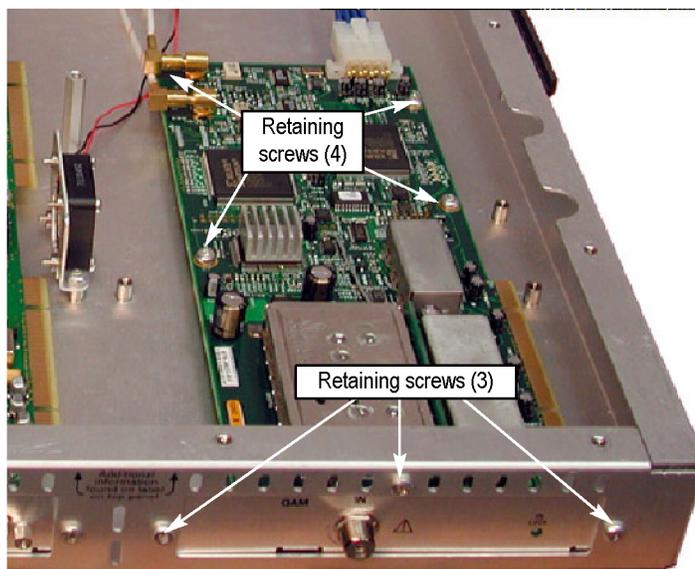


Figure 5-5: Retaining screw locations for QAM (Annex A), QAM (Annex B1), QAM (Annex C), and QPSK (L-Band, old version) interface cards

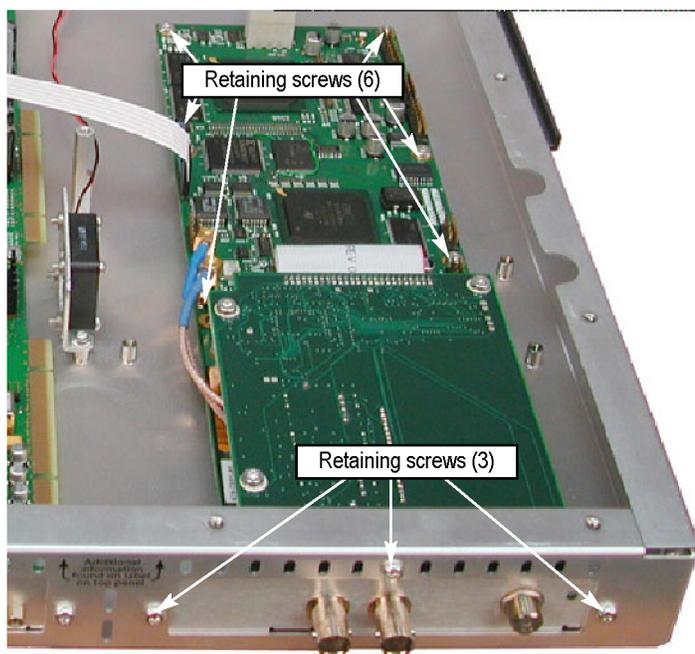


Figure 5-6: Retaining screw locations for QAM (Annex B2), 8PSK/QPSK, DVB-S2, 8VSB, and COFDM interface cards

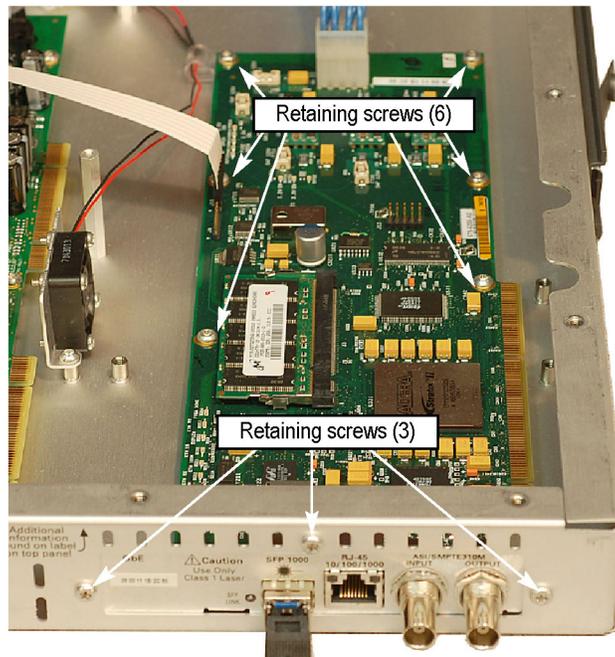


Figure 5-7: Retaining screw locations for GbE interface card

10. Lift the interface card clear of the instrument and place the card on a static-free surface.



CAUTION. To prevent static damage to the removed card, be sure to store the card in static-free packaging. Failure to properly store the card may result in the card needing repair before it will operate properly when reinstalled.

Install the New Interface Card

11. If an interface card was not previously installed in the instrument, a blank cover is installed on the right side of the rear panel (as viewed from the rear of the instrument). If your instrument has a blank cover, remove the three retaining screws and remove the blank cover.
12. Place the new interface card into the right side of the instrument (as viewed from the rear of the instrument). (See Figure 5-2 on page 5-5.) (See Figure 5-3.) (See Figure 5-4 on page 5-6.)

13. Line up the mounting points and install the retaining screws as described below:
 - a. For QAM (Annex A), QAM (Annex B1), QAM (Annex C), and QPSK (L-Band, old version) interface cards, install the four retaining screws in the card and install the three retaining screws in the rear panel. (See Figure 5-5.)
 - b. For QAM (Annex B2), 8PSK/QPSK, DVB-S2, 8VSB, and COFDM interface cards, install the six retaining screws in the card and install the three retaining screws in the rear panel. (See Figure 5-6.)
 - c. For GbE interface cards, install the six retaining screws in the card and install the three retaining screws in the rear panel. (See Figure 5-7.)
14. Connect the signal and power cables as described next.



CAUTION. *To prevent damage to the interface card connectors, do not use unnecessary force to connect the cables. All of the connectors are polarized and they will only fit into their respective socket in one way.*

- a. For QAM (Annex A), QAM (Annex B1), QAM (Annex C), and QPSK (L-Band, old version) interface cards, make the following cable connections. The cable connections for these interface cards are also described. (See Table 5-1 on page 5-5.)
 - Connect one coaxial cable from the connector labeled O/P on the interface card to the connector labeled I/P A on the TS Processor card. This is a push-fit connector. (See Figure 5-8.)
 - Connect the other coaxial cable from the connector labeled I/P on the interface card to the connector labeled O/P A on the TS Processor card.
 - Connect the eight-wire power cable from P1 on the interface card to J7 on the Power Distribution card.

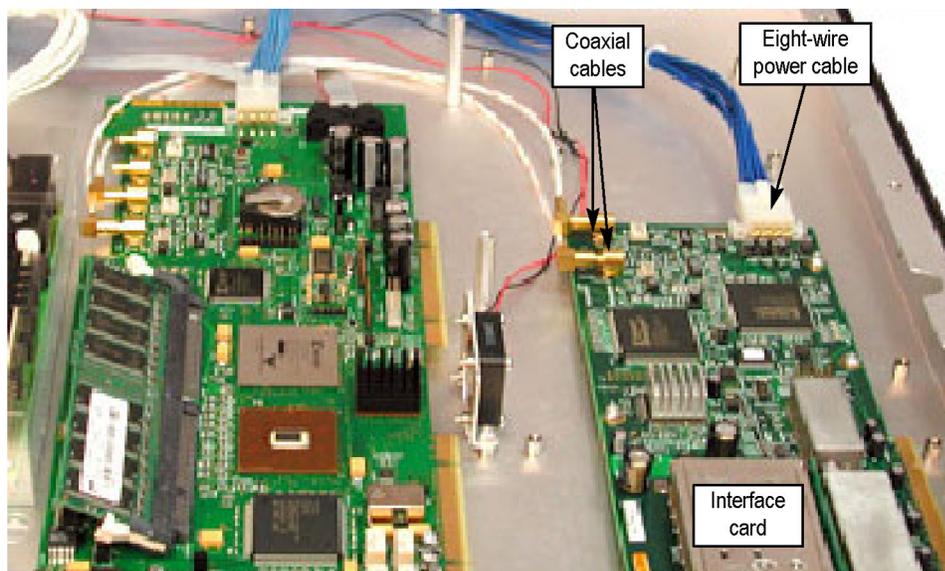


Figure 5-8: Cable connections for QAM (Annex A), QAM (Annex B1), QAM (Annex C), and QPSK (L-Band, old version) interface cards

- b.** For QAM (Annex B2), 8PSK/QPSK, DVB-S2, 8VSB, and COFDM interface cards, make the following cable connections. The cable connections for these interface cards are also described. (See Table 5-2 on page 5-7.)
- Connect the ribbon cable from the connector labeled J14 on the interface card to the connector labeled J750 on the TS Processor card. (See Figure 5-9.)
 - Connect the eight-wire power cable from JR1 on the interface card to J7 on the Power Distribution card.
 - Verify that the two coaxial cables on the interface card are firmly attached to their connectors.

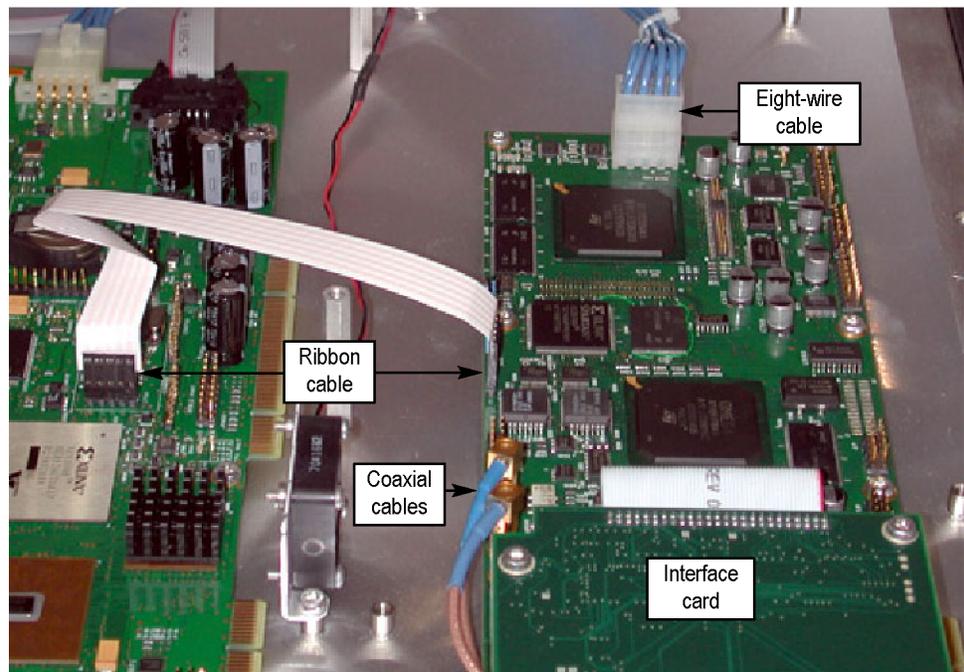


Figure 5-9: Cable connections for QAM (Annex B2), 8PSK/QPSK, DVB-S2, 8VSB, and COFDM interface cards

- c. For GbE interface cards, make the following cable connections. The cable connections for these interface cards are also described. (See Table 5-3 on page 5-8.)
- Connect the ribbon cable from the connector labeled J10 on the interface card to the connector labeled J750 on the TS Processor card. (See Figure 5-10.)
 - Connect the eight-wire power cable from J8 on the interface card to J7 on the Power Distribution card.

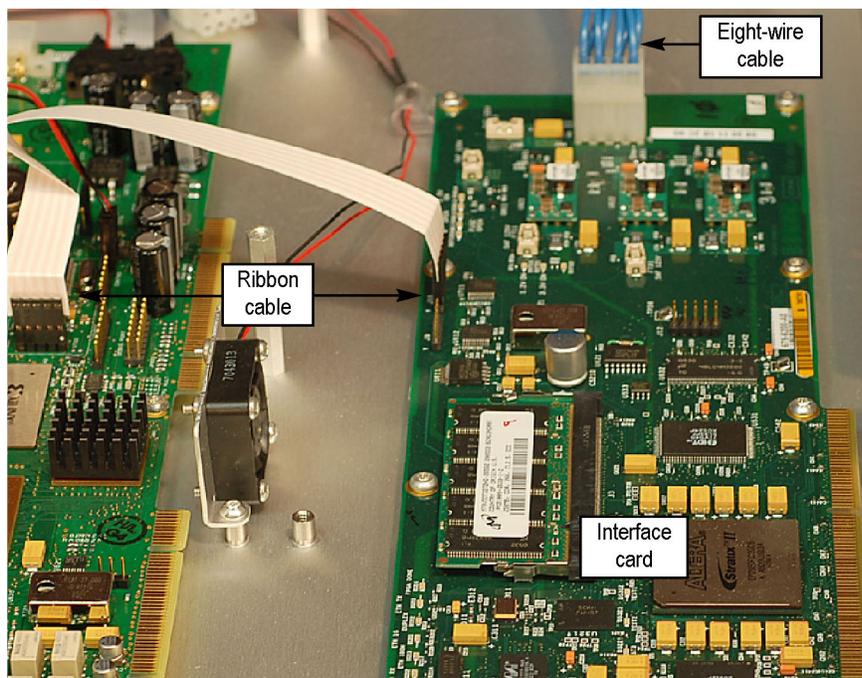


Figure 5-10: Cable connections for GbE interface card

15. Line up the instrument top cover and replace the 21 retaining screws. (See Figure 5-1 on page 5-3.)

Select the Interface

16. The interface card will be detected and initialized when the DTV monitor is switched on. Before the Interface card can be used, it must be selected through the user interface and an input must be provided.

Refer to the *Interface Card Configuration* for instructions on how to configure the interface card. (See page 3-35.)

Battery Maintenance

The DTV monitor uses a pair of Lithium batteries to provide power to the backup circuits when mains power is off. Under normal circumstances, the shelf life of the batteries is in excess of five years.

NOTE. *The following precautions must be observed when replacing and handling the batteries:*

Batteries must be replaced only with the correct Tektronix part. (Refer to the MTM400A, IPM400A, QAM400A, and RFM300 Specifications and Performance Verification Technical Reference.)

Both batteries must always be replaced.

Batteries must be disposed of in accordance with local regulations.

Replacing the Batteries

The batteries are mounted on the Transport Stream Processor card. It is only necessary to remove the top panel to gain access to the batteries.



WARNING. *To avoid personal injury or damage to the unit, do not operate without covers.*

Disconnect power to the unit before removing the covers or panels.

Do not operate this product with covers or panels removed.



CAUTION. *Only qualified personnel should perform this procedure. Read the Service Safety Summary and the General Safety Summary before performing this procedure.*

NOTE. *When the batteries are depleted or removed, all configuration information will be lost, including the network address. The network installation procedure will have to be repeated. (Refer to Network Installation in the DTV Monitor Quick Start User Manual.)*

It is also recommended that you save the configuration information to a storage slot, since this will also be lost. (See page 3-12, Slot Management.)

Perform the following steps to replace the batteries:

1. Remove the top panel. (See page 5-2, *Remove the Instrument Cover.*)
2. The batteries are held in a battery holder by a metal clip on the Transport Stream Processor card. Slide the batteries out of the holder.



CAUTION. *Dispose of the batteries in accordance with local regulations.*

Use only the specified battery (refer to MTM400A, IPM400A, QAM400A, and RFM300 Specifications and Performance Verification Technical Reference).

3. Replace the batteries. The positive symbol (+) should be uppermost.
4. Before replacing the cover, ensure that all components are in place and that all connections are secure.
5. Replace the 21 cover retaining screws and tighten them uniformly.
6. Reconnect the unit and apply power. (Refer to the MTM400A, IPM400A, RFM300, or QAM400A DTV Monitor Quick Start User Manuals.)
7. Reinststate the network identity of the unit. (Refer to the MTM400A, IPM400A, RFM300, or QAM400A DTV Monitor Quick Start User Manuals.)
8. If required, reinststate the configuration information. (See page 3-12, *Slot Management.*)

Repacking for Shipment

If an instrument is to be shipped to a Tektronix field office for repair, attach a tag to the instrument showing the following:

- Owner's name and address
- Serial number
- Description of the problem(s) encountered and/or service required.

The DTV monitor is shipped in cartons designed to provide it with the maximum protection. If you ship the instrument subsequently, you will need to use these cartons, the spacer pads, the protective bag, and the instrument support inserts to provide adequate protection.



CAUTION. *Tektronix cannot honor the instrument's warranties if the DTV monitor arrives at the service center in a damaged condition. The unit must be packed in its original carton (and its supporting packaging material) or in such a way as to provide similar protection.*

To prevent the loss of your instrument's warranties, Tektronix strongly recommends that you use an DTV monitor shipping carton (that is in good condition) when you ship your instrument to another location or when you return the instrument to a Tektronix service center for repair.

New packaging material is available from Tektronix. To obtain these items, contact your nearest Tektronix office or representative.

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