User Manual

Tektronix

Transport Stream Compliance Analyzer (Demo)

071-2468-00

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Preface

This manual supports the Transport Stream Compliance Analyser demo.

Other documents are available on the Tektronix Web site (www.tektronix.com/manuals):

- *MTS400 Series MPEG Test System Getting Started Manual* (071-1505-xx).
- *MTS400 Series MPEG Test System Programmer Manual* (071-1725-xx). This manual specifies the remote control and status monitoring interfaces available to a management application.

Manual Conventions

The following formatting conventions apply to this manual:

- **Bold** text refers to specific interface elements that you are instructed to select, click, or clear.
  Example: Select **Settings** from the Configuration menu.
- Mono-spaced text can indicate the following:
  - Text you enter from a keyboard.
    Example: Enter the network identity (`http://TSMonitor01`).
  - Characters you press on your keyboard.
    Example: Press CTRL+C to copy the selected text.
  - Paths to components on your hard drive.
    Example: The program files are installed at the following location: `C:\Program Files\Tektronix\.`

Introduction to the Demo Version

The MTS400 MPEG Transport Stream Compliance Analyzer (TSCA Demo version) enables you to monitor and interpret the contents of real-time, previously recorded or synthesized transport streams using the latest MPEG, DVB, ATSC, ISDB-T, and ISDB-S standards.

The demo analyzes only built-in TS and PCAP stream files.

Installing the Program

You can download the TSCADemoInstall.exe file from www.tektronix.com/software and follow these steps to install the demo version of TSCA.

1. Double-click TSCADemoInstall.exe to start the InstallShield Wizard that installs the TSCA demo version on your computer. Click **Next** to continue.

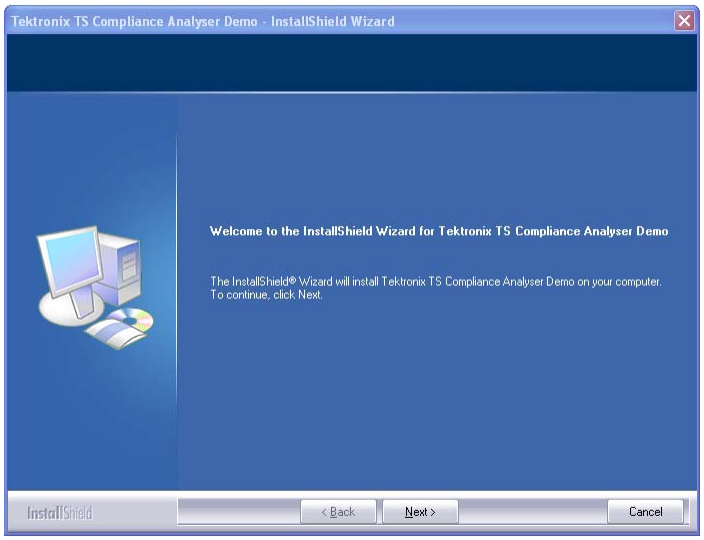
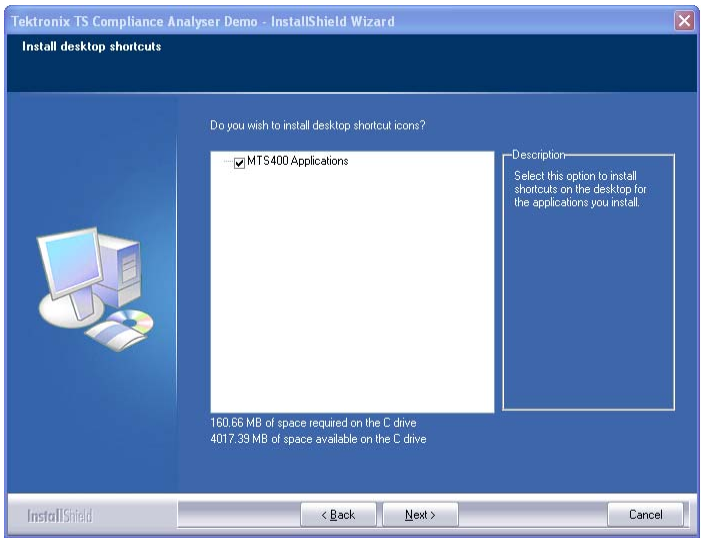
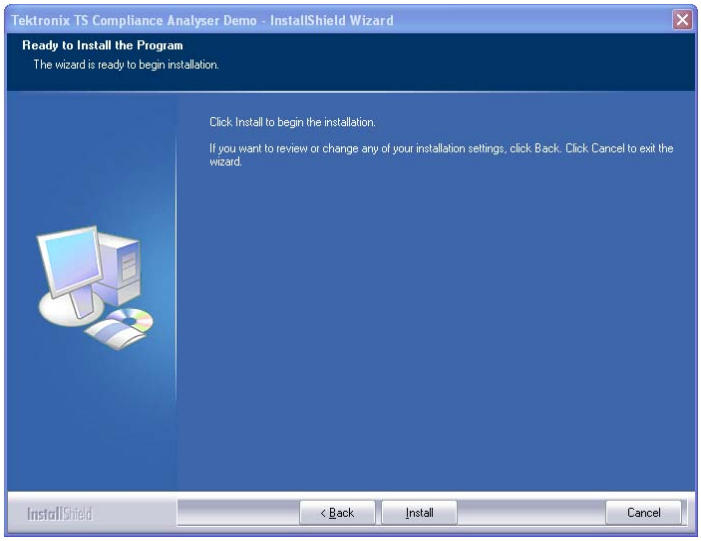


Figure 1: InstallShield Wizard

2. Click **Next** to install the desktop shortcut icons.



3. Click **Install** to begin the installation.



The InstallShield Wizard installs the application displaying the progress.

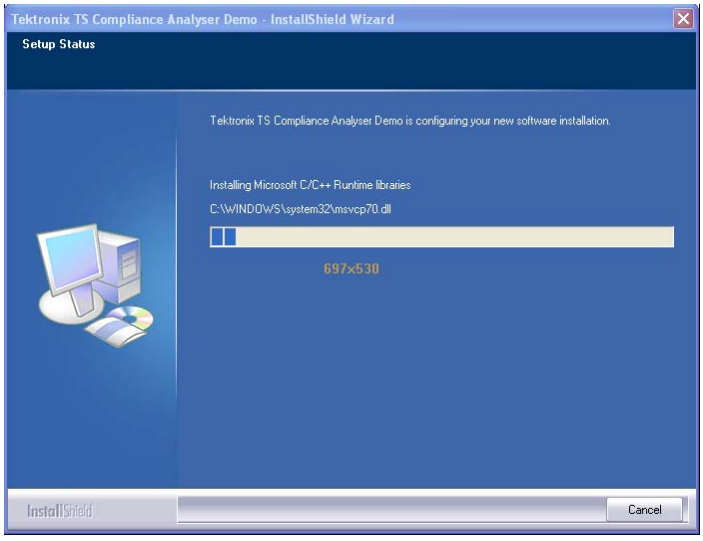
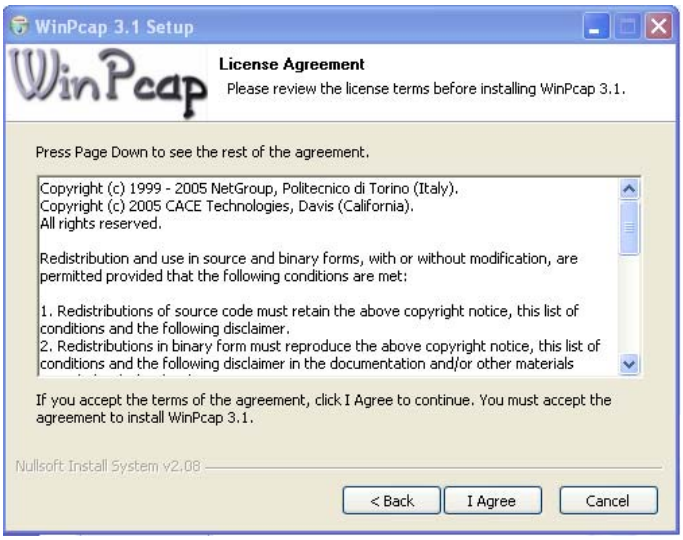


Figure 2: Setup status

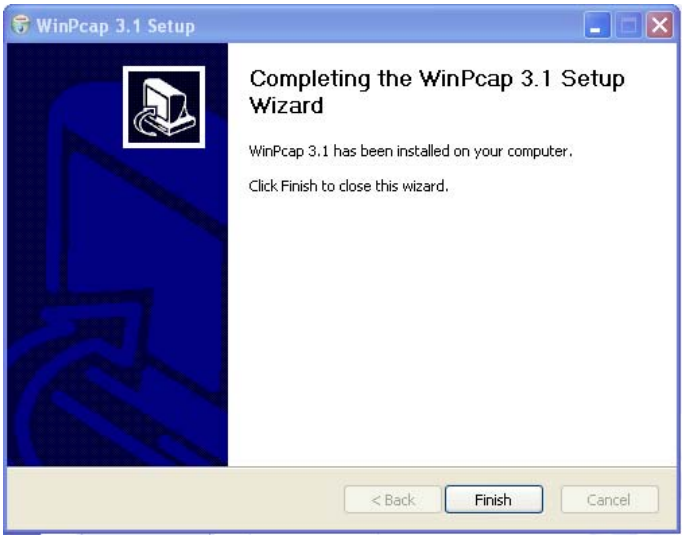
4. Click **Next** to install the WinPcap 3.1 Setup.

Figure 3: WinPcap 3.1 Setup

5. Click **I Agree** to continue with WinPcap installation.

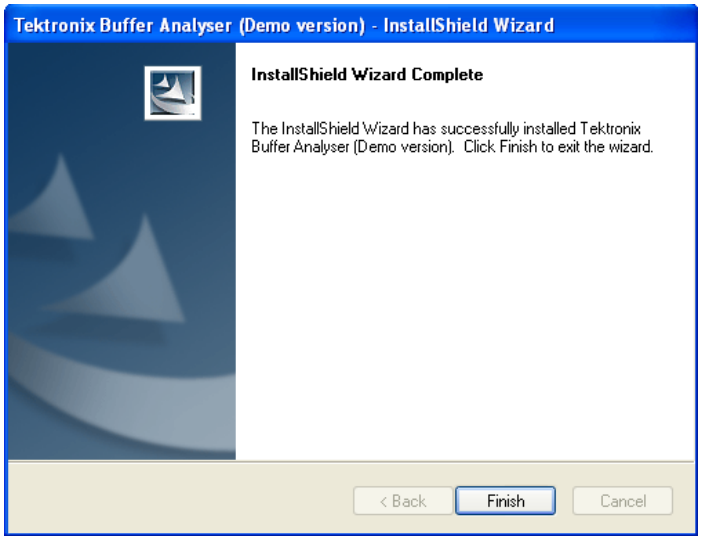


6. Click **Finish** to complete the WinPcap 3.1 Setup.



If WinPcap 3.1 is already installed in your system, a message is displayed as follows. Click OK to continue.

7. Click **Finish** to exit the Wizard and the demo version is successfully installed.



Starting the Program

Start the program by selecting the TS Compliance Analyser option from the **Start > Programs > Tektronix (Demo versions) > Analysers** menu or by double-clicking the TS Compliance Analyser Demo shortcut on the desktop.

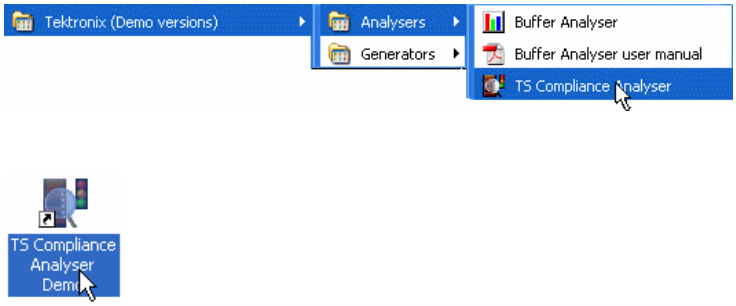


Figure 4: TSCA desktop shortcut

Opening a File

When you start the TS Compliance Analyzer Demo version, the TSCA Demo window with the overlaid Open Transport Stream dialog box is displayed.

The Open Transport Stream dialog box allows you to use either of the built-in streams, namely the MPEG-2 Transport Steam file or the IP capture file. You do not have the option to browse and select the stream of your choice.

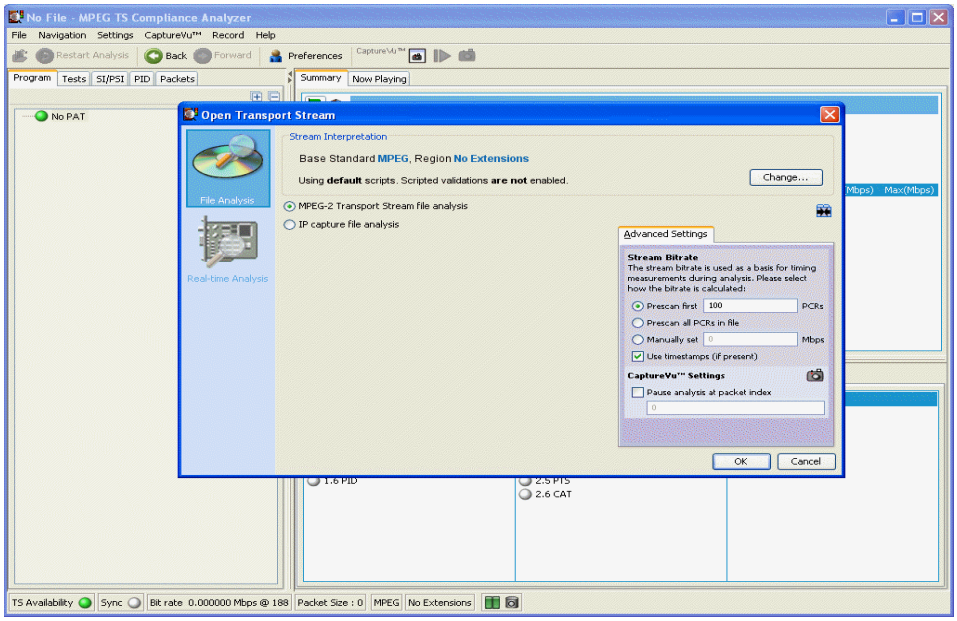


Figure 5: Initial appearance of the main window

PCAP File

The IP capture file (PCAP) supports two TS sessions, either of which may be selected for file analysis.

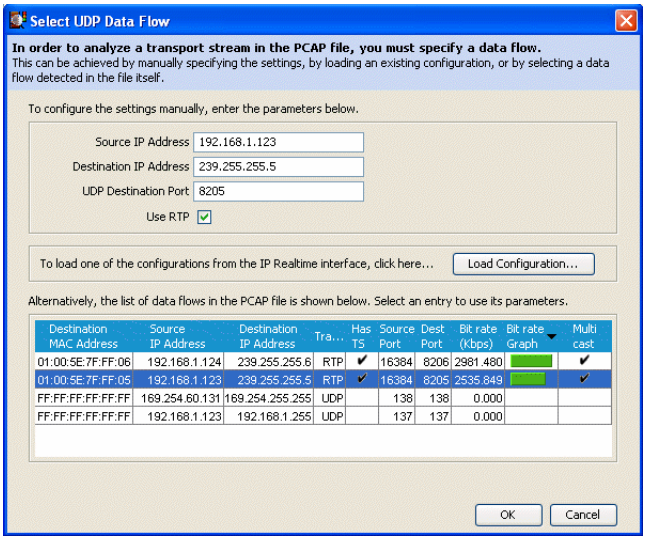


Figure 6: Example PCAP file containing two TS sessions

Stream Interpretation

The example TS file and the real-time TS input contain DVB and ATSC SI. You can use the Stream Interpretation dialog box to select the standard of your choice.

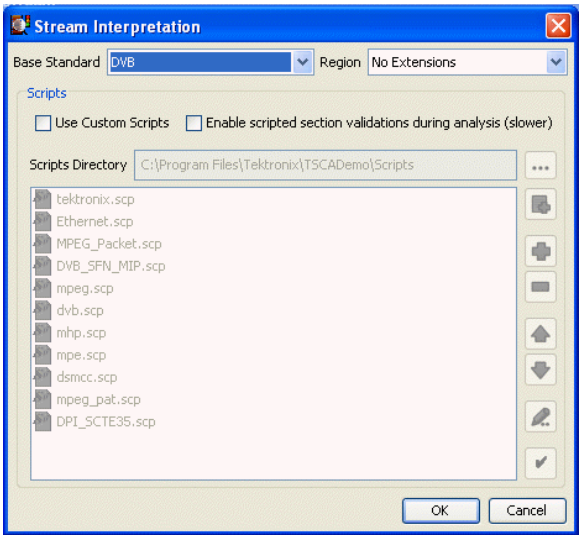


Figure 7: Stream Interpretation dialog box

Real-Time Analysis

Real-time analysis is enabled and stream inputs on the IP, ASI, DVB Parallel, and SMPTE interfaces are simulated. The following steps describe how to select a TS session for analysis when using the IP interface:

1. Select **Real-time Analysis** from the Open Transport Stream dialog box to display the real-time analysis options.

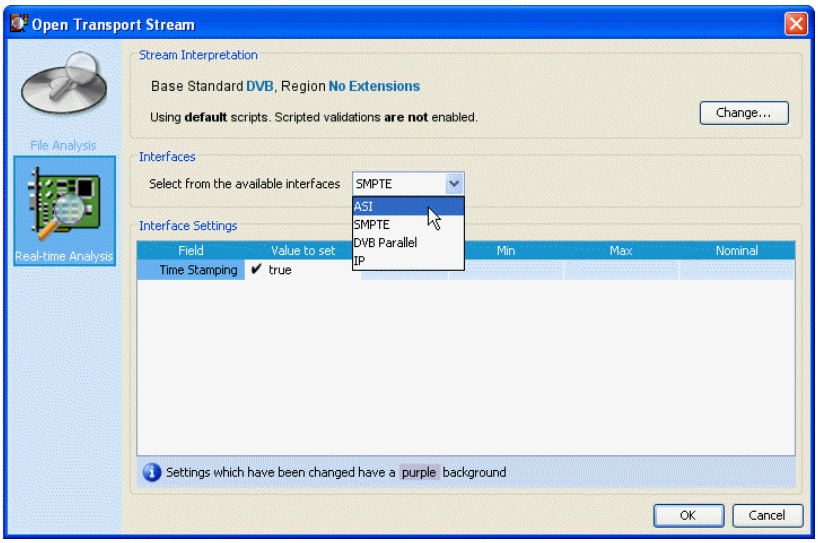
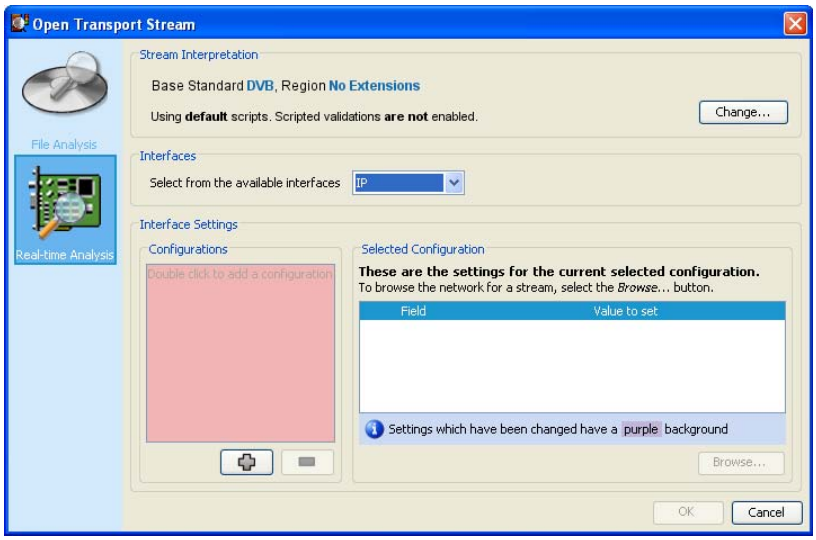
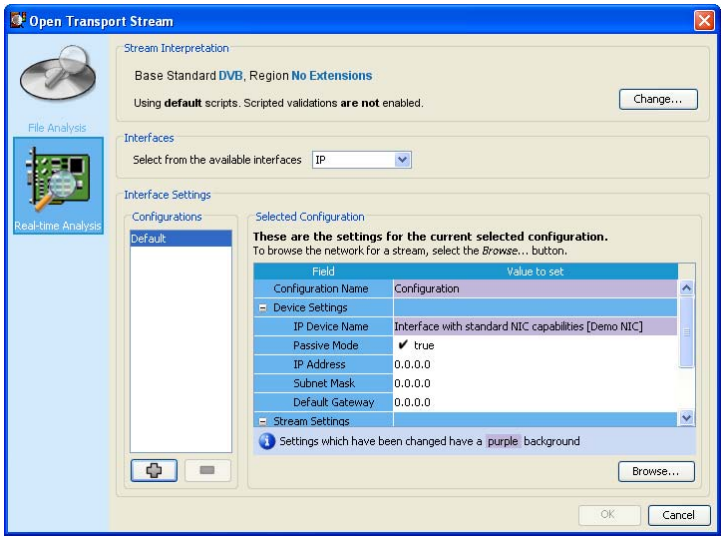


Figure 8: Real-time analysis dialog box

2. Select IP from the **Interface** drop down list to display the interface settings. Click the + button to add a Configuration.



3. Click **Browse...** to select the UDP flow.



A message that informs you to apply the configuration changes is displayed. Click **Apply** to display the Browse for UDP flow... dialog box and select one of the listed TS sessions.

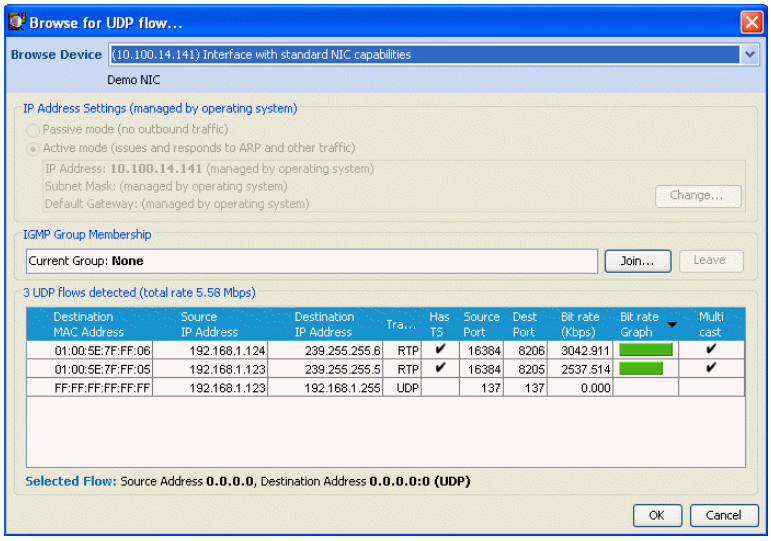


Figure 9: Browse for UDP flow dialog box

TSCA Main Window

Once the built-in stream is selected from the Open Transport Stream dialog box, the main window is displayed as follows. The title bar of the main window shows TSCA to be a demo version.

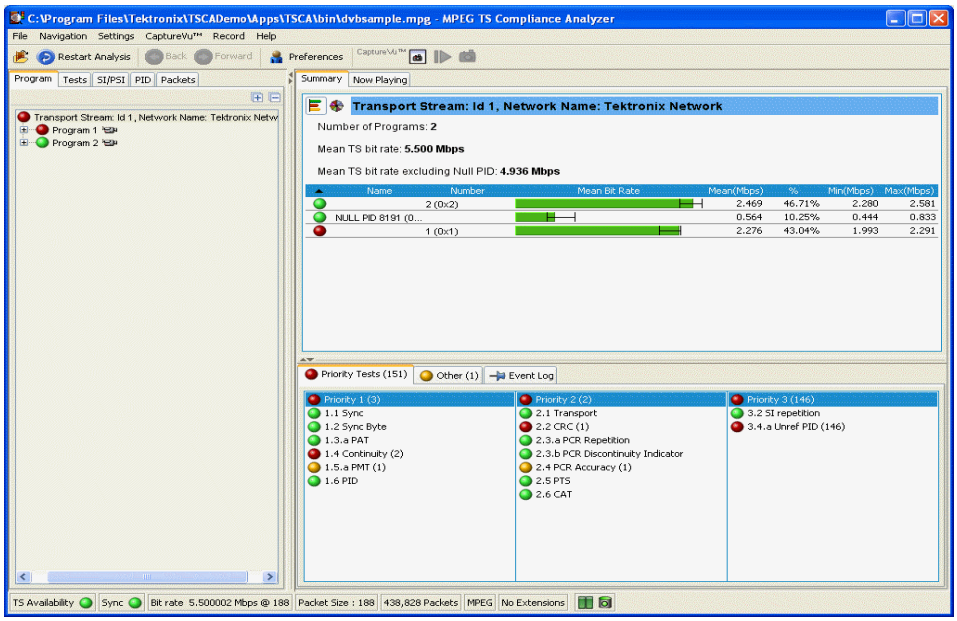


Figure 10: TSCA main demo window

Menu Options

The demo version of the application supports all the menus options available in the full version except for the Record and File menu options.

File Menu Options

The File menu options available in the demo version are listed in Table 1:

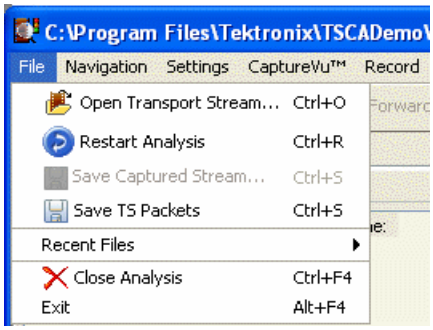


Figure 11: File menu options

Table 1: File menu options for demo version

Command	Function
Open Transport Stream...	Opens the Open Transport Stream dialog box from which the built-in source stream file (file or real-time) and the interpretation standard can be selected.
Restart Analysis	Restarts the current analysis.
Save Captured Stream...	Disabled for the TS Compliance Analyser Demo version.
Save TS Packets	Disabled for the TS Compliance Analyser Demo version.
Recent Files	Lists the most recently analyzed files (built-in files). Select a file name to reanalyze the file.
Close Analysis	Stops and closes the current anlaysis, leaving the TS Compliance Analyser Window open.
Exit	Exits the program.

When you click the **Save TS Packets** option of the File menu, the file is not saved. Instead a message informs you that the save option is disabled.

Record Menu Option

The Record feature is not supported by the demo version and thus the Record menu options are disabled.

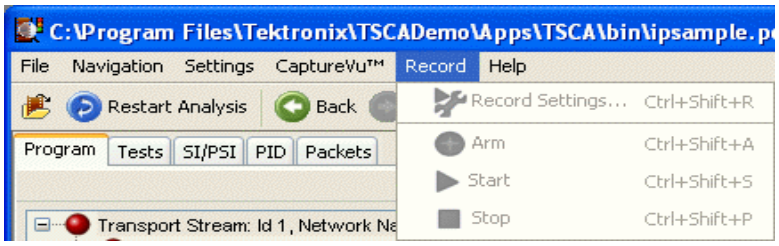


Figure 12: Record menu options

Transport Stream Compliance Analyzer - Getting Started

The MTS400 MPEG Transport Stream Compliance Analyzer (TSCA) enables you to monitor and interpret the contents of real-time, previously recorded or synthesized transport streams using the latest MPEG, DVB, ATSC, ISDB-T, and ISDB-S standards.

The TSCA is specifically designed to enable you to quickly locate and identify problems within a transport stream using a minimum number of mouse clicks. By quickly identifying the problem areas, the TSCA software helps you save time during the development and test of equipment, networks, and services. You can configure the TSCA software to display stream information in user-selected fonts. This feature enables you to view stream information in your local language or to use custom fonts.

The TSCA software will run stand-alone on computers with Microsoft Windows 2000 or Windows XP operating systems.

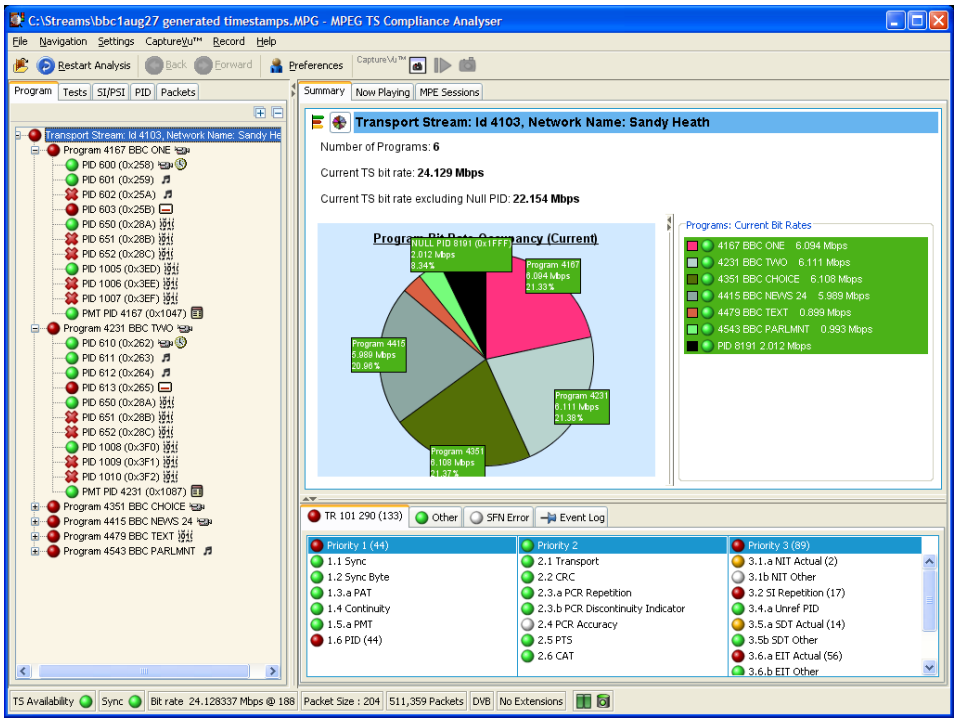


Figure 13: TSCA Program view - Deferred analysis

TSCA Features

- Easy “program centric” user interface quickly isolates information of interest
- CaptureVu™ technology captures and analyzes system events in real or deferred time
- In-depth analysis of stored transport streams including support for MPEG, ATSC, DVB, ISDB-T and ISDB-S table types
- Data summaries and automated filters simplify the analysis of complex transport streams
- TR 101 290 Priority 1, 2 and 3 tests
(European Telecommunications Standards Institute (ETSI) TR 101 290: Digital Video Broadcasting (DVB); Measurement Guidelines for DVB Systems.)
- Syntax analysis and display supported for TMCC and IIP data
- Consistency checks performed between SI, TMCC, and IIP data
- Proprietary PSI/SI syntax section rate error testing
- Error logging
- Suspension of all tests at program changeover based on PMT version change
- DII and DDB error checking

Deferred and Real-Time Modes

The TSCA can be run in Deferred or Real-Time mode.

The Deferred mode is available on any recommended platform (including the user’s own PC). In Deferred mode, a static stream can be analyzed and displayed; the content can then be inspected at leisure.

The Real-time mode, with which a live stream can be analyzed, is available when the TSCA is installed on a Tektronix MTS400 series MPEG Test System or an MTX100B with an Option 7 interface card. Real-time streams can be paused for detailed offline analysis and then when the issue has been found, real-time analysis can be resumed. Real-time monitoring of Video over IP (internet protocol) is also available as a standalone application on a user’s own PC.

Technical Background

The analyzer has a client-server architecture. Every time the analyzer opens, it starts two processes: tsca.exe, which is the client, and MpegCore.exe, which is the MPEG analysis engine. Additionally, when the analyzer opens for the first time, another single process, CoreManager.exe, is started. CoreManager.exe forms an intermediary between TSCA clients and MPEG cores.

The tsca.exe, MpegCore.exe, and CoreManager.exe processes use SNMP (Simple Network Management Protocol) and HTTP (Hypertext Transfer Protocol) to communicate. The port numbers used for communication are read from a configuration file, CoreInfo.xml. In a default installation, this file can be found in c:\program files\tektronix\mpeg\mts400\apps\tsca\xml\. The default port range is 15700-15800. These values can be changed if they conflict with other applications.

On the MTS400 platform, another process, mint.exe, runs from system startup. This process controls shared access to the MTS400 Series hardware by the analyzer and player.

You must have local administrator rights to be able to use IP analysis. If you need to change your rights , please consult your system administrator.

User Interface

The TSCA software uses a single main program summary window with different context sensitive views contained within tabbed frames. This provides the maximum amount of useful information while keeping the screen from appearing cluttered. From the main window, you can access the following views: Program, Tests, Tables,PID, Packets, and Interface.

Program View

The Program view provides a fast overview of the transport stream contents in terms of program content, bit rate use by each program, and TR 101 290 test results. Red, amber and green LEDs highlight errors associated with each program, or element of a program, within the transport stream. Red LEDs indicate that there are current errors in the stream, amber LEDs indicate that errors have occurred but are now clear, and green LEDs indicate that no errors have been detected.

Errors that are detected at lower levels in the program stream hierarchy propagate up to the highest level. This allows you to monitor all of the programs in the stream at a high level and then quickly go to lower levels as necessary to locate a problem.

Tests View

The Tests view enables you to isolate errors to the specific tests that have been applied to the transport stream. The error log is automatically filtered by the selected test, and can also be filtered by Packet Identifier (PID). In addition to the standard first, second, and third priority tests included in TR 101 290 standard, tests are available for Program Clock Reference (PCR) jitter and program/PID bit rate. A variability test enables you to test the changes in the bit rate of a specific PID, and there are many tests that are specific to ISDB-T and ISDB-S streams.

SI/PSI (Tables) View

The SI/PSI (Tables) view displays the service information tables that have occurred in the analyzed stream which comply with the selected digital video standard. This includes MPEG-specific program information, DVB service information, and ATSC, ISDB program, and system protocol information. The tables are grouped together by function and hyperlinks enable you to quickly access related information within other tables.

PID View

The PID view displays information about all of the PIDs found in the transport stream. When you select the transport stream, the associated summary view provides a PID-oriented overview of the transport stream, displaying the relative data rates of all of the PIDs contained within the stream. The information can be displayed as either a bar chart or as a pie chart. Pop up menus enable fast limit selection and links.

Each PID is associated with a number of tests. When one or more tests fail, each failed test will be listed under the relevant PID. Select a specific PID to display a summary of all the associated tests. Select a specific test to display the Event Log and Parameters for only that test.

Packets View

The Packets view displays information about all of the packets found in the transport stream grouped according to content. These groups include PID value, SFN mega-initialization packets (MIPs) (DVB only), and ISDB-T information packets (IIPs). When you select a specific PID or MIP, only packets carrying that particular PID or MIP are displayed. A section view is also available. Deferred analysis of PCAP files allows you to see the ethernet packets.

The Packets view is not available in real-time mode. However, packets in a real-time stream can be examined using the CaptureVu feature.

Interface View

The Interface view provides a central location for information related to the RF interface card (where installed).

- Test results
- Graphical representation of specific RF card readings
- RF card readings and control settings

The graphical views display a selection of graphs of instantaneous measurements and measurement trends. Also available are an Event Log and a Parameter view.

The Interface tab is displayed only when an interface is installed.

CaptureVu Feature

The CaptureVu feature captures a snapshot of system events in real and deferred time, and allows you to debug the intermittent and complex problems that traditional analyzers miss. You can initiate CaptureVu either manually or automatically by associating a CaptureVu Breakpoint with any test event. When a breakpoint is detected, either manual or automatic, the stream is paused and an in-depth deferred time analysis can be performed on stored data. This powerful debug mode enables fast debugging of troublesome intermittent problems.

Triggered Recording

During real-time analysis, stream information can only be held for a finite time - eventually it will be overwritten by more up-to-date information. Triggered recording allows a portion of a stream to be recorded and subsequently analyzed in detail.

The following trigger sources and conditions apply:

- Any test event
- External input; (TTL) edge specifiable
- Date and time
- Recorded file size can be specified
- Pretrigger buffer size can be specified as a percentage of the overall file size range from 0 – 100%

Starting the TSCA Software

The TSCA can analyze transport streams in either real-time or off-line (deferred) mode.

Opening the TSCA

From the Windows Desktop, select **Start** > **Programs** > **Tektronix MTS400** > **Analyzers** > **TS Compliance Analyzer**.

The TSCA is opened, initially overlaid with the **Open Transport Stream...** dialog box.

Click File Analysis to select the transport stream file to analyze and to select the method for calculating the rate of the stream.

Click Real-time Analysis to select an input source (IP or hardware interface) for real-time analysis.

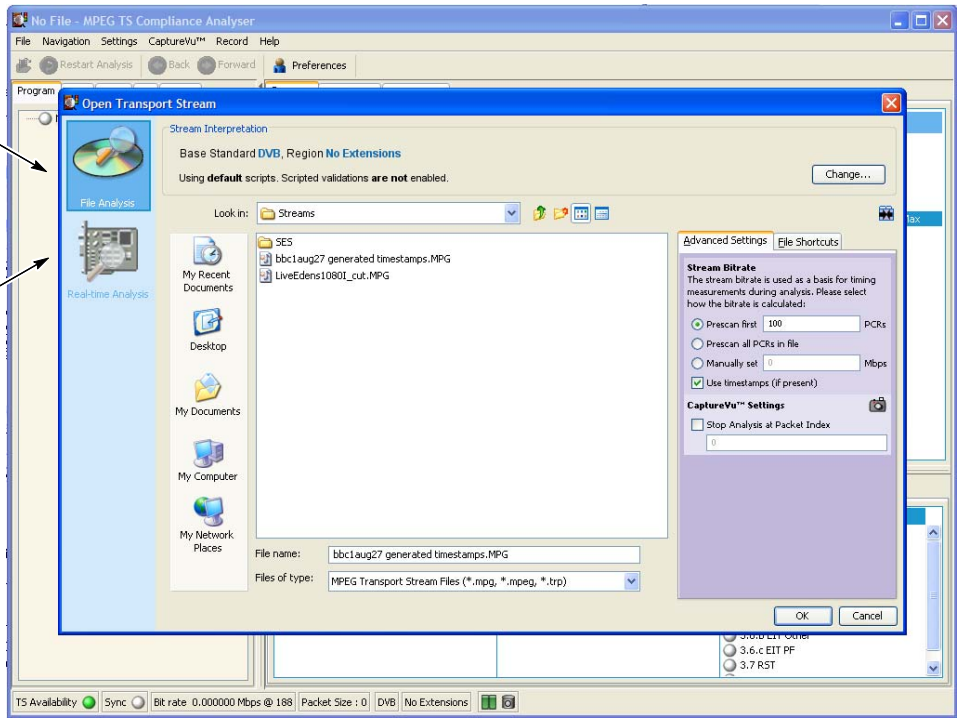


Figure 14: TSCA startup

The **Open Transport Stream...** dialog box allows you to:

- Select the interpretation standard to be used for analysis.
  (The stream interpretation should be checked and, if necessary, set first.)
- Identify a stream file for deferred analysis. Files can be selected either directly from the disk drive or using previously set up shortcuts.
- Identify an input (IP, ASI or SMPTE or DVB Parallel) receiving a stream and start real-time analysis.

Interpreting a Stream

You can set up the stream interpretation standard in the following way:

1. Click **Change...** in the Open Transport Stream dialog box to open the Stream Interpretation dialog box.

***NOTE**. The TSCA software analyzes streams in strict accordance with the standards defined by the digital television authorities: DVB (Digital Video Broadcasting), ATSC (Advanced Television Systems Committee), and ISDB (Integrated Services Digital Broadcasting).*

The TSCA software uses preloaded scripts which establish the expected content and syntax of the analyzed stream. The analyzer is supplied with a comprehensive range of scripts, which, in different combinations, can interpret the full range of digital television standards.

2. Select the **Base Standards** and then (if available) select the **Region**. The analysis scripts that will be used are displayed in the Script Files pane.

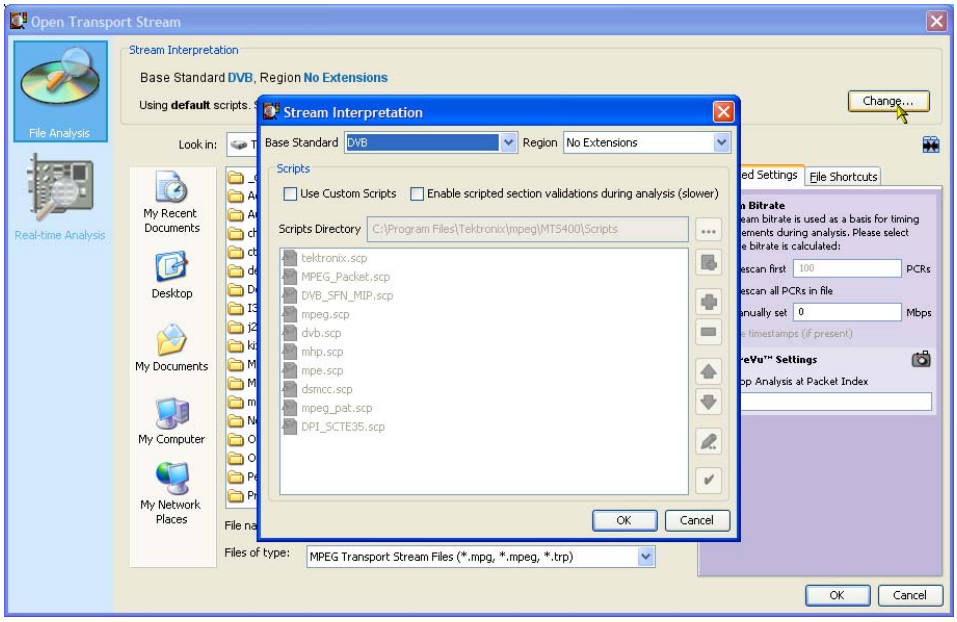


Figure 15: Stream Interpretation dialog box

3. Select **OK**.

4. The stream interpretation is now set. Choose one of the analysis options to select a file or real-time analysis.

(For details of the Stream Interpretation management, see *Script Files* on page 149.)

***NOTE**. The selected stream interpretation standard is not implemented until stream analysis is started. If the Open Transport Stream dialog box is closed without starting analysis, the stream interpretation settings are lost; they revert to the settings that were in effect when the application was last closed.*

Off-Line (Deferred) Analysis

Perform the following steps to start analyzing a transport stream file:

1. In the Open Transport Stream dialog box, with File Analysis selected, browse to a transport stream file.

   If necessary, select a file type from the Files of type drop-down list. Currently, two types are available: MPEG Transport Stream files and PCAP files.

   - MPEG transport stream files contain interlinked tables and coded identifiers, which separate the programs and the elementary streams within the programs.
   - PCAP files contain raw packets of network data. A PCAP may contain more than one session. You will need to select a session using the Browse dialog box.

2. When you select a stream, the stream name appears in the field at the bottom of the window.

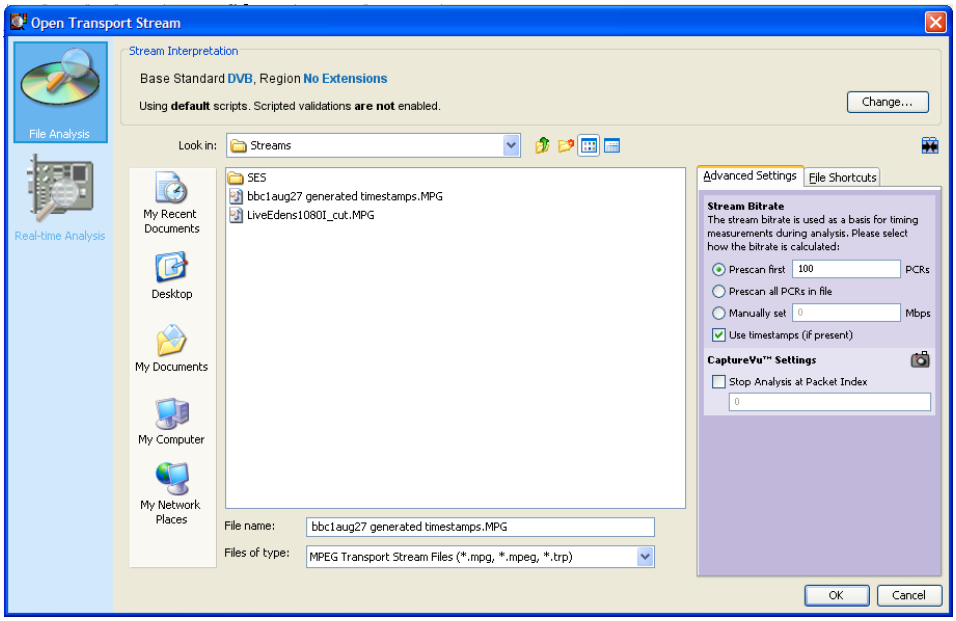


Figure 16: TSCA File Analysis (Offline) dialog box

3. **Calculating the Transport Rate.** To analyze a transport stream correctly, you must do one of the following:

   - Calculate the bit rate from PCRs (Program Clock Reference) carried in the stream

   ***NOTE**. When the TSCA software analyzes a transport stream, it compares the bit rate of the stream to the expected rate. Errors are reported based on the expected rate of the stream. To analyze a stream correctly, it is necessary to know the original bit rate of the stream or to calculate the bit rate from PCRs (Program Clock Reference) carried in the stream. PCRs are generated as a stable clock reference and are added to the stream during its generation. During analysis, the PCRs are extracted and synchronized with a local clock reference.*

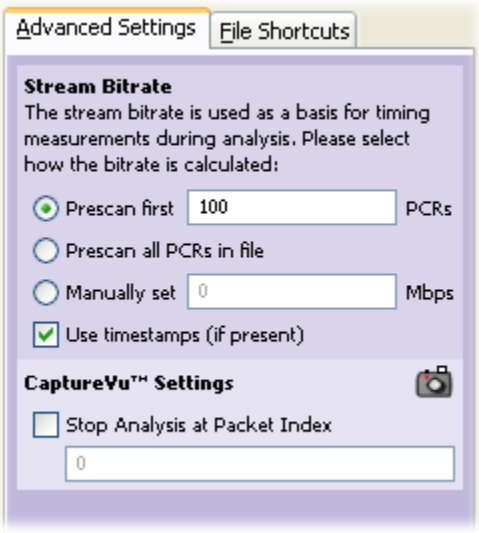
   - Know the original bit rate and enter it manually
   - Use timestamps included with the stream

4. After you select the desired stream, select one of the following methods for calculating the rate of the transport stream:

   - Prescan the first nnn PCRs. When you select this method, the TSCA software calculates the rate of the stream by prescanning the stream for embedded PCRs. The entry box lists the number of PCRs that the TSCA

software recommends are necessary to determine the stream rate. You can use the entry box to enter a different number.

- Prescan all PCRs in a file. When you select this method, the TSCA software calculates the rate of the stream by prescanning the stream for all of the embedded PCRs.
- Manually set nnnn Mbps. When you select this method, the TSCA software uses the absolute value (in Mbps) that you enter as the expected stream rate.



***NOTE**. Timestamps, which are added when the stream is generated, will be used, if present, and if the Use Timestamps checkbox is enabled. Using timestamps will override the PCR options (Prescan PCRs and Scan entire file). The manual bit rate setting will override both PCRs and timestamps.*

5. If the TSCA software cannot calculate the bit rate from the embedded PCRs, or timestamps, a message box is displayed. You must enter an estimated bit rate before the TSCA software can analyze the stream.

   If the CaptureVu feature is to be used, the whole file can be captured or analysis can be stopped either by a previously set CaptureVu breakpoint or at a specific packet.

6. To stop analysis at a specific packet, enable **Stop Analysis at Packet Index** and enter a packet number.

With a file selected and the transport rate calculation set up, you can start the analysis (see page 26).

Real Time Analysis

Perform the following steps to start analyzing a transport stream received through an IP or a hardware interface.

1. In the Open Transport Stream dialog box, with Real-time Analysis selected, select an interface from the drop-down list.

***NOTE**. For stand-alone installations, only the IP interface is available.*

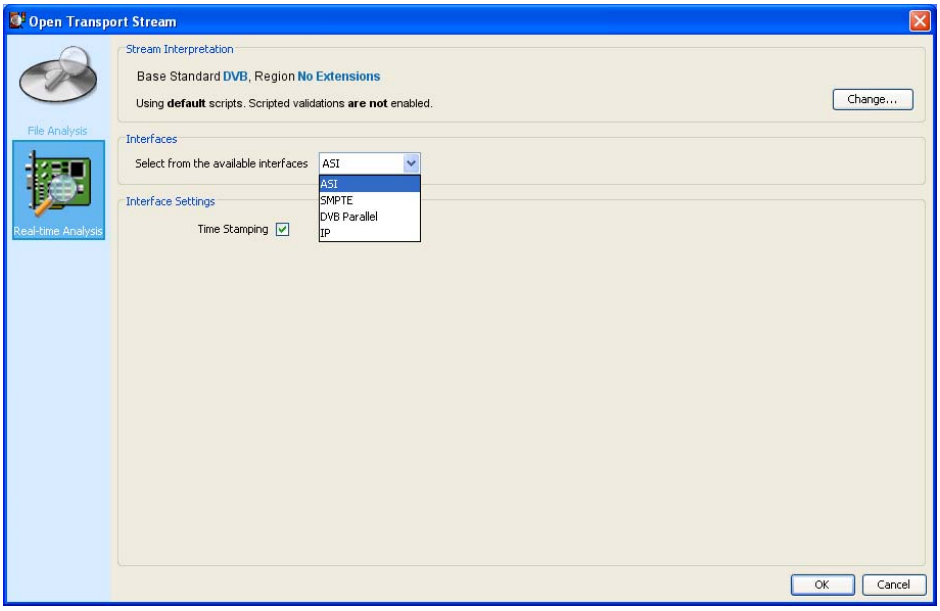


Figure 17: TSCA Real-time Analysis dialog box

Real-time analysis will not be available if the appropriate software key permissions are not found. A warning message is displayed when real-time analysis is not available.

2. Make any necessary interface settings. During analysis, the interface selected will be shown in the status bar. (The IP interface settings are described on page 27.)

Start the Analysis

To start the analysis, follow these steps:

1. After you have selected the interpretation standard and the stream source, click **OK** to continue.

   The TSCA software starts analyzing the selected stream. During deferred analysis, a progress bar is displayed. The TSCA starts reporting analysis results (see Figure 18).

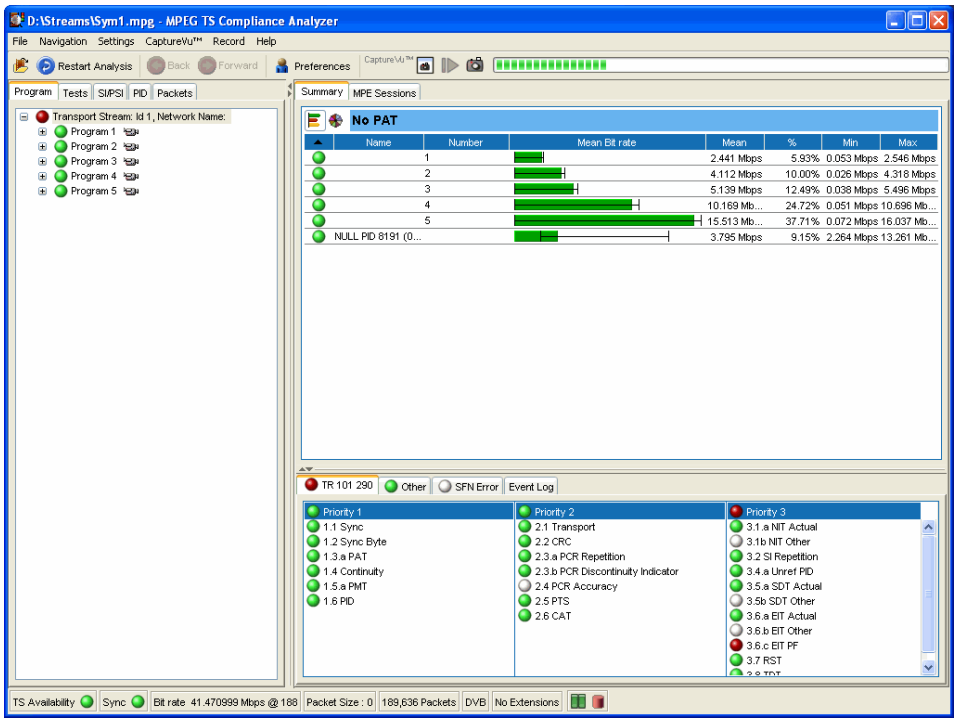


Figure 18: TSCA window showing analysis progress

2. When sufficient data has been gathered and the display has stabilized, you can start using the TSCA to view the analysis.

3. To analyze another stream file or to reanalyze the current stream using different standards, use the File > Open Transport Stream menu selection.

Setting Up the IP Interface

Two Ethernet interfaces are standard on the MTS400 Series systems (one 10/100 Base T and one 10/100/1000 Base T GigE). A high performance Gigabit Ethernet interface (1000 Base T GigE) can be acquired as an option; this provides accurate hardware timestamping, hardware filtering and a variety of connection options, including copper and optical. These allow for basic detection and display of all UDP (User Datagram Protocol) traffic on a network. Extraction of an MPEG over IP stream is possible (if the licensed option is enabled).

- IP multicast addresses are indicated. Note that the TSCA will not automatically join a multicast group (see *IGMP Group Membership*, page 28).
- UDP streams carrying MPEG TS traffic are indicated.
- A selected UDP stream carrying TS traffic can be selected for analysis and recording, in a similar manner to any other physical interface.

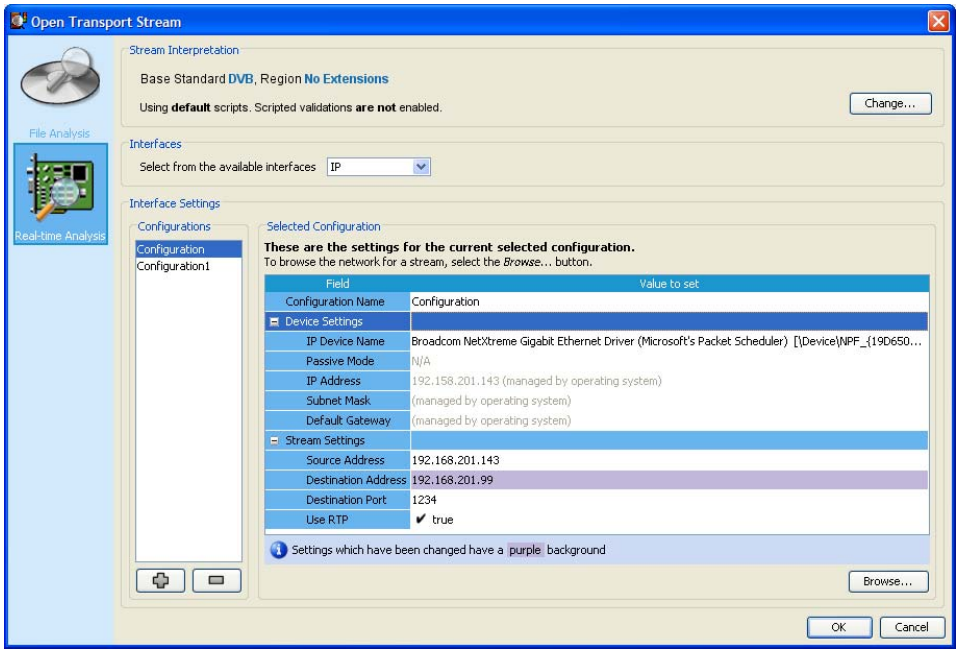


Figure 19: Setting up the IP interface

In the Open Transport Stream… dialog box with IP selected in the Select Interface drop-down menu, the current settings for the selected configuration are shown. The individual settings are described next.

Select OK to confirm the IP setting and start analysis.

Interface Settings Configurations

You can save individual IP settings configurations to disk; they can be recalled when required. Up to 128 configurations can be specified.

The Open Transport Stream - Real-time Analysis dialog box shows the settings associated with the currently selected configuration.

Different settings can be entered on this screen; the new settings will be used when OK is selected. The new settings can also be saved as a new configuration for future use if required.

IGMP Group Membership. Multicast broadcasts can be joined by entering the multicast address in the IGMP Group Membership field in the Browse dialog box. The sessions detected will be listed in the dialog box.

Create a New IP Configuration. In the Open Transport Stream - Real-time Analysis dialog box, select the plus button to create a new configuration.

A default configuration name is allocated and displayed in the IP Configuration Name field. You can enter a more meaningful name. New values can be entered as required. This name and the settings associated with it will remain available for recall.

Alternatively, the streams available can be viewed and a new one selected.

Select New to open the Edit IP Configuration dialog box. Select Browse and the Browse for UDP flow... dialog box will be displayed (see Figure 20).

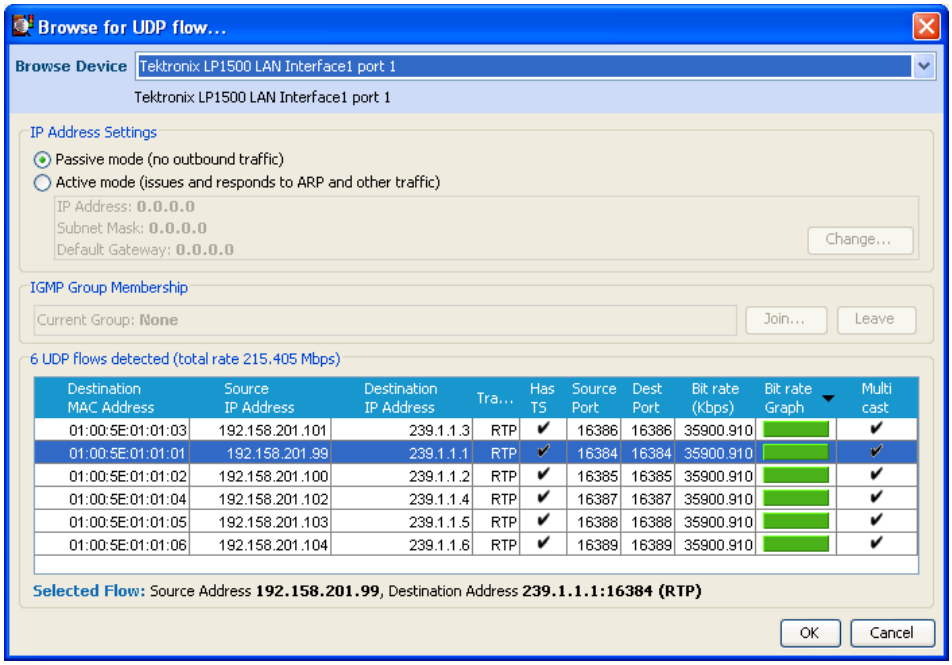


Figure 20: UDP flow selection dialog box

The names of any network devices installed in the instrument are displayed in the Browse Device field. Select the network device required from the drop-down list. The traffic present on the selected interface is displayed in the bottom half of the dialog box. A summary of the UDP flows detected is displayed in the table header. The bit rates given are UDP bit rates, not transport stream bit rates.

The Source and Destination addresses can be set up in two ways:

- In Open Transport Stream > Real-time Analysis > Selected Configuration area, enter the data into the Stream Settings fields. Multicast sessions can be identified by entering the appropriate address in the IP Destination Address field.
- In the Browse for UDP Flow dialog box, highlight a session in the current traffic area; the values are entered automatically in the Selected Configuration, Stream Settings fields. Traffic carrying transport streams will have a check mark in the Has TS column.

The TSCA should detect whether traffic is transmitted over UDP or RTP; this will be indicated in the Transport column. The Use RTP check box will be updated to match the protocol indicated for the selected session; this setting can be overridden by selecting or clearing the Use RTP setting if it is believed that the protocol indicated is incorrect.

When the settings are correct, select **OK** to confirm and save the configuration. The Edit IP Configuration dialog box closes and the new configuration is immediately available in the Open Transport Stream dialog box.

Edit an Existing IP Configuration. An existing IP configuration can be modified as required. Modify the individual fields in the Selected Configuration, Stream Settings fields or select a new entry in the Browse for IP Flow dialog box.

Select an Alternative IP Connection. Select a new configuration from the Interface Settings drop-down list. Note the change in the Current Settings section of the window.

Delete an IP Configuration. To delete an IP configuration, ensure that the configuration to be deleted is displayed in the Open Transport Stream dialog box and select the minus button. The selected IP configuration is deleted and the next available IP configuration is displayed.

Setting the Stream Content Font

You can configure the TSCA software to display stream content information in a user-defined font style or language, such as Japanese or Chinese.

***NOTE**. How the TSCA displays the text strings carried in the stream itself is dictated by the TSCA font setting and by the interpretation standard used during the analysis.*

How the TSCA displays entries in the Event Log is dictated by the TSCA font setting and fonts used by a local computer. For example, if the default language of the TSCA computer is Japanese, the event log will be displayed in Japanese characters. You must choose a suitable font for the characters to display correctly.

Selecting the Display Font

Perform the following steps to set the font that will be used by the TSCA software to display stream content. You can configure the TSCA software to display stream content using any font that is installed on your computer.

1. Select Settings > Preferences… to open the Preferences dialog box.
2. Select Font at the left of the Preferences dialog box to display the window shown in Figure 21.

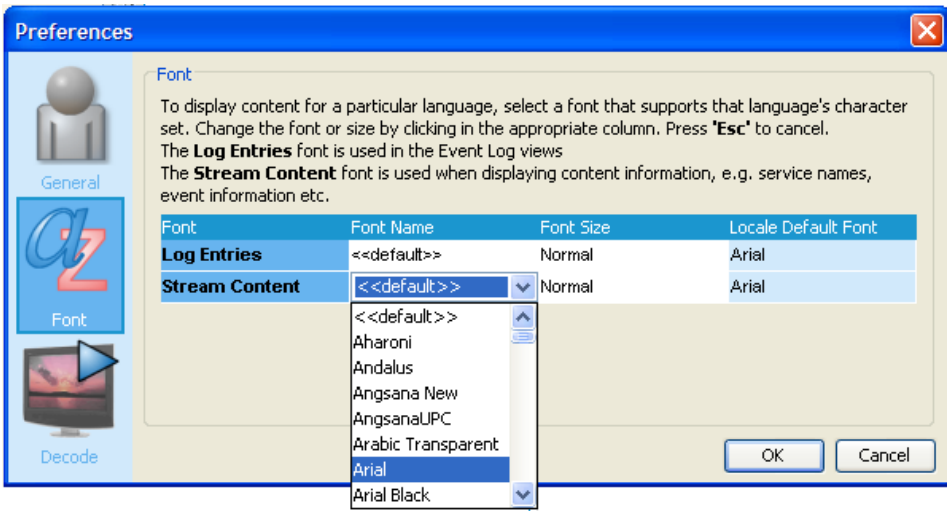


Figure 21: Selecting a display font from the Preferences dialog box

3. The dialog box lists the default font used by your computer for the Log Entries and Stream Content displays on the TSCA software. Use the Font Name and Font Size drop-down boxes to select a desired font style and size.
4. Click **OK** to accept and save any changes.

Installing Asian Language Fonts

Computers that are using local versions of MS Windows 2000 (such as Japanese or Chinese), or MS Windows XP, should have the Asian language fonts already installed on their systems.

If your computer or MPEG test system does not have Asian fonts installed, perform the following steps to install the Asian fonts:

1. Insert the MS Windows OS CD-ROM, which was supplied with your computer or MPEG test system, into the CD-ROM drive.
2. Locate the LangPack directory on the CD-ROM. This directory contains a number of *.inf files for various languages. For example, you can install japanese.inf and tchinese.inf, for Japanese and Traditional Chinese language fonts.
3. To install new fonts, right click on each desired font file in the LangPack directory and select **Install**.
4. The new fonts you installed should now appear as possible font selections in the Preferences dialog box. You must select the new font in the Preferences dialog box before the new font will be used to display stream content.

Loading a Custom Extension Font

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. 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 MS Windows installation.

To install a font extension set on your computer:

1. Open the MS Windows Private Character Editor.
   a. Select **Run** from the Start menu.
   b. Enter eudcedit in the Run dialog box and click **OK**.
2. After the Private Character Editor opens, close the Select Code dialog box.
3. Select **Font Links…** from the File menu.

4. In the Font Links dialog box, select **Link with Selected Fonts**.

***NOTE**. If you select Link with All Fonts, the following actions will overwrite any existing font extension sets.*

5. In the Select Fonts box, find and highlight the font to which you are adding the extension. This font should be the one you selected in the TSCA font preferences dialog box.
6. After you select the font to which you are adding the extension, click on Save As….
7. In the Modify Private Character Filename dialog box, browse to the TrueType extension file you are adding (*.tte) and click Save.
8. In the Font Links dialog box, click **OK**.
9. Close the Private Character Editor window.
10. To verify that the font extension has been successfully installed, open the Character Map application.
    a. Select **Run** from the Start menu.
    b. Enter charmap in the Run dialog box and click **OK**.
11. Browse through the font list for the name of the font to which you added the extension. The term “Private Characters” should follow the font name. When you select the font name in the list, you can view the extended character set.
12. Close the Character Map application.

The new font extension you installed should now appear as a possible font selection in the Preferences dialog box. You must select the new font in the Preferences dialog box before the new font will be used to display stream content.

Understanding the Analyzer Window

On start up, you can immediately open and analyze a transport stream (see *Starting the TSCA Software* on page 20). This will result in a display similar to that shown in Figure 22. This is the working display.

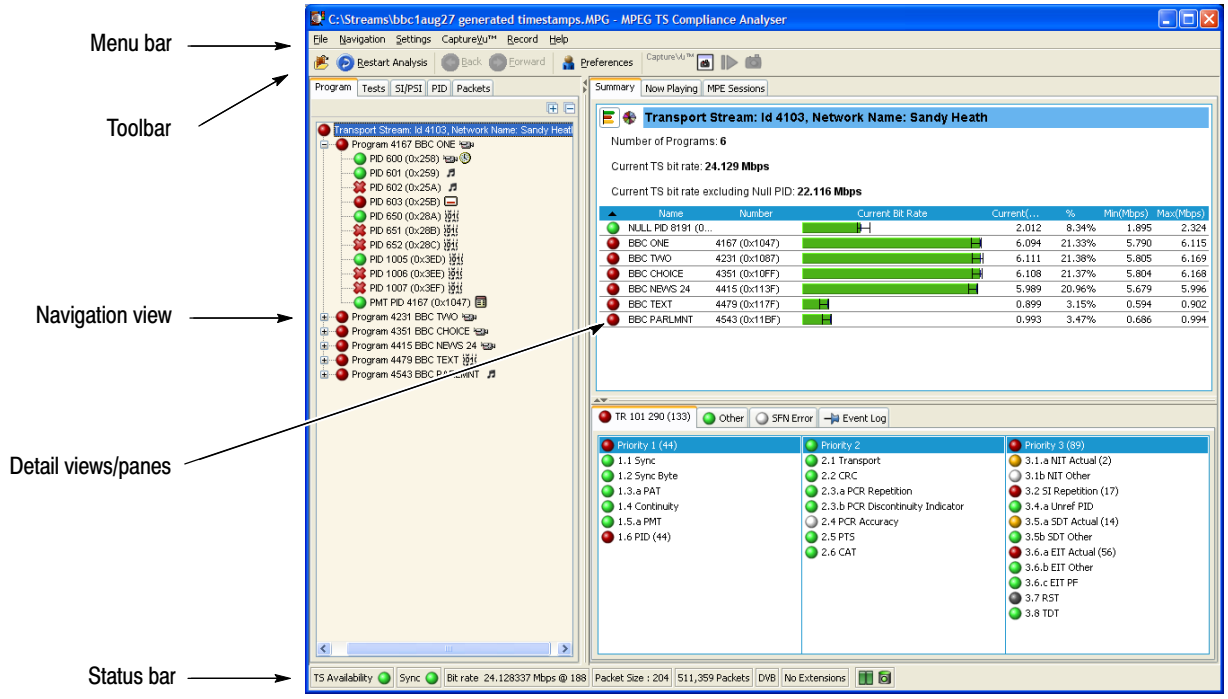


Figure 22: Analyzer window

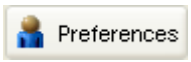
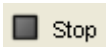
TSCA Window Components

The TSCA window contains the following components:

Menu Bar The Menu Bar provides access to a selection of system options using drop-down menus (see *Menu Bar and Options*, page 144).

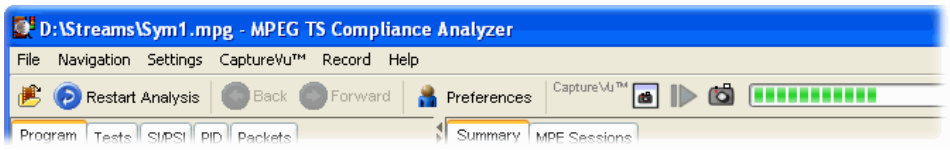
Toolbar The buttons displayed on the toolbar provide shortcuts to often-used menu options. Additional buttons displayed during real-time analysis are shown in Table 2:

Table 2: Toolbar icons

Deferred and Real-time Analysis	
	Opens the Open Transport Stream dialog box.
	Restarts analysis.
 	User actions are recorded during a session. The forward and back buttons allow you to step through the actions in order to review or repeat them.
	Opens the Preferences dialog box from which you can set your preferences.
CaptureVu	
	View CaptureVu status.
	Resume file analysis.
	Stop and capture analysis.
Real-time analysis	
	View record setting.
	Arm record feature.
	Start recording.
	Stop recording.

Progress Bar

The progress bar indicates the progress of processing during deferred analysis of a stream.



To stop the analysis process, click the Stop button on the toolbar.

Navigation View

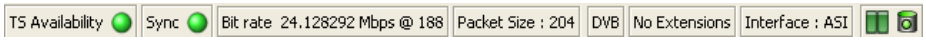
The left side pane in the main window is the navigation view and provides the main analysis information for the transport stream in a number of forms: Programs, Tests, SI/PSI, PID, Packets and Interface. Views are selected using the tabs at the top of the pane. The background of each view is color-coded to aid identification.

Detail View/Panes(s)

The right side pane in the main window is the detail view and provides details related to the selection made in the current navigation view. The overall view may be subdivided into one or more panes; you can access individual views in multiple pane views using tabs.

Status Bar

The status bar, when not hidden, is displayed at the bottom of the main window and shows a summary of stream statistics.



The fields, from left to right, are as follows:

TS Availability	Indicates that either the stream bit rate has fallen below the minimum value or that synchronization has been lost (see also Sync below). The minimum stream bit rate is set using the “Min stream bit rate for processing” parameter, see *Parameter Edit*, page 118.
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.
Bit rate	Total bit rate of the transport stream. The packet value (188 or 204) is set using the Preferences feature (see page 147).

Packet Size — Packets in a stream can be either 188 or 204 bytes long. This is detected automatically.

Stream Interpretation, Base Standard — This is the set of tests that is being used to analyze the stream.

Stream Interpretation, Region — This subset of tests modifies the base standard; it can add tests or modify existing ones.

Physical Interface — The current interface for real-time analysis.

Partial Reception Availability 

(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:

Gray:	Partial reception availability is unknown.
Green:	Partial reception data is available.
Gray + red cross:	Partial reception data is not available.

Processing Throttle Indicator 

This icon consists of two adjacent LED indicators which show the status of the TSCA processing engine. The left indicator shows the “strained” status; that is whether throttling is being applied to cut down on the information being processed. The right indicator shows the “overwhelmed” status; that is whether the processing engine is able to cope with the amount of information in the stream even after throttling. The colors indicate the status as follows (The general color coding scheme is described in *Error Status LEDs*, see page 40):

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

System Log Status  Shows the status of the system log which records system-wide events, for example, scripting errors. The color of the LED (in the body of the icon) indicates the most serious event state in the log. When the top surface of the icon is gray, it indicates that all entries in the log have been viewed.
Double-click the icon to view the log.

Gray:	The log is empty
Amber:	There are entries in the log, but none since the log was last viewed
Red:	There are new entries in the log

Analyzer Window - No Stream Available

If you choose not to select and analyze a stream, the screen will appear as shown in Figure 23. The analysis structure is present, but with no stream content.

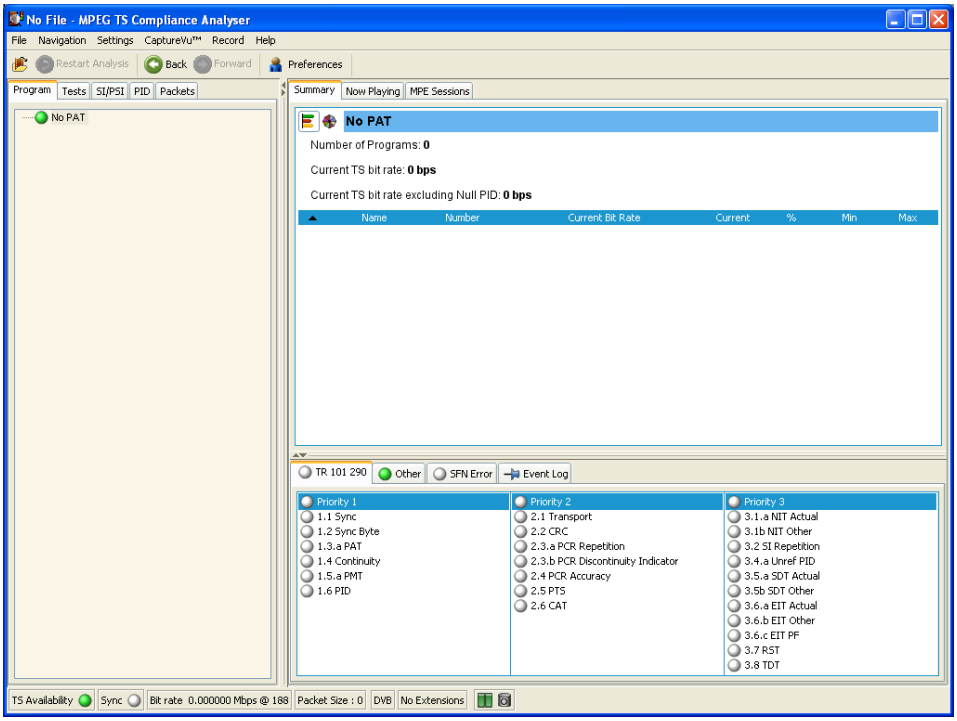


Figure 23: Analyzer window - no file

Error Status LEDs

A major feature used throughout the TSCA interface is error status LEDs that represent the status of the tests applied to associated items, for example, programs, tests and PIDs. Colors used are as follows:


(Red) Error; test failed


(Yellow) Transient error (error not currently being detected but has been seen since last reset)


(Green) No error; test passed


(Dark Blue) Warning (Interface tab only)


(Light Blue) Transient warning (warning not current, but has been detected since last reset) (Interface tab only)


(Gray): Test disabled


(White) Test not applicable or unknown state


(Red) PID referenced but not found in the stream


(Green) PID referenced but not found in the stream. Applicable test disabled.

When an LED represents a parent node in a tree (for example, a program node is the parent of elementary stream nodes), the color represents the worst case of all of its tests and the worst case of all of the tests represented by its child nodes.

Similarly, when an LED representing a parent node in a tree is disabled or enabled, all subsidiary (or child) nodes are also disabled or enabled to reflect the state of the parent node. When an LED representing a parent node is reset, all the child nodes are also reset.

***NOTE**. The color scheme described here is used throughout the TSCA interface, for example, the bit rate bars in the navigation views.*

Test Management Shortcut Menu Options

Tests can be disabled and enabled as required using the shortcut menu associated with the LED icon. However, it is important to note that the extent of the action depends on the hierarchical level of the icon chosen. For example, choosing Disable from a program node shortcut menu will disable all tests in the program group.

***NOTE**. In deferred time, if any disabled events are reenabled at the end of analysis, the LEDs will become green. You will have to restart the analysis if you wish to see the status of the test when the test is enabled.*

Shortcut Menus

Shortcut menus provide an important way of navigating around the TSCA application. They are available on most displayed objects, for example, program tree nodes. These menus provide options relevant to the selected object. For example, after failure, all tests associated with a node can be reset, by selecting the shortcut menu option Reset All Tests. The shortcut menu options provide both actions (for example, enable and disable a function) and quick links to associated objects in other views.

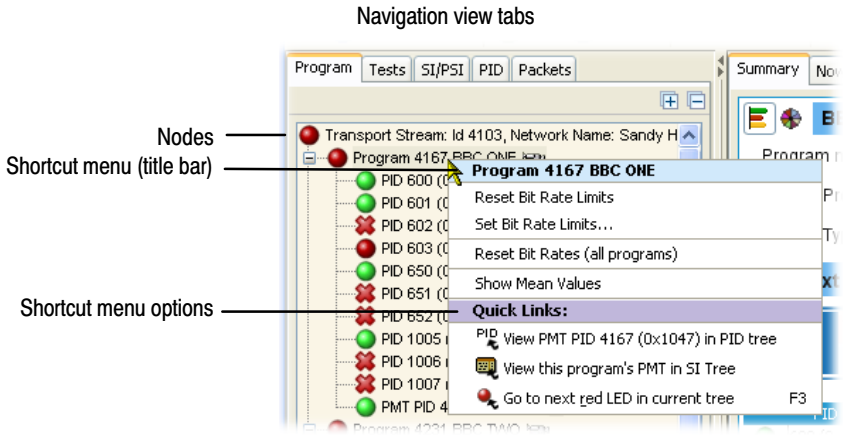


Figure 24: Shortcut menu (example)

To view shortcut menus, right-click an object. The menus are associated with node types (for example, a PID node). Note that node types can be displayed in more than one view; for example, PID nodes are displayed in the Program view and the PID view. All shortcut menus have a title bar that indicates the node selected.

Using the Program View

The Program view is displayed when the Program tab is selected in the navigation tabbed pane. The navigation view initially displays the top node of the program tree, which represents the analyzed transport stream from a program perspective.

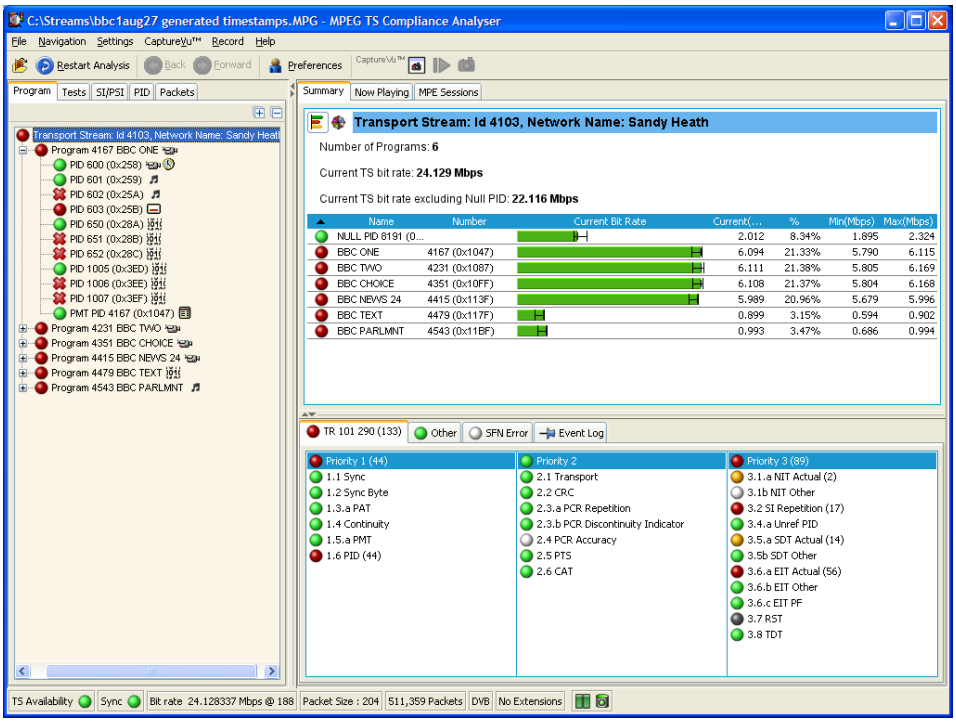


Figure 25: Program view

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

With the tree expanded, the navigation view shows the makeup of the stream as shown in Figure 25; the stream display consists of the nodes shown in Figure 26.

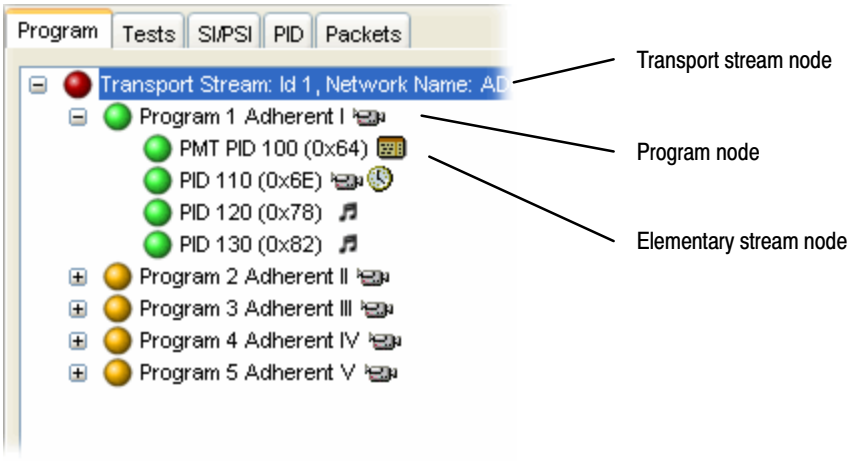


Figure 26: Program view nodes

Table 3 shows which information is available for each node.

Table 3: Program view tabs

Tabs / Node	Summary	Now Playing	IP Graphs	MPE Sessions	Summary / Associated Tests	Graph - Bit Rate	Graph - Timing	Event Log	Parameters
Transport Stream	✓	✓	✓	✓	✓	-	-	✓	-
Program	✓	✓	-	-	✓	✓	-	✓	✓
Elementary Stream	-	-	-	-	✓	✓	✓	✓	✓

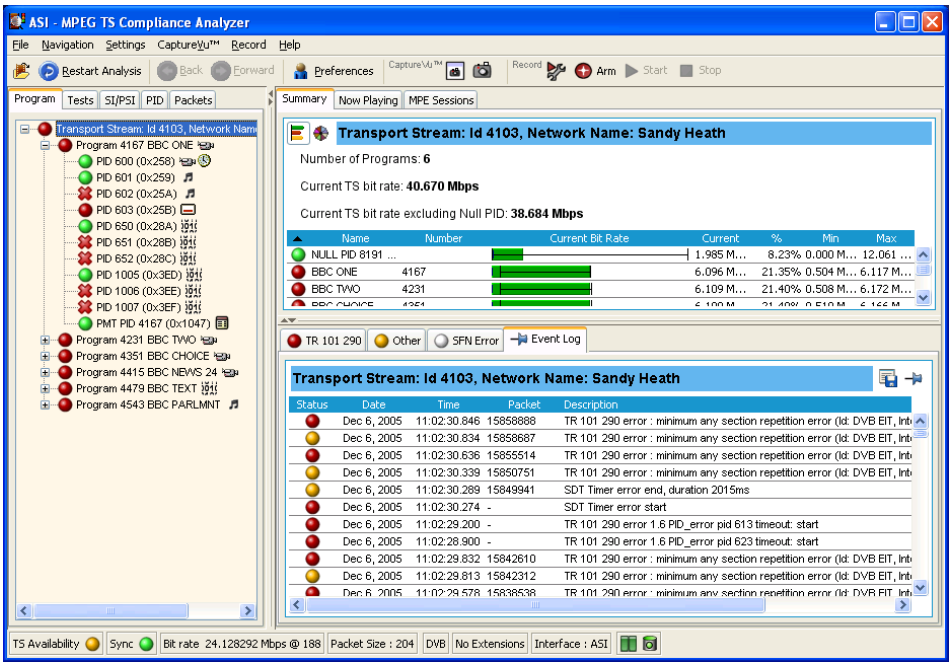
In DVB analysis mode, the MPE tab is always present. However, the MPE view will be populated only when MPE data is present in the stream (see page 133).

Pressing the F3 key on the keyboard (or selecting **Go to the next red LED in current tree** from one of the shortcut menus) will highlight the next red LED in the current view. Only the lowest level nodes will be considered and highlighted in the search since the parent nodes simply reflect the state of the lowest level nodes.

Program Navigation - 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-orientated 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 either a bar chart or as a pie chart.

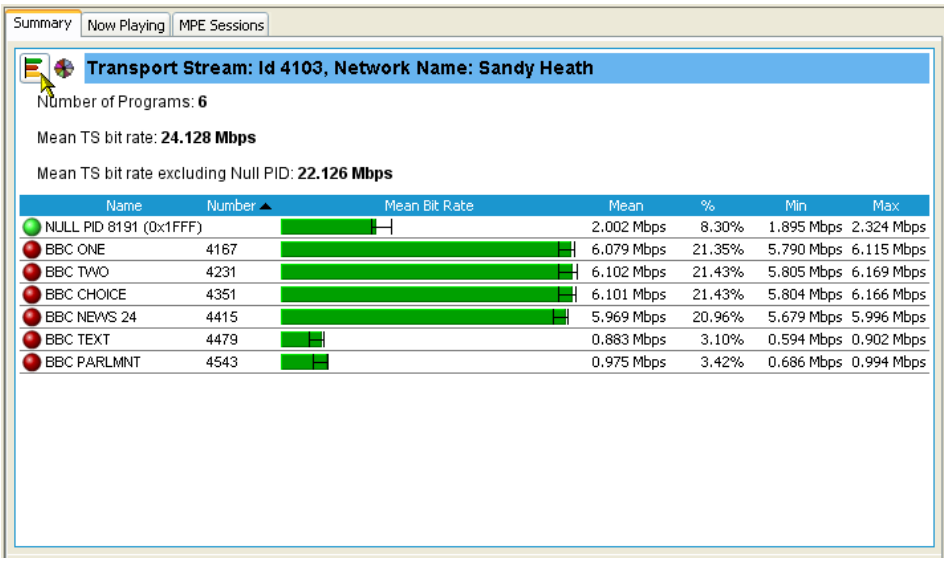


The data rate of a program is the cumulative data rate of all the PIDs that are associated with that particular program, including PCR and ECM PIDs.

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

Bar Chart

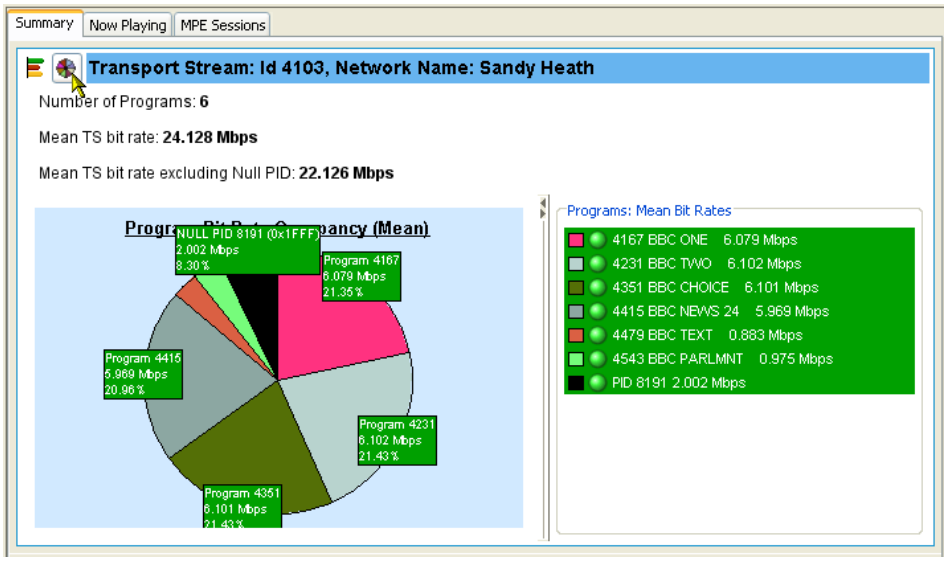
You can display the transport stream bar chart by selecting the bar chart icon.



Each program identified in the stream is allocated one row of the table. Related information includes the overall program status (icon), the program name, program number, and the maximum, minimum and average bit rates.

In addition to the basic display, you can associate a maximum and minimum threshold value with each program in the bar chart (see page 125). For deferred analysis, where these values are set after analysis, the stream must be reanalyzed for the new values to be applied. In real-time analysis, the new values will take effect immediately. The color of the bit rate bar indicates that the program has stayed within the bit rate limits (green) or exceeded the limits (red).

Pie Chart You can display the transport stream pie chart by selecting the pie chart icon.



The pie chart view is divided into two panes. The left pane shows the pie chart, and the legend on the right 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. The values given in the pie chart labels are bit rates expressed as percentages of the overall bit rate. The Null PID is shown in this view.

The color of the bit rate labels (and the bit rate values in the legend) reflects the status of the bit rate measurement, for example, green indicates that the program has stayed within the bit rate limits, and red indicates that the bit rate has exceeded the limits.

Bit Rate Value Display

You can toggle the bit rate displays between the mean bit rate and the current bit rate by selecting or clearing the **Show Mean Values** option on the detail view shortcut menus (see Figure 27). A check mark adjacent to the option indicates that mean values are to be displayed.

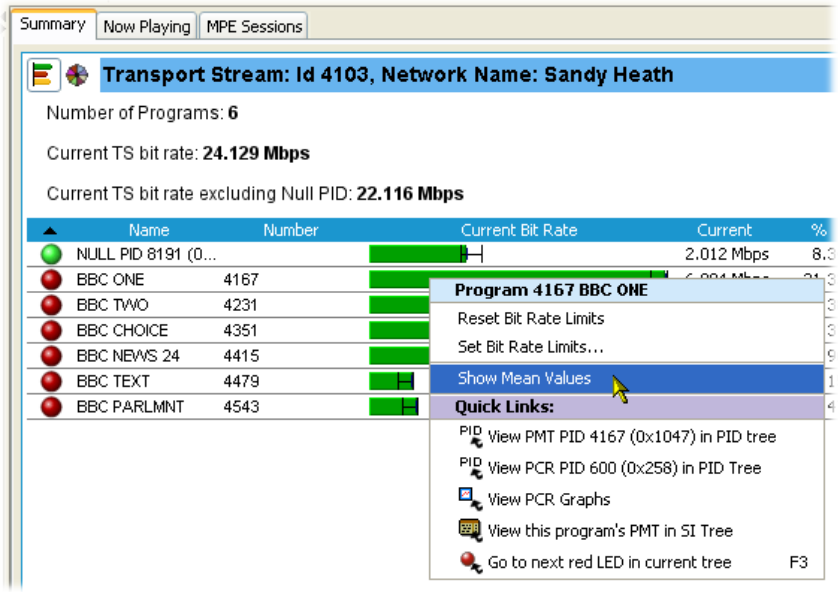


Figure 27: Bit rate values display

***NOTE**. The bit rate value shown in the Status Bar is always the mean bit rate. It is unaffected by the mean/current selection.*

Test Status Panes

The lower view pane allows you to see a summary of the states of all the associated tests as well as the event log for the entire transport stream (an unfiltered event log). The test tabs available will depend on the interpretation standard chosen. 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 *SI/PSI Nodes*, page 171). When any test in the transport stream has failed (and has not been reset), you can identify which individual tests have failed by observing the red LEDs.

You can use the shortcut menus to reset and disable tests, to set alarms, CaptureVu Breakpoints and record flags, and to jump to associated tests.

Event Log

The Event Log (Figure 28) displays the log entries for the whole transport stream. In deferred mode, the packet generating the error report can be inspected by highlighting the error and selecting **Go to packet** from the shortcut menu. Similarly, in real-time analysis mode, and where an event concerns a PID carrying a PCR, you can use the shortcut menu to jump to the relevant PCR graph. Deferred PCAP file analysis enables a shortcut that allows Ethernet packets to be viewed.

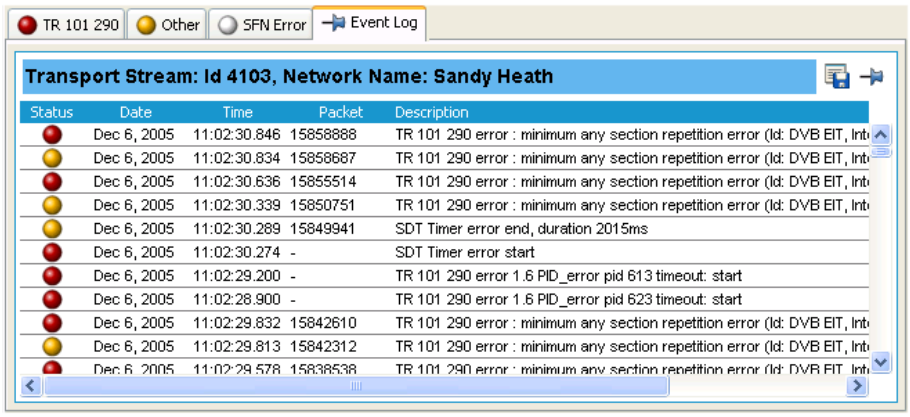


Figure 28: Event log

Two buttons are available in the Error Log toolbar:

 Pin log / Log is Pinned.

 Export Log.

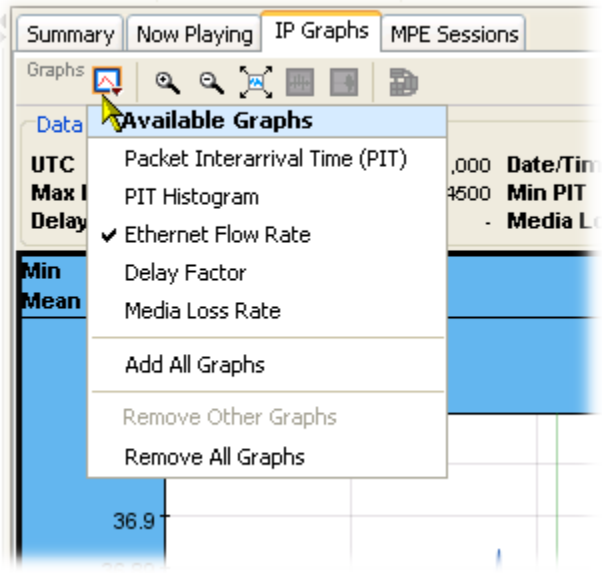
The buttons are described in detail in *Event Log*, page 121.

IP Graphs

The IP graphs available are as follows:

- Packet Interarrival Time (PIT):
  Shows the mean interarrival time of IP packets.
- PIT histogram:
  Shows the distribution of packet arrival intervals. The X axis contains accumulators where interval times are collected. The Y axis corresponds to number of intervals that collect in each accumulator.
- Ethernet flow rate:
  Bit rate of the Ethernet flow being analyzed.
- Delay factor:
  A measurement which characterizes IP packet cumulative jitter and delay. (Delay factor is the amount of buffer, in milliseconds, that would be required to subtract IP packet arrival deviations from the rate determined by the media payload.)
- Media loss rate:
  Media packets lost per second.

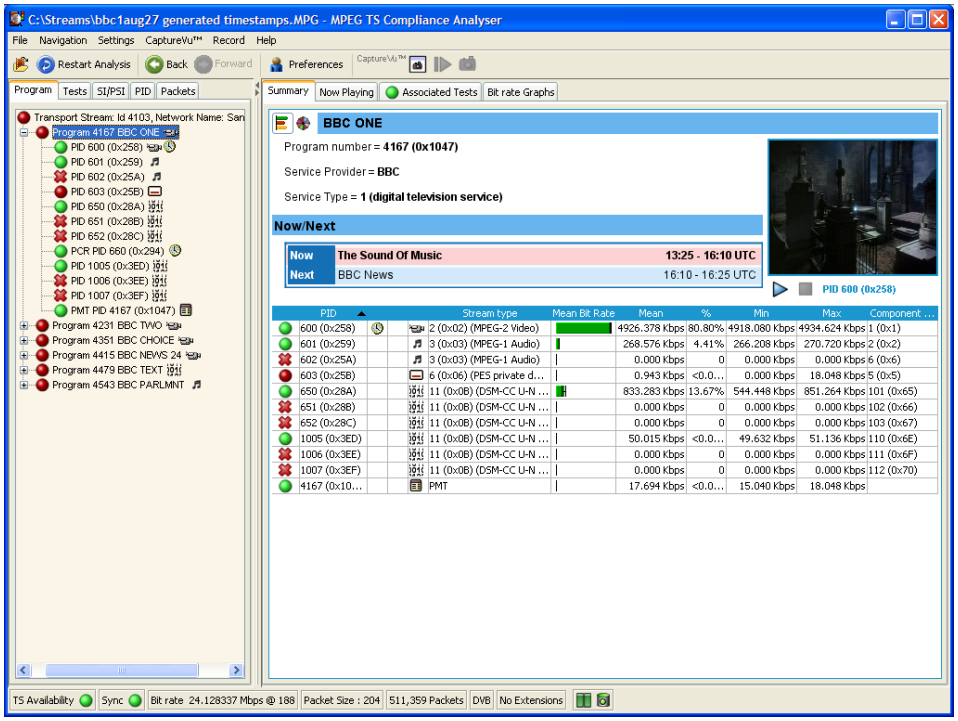
The graphs actually available are dependent upon the IP interface options being used. Unavailable graph names will be grayed out in the selection menu.



***NOTE**. Graph management and timing graphs are described in more detail in the Common User Interface Concepts section of this manual (see page 99).*

Program Navigation - Program Nodes

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.



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 or H.264 video stream, it is decoded to produce a thumbnail picture of the content; this is updated during real time analysis. Similarly, where EPG information is associated with the program, a summary (Now and Next program) is displayed. PID content is indicated using icons, which are described on page 101. Bar chart and pie chart views are available.

PID related information is available under the Summary tab.

The Now Playing tab displays details of the streams and thumbnails for each of the programs (where available). (See also *Now Playing Views*, page 116).

The Associated Test tab shows tests related to the program. Similarly, the Bit rate Graphs tab displays the program bit rate in graph form.

The Parameters view displays the parameters associated with the currently selected test in the Associated Tests pane (if applicable). You can change the parameter values, as well as display the current, minimum and maximum values for each of the test parameters. For deferred analysis, where these values are set after analysis, the stream must be reanalyzed for the new value to be applied. In real-time analysis, the new values will take effect immediately.

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.

VLC Media Player

The VLC Media Player is a portable multimedia player for various audio and video formats. The player allows program content displayed in the TSCA thumbnails to be played in a larger window. The media player is automatically accessed from the TSCA when you want to view or listen to the video and audio content of program streams.

***NOTE**. The VLC Media Player is not installed as part of the MTS400 Series system. Installation of the player is described in the* MTS400 Series Getting Started *manual (Tektronix part number: 071-1505-xx).*

You can find full documentation of VLC on the http://www.videolan.com.

To start the media player, click the start button (below the thumbnail) in the Program Summary view.

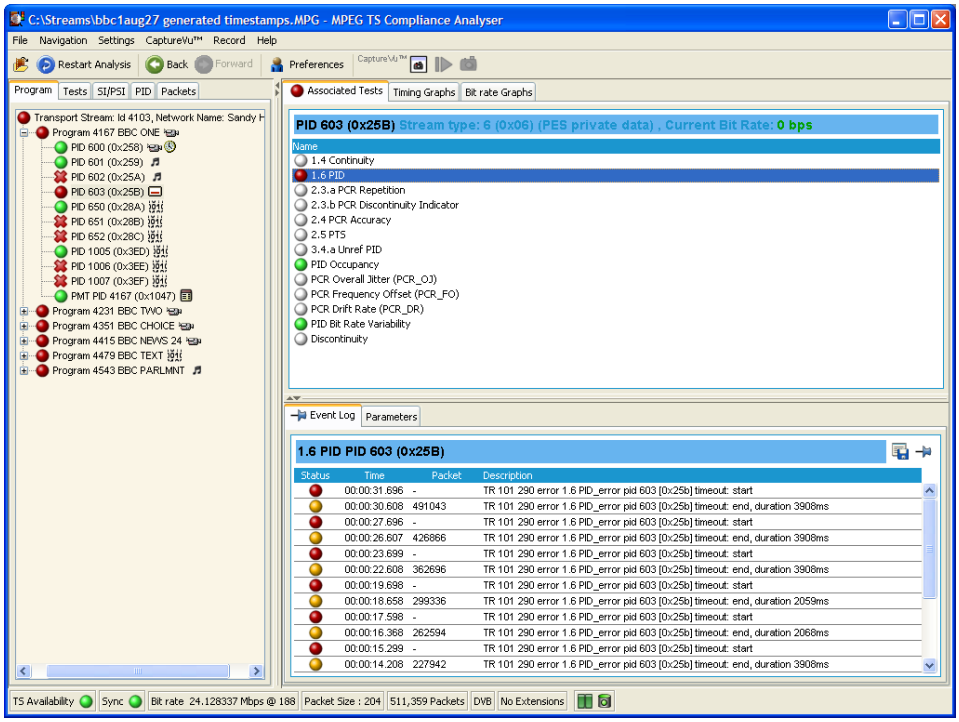
The VLC Media Player is opened automatically and the selected program content (video and/or audio) will be played. You can close the player by clicking the stop button (below the thumbnail). The player will close automatically.

***NOTE**. The VLC Media Player can open "behind" the TSCA window. Use the Windows controls to bring it forward.*

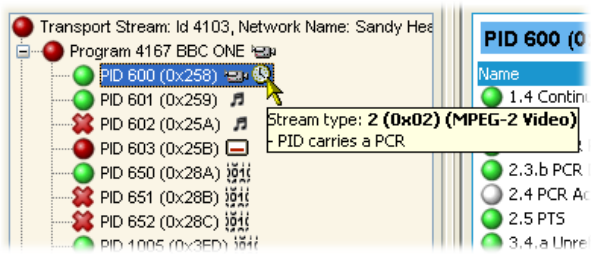
***NOTE**. If the VLC Media Player is installed on the MTX100B instrument, the audio feature in the media player must be disabled. Refer to the* MTS400 Series Getting Started *manual (Tektronix part number: 071-1505-xx).*

Program Navigation - 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 Elementary Stream summary view.



In addition, when the cursor hovers over the elementary stream node, a tooltip is displayed giving stream type and description.



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.

***NOTE**. Graph management and timing graphs are described in more detail in the Common User Interface Concepts section of this manual (see page 99).*

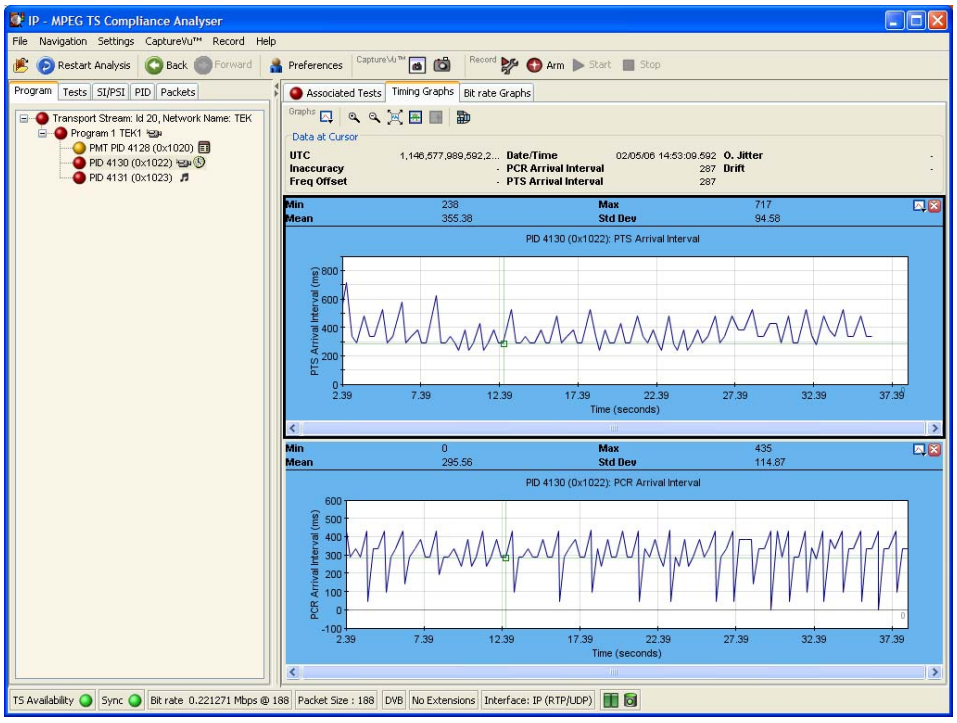


Figure 29: PCR Graphs view

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

The Parameters view displays all of the parameters for the currently selected test in the Associated Tests pane (if applicable). As well as displaying the current, minimum and maximum values for each of the test parameters, you can change the parameter value. For deferred analysis, when values are changed, the stream must be reanalyzed for the new values to be applied. In real time, the changes will take effect immediately.

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.

Using the Tests View

The Tests view displays test information relevant to the transport stream being analyzed. The view is displayed when the Tests tab is selected in the Navigation tabbed pane (see Figure 30).

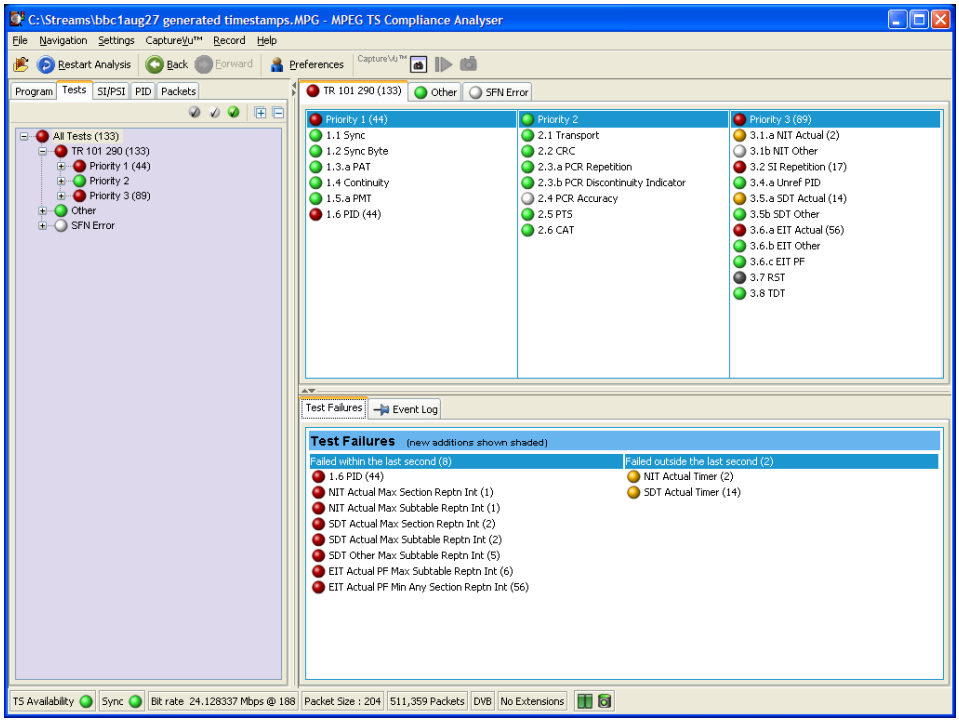


Figure 30: Tests Navigation view

The view displays a test tree which represents all the tests that have been applied to the analyzed transport stream. Figure 31 shows the nodes available in the navigation view.

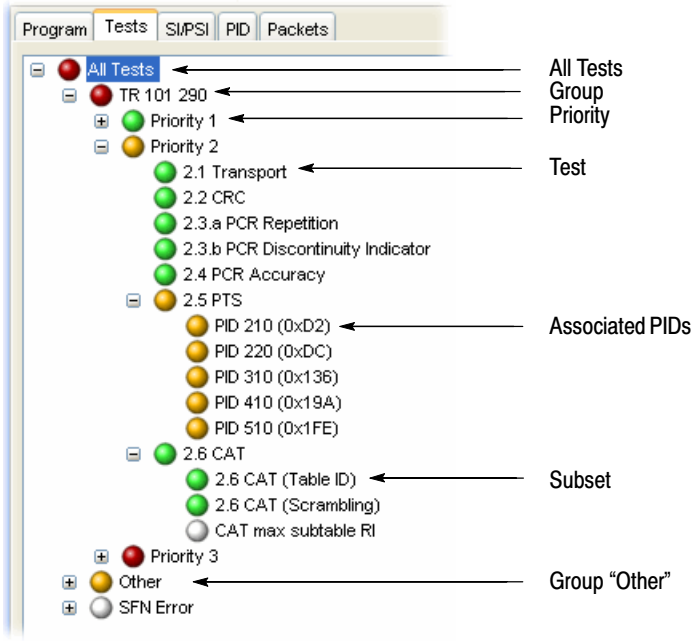
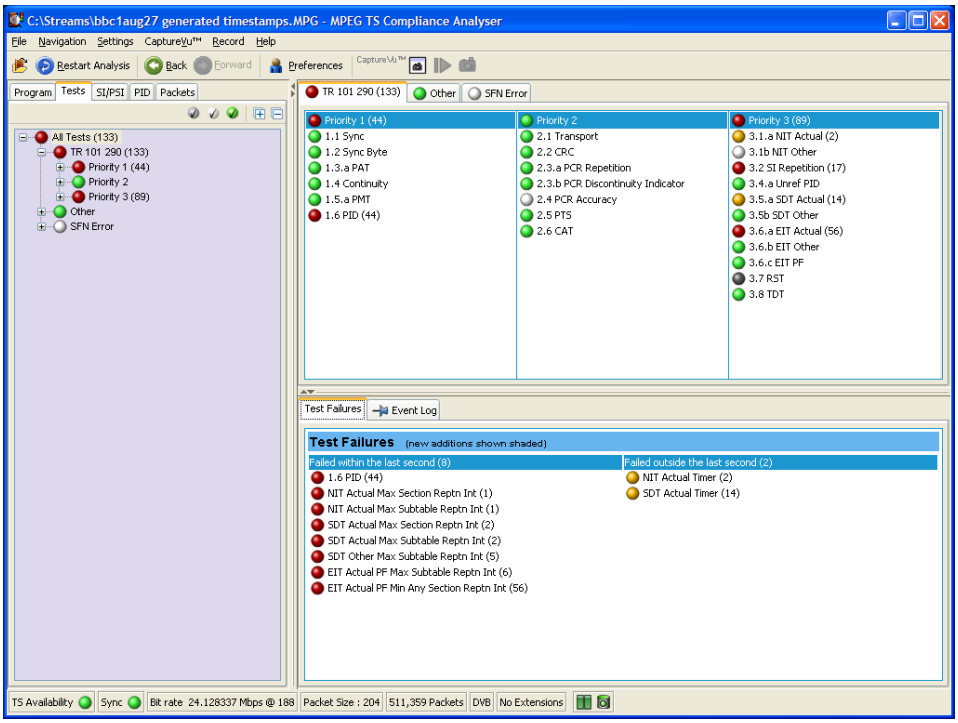


Figure 31: Test view nodes

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.

An example of a tree structure for a selected standard is the TR 101 290 group of tests for DVB transport streams (shown in Figure 31). 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. Note that 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.

The LED associated with each node indicates the status of the node and its child node tests (see *Error Status LEDs* on page 40). Total entries in the Event Log for each group of tests and for each test are are indicated in parenthesis; resetting a group of tests or a test restarts the count in parenthesis.

Test Filtering

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

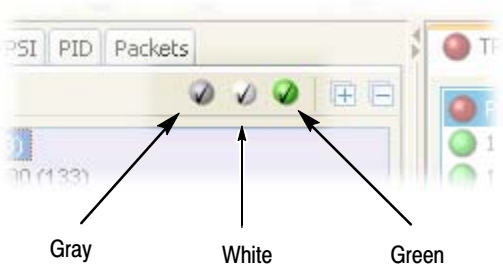


Figure 32: Test filtering buttons

Each button, when selected, will hide a category of tests in the display.

- When you select the gray button, tests that are currently disabled will not be displayed in the test tree.
- When you select the white button, tests that currently have either unknown or not applicable status will not be displayed in the test tree.
- When you select the green button, tests that currently have OK status will not be displayed in the test tree.

Tests Navigation - All Tests

The detail view when the All Tests node is selected is shown in Figure 30 on page 57. In addition to a summary of all tests, the event log shows the most recent 10000 events that have occurred during analysis of the stream.

Test Failures View

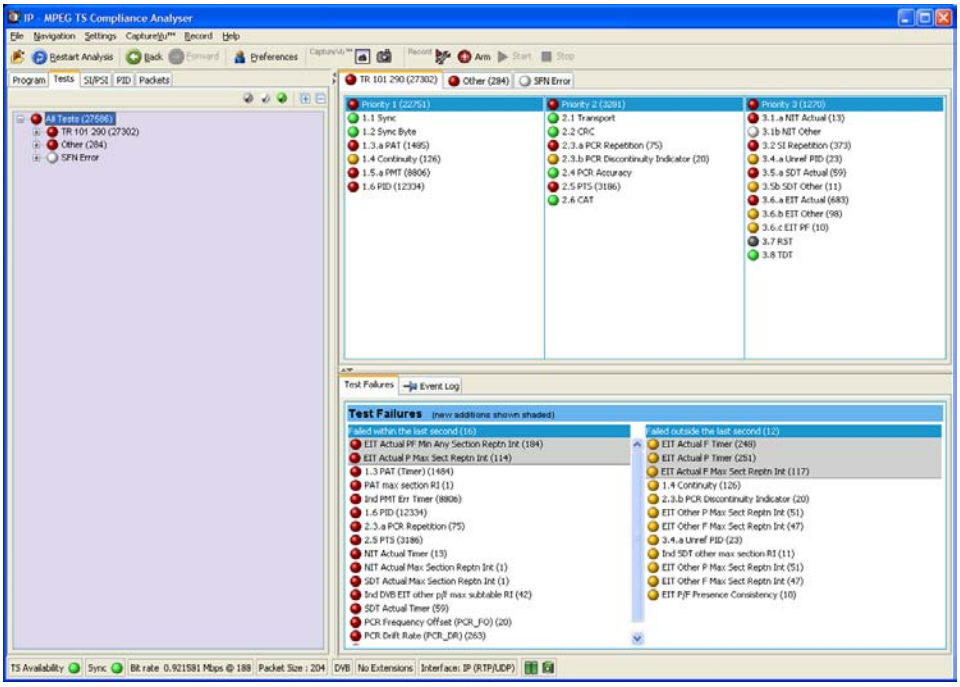


Figure 33: Test Failures screen

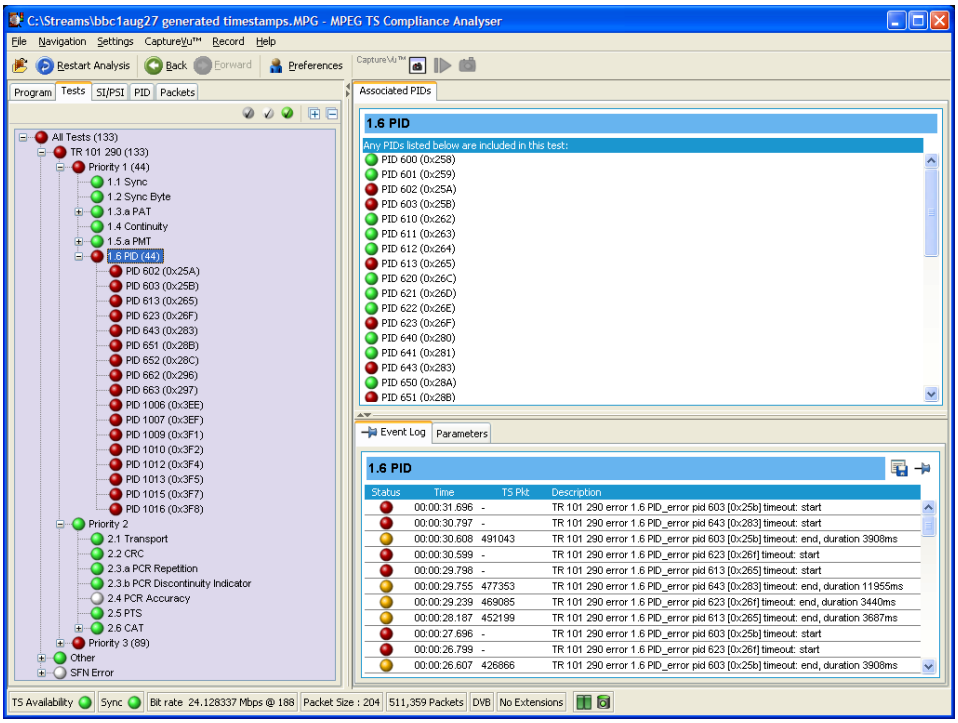
The Test Failures view provides an overview of the tests that have failed during stream analysis. The view is divided into two panes. The left panes shows those tests that have failed in the last second. The right pane shows those tests that have failed, not including those that have failed in the last second, and are displayed on the left side.

If a test fails, it will be displayed on the left side. When it no longer fails, it will be removed from the left side and listed on the right side as a test that has previously failed. If the test fails again, it will be removed from the left side and redisplayed on the right side until it no longer fails.

Additionally, tests that have been listed (in either pane) in the last second are displayed at the top of the list and shaded.

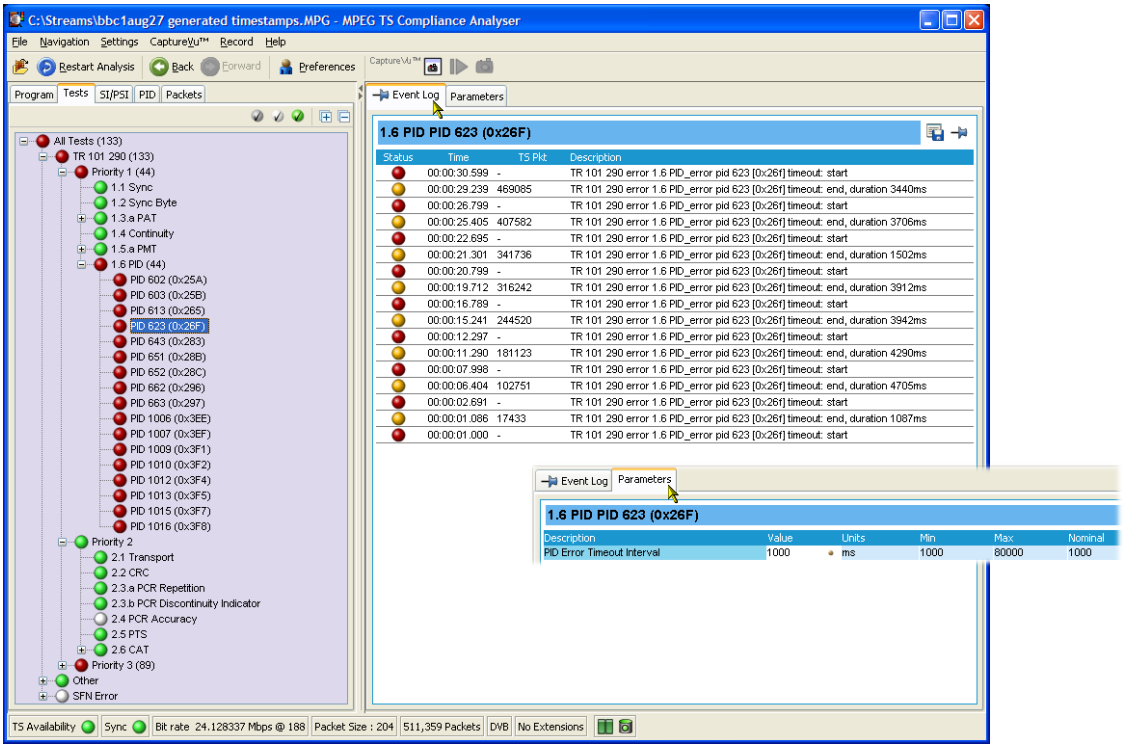
Test Navigation - Test Nodes

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. Where parameters are applicable to the test, you can modify them under the Parameters tab.



Test Navigation - 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, Parameters for the PID, and the test in the detail view.



Using the Tables View

The Tables view (SI/PSI tab) displays service information in tree form, as in the other navigation views. The tree represents the service information tables that have occurred in the analyzed stream and which 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. Figure 34 shows an example of the Table navigation view with DVB stream interpretation selected.

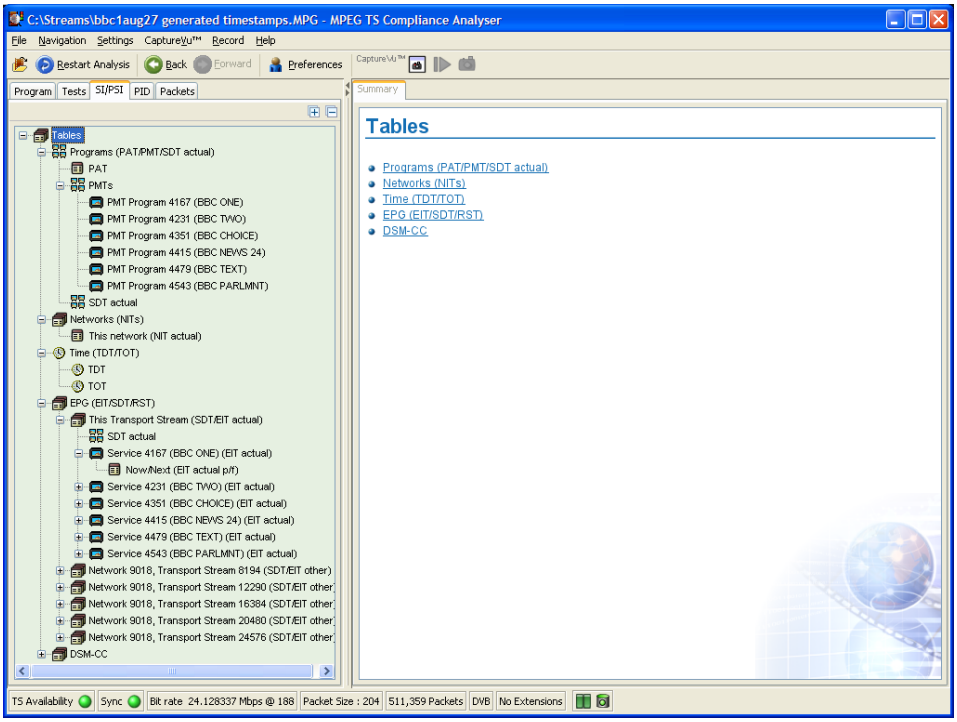


Figure 34: Tables view

Every node within the service information tree has a corresponding summary view. Nodes that represent tables will also provide you with access to the table structure and hex data (see *Tables Detail View - Section View* on page 67), and graphical displays of data rates and interval data (see *Tables Detail View - SI Repetition Graphs* on page 69).

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 analyzed 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 (underlined text) are provided to associated objects, for example, in the programs summary (Figure 35), links are provided to the individual program summary views. 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 PID view.

Figure 35 shows an example of the summary pane with the PMT PIDs node selected in the navigation view.

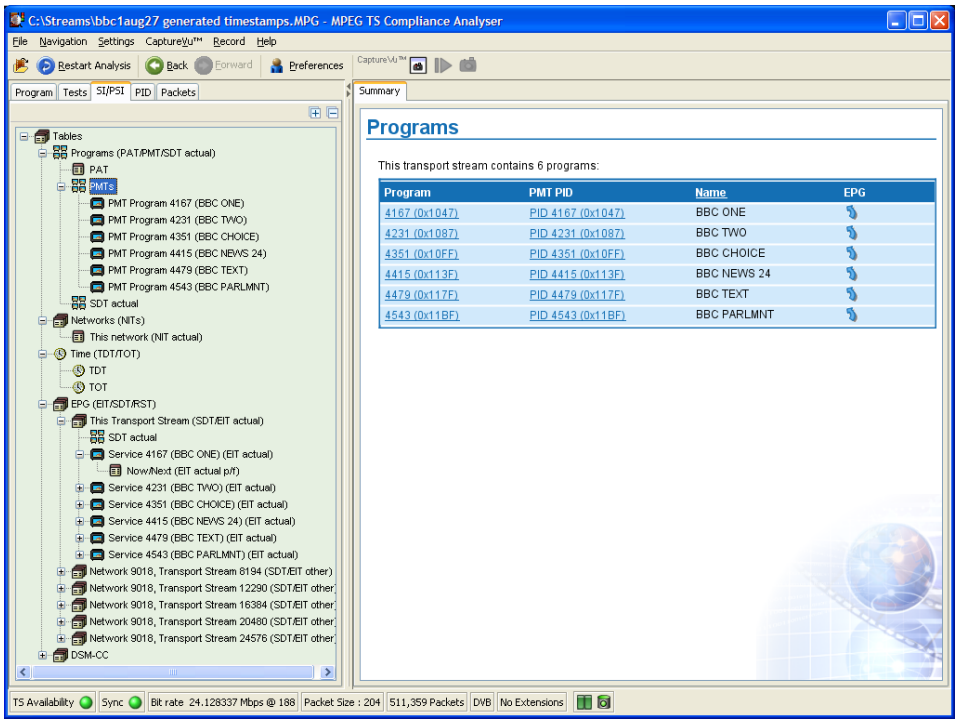


Figure 35: Tables view - Programs (example)

EPG Views

A specific departure from the Table Summary view described previously is the EPG view that is displayed when a section of the EPG table is highlighted. For a description of the general presentation of the EPG view, see page 129.

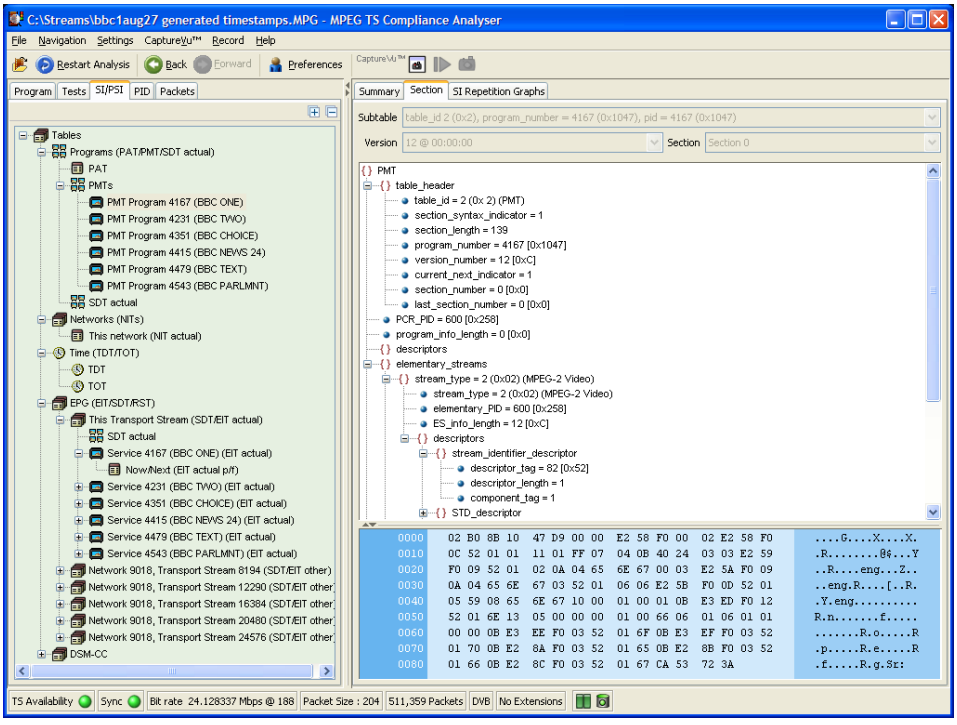
Tables Detail View - Section View

The detailed section view is available when the selected node in the service information tree represents a table or subtable in the transport stream. During real-time analysis the view is continually updated.

The subtable identity, version, and section are displayed at the top of the table pane.

***NOTE**. In deferred mode, where two or more subtables, versions or sections are found in the stream, the relevant field is active and an alternative selection can be made from the drop-down list.*

In real-time mode, only the latest version and section can be viewed.



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 (refer to Figure 36).

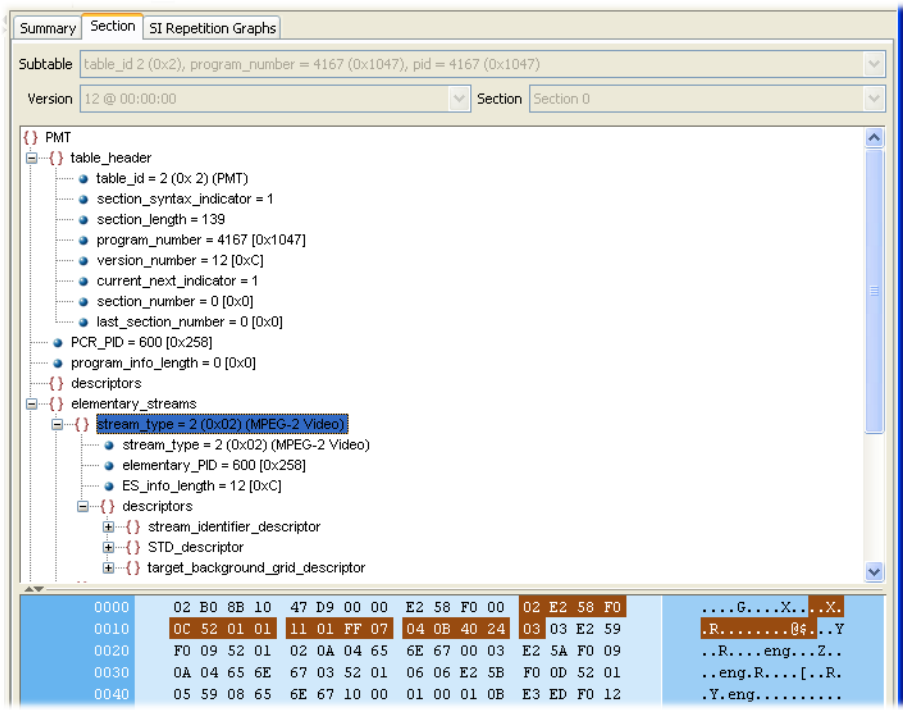


Figure 36: Section payload

If the section is corrupt or empty, the hexadecimal view background is red instead of blue.

Tables Detail View - SI Repetition Graphs

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:

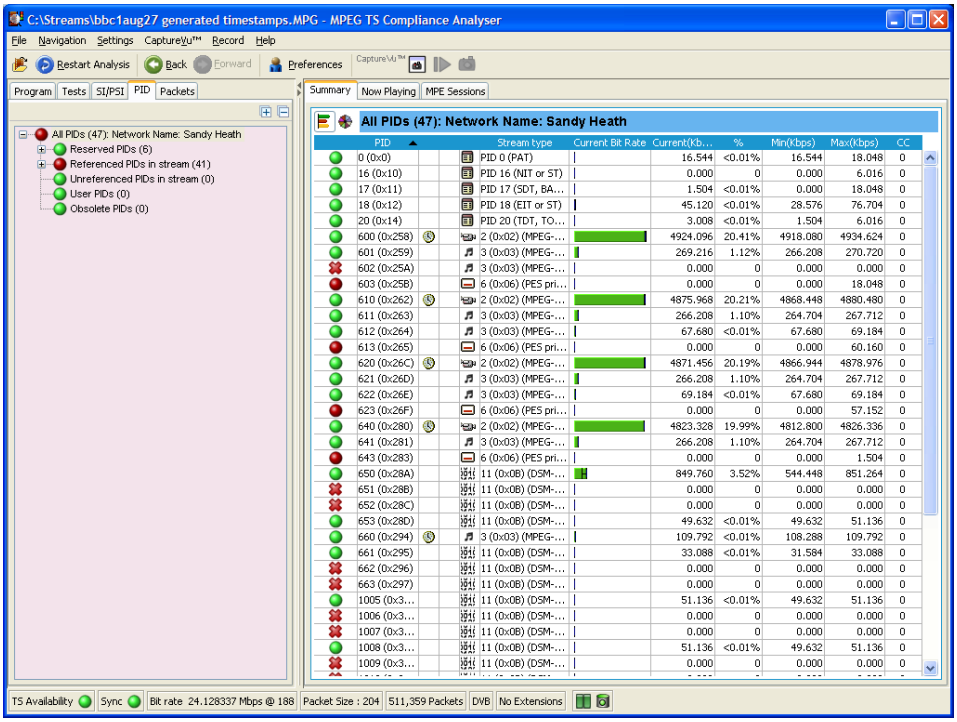
- Section repetition interval:
  This graph displays the interval between two sections of a table on a particular PID.
- Subtable intersection gap:
  This graph displays the interval between sections in a particular subtable.
- Subtable repetition interval:
  This graph displays the time between receiving 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 the Common User Interface Concepts *section of this manual (see page 99).*

Using the PID View

The PID view displays information about all of the PIDs found in the transport stream being analyzed. The navigation view contains the PID tree structure representing all of the PIDs that have occurred within the transport stream.



In DVB analysis mode, the MPE tab is always present. However, the MPE view will only be populated when MPE data is present in the stream (see page 133).

PID View - All PIDs

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

- Reserved PIDs
- Referenced PIDs
- Unreferenced PIDs
- User PIDs
- Obsolete PIDs (deferred analysis only)

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 these subordinate nodes contains PIDs belonging to that group. PIDs are allocated during analysis, 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 on the column header. PID related information is available under the PID Information tab.

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.

PID View - Detail View (All PID and PID Group)

The All PID 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 navigation 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.

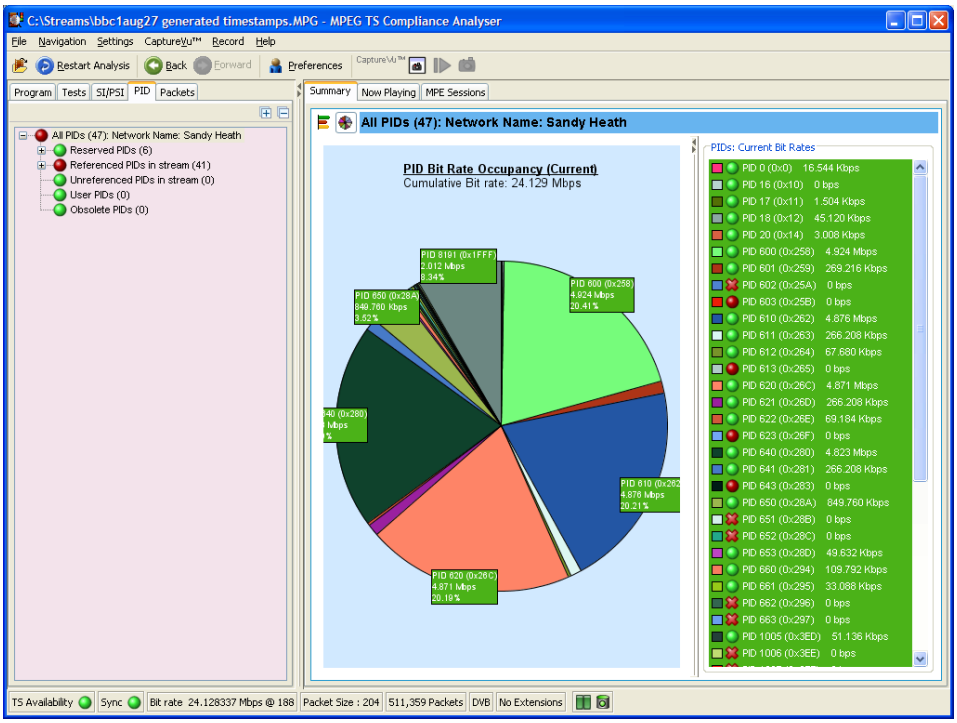


Figure 37: PID Summary view

The PID Information view (see Figure 38) provides 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. The icons provide an indication of the PID content (see *Icons*, page 101).

Where a PID carries video or audio, thumbnails are displayed under the Now Playing tab.

In deferred mode (or during CaptureVu analysis), you can view the packets carrying a PID by highlighting the PID, and selecting the Go To Packets view

from the shortcut menu. The packet will be added to the PIDs list (in the Packets view).

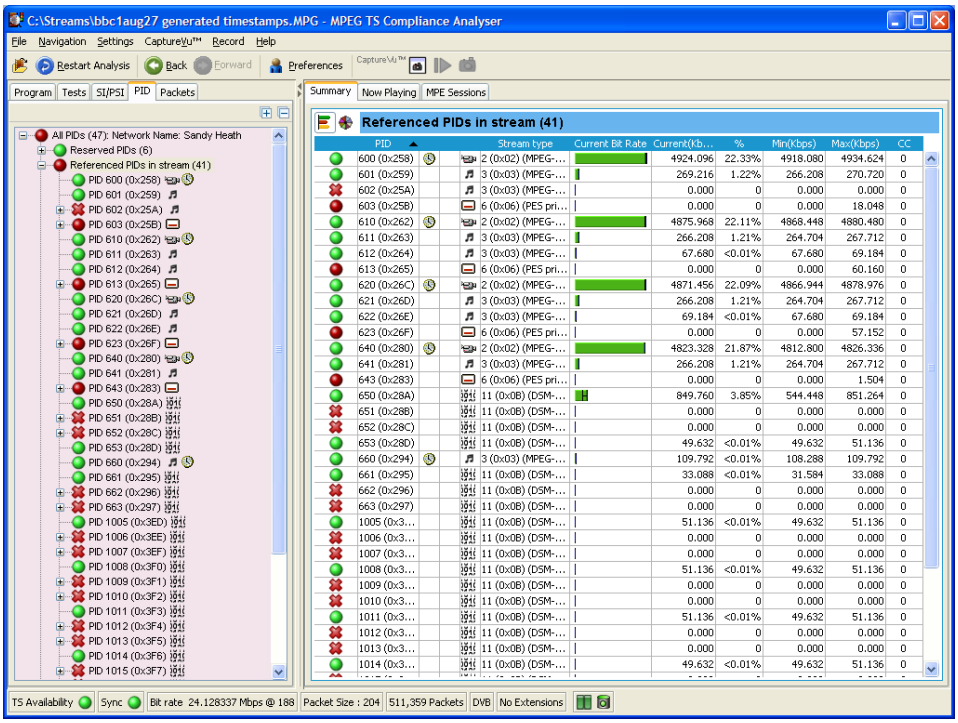


Figure 38: PID Information view

PID View - 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.

During deferred or captured analysis, the packets carrying the PID can be examined in more detail by highlighting a PID, and selecting the Go to Packets view from the shortcut menu.

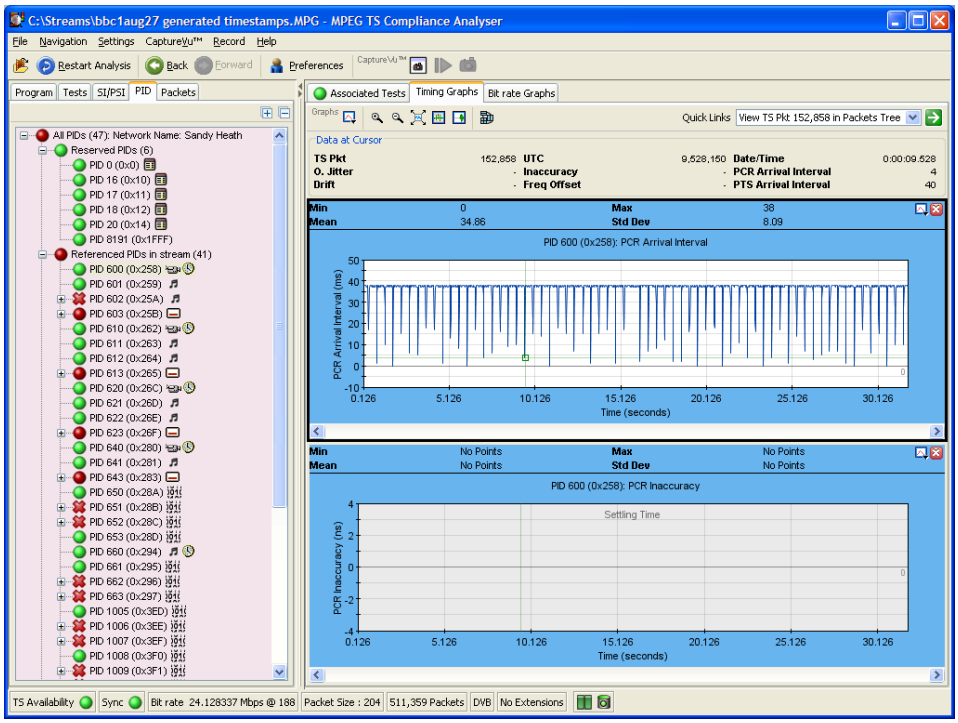
Ordinary PID Selected

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 Bit rate Graphs which show the bit rate of the selected PID in graphical form.

Also on the Associated Tests tab is an event log and a parameters pane. The event log shows all PID related events. If a test is selected in the PID pane, only the events associated with that test on that PID are shown. Similarly, when a test is selected, the Parameters pane shows the parameters associated with that test (when applicable).

PCR PID Selected

When the selected PID contains PCR information, PCR inaccuracy and PCR interval data graphs will be displayed in addition to a bit rate graph. When the transport stream contains time stamped data, the PCR overall jitter, the PCR frequency offset, and the PCR drift rate graphs will also be available. For real-time IP analysis, the Packet Interval Timing (PIT) graph is also available (see page 115).



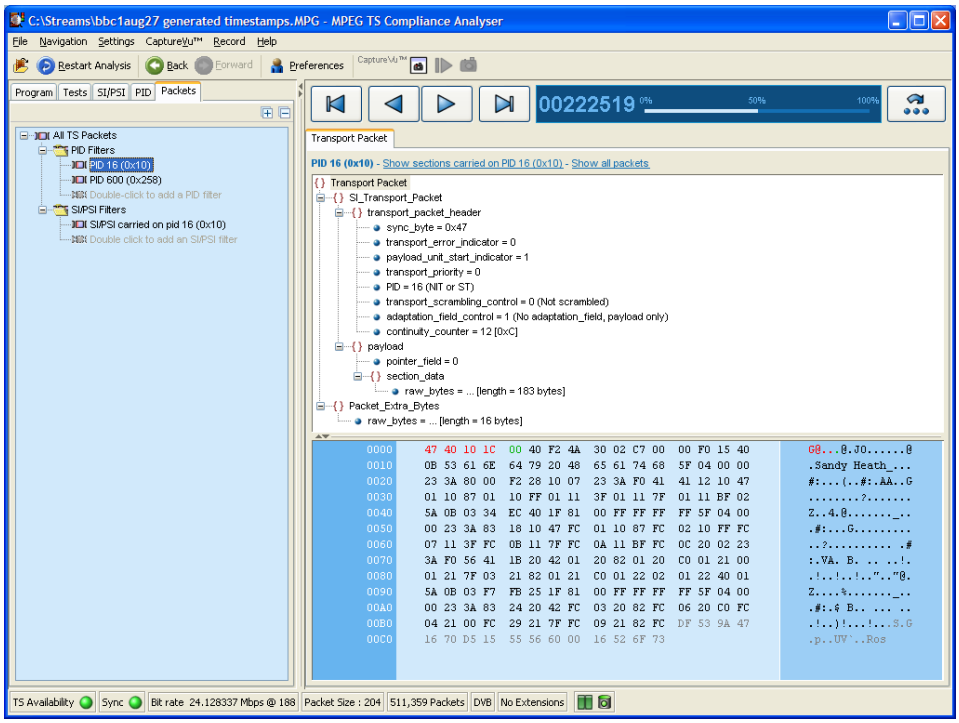
A Presentation Time Stamp (PTS) graph may also be available on PIDs carrying audio and video information.

(See also *Graph Management*, page 105 and *Timing Graphs*, page 111.)

Using the Packets View

***NOTE**. The Packets view is available only during deferred analysis and CaptureVu analysis.*

Data in the stream is carried in 188- or 204-byte packets. The Packets view allows you to examine the contents of each packet in the analyzed stream.



The packet navigation view shows a tree structure which represents the packets within a stream grouped according to content, including PID value, SFN mega-initialization packets (MIPs) (DVB only), and ISDB-T information packets (IIPs).

The All Packets, MIP and IIP nodes do not have any child nodes. The All Packets node represents all of the packets in the transport stream. The MIP node represents all of the DVB SFN MIPs in the transport stream. The IIP node represents all of the ISDB-T information packets in the transport stream.

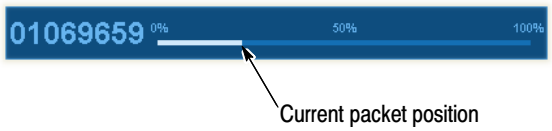
The PIDs node represents all of the PIDs that are of interest. You can add PIDs in the transport stream to this node, and to PIDs that are contained within the user PID list.

Selecting any leaf node in the packet tree will apply a packet filter to the associated packets. For example, selecting a PID node will only allow packets carrying that particular PID to be displayed in the associated summary view. Similarly, selecting the MIP node will only allow MIP information to be displayed in the associated summary view.

Packet Navigation Bar

In the packet summary view, you can use the top bar to navigate the packets in the stream.

The packet position bar shows the position of the selected packet in the stream.



The navigation bar functionality depends on the selection in the packet navigation view. If you select All Packets, the controls will operate on all packets. If you select a single PID, a filter is in operation, and the controls will work only for those packets carrying that PID.

	Selects the first available packet (in the stream or carrying the selected PID)
	Selects the previous available packet (in the stream or carrying the selected PID)
	Selects the next available packet (in the stream or carrying the selected PID)
	Selects the last available packet (in the stream or carrying the selected PID)
	Opens the Go To Packet dialog box

You can also use the packet position bar to navigate through the stream. To do so, use the cursor to point to and click the next packet to be displayed. Double-click the packet number in the bar to open the Go To Packet dialog box. Enter the required packet number and select OK. For both methods, remember that the destination packet is dependent on the node selected in the navigation view.

Packet Navigation - Filter Nodes

The packet filters allow you to view packets carrying PID.

To inspect the sequence of packets carrying a particular PID, you must add the PID to the PID Filters node in the Packet Navigation view. PIDs carrying sections can also be viewed. You can add as many PIDs as are required. There are a number of ways to add a PID to the node; as described in the following paragraphs.

Adding a PID in the Packet View

1. In the Packet view, expand the PIDs node by doing one of the following:
   - Double-click the child node (double-click to add a PID)
   - Select Add PID... from the PIDs node shortcut menu
2. In the Add PID... dialog box, expand the nodes, locate and select the required PID.
3. Click OK.

   The selected PID is added to the PIDs node, and the first occurrence of a packet carrying the selected PID is displayed in the summary view.

Added PIDs will be stored when the application is closed. They will be reinstated when the application is reopened. However, if a different stream is analyzed, the stored PIDs can not be used.

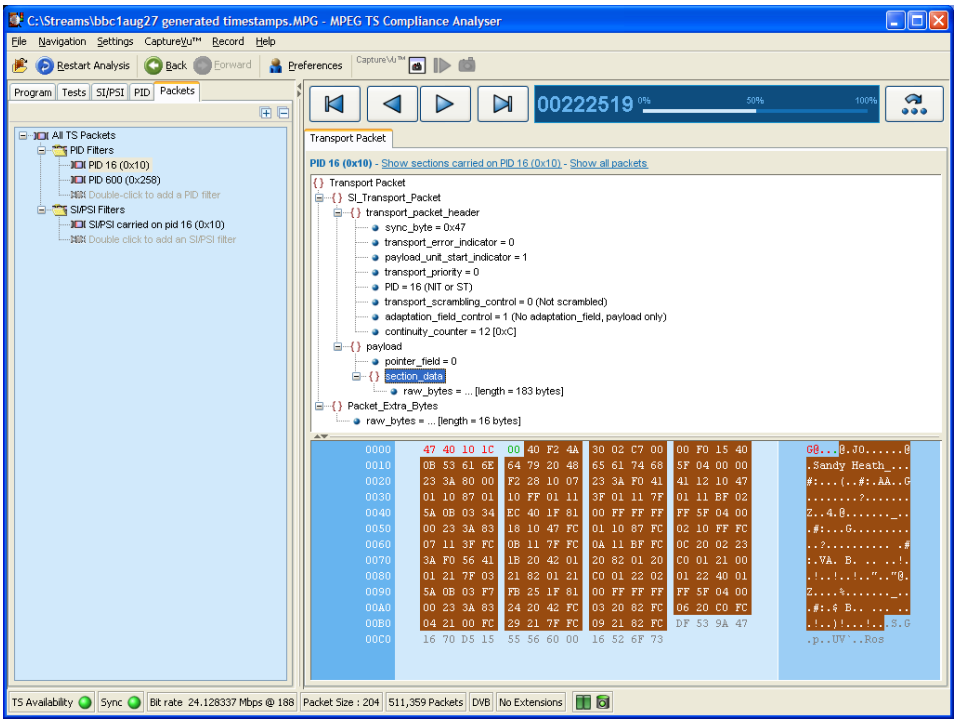
Removing PIDs

All PIDs previously added to the PID node can be removed by selecting Remove All from the PIDs node shortcut menu.

Packet Detail View

The detail view shows the fields and data that are contained in a packet. The fields are arranged in a hierarchical order. The presence of subordinate fields is indicated using { } bracket symbols adjacent to the container field. To expand or collapse the container, click 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 packet. When you select a node in the table pane, the bytes that make up the selected node (including the subordinate nodes) are highlighted in the hexadecimal data pane.



The packet transport header bytes are displayed in red. Similarly, bytes greater than 188 are displayed in gray. The adaptation field, where present, is displayed in blue.

If the section is corrupted or empty, the background of the hex view is red instead of blue.

ISDB Streams

Figure 39 and Figure 40 show an example of the packet detail view with an analyzed ISDB-T stream. Note the IIP tab and the additional TMCC and IIP nodes.

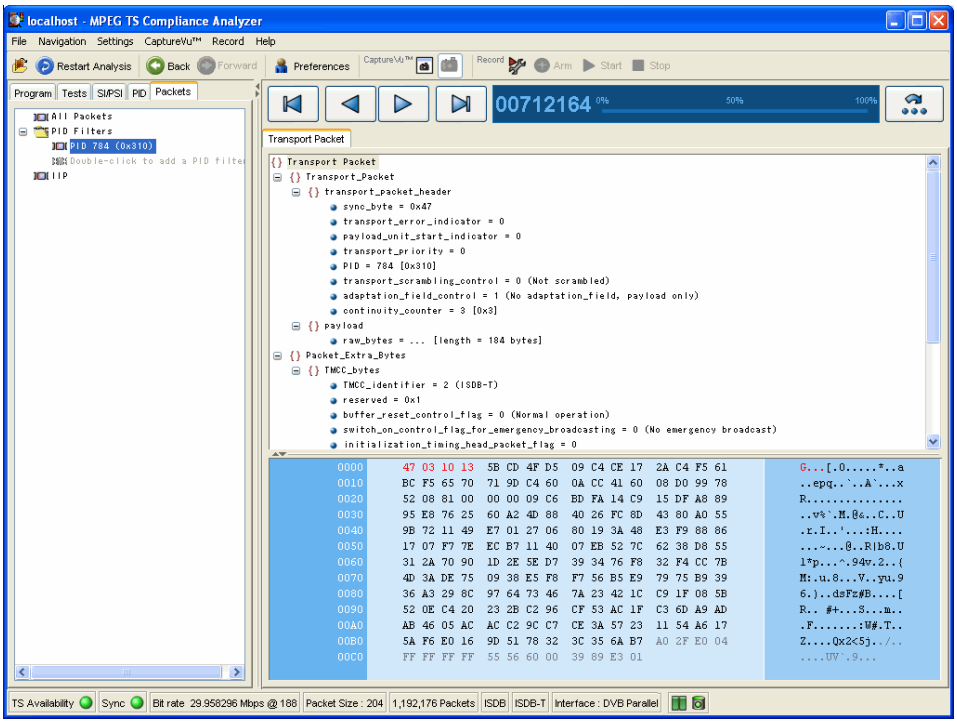


Figure 39: Packet view - ISDB detail -IIP

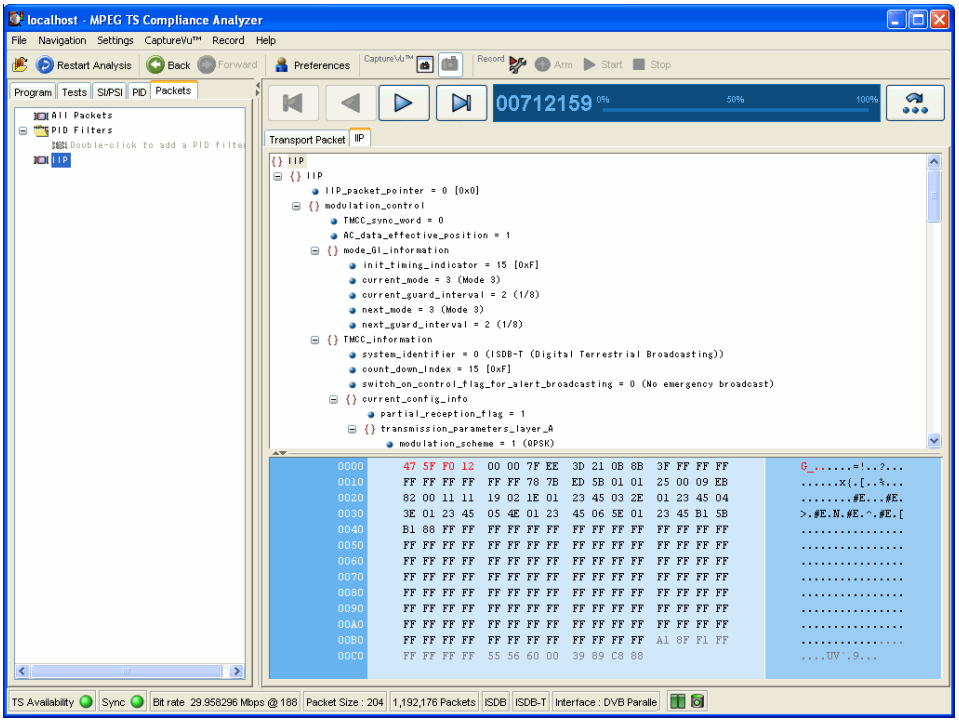


Figure 40: Packet view - ISDB detail - transport packet

Using the Interface View

If real time analysis using an interface card is invoked, the Interface tab is displayed in the Navigation view of the TSCA window.

***NOTE**. The Interface view is available only if an interface card is selected for real-time analysis.*

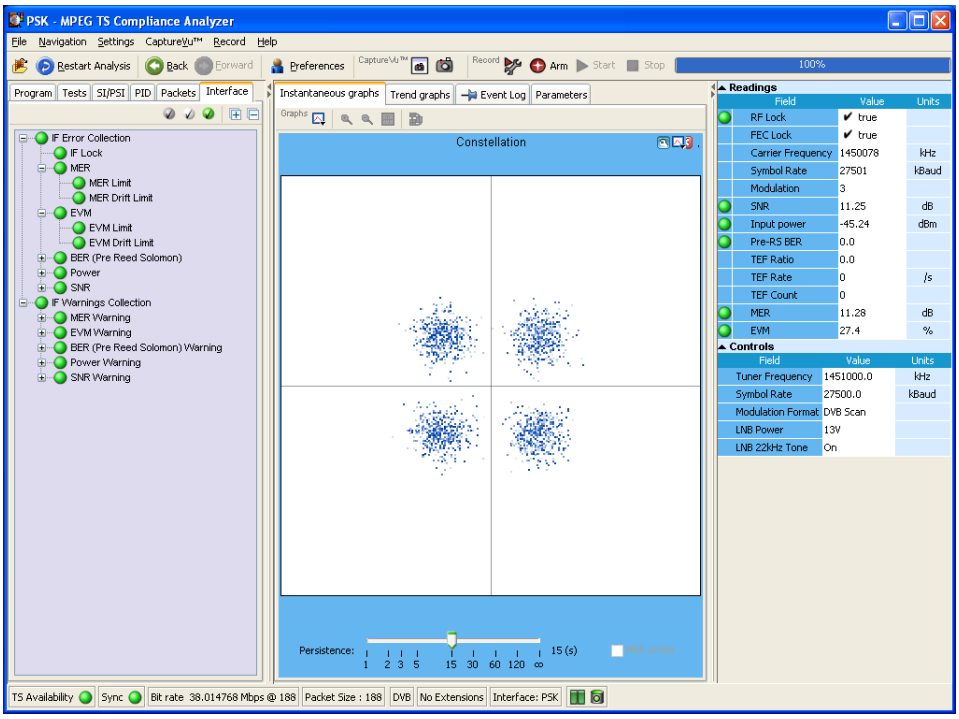


Figure 41: Interface view - example

Two interface card test nodes are displayed in the navigation view: IF Error Collection and IF Warning Collection. Each collection contains a range of tests (see Figure 41).

The detail of the interface view is different for each interface type.

Detail View Tabs

The detail view contains four tabs: Instantaneous graphs, Trend graphs, Event Log, and Parameters. This section describes the tabs in general terms. The following sections describe in detail the tabs associated with each interface type.

Instantaneous Graphs The instantaneous graphs display instantaneous measurements in graphical form.

Trend Graphs The trend graphs display trends in measurements in graphical form.

Event Log The event log displays a history of the events related to the item selected in the navigation view.

Parameters The parameters tab display the parameters associated with the test highlighted in the navigation view. Parameter editing is described in the *Common User Interface Concepts* section, page 118.

Readings and Controls

The right panel contains Readings and Controls. The Readings area displays values received from the card itself.

The RF Lock LED conveys different types of information. 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.

In the Readings area, the LED colors are as follows:

Green	On
Red	Out of range or failed test
Gray	Off or not applicable

The Readings background colors are as follows:

White	In range
Red	Out of range; for example, too much or too little power or out of order packets per second being greater than zero
Yellow	Not recently updated
Gray	Not applicable; for example, out of order packets not being available when the UDP protocol is selected

The Controls area contains user controls. Values entered here will be applied to the card and will affect its performance. These controls correspond exactly with those on the Open Transport Stream dialog box.

RF Interface Card Overview

This section describes the configuration and interpretation of results of the RF interface cards that can be installed in MTS400 Series MPEG Test Systems.

The interface settings described are as follows:

- QAM (Quadrature Amplitude Modulation) (Annex B II) (see page 88)
- COFDM (Coded Orthogonal Frequency Division Multiplexing) (see page 91)
- QPSK/8PSK (Phase Shift Keying) (see page 96)
- 8VSB (Vestigial Side Band) (see page 94)

(Refer to the *MTS400 Series Technical Reference*, 071-1724-xx for the interface technical specifications.)

Only one RF interface card can be installed in the MTS400. All RF interface measurements and graphs include a constellation diagram with MER rings, EVM, SNR, and BER measurements. The installed interface can be used simultaneously with an IP input. All interfaces have dual-level warning and failure alarms plus RF drift tests for long term trend monitoring.

The input card screen and configuration of the card will depend on which interface card is installed.

RF Interface Card Setup

The RF interface card configuration is set up when analysis is started using the Open Transport Stream dialog box. The settings can subsequently be changed during analysis from the Interface View.

When real-time analysis is selected and an RF interface is selected from the Interfaces drop-down list. The Firmware Version and the current Interface Settings of the card are displayed.

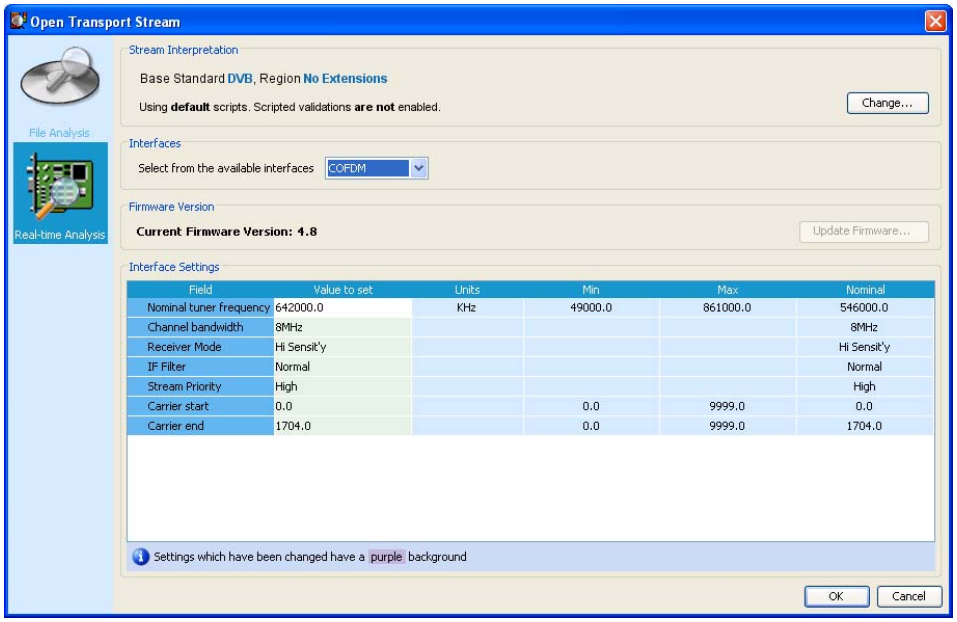


Figure 42: Open Transport Stream dialog box

If the firmware version is incorrect, the Update Firmware... button is enabled, and you will not be able to proceed with the setup and analysis until the firmware is updated (see page 87).

1. In the Open Transport Stream dialog box, select Real-time Analysis.
2. Select the RF interface from the Interfaces drop-down list.
3. Enter the interface settings required (see the following pages for descriptions of the settings for each RF interface card).
4. Select OK to start the analysis.

The name of the interface selected is displayed in the TSCA status bar.

RF Interface Card Firmware Update

If the interface card firmware needs updating, a message will be displayed when real-time analysis is selected. The Update Firmware... button will also be enabled.

Update the interface card firmware as follows:

1. Select Update Firmware....
2. In the Update Firmware dialog box, select Start.

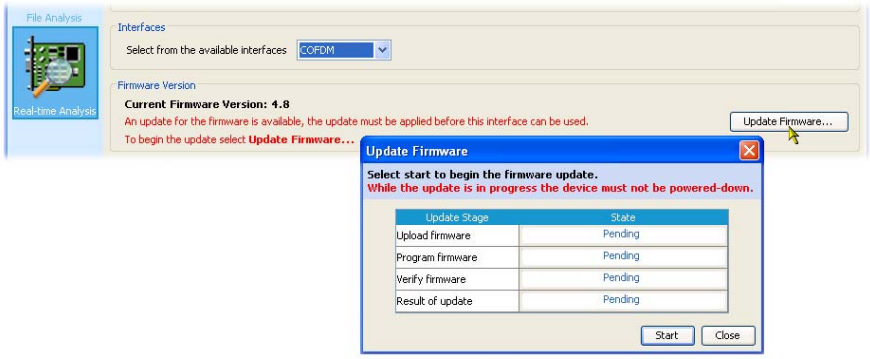


Figure 43: RF Firmware update

3. The dialog box will display progress of the update. The box will close when the update is complete.

CAUTION. *Removing power from the MTS400 while the firmware upgrade is in progress can cause fatal corruption of the firmware files.*

RF Interface View Screens

This section describes the settings and displays associated with the RF interface cards.

RF Interface - QAM (Annex B)

The settings and displays of the QAM (Annex B) RF interface card are as follows: QAM(B) Interface Settings, QAM(B) Instantaneous Graphs, and QAM(B) Trend Graphs.

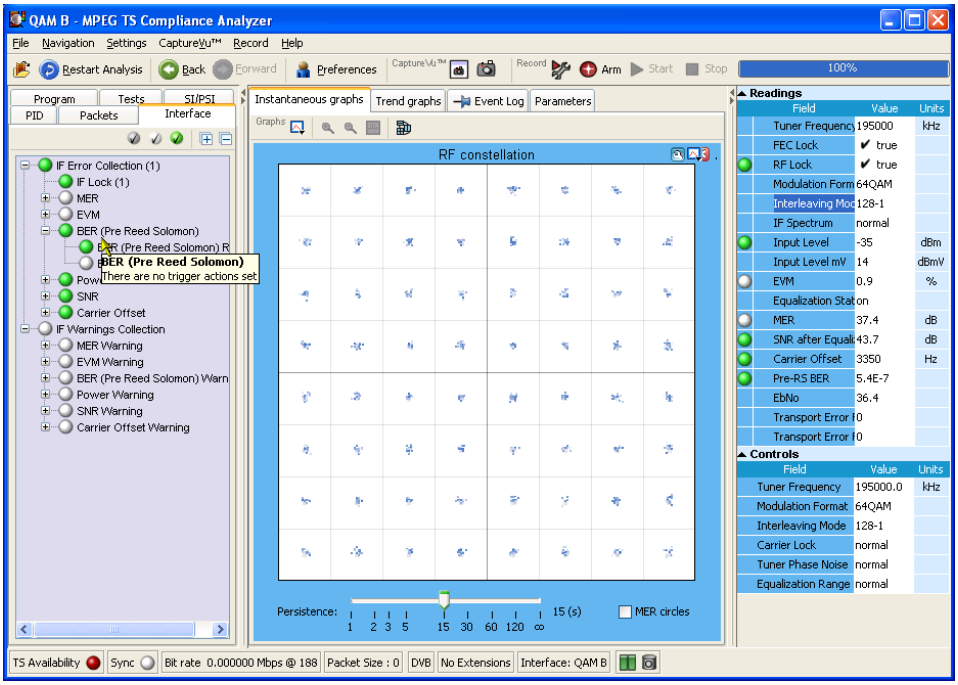


Figure 44: Interface view - RF - QAM (Annex B)

QAM(B) Interface Settings. The following QAM (Annex B) settings are available on the Open Transport Stream - Real Time Analysis dialog box, and also in the Interface tab - Controls area.

Tuner Frequency : 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. Note that 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.

QAM(B) Instantaneous Graphs. The following instantaneous graphs are available for the QAM (Annex B) RF interface card.

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 Persist slider control at the bottom of the graph.

MER (Modulation Error Ratio) and EVM (Error Vector Magnitude) calculations are performed on the constellation data according to the formulas in ETR290-101.

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.

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

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.

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

QAM(B) Trend Graphs. The trend graphs extend the principle of the instantaneous graphs by graphing measurements over longer periods. Each graph is associated with a measurement that is also displayed in the Readings panel on the right side of the display. The measurements have status LEDs associated with them.

Individual trend graphs can be opened by making a selection from the drop-down menu of the Trend graph or from the context menu of the measurement in the Readings panel.

The following trend graphs are available for the QAM B interface card: RF Lock, MER, EVM, Pre-RS BER, Input Level, SNR after Equalizer, and Carrier Offset.

RF Interface - COFDM

The settings and displays of the COFDM RF interface card are as follows: COFDM Interface Settings, COFDM Instantaneous Graphs, and COFDM Trend Graphs.

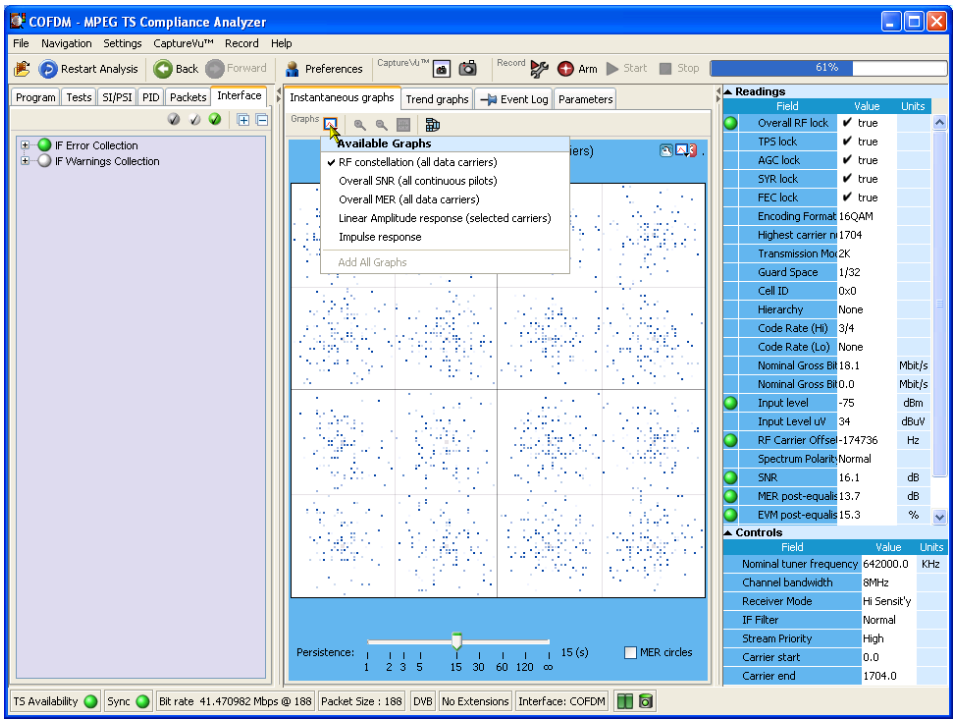


Figure 45: Interface view - RF - COFDM

COFDM Interface Settings. The following COFDM settings are available on the Open Transport Stream - Real Time Analysis dialog box, and also in the Interface tab - Controls area.

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 can 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).

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).

COFDM Instantaneous Graphs. The following instantaneous graphs are available for the COFDM RF interface card.

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 ETR290-101. 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 MER (all data carriers):
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 form the linear amplitude response, transformed into the time domain.

COFDM Trend Graphs. The trend graphs extend the principle of the instantaneous graphs by graphing measurements over longer periods starting from one minute. Each graph is associated with a measurement that is also displayed in the Readings panel on the right side of the display; the measurements have status LEDs associated with them.

Individual trend graphs can be opened by making a selection from the drop-down menu of the Trend graph or from the context menu of the measurement in the Readings panel.

The following trend graphs are available for the COFDM interface card: Overall RF lock, MER post-equalizer, EVM post equalizer, Pre-RS BER, Pre-Viterbi BER, Input level, SNR, and RF Carrier Offset Frequency.

RF Interface - 8VSB

The settings and displays of the 8VSB RF interface card are as follows: 8VSB Interface Settings, 8VSB Instantaneous Graphs, and 8VSB Trend Graphs.

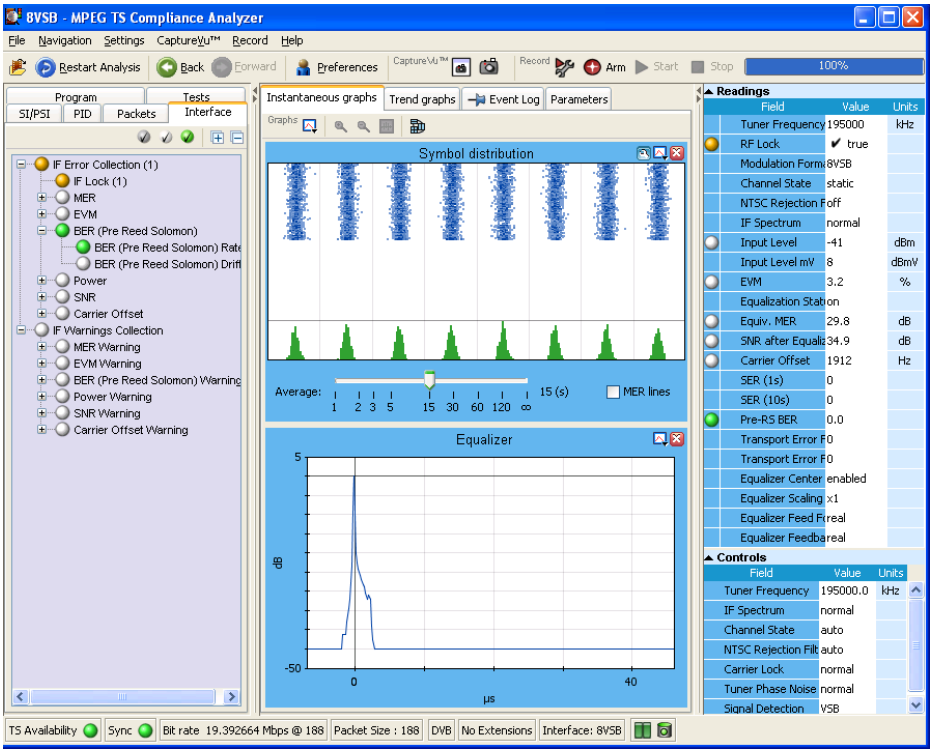


Figure 46: Interface view - RF - 8VSB

8VSB Interface Settings. The following 8VSB settings are available on the Open Transport Stream - Real Time Analysis dialog box, and also in the Interface tab - Controls area.

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 co-channel 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).

8VSB Instantaneous Graphs. The following instantaneous graphs are available for the 8VSB RF interface card.

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 only approximate.*

8VSB Trend Graphs. The trend graphs extend the principle of the instantaneous graphs by graphing measurements over longer periods. Each graph is associated with a measurement that is also displayed in the Readings panel on the right side of the display. The measurements have status LEDs associated with them.

Individual trend graphs can be opened by making a selection from the drop-down menu of the Trend graph or from the context menu of the measurement in the Readings panel.

The following trend graphs are available for the 8VSB interface card: RF Lock, Equiv. MER, EVM, Pre-RS BER, Input Level, SNR after Equalizer, and Carrier Offset.

RF Interface - QPSK/8PSK

The settings and displays of the QPSK/8PSK RF interface card are as follows: QPSK/8PSK Interface Settings, QPSK/8PSK Instantaneous Graphs, and QPSK/8PSK Trend Graphs.

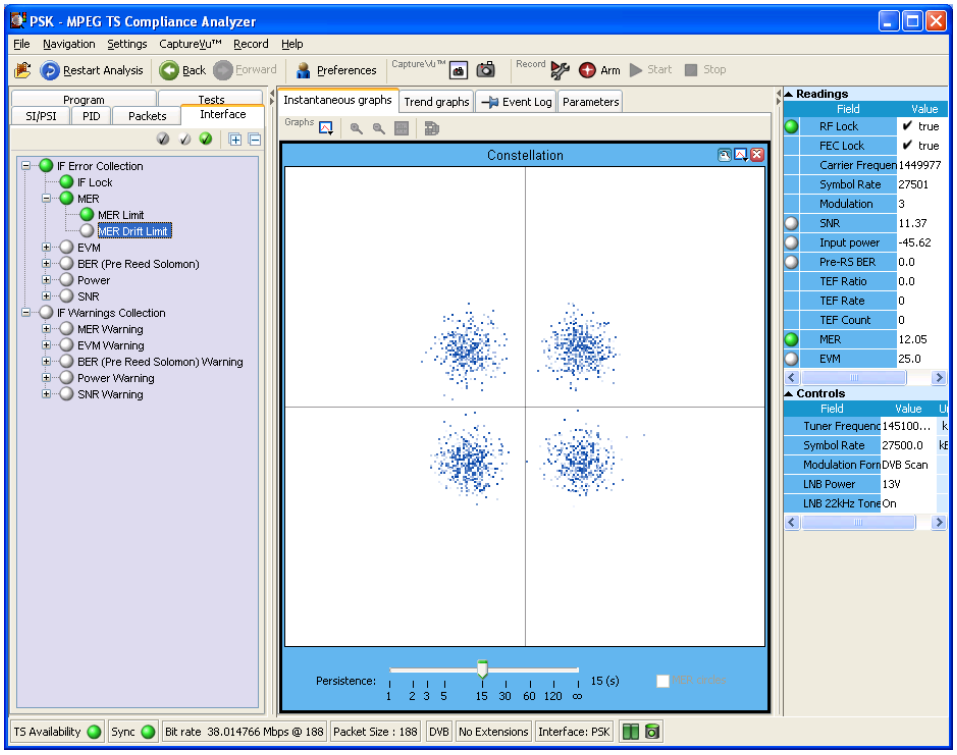


Figure 47: Interface view - RF - QPSK/8PSK

QPSK/8PSK Interface Settings. The following QPSK/8PSK settings are available on the Open Transport Stream - Real Time Analysis dialog box, and also in the Interface tab - Controls area.

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 dropdown dialog box. A Scan function is also provided, allowing automatic acquisition if the precise code rate is not known.

LNB Power: The QPSK/8PSK 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, is selectable between Off (default), 13V and 18V. The output current is limited to 200 mA maximum, and is foldback limited to a low value in the event of an overload.

LNB 22 kHz 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.

QPSK/8PSK Instantaneous Graphs. The following instantaneous graphs are available for the QPSK/8PSK RF interface card.

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 collected samples 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 formulas given in ETR290-101

QPSK/8PSK Trend Graphs. The trend graphs extend the principle of the instantaneous graphs by graphing measurements over longer periods. Each graph is associated with a measurement that is also displayed in the Readings panel on the right side of the display. The measurements have status LEDs associated with them.

Individual trend graphs can be opened by making a selection from the drop-down menu of the Trend graph or from the context menu of the measurement in the Readings panel.

The following trend graphs are available for the QPSK/8PSK interface card: RF Lock, MER, EVM, Pre-RS BER, Input power, and SNR.

Common User Interface Concepts

Many user interface concepts are used throughout the analyzer. The following common elements are described in this section:

- Windows Management
- Icons
- Graph Management
- Timing Graphs
- Bit Rate Graphs
- PIT Graph
- Now Playing Views
- Parameter Edit
- Event Logs
- Bit Rates
- EPG View
- MPE Views
- CaptureVu Features
- Triggered Recording
- Menu Bar and Options
- Preferences
- Script Files

Windows Management

***NOTE**. For basic Windows operations, such as minimizing windows or using the scroll bars, refer to the MS Windows documentation.*

In addition to the standard windows management methods, the following controls are added which allow the windows panes to be resized.

Horizontal and Vertical Controls

Horizontal and vertical control icons are placed between adjacent panes. Clicking on an icon will expand the adjacent pane in the direction shown by the icon.

The size of panes can also be controlled by placing the cursor over the horizontal or vertical dividing bar so that it changes to a bidirectional arrow. The dividing bar can then be dragged to the required position, as shown in Figure 48.

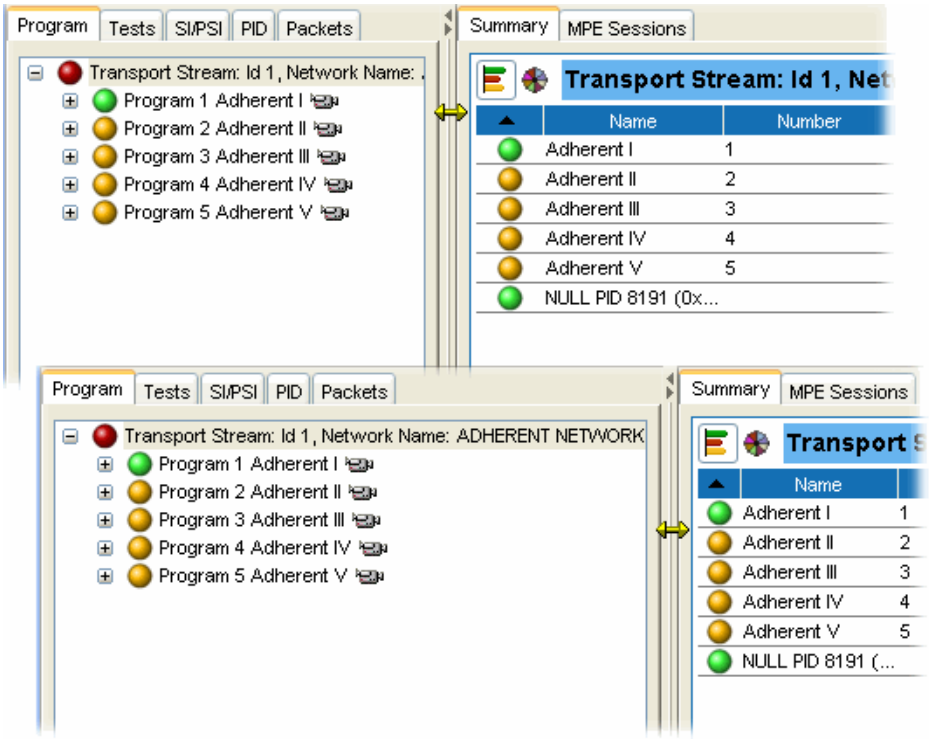


Figure 48: Window size adjustments

Table Manipulation

In views such as the PID summary view, which take the form of a table, the columns can be sorted in ascending or descending order by clicking the section of the header bar on which the table is to be sorted. Similarly, column widths can be adjusted by dragging the column divider bar to the required column width.

Icons

Icons are used in the TSCA to convey information about a node or function.

Table 4 and Table 5 show the icons used in the TSCA with a brief description of each. Table 6 shows the icons used in the quick link section of shortcut menus.

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

Table 4: Object identification icons

Icon	Description
	Application Information Table (MHP)
	Audio
	Conditional Access PID
	Data stream
	Packet
	PCR
	Program
	Programs
	SI table
	SI table container
	SI tables
	Stream scrambled
	Subtitles
	Teletext
	Video
	Video + audio
	Closed caption - CC-EIA608
	Closed caption - CC-EIA708

Table 5: Interface management icons

Icon	Description
	Open transport stream
	View CaptureVu settings
	Capture analysis
	Bar chart
	Pie chart
	Link to
	Preferences
	Audible alarm
	CaptureVu breakpoint
Graph management	
	Graph selection
	Zoom in
	Zoom out
	Show full dataset
	Hide/show limits
	Hide/show settling time indicators
	Rotate graph view
Packet management	
	Remove all PID packets
	Remove PID packet
	Add PID packet
	PID packet group
	PID packet placeholder

Table 5: Interface management icons (Cont.)

Icon	Description
	Go to first packet
	Go to previous packet
	Go to next packet
	Go to last packet
	Open Go To Packet dialog box
Action control	
	Go to previous view
	Go to next view

Table 6: Quick link icons

Icon	Description
	Go to next red LED in current tree
	View this PID in PID tree
	View packets with this PID
	View packets in Packet tree
	View PCR graphs
	View this program's PMT in SI tree
	View this test in Tests tree

Graph Management

A number of screens displaying graphs are available in the analyzer. 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

For streams received over IP, the PIT (packet interarrival time) graph is available.

The graphs that can be displayed depend on the selection made in the navigation view. However, the menus and options for the graphs are similar and as 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. During real-time analysis, the graph is constantly being filled (from the right to left), and 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.

Overview

Figure 49 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.

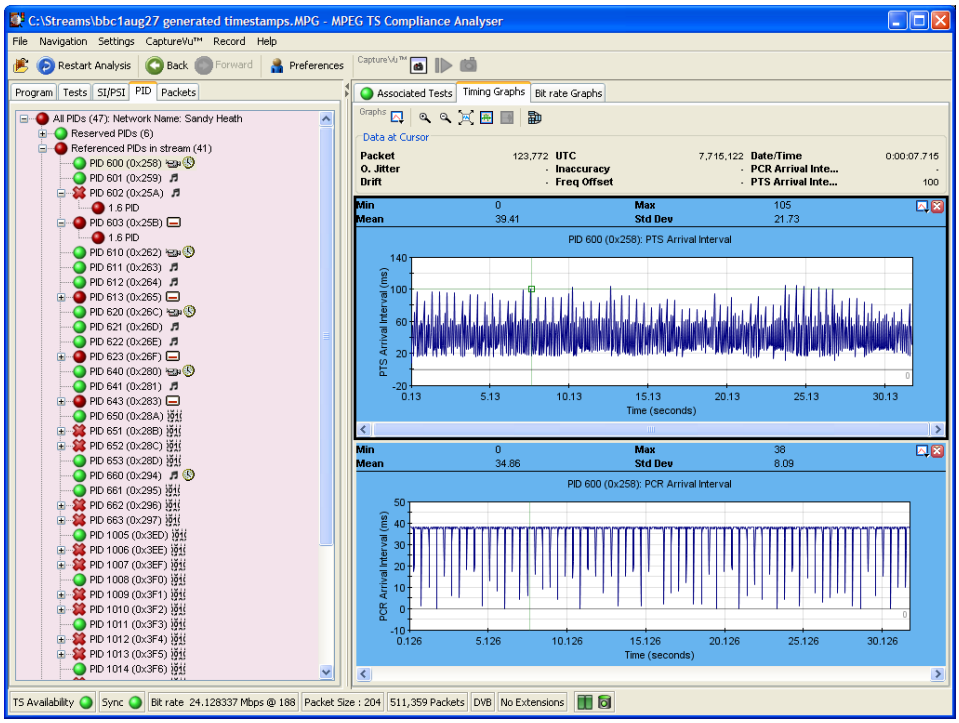


Figure 49: Timing graphs

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.

Cursor Data and Control

A cursor can be displayed on the graphs allowing you to see accurate measurements in the adjacent data panel. You can place the cursor by clicking any data point on one of the graphs. Note that the cursor is displayed at the same point on all of the visible graphs.

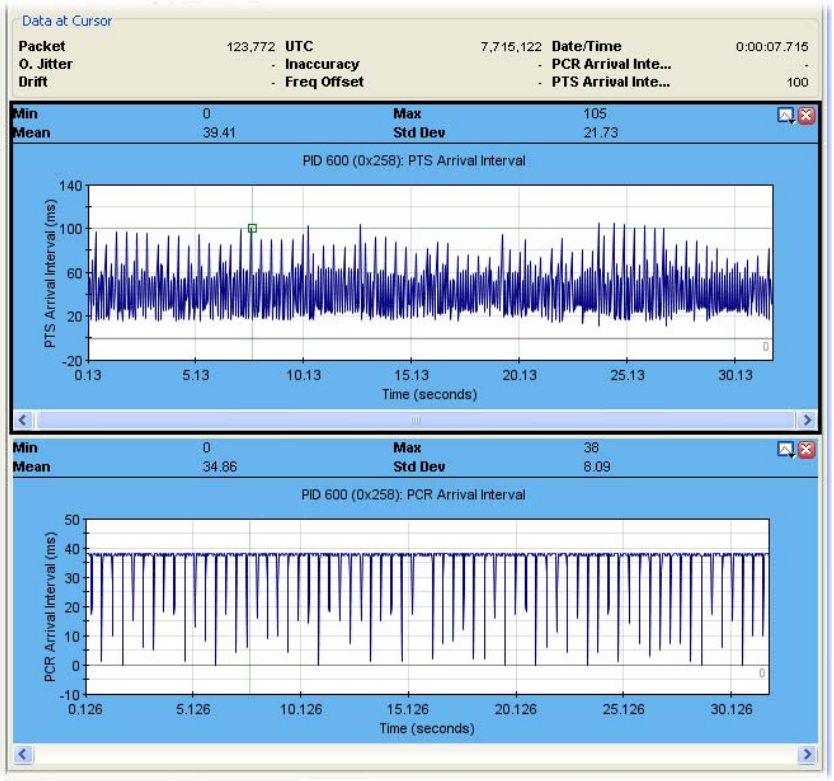


Figure 50: Graphs - cursor

A tooltip is displayed when a point is selected giving the X and Y coordinates of the point; the values of these will vary depending on the graph.

Data associated with the selected point will also be displayed in the statistics panel (above the graphs). The displayed values (maximum, minimum, mean and standard deviation) are calculated for all of the data that is received while the navigator node is highlighted.

Similarly, data for all graphs is displayed in the Data at Cursor panel. A link to the associated packet is provided in the shortcut menu.

The cursor can be moved either by clicking a new position on the graph, or one point at a time by using the left or right controls on the keyboard.

Graph Menu and Toolbar

The Graph Toolbar allows you to select and control the available graphs (see Figure 51).

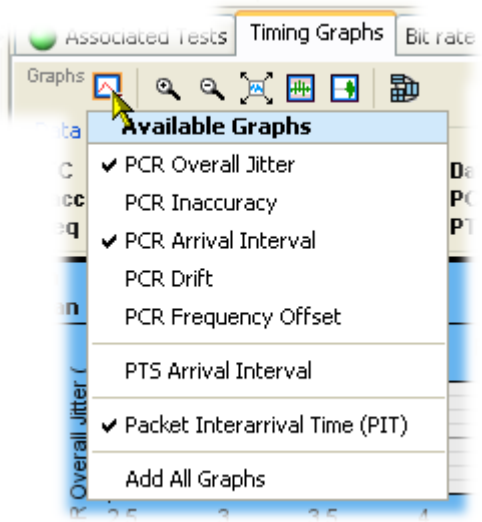


Figure 51: Graph toolbar

At the left end of the 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 *Timing Graphs*, page 111 for an explanation of the 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 shortcut menu can be displayed by right-clicking anywhere in a graph display area. The options on the menu are applicable to only the graph from which the menu was selected.

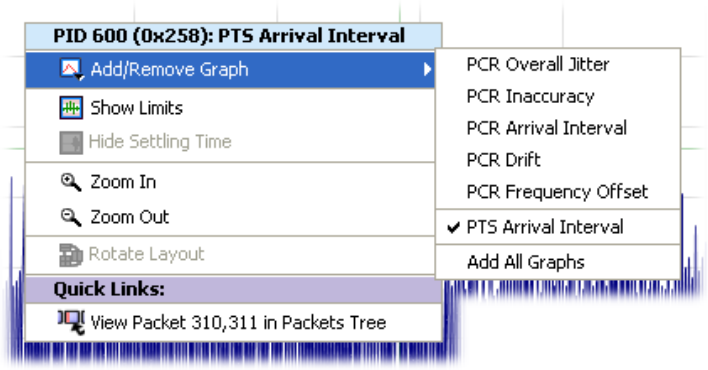


Figure 52: Graph shortcut menu

The title bar displayed at the top of the menu shows which object the graph applies to (for example, PID 600).

Adding and Removing Graphs

Graphs can be added by selecting them from the shortcut menu or from the drop-down menu either in the 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 shortcut 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 *Parameter Edit*, page 118). 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 Figure 53). In this example, the PTS Arrival Interval has been set at 700 ms. The area outside the limits is shaded (red). The Y axis is rescaled to show the maximum and minimum data points.

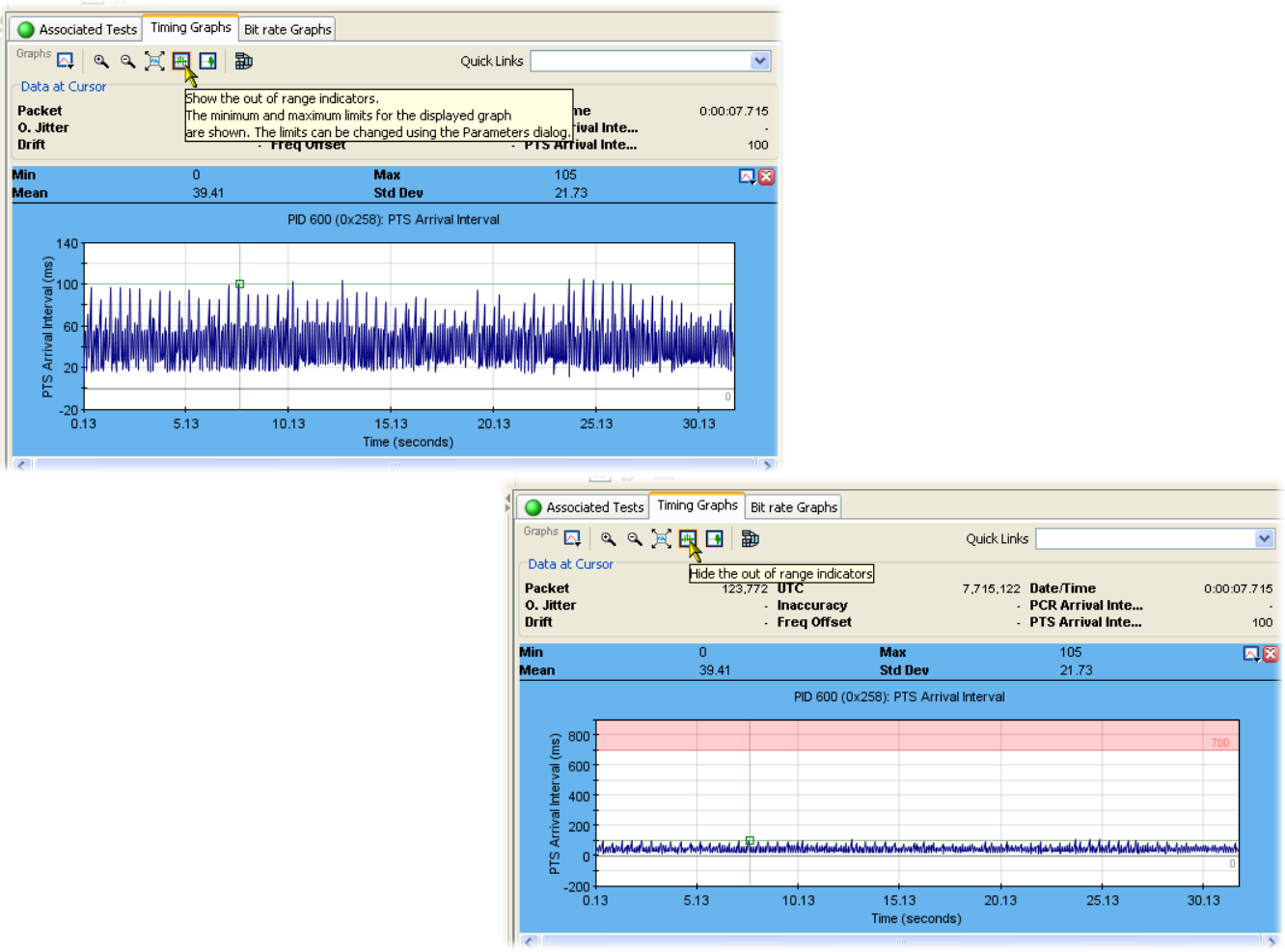


Figure 53: Out of range indicator

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”.

Zoom Feature

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 locked while the Y axis is expanded or contracted.

During real-time analysis, expanding (zooming in) an area of a graph generates a static snapshot of the graph. Because of the way that the measurements are stored in the circular buffer, the display will eventually clear. The only way to redisplay the graph is to return to full-scale display.

Timing Graphs

Table 7 shows the timing graphs that are available for PIDs carrying PCR and PTSs. If a PCR PID is also carrying time stamp information, the full set of graphs will be available.

The graphs available will depend on whether the PID is carrying PCR and/or time stamp (TS) information.

Table 7: Timing measurement graphs

Graph type	PID + PCR	PID + PCR + TS
PCR Inaccuracy	✓	✓
PCR Arrival Interval	✓	✓
PCR Drift Rate	-	✓
PCR Frequency Offset	-	✓
PCR Overall Jitter	-	✓
PTS Arrival Interval	-	✓

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 Inaccuracy (PCR_AC)

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 default limits are set to ±500 ns.

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 default limit (Maximum Repetition Period set in ETR 101 290 test 2.3) is 40 ms.

The PCR Maximum Repetition Interval limit can be adjusted by modifying the PCR max repetition interval.

PCR Drift Rate (PCR_DR)

This 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 (PCR_FO)

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.

PCR Overall Jitter (PCR_OJ)

The 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.

MTS400 PCR Measurements and Settling Time

Demarcation Frequency. The PCR measurements provided by the MTS400 Transport Stream Compliance Analyzer are defined by TR 101 290. Appendix I of TR 101 290 describes the measurements in detail, and also 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.

From the menu bar, select Settings > PCR filter settings... to open the PCR Drift/Jitter Demarcation Filters dialog box (see Figure 54). 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.

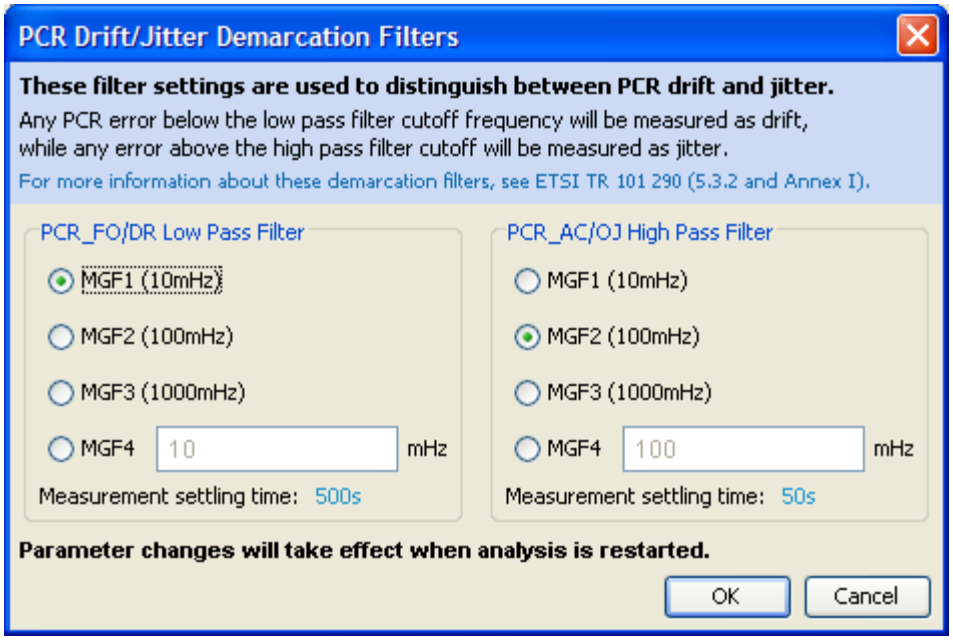


Figure 54: PCR Drift/Jitter Demarcation Filters dialog box

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 by selecting Settings > Parameters... from the menu bar, scrolling to the appropriate parameters, and making the required changes.

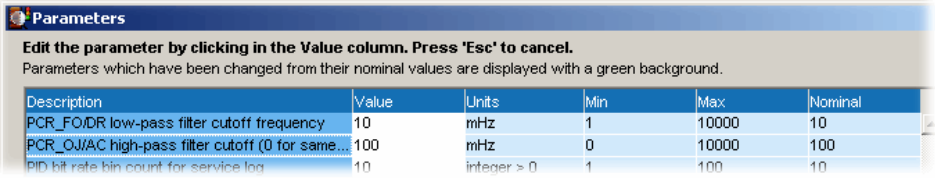


Figure 55: PCR parameters - Filter settings

Please note that 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. The measurements will not return valid values before this time elapses. The settling time is indicated on the PCR graphs in the TSCA.

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.

Table 8: PCR settling times

Filter cut-off	Settling time	TR101-290 profile	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 (1Hz)	5 s	MGF3	-
1 mHz - 10,000 mHz	5000 s – 0.5 s	MGF4	User-defined profile

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

PTS Graph

Presentation Time Stamps (PTS) indicate the exact moment where a video frame or an audio frame has to be decoded or presented to the user respectively. The PTS graphs show the PTS arrival intervals. (See also *Graph Management*, page 105.)

Bit Rate Graphs

Bit rate graphs are available on program and PID nodes. (See also *Graph Management*, page 105.)

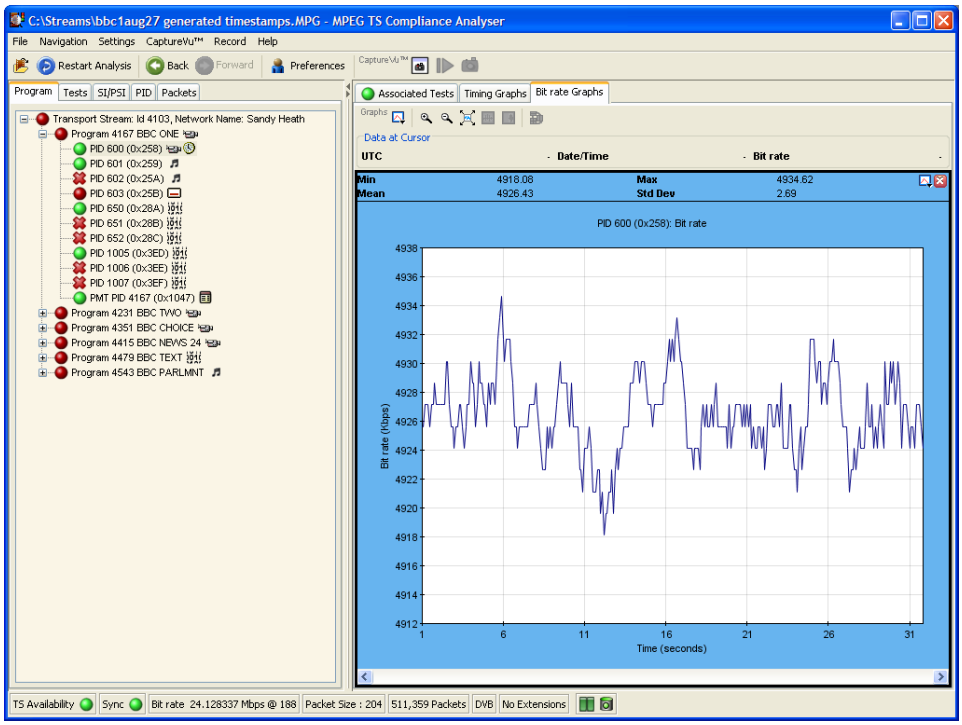


Figure 56: Bit rate graph

PIT Graph

The PIT Graph displays the mean interarrival time of IP packets. This can be viewed from the Transport Stream node in the Program view. It can also be viewed alongside other timing graphs for PIDs with PTS and/or PCR information. This can help you coordinate apparent problems with PCR and PTS timing with IP packet timing.

Now Playing Views

The Now Playing tab provides thumbnails of the video content at the transport stream and program node levels. Icons (Thumbnails, Summary, and Details) at the top right of the Now Playing screen provide three levels of detail and thumbnails layout. Figure 57 through Figure 59 illustrate the level of detail provided by each icon.

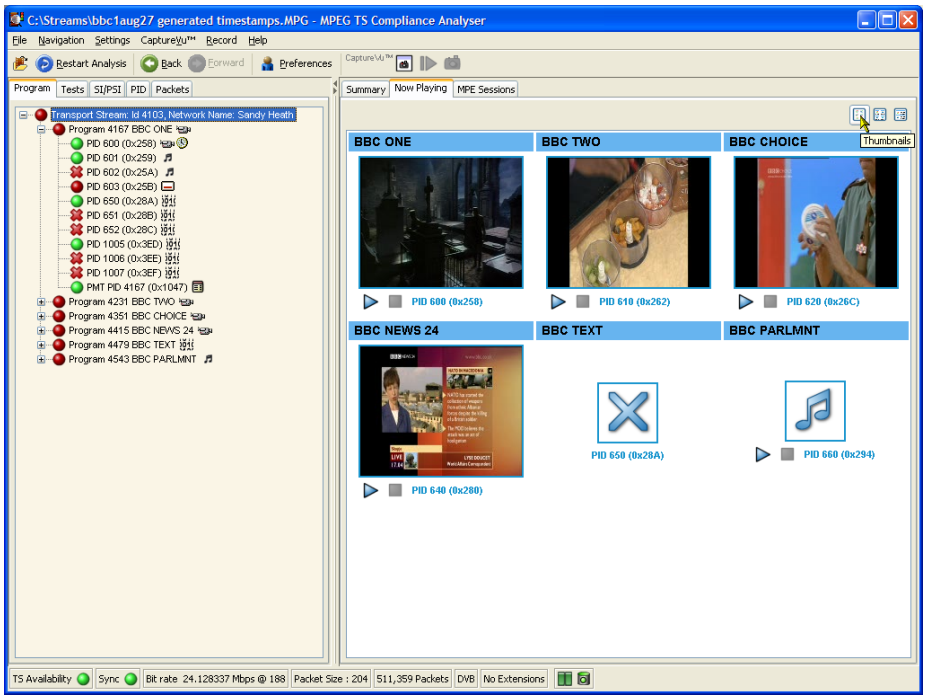


Figure 57: Now Playing - Thumbnail view

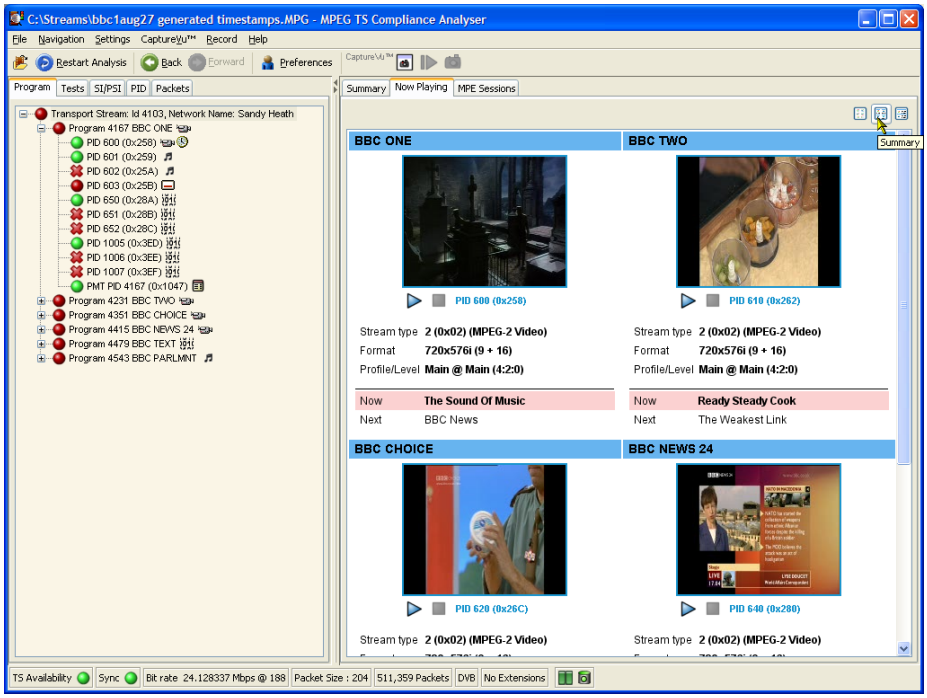


Figure 58: Now Playing - Summary view

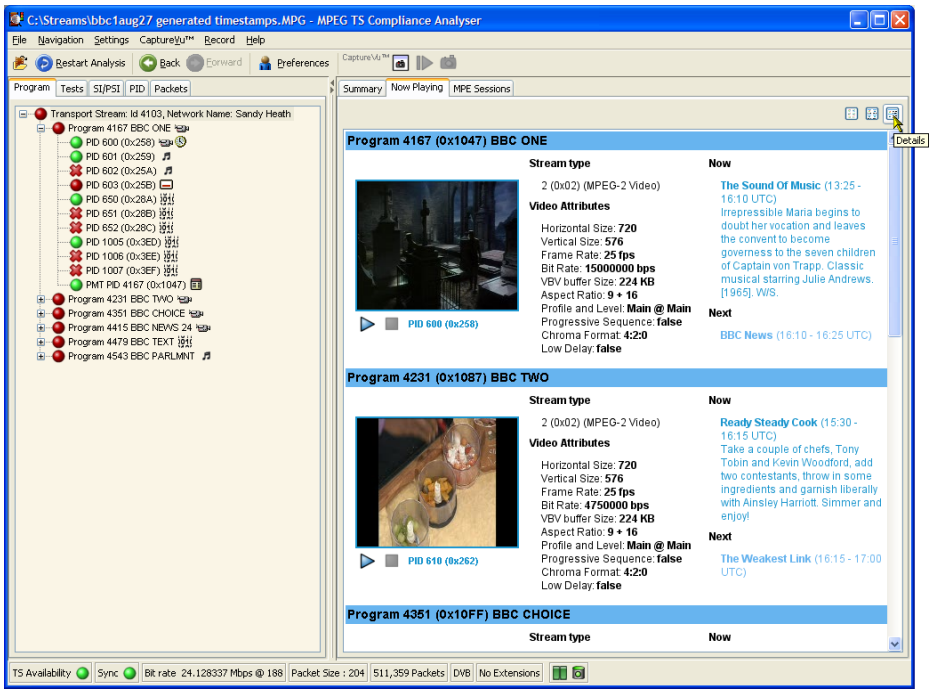


Figure 59: Now Playing - Detail view

Parameter Edit

Each of the error states displayed on the user interface are the result of making one or more measurements or tests on the analyzed transport stream. The displayed tests are derived from the selected interpretation standard. Additional proprietary tests are also included.

Some measurements and tests translate directly to an error state, and others are the result of a combination of tests. For many of the tests, you can affect the result by varying parameters that influence the test result, for example, maximum and minimum bit rate values, although the test result may not then conform to the chosen interpretation standard.

Figure 60 shows the parameters that are available for the ETR 101 290 test 2.5. Figure 61 shows the parameters that are available for a single PID under ETR 101 290 test 2.5. Not all parameters applied to a test are necessarily applied to a PID.

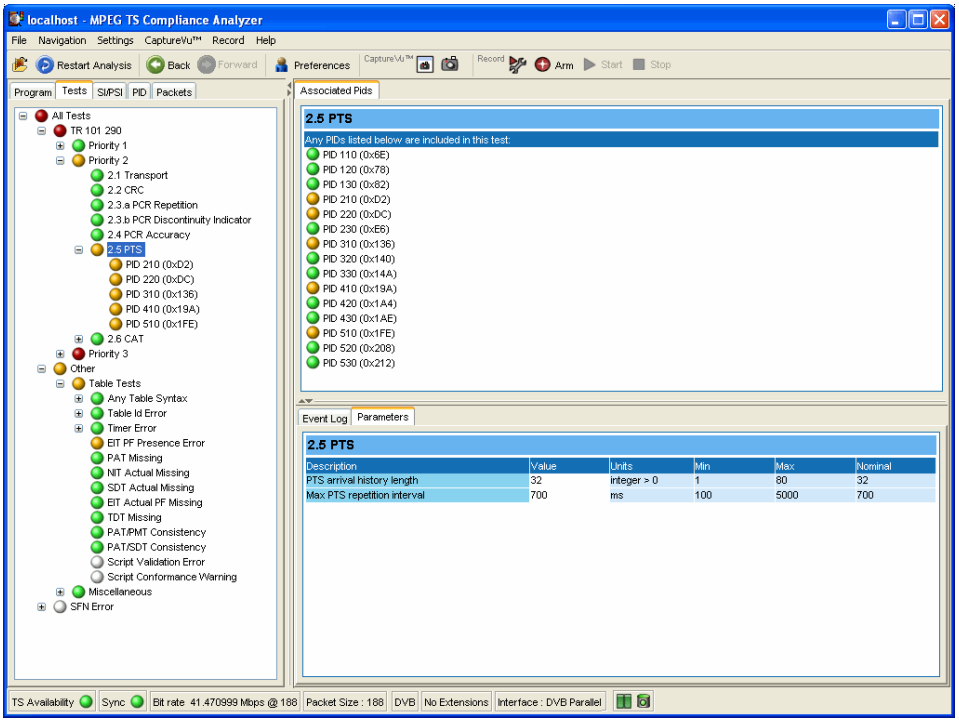


Figure 60: Test parameters

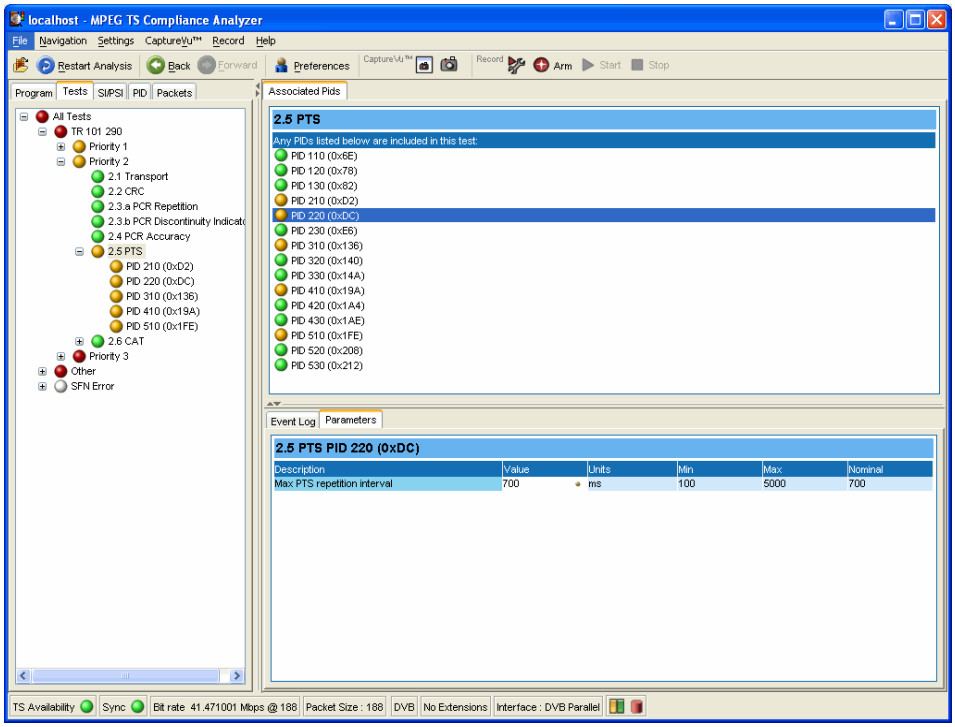


Figure 61: PID test parameters

Each test parameter entry includes the following fields:

- Description of the parameter.
- Value - the current setting. If the setting is the same as the nominal value, an icon will also be displayed in this field.
- Units in which the measurement is made.
- Maximum and minimum values. These are the maximum and minimum values recommended by the selected standard.
- Nominal value. This is the value or setting recommended by the selected interpretation standard.

It is important to understand the difference between default and nominal values.

If a parameter value is set for a test, it becomes the default value for the test and for all PIDs subject to that test. PIDs using the default value will have a bullet icon displayed in the Value field (see Figure 62).

Figure 62: Parameter value - default icon

However, you can also set individual PID parameter values. The value set is applied to only that PID, not to the other PIDs using the same test or the test default value.

The nominal value is provided by the interpretation standard; it cannot be changed using the user interface.

Changing a Test Parameter Value

To change the value of a test parameter:

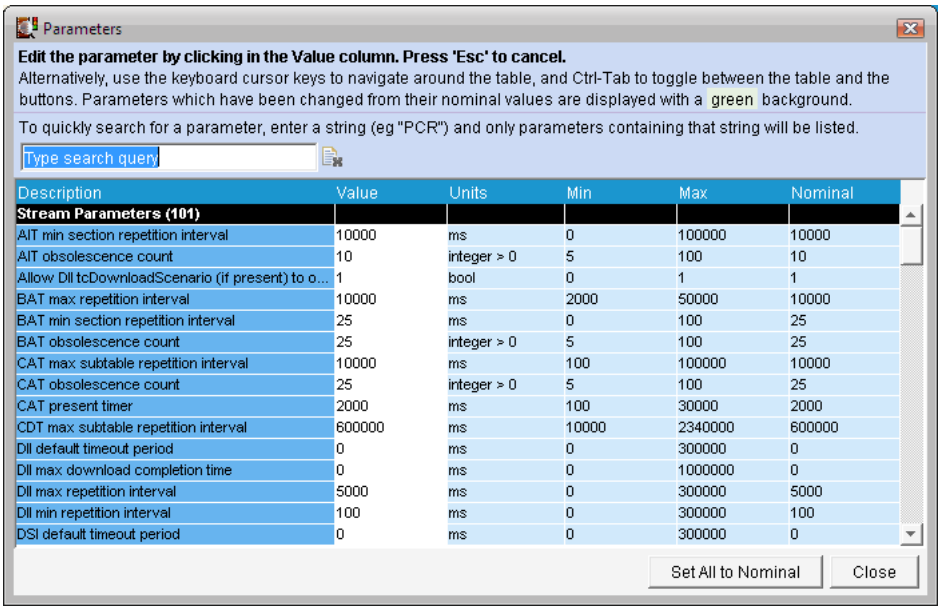
1. Click in the Value field.
2. Enter the required value.
3. Press Enter.

***NOTE**. For a new value to take effect during deferred analysis, the stream must be closed. Select* Restart Analysis *to open and reanalyze the stream.*

Access to All Parameters

All parameters are accessible from the Parameters menu option (Settings > Parameters…). Parameters are initially listed in alphabetical order. To quickly search for a parameter, enter text in the search field, for example ‘BER’. Only parameters containing the entered text in their description will be displayed. You can clear search text by selecting the button adjacent to the search field.

Parameter values can be changed in the same way as individual parameters. Changes made to values in this dialog box are also applied to the individual PID parameters, since changes made here become the default value for the parameter.



Select the Set All to Nominal button to return all parameter values to their factory settings. During deferred analysis, the current stream will need to be closed and reopened (reanalyzed) for the new parameter settings to take effect.

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 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. 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 recommence.

Event Log Pinning

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 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 shortcut 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.

Note that pinning the log may take a few seconds. The whole log is saved, up to 1000 entries.

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

Exporting the Event Log

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

You can export the log by selecting the Export icon or Export Log from the shortcut 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 (as shown in Figure 63). Color-coding can be done from any event log display. The color-coding dialog box is available from the event log shortcut menu.

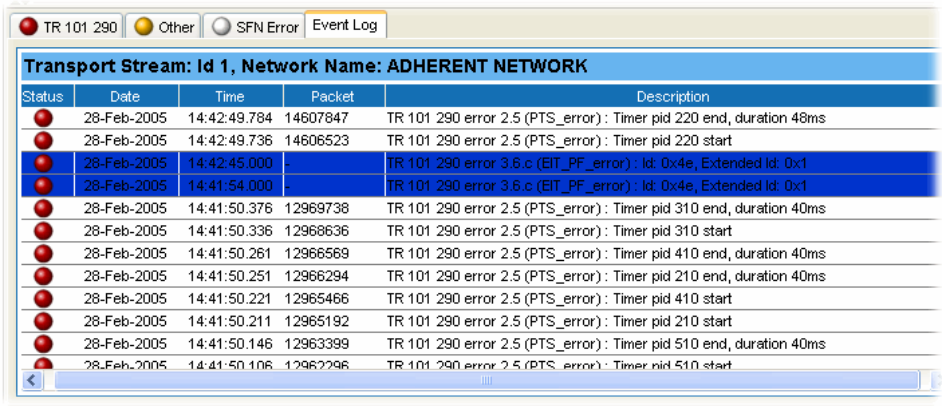


Figure 63: Event log - color coding

1. Highlight the event type and select Color from the shortcut menu (see Figure 64). Figure 65 shows the Color dialog box.

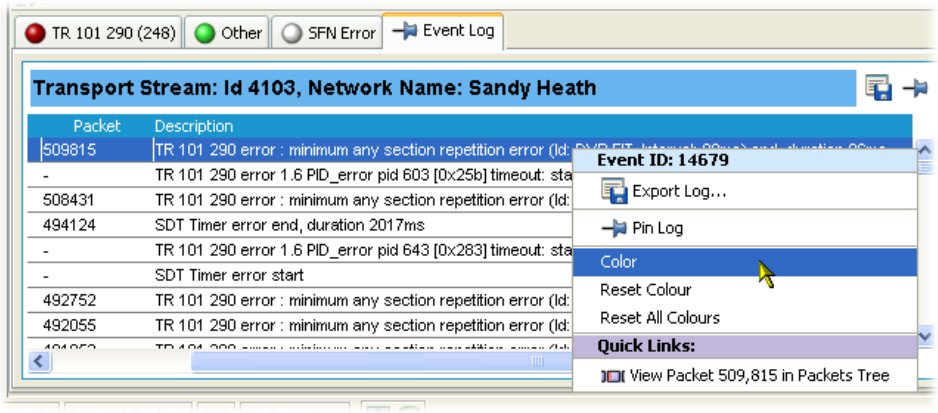


Figure 64: Event log - shortcut menu - color

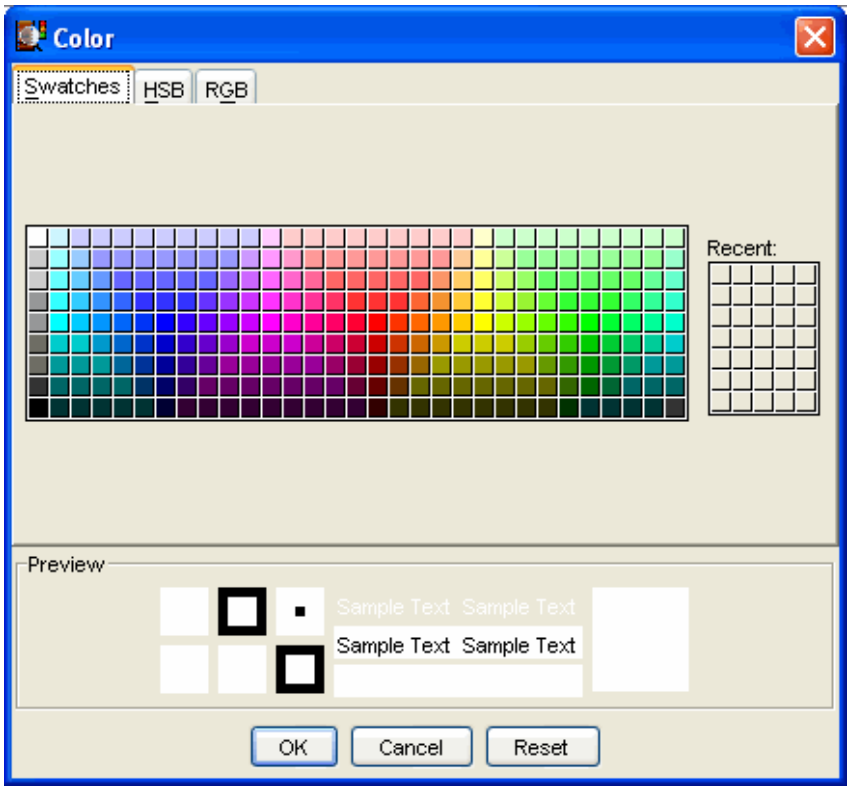


Figure 65: Event log - color dialog boxes

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 shortcut menu. Color-coding can be removed from all event types by selecting Reset All Colors from the shortcut menu.

Bit Rates

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 66: Bit Rate display selection

Bar Charts

The following information is included with the bit rate bar charts:

- 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).

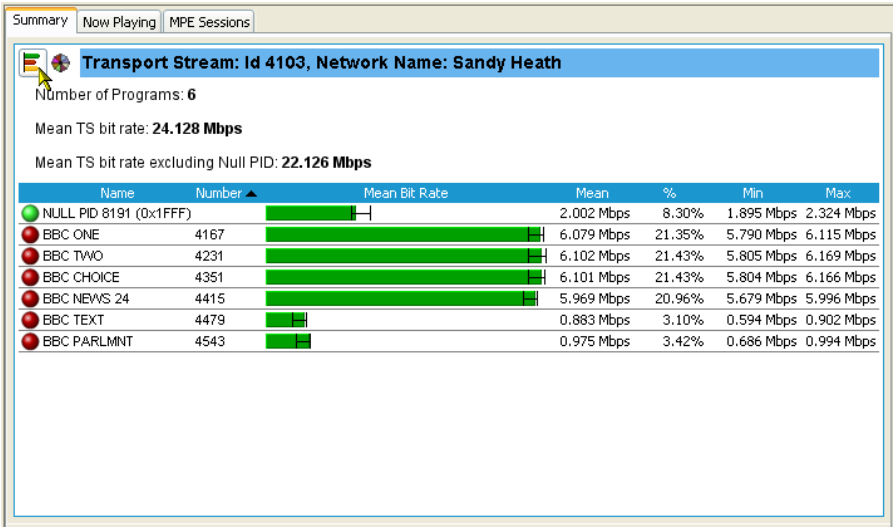


Figure 67: Bar chart

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

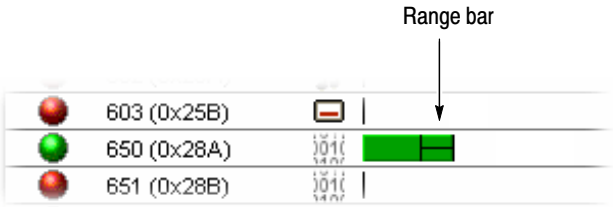
Column widths can be adjusted by dragging the line dividing the title bar to the left or right with the mouse.

Error Indication

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.

Range Bar

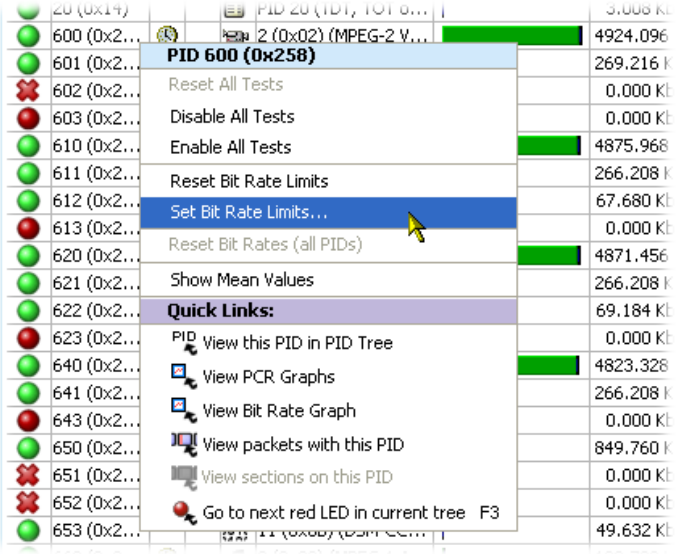
A range bar indicates the variation of bit rate in each program or PID. The ends of the bar show the maximum and minimum values of the bit rate since monitoring started.



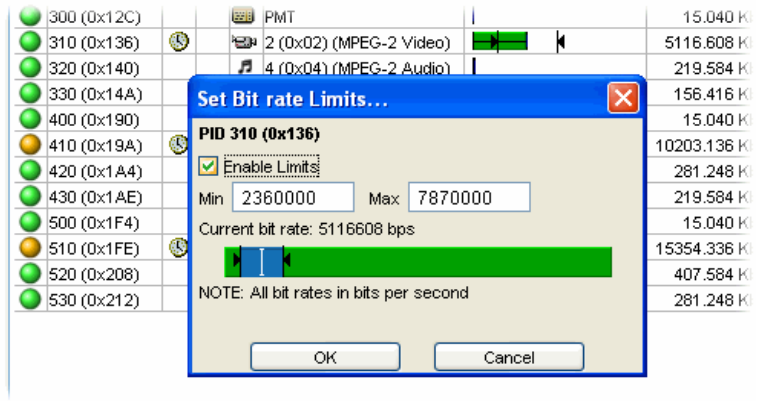
Bit Rate Limits

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 select Set Bit Rate Limits... from the shortcut menu.



The Set Bit Rate Limits dialog box is opened:



You can enable the limits by selecting the Enable Limits checkbox 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.

During deferred analysis, the stream must be closed and reopened to reanalyze it and view the effects of the limits. Real-time limits take effect immediately. Limit values are retained when the application is closed. Limits set for specific PIDs will be applied (to a PID with the same number) irrespective of the stream being analyzed.

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 Limits button at the top of the Programs screen.

Pie Charts

The pie chart shows similar information as the bar chart.

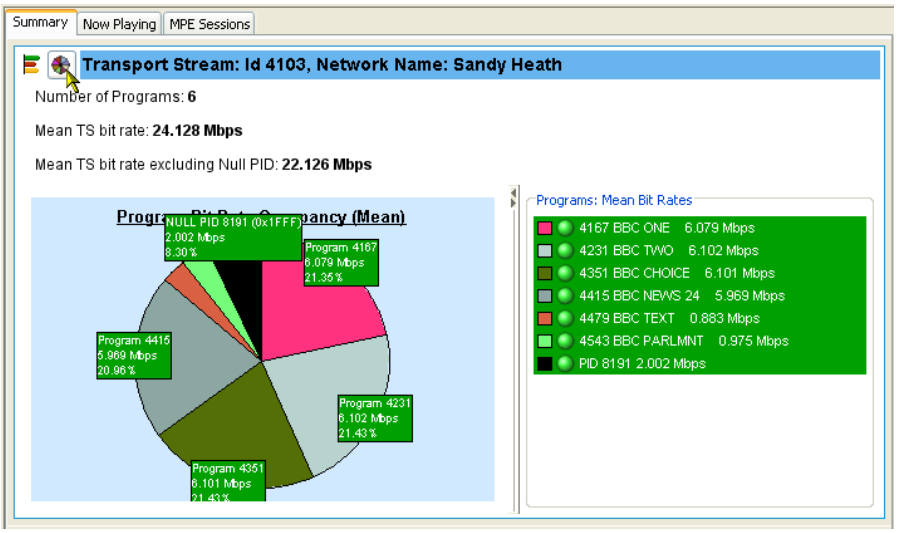


Figure 68: Pie chart

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.

EPG View

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 can also be included. Events for services which 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 as shown in Figure 69.

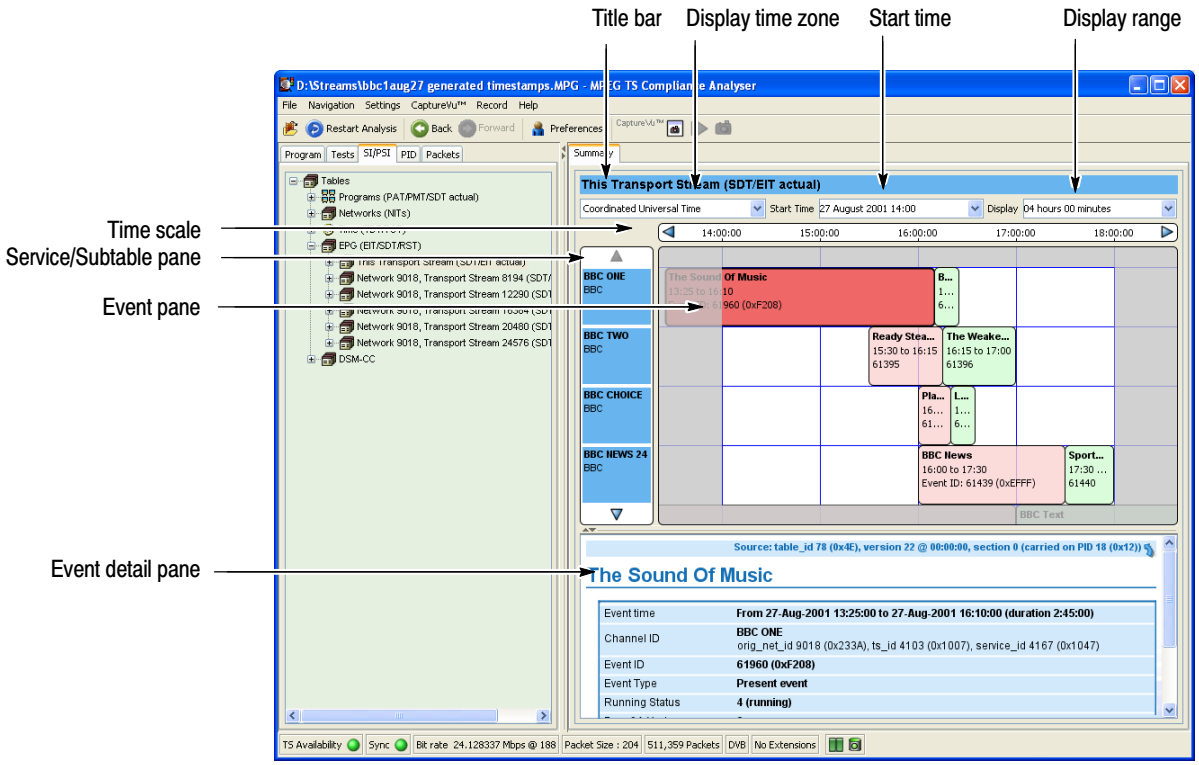


Figure 69: EPG Summary view

EPG Node Summary

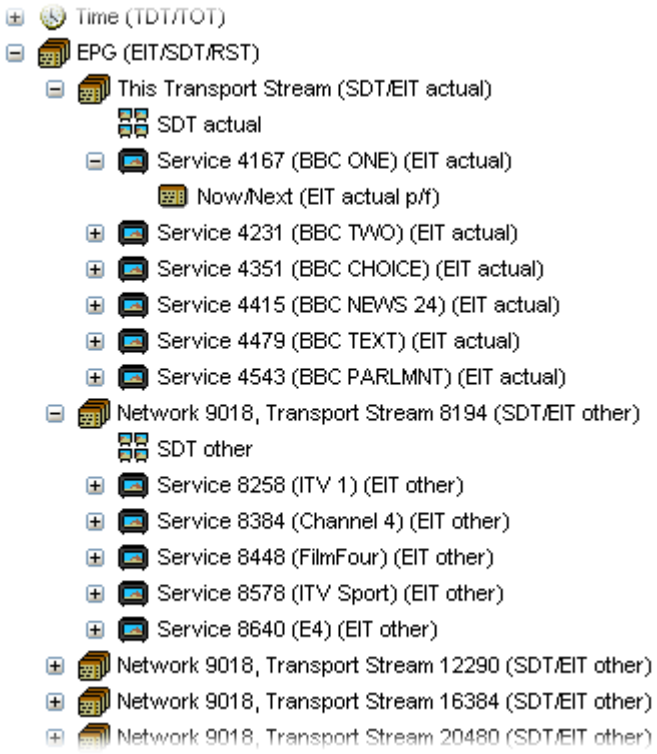


Figure 70: EPG nodes

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 nodes (Service Description Table):	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.

EPG Summary View

The screen elements highlighted in Figure 69 are described below:

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 can be derived either from the transport stream, UTC (Co-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.

In deferred mode, the initial date and time will be dictated by the information found in the stream. If the selected date is beyond that held in the EPG information, the date will be automatically set to the last date held in the information.

Note that in real-time mode, this information is updated regularly.

Display: 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.

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

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).

MPE Views

Multi-Protocol Encapsulation (MPE) provides a mechanism for transporting data network protocols on top of the MPEG-2 transport streams in DVB networks. MPE data has been optimized to carry the internet protocol (IP). MPE covers unicast (datagrams targeted to a single receiver), multicast (datagrams targeted to a group of receivers), and broadcast (datagrams targeted to all receivers). The 48 bit MAC (Media Access Control) addresses are used for addressing receivers.

The MPE views display the MPE data flow currently available in the stream.

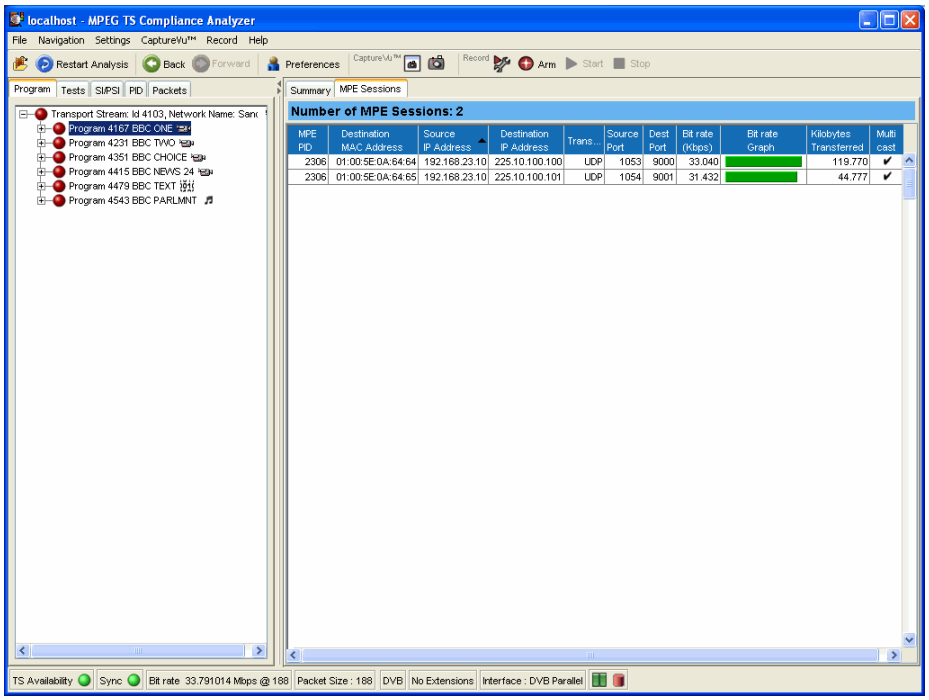


Figure 71: MPE view

CaptureVu Feature

The CaptureVu feature allows you to capture and analyze system events during deferred or real-time analysis to debug the intermittent and complex problems that traditional analyzers miss.

The feature can be activated either manually by selecting the Capture button during analysis or automatically by a CaptureVu breakpoint preset on a test. For deferred analysis, a packet number can be identified at which analysis will stop. Any of these actions freezes the analysis and allows details of the analysis up to that moment to be examined.

Links to the packet and the test (where applicable) at the point at which the Capture button was pressed or a designated test failed are displayed in the CaptureVu Settings dialog box.

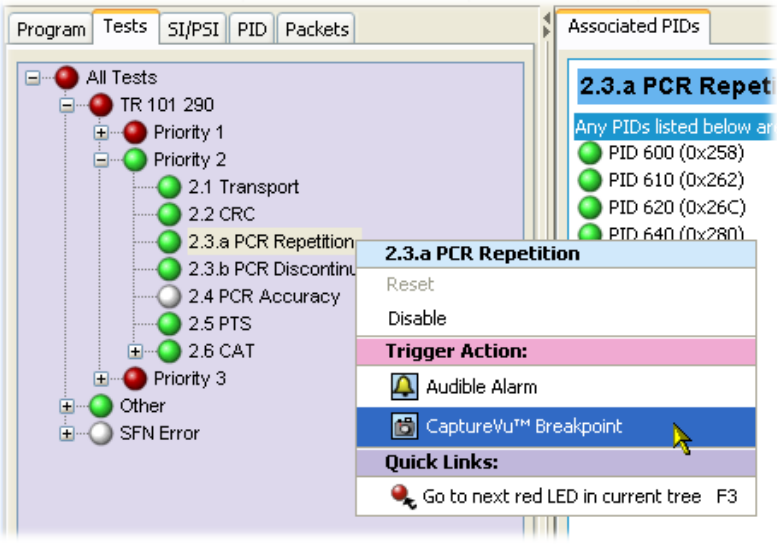
NOTE. *If a recurring test failure needs to be examined in its true context, it is advisable to make a triggered recording. With pretriggering set, it is then possible to examine the events surrounding a test failure. See* Triggered Recording, *page 140.*

Setting Up the CaptureVu Feature

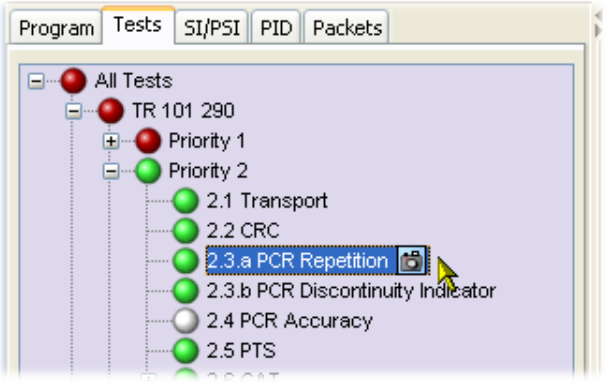
The feature can be activated when a test flagged with a CaptureVu breakpoint does not fall within the parameters set for the test. Breakpoints can be set at any time. They will be activated during real-time analysis as soon as the flagged test fails. To operate successfully in a deferred analysis stream, the stream may need to be reanalyzed.

You can set a CaptureVu breakpoint as follows:

1. In either the Program or Tests view, locate and highlight the required test.
2. From the shortcut menu, select CaptureVu Breakpoint.



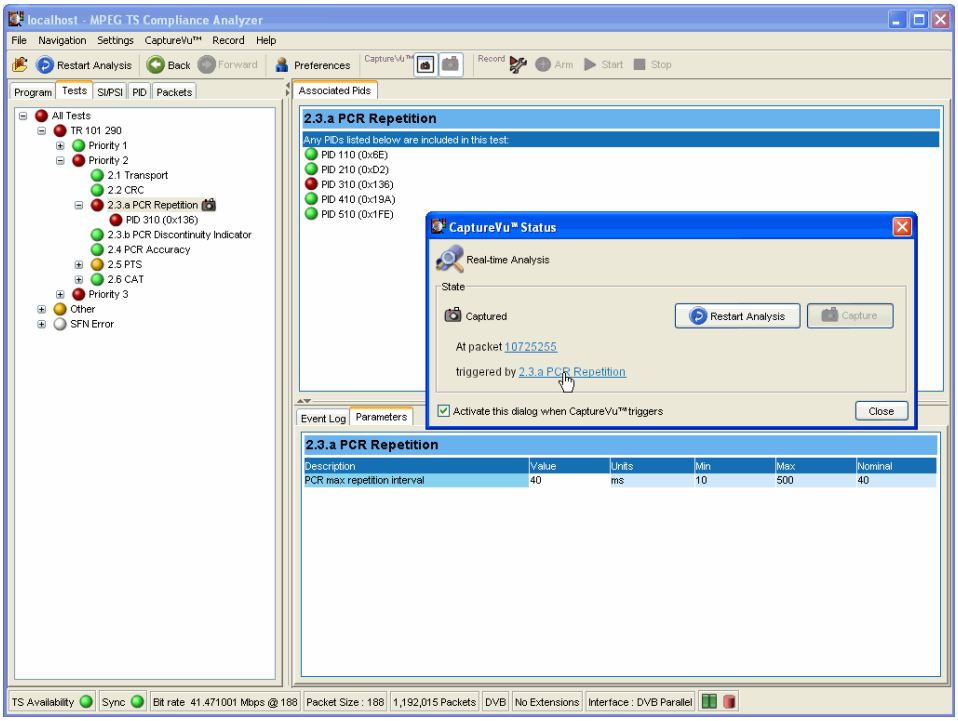
Note the addition of the breakpoint icon beside the test entry.



The CaptureVu breakpoint is now set. You can set as many breakpoints as you require. The next time an error is detected on any breakpoint test, analysis (real-time or deferred) will stop and the test will be identified.

CaptureVu Analysis

The CaptureVu breakpoint will operate during real-time and during deferred analysis. The CaptureVu Settings dialog box is displayed as soon as a breakpoint is reached or the CaptureVu feature is activated from the toolbar.



The dialog box contains the following fields:

State: This panel displays the test and packet in which the test has failed. Clicking either the test or the packet identity will open the related view (Tests or Packets) and highlight the test or packet (see Figure 72 and Figure 73).

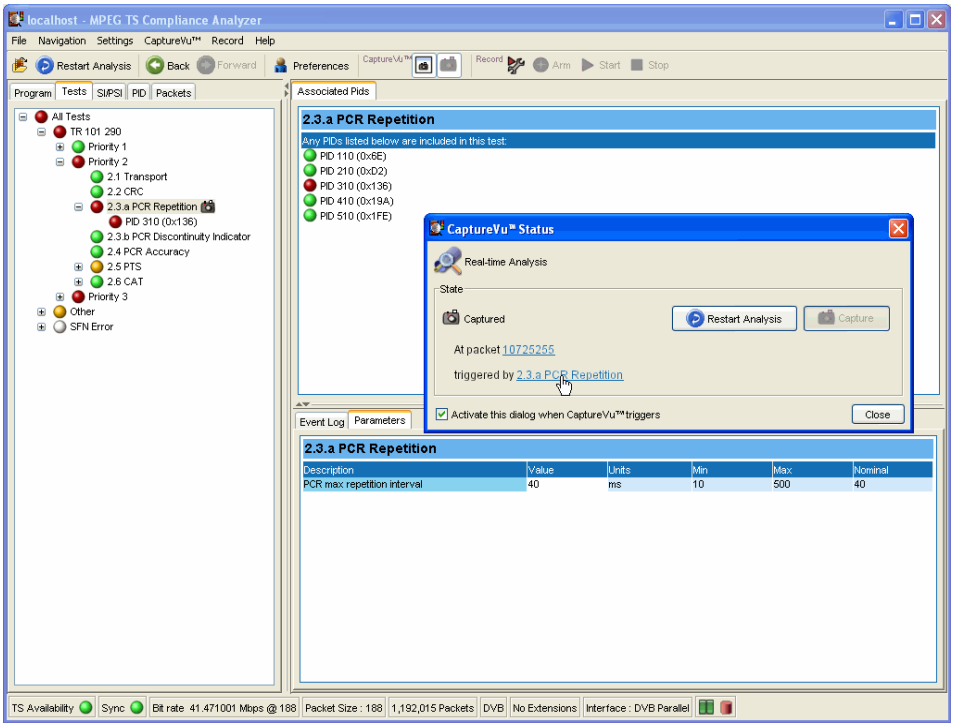


Figure 72: CaptureVu breakpoint - Test view

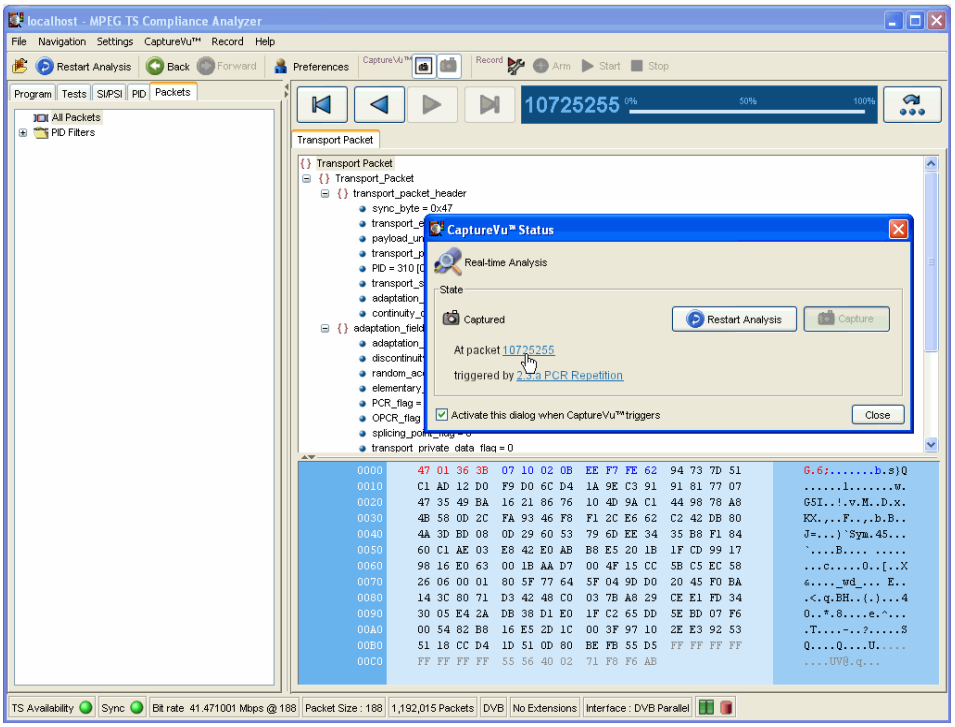


Figure 73: CaptureVu breakpoint - Packet view

You can activate this dialog box when the breakpoint triggers. When enabled, the CaptureVu setting dialog box is opened automatically when a breakpoint occurs.

The CaptureVu Settings dialog box can also be viewed at any time by selecting the CaptureVu Settings button on the toolbar.

With the CaptureVu feature activated, all of the TSCA tools are available for you to analyze and inspect the saved information.

***NOTE**. In Packets view, only the packets contained in the last 200 MB are available for analysis.*

Resuming Analysis

You can resume deferred analysis by selecting the Resume Analysis button from the dialog box or the toolbar.

***NOTE**. When you select the Resume Analysis button, analysis will continue from the point at which analysis was paused.*

Similarly, you can resume real-time analysis by selecting the Restart Analysis button from the dialog box or the toolbar.

***NOTE**. While real-time analysis is paused, further analysis is stopped. When the Restart Analysis button is pressed, analysis is restarted at the current time.*

Triggered Recording

During real-time analysis, stream information can only be held for a finite time. Eventually, the stream will be overwritten by more up-to-date information.

To examine events that occur in real-time mode more closely, recordings can be made manually or automatically. Recordings are saved to hard disk and can be subsequently analyzed and examined in more detail.

The Triggered Recording setup is accessed by the Record Setting button on the toolbar or Record > Record Settings... on the menu bar; the Recording Settings dialog box is displayed. The dialog fields are described below:

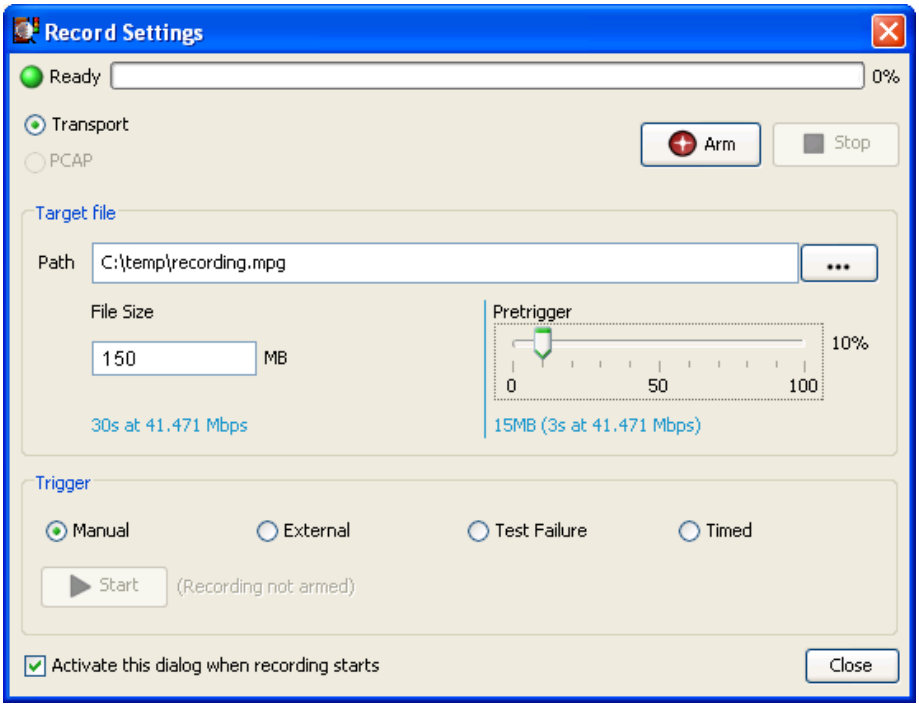


Figure 74: Record Settings dialog box

Source selection: Transport: Default selection.
PCAP: Only available when Enhanced performance IP card is fitted.

Status bar: Indicates the trigger status (Ready, Armed, Recording, or Complete) and the pretrigger/recording progress. The status and progress are also displayed on the toolbar in the main window.

Target file

Path: Enter the file name and path for the recording or use the browse button to find and select an existing file name. If this file name already exists, you must approve the overwriting of the old file when recording is initiated.

File Size: Enter the file size required in megabytes.
For example, for a stream at 30 Mbps, a file size of 600 MB would record approximately 160 seconds of stream information.

Pretrigger: A proportion of a stream can be recorded before a trigger event occurs. (See *Pretrigger Recording*, page 143.) Enter the pretrigger size (as a percentage of file size) that is to be recorded.

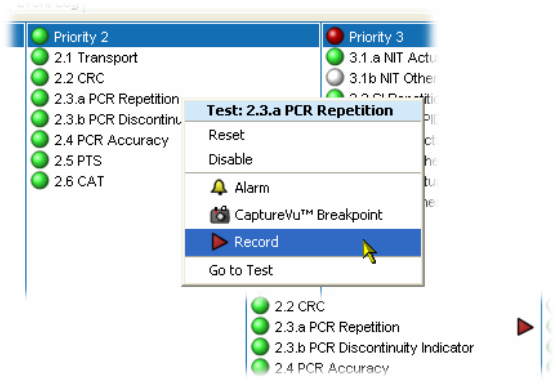
Trigger Type: The event that triggers the recording can be one of four types, selected from the drop-down list. In each case, the trigger is set and pretrigger recording starts when Arm is selected. Pretrigger recording must be complete before triggered recording will start.

Manual: Recording will start when the Start button is pressed. IP analysis supports only manual recording.

External: Recording will start when a rising or falling signal edge is detected at the external trigger input connector. (Refer to the *MTS400 Series Technical Reference*, 071-1724-xx for specifications.)

Test Failure: Recording will start when an error occurs on a flagged test.

Tests are flagged by highlighting a test in the Program or Tests view and selecting Record from the shortcut menu. The record icon is displayed next to the test.



You can set the Record flag on as many tests as you require; recording will be triggered by the first flagged test that is encountered.

Timed: Recording will start when the time and date set in the Start recording at field is reached.

You can enter the date and time manually (in the format displayed). The date can be selected from the drop-down calendar.

For all trigger types, except manual, when recording is complete, the starting packet is indicated in the Record Settings dialog box. Click on the packet number to display it in the Packets view.

Arm button: Places the recording function into an armed state. If a pretrigger value has been specified, the pretrigger recording will start (as shown by the progress bar). Full recording will start when any trigger requirements are met.

Stop button: Only active during recording, this button either disarms the previously armed trigger or stops recording immediately. Any recording made up to the point when the button is pressed will be lost.

Start button: For manual recording, this button becomes active after arming and any pretrigger conditions have been met; when pressed, recording will start immediately.

The Recording Settings dialog box can be left open while waiting for a recording to take place. If, after setting up the recording, the dialog box is closed, the recording can be controlled from the toolbar.

Pretrigger Recording

Setting a pretrigger size allows the condition of the final recording to be examined both before and after a trigger event. Pretriggering a recording allows a section of a recording to be recorded before the trigger event. The pretriggered portion of the file is filled and written over repeatedly until the trigger event occurs.

Pretrigger recording starts when the trigger is armed by pressing Arm.

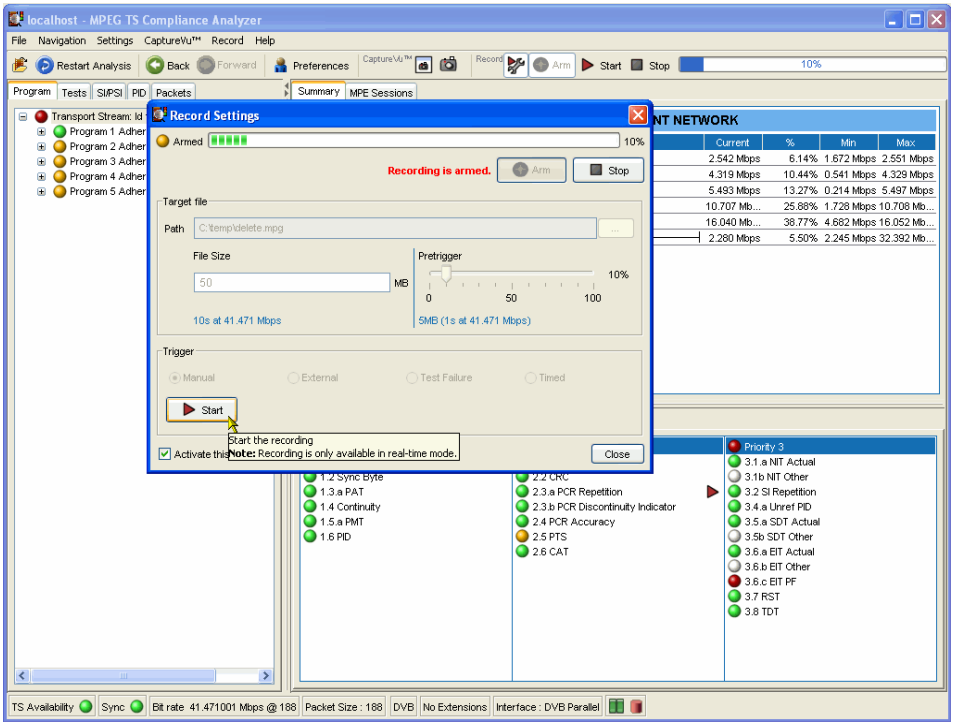


Figure 75: Record Settings dialog box - Armed state

CAUTION. *Recording may fail if the hard disk is unable to match the data rate of the stream. This can be caused by a fragmented hard disk. Regular defragmentation of the hard disk is recommended (refer to your Windows documentation or on-line help).*

NOTE*. No timestamps are stored when performing a recording through an IP interface*

Menu Bar and Options

The Menu Bar provides access to a selection of major system options using drop-down menus.

The menus and their options are described in the following paragraphs.

File Menu

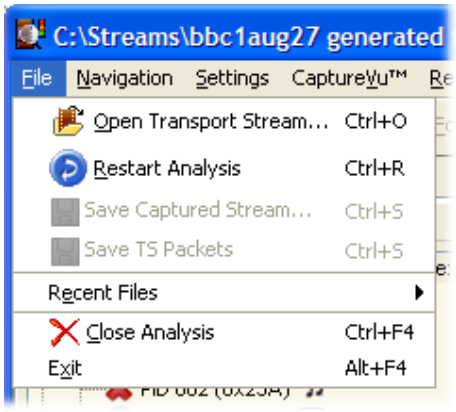


Table 9: File menu options

Command	Function
Open Transport Stream…	Opens the Open Transport Stream dialog box from which a stream source (file or real-time) and the interpretation standard can be selected.
Restart Analysis	Restarts the current analysis.
Save Captured Stream…	Saves the captured stream (200 MB maximum). Only available in real-time mode.
Save TS Packets	Saves the transport packets from a pcap file with the current IP filtering. Only available in deferred mode.
Recent Files	Lists the most recently analyzed files. Select a file name to reanalyze the file.
Close	Stop and close the current analysis, leaving the TSCA open.
Exit	Exits the TSCA.

Navigation Menu

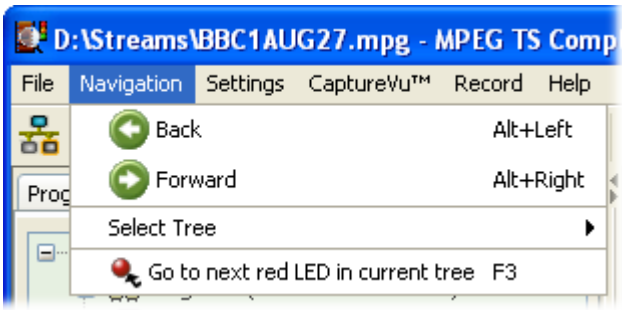


Table 10: Navigation menu options

Command	Function
Back	Returns to previous view.
Forward	Goes to next view.
Select Tree	Allows selection of a navigation view (Programs, Tests, SI/PSI, PIDs, Packets).
Go to next red LED in current tree	Goes to and highlights the next leaf node with an error; parent nodes are passed over since they only indicate lower level errors.

Settings Menu

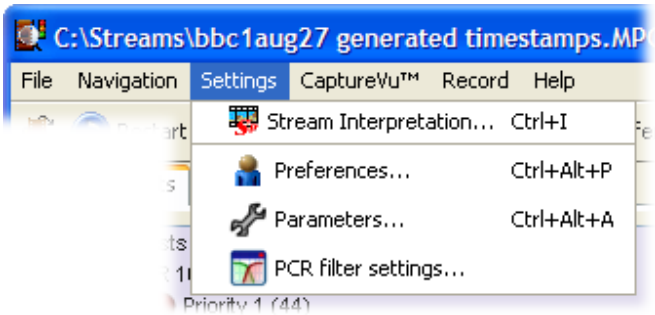


Table 11: Settings menu options

Command	Function
Stream Interpretation...	Opens the Stream Interpretation dialog box (see page 21); the current settings can be changed; analysis will be restarted when the new settings are accepted.
Preferences…	Opens the Preferences dialog box which enables interface management (see *Preferences*, page 147).

Table 11: Settings menu options (Cont.)

Command	Function
Parameters…	Opens the Parameters dialog box which allows all stream parameters to be viewed and edited.
PCR filter settings...	Opens the PCR Drift/Jitter Demarcation Filters dialog box which allows PCR drift and PCR jitter to be differentiated.

CaptureVu Menu

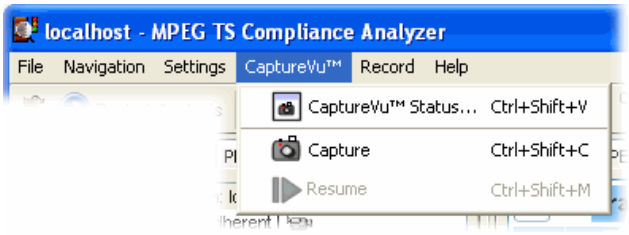


Table 12: CaptureVu menu options

Command	Function
CaptureVu Status…	Opens the CaptureVu status dialog box.
Capture	Pauses the current analysis to allow detailed inspection.
Resume	Resumes analysis (only available in deferred analysis mode.)

Record Menu

The Record menu is only available during real-time analysis.

Table 13: Record menu options

Command	Function
Record Settings	Opens the Record Settings dialog box.
Arm	Arms the record function.
Start	Starts recording.
Stop	Stops recording.

Help Menu

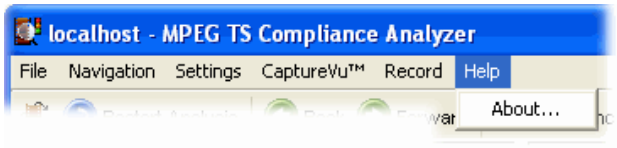


Table 14: Help menu options

Command	Function
About…	Displays application and system information.

Preferences

Three options are offered when the Preferences dialog box is opened (Settings > Preferences...): General, Font, and Decode.

General

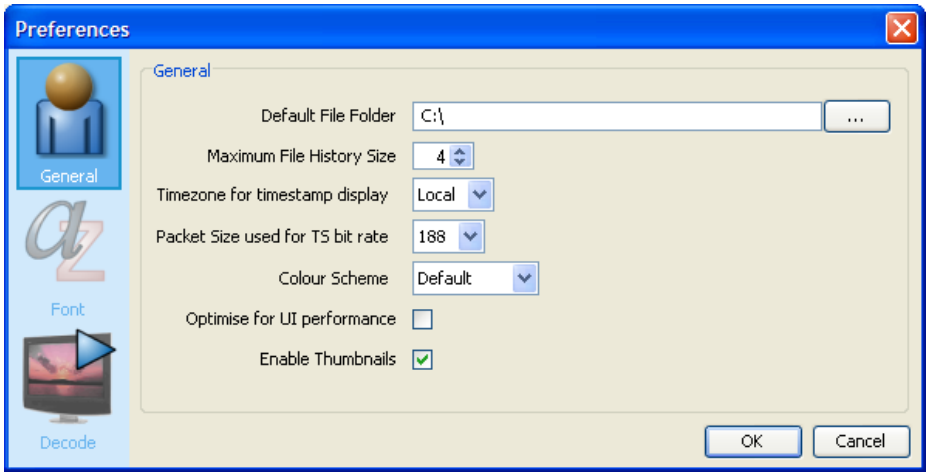


Figure 76: Preferences - General

The General preferences option allows you to specify a default folder for loading and saving files. Either enter the path required or use the browse button to locate the folder. Select OK to save the setting and close the dialog box.

Default File Folder: Specify the default folder for loading and saving files.

Maximum File History Size:
Specify the maximum number of file names to be shown in the File > Recent Files list.

Timezone for timestamp display:
This selection is not currently used. Ensure that it is set to **Local**.

Packet Size used for TS bit rate:
Specify the packet size (188 or 204) to be used to calculate the transport stream bit rate. This is displayed in the status bar.

Color Scheme: Select the background color for all graphs. When Default is selected, the graphs are based on a white background. When Instrument is selected, the graphs are based on a black backgrounds.

Optimize for UI performance:
Under some circumstances when analyzing large files or using low specification instruments, the user interface may appear to freeze until the deferred analysis is complete. Enabling this feature will cause the user interface to refresh at more regular intervals, thus reassuring you that the analysis is progressing.

Enable thumbnails: Thumbnail views of program content will be displayed when this option is enabled.

Font

The Font preferences option allows you to specify the display font and size for log entries and stream content. Place the cursor in the field to be changed and select the font name or font size required from the displayed drop-down list.

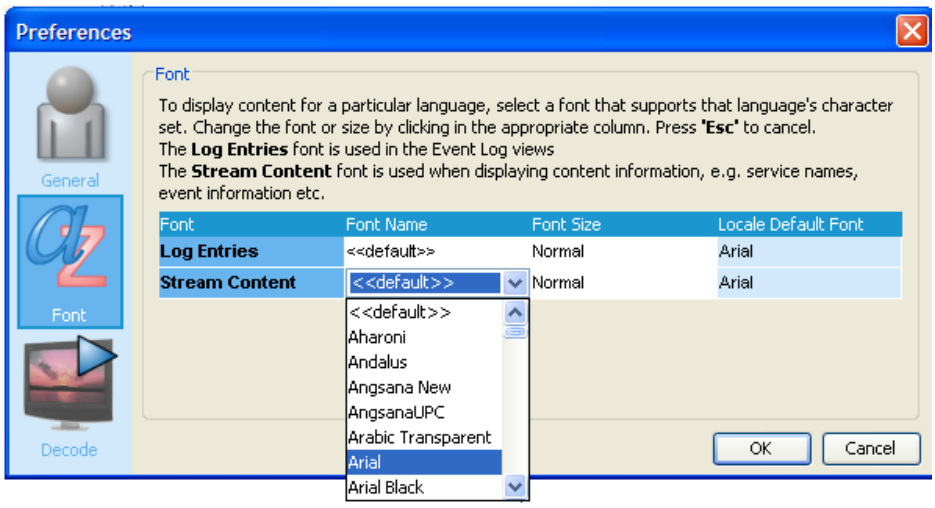


Figure 77: Preferences - Font

Decode

The decode preferences relate to the VLC Media Player that can be used to play elementary stream video and audio content.

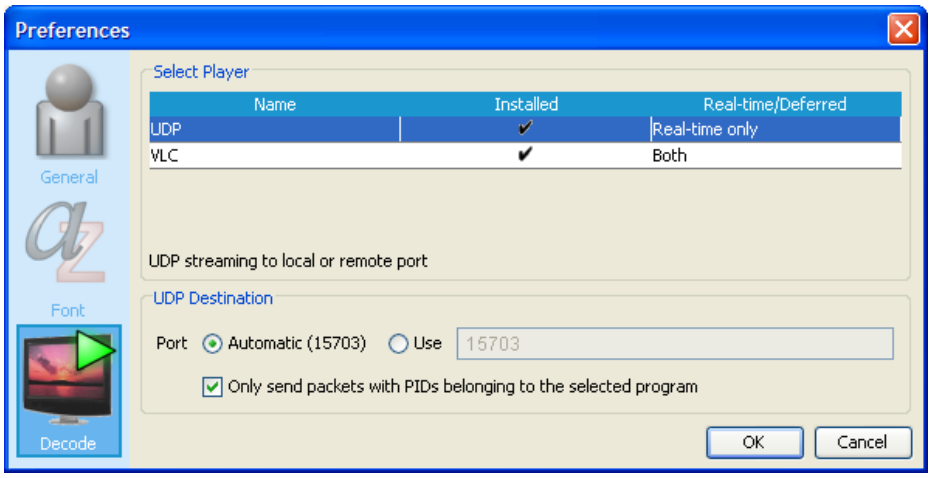


Figure 78: Preferences - Decode

VLC. Selecting the VLC setting indicates that a stream should be sent to the VLC Media Player.

UDP. The UDP setting, which is only available for real time systems, is used to designate the port over which streams should be sent to external players, for example, the MPlayer. The UDP Destination can be set either automatically or manually.

Script Files

In the TSCA, scripts provide a method of interpreting and displaying standards during analysis. Scripts provide templates, which determine how the SI information found during stream analysis will be displayed. The scripts must cater for all the information that is found in a stream, including the various table types found in all of the identified standards. To this end, it has been found that the best approach is to make the scripts modular; each script module deals with different aspects of the SI and standards.

For example, when DVB is identified as the standard against which to analyze, the scripting dialog box displays a list of Script modules. Additionally, when it is known that tables or descriptors not commonly carried in the identified base standard and region are likely to be included, extra scripts can be written and added to the Script Files list to be used for the analysis.

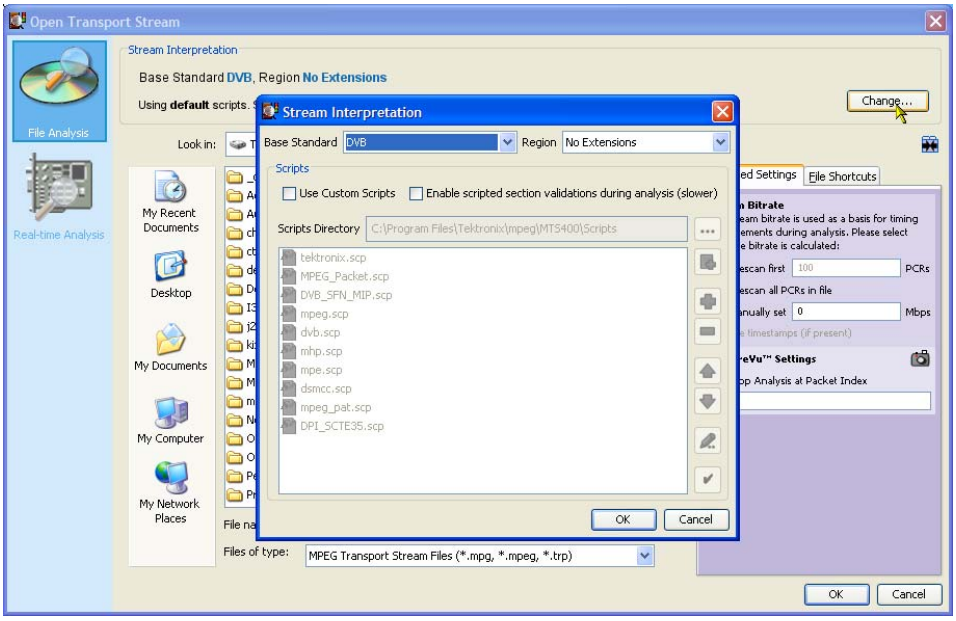


Figure 79: Stream Interpretation dialog box

Essential scripts are installed and enabled using the Stream Interpretation dialog box. In the absence of any enabled scripts, only the PAT table will be analyzed, and all other data will be presented as private data.

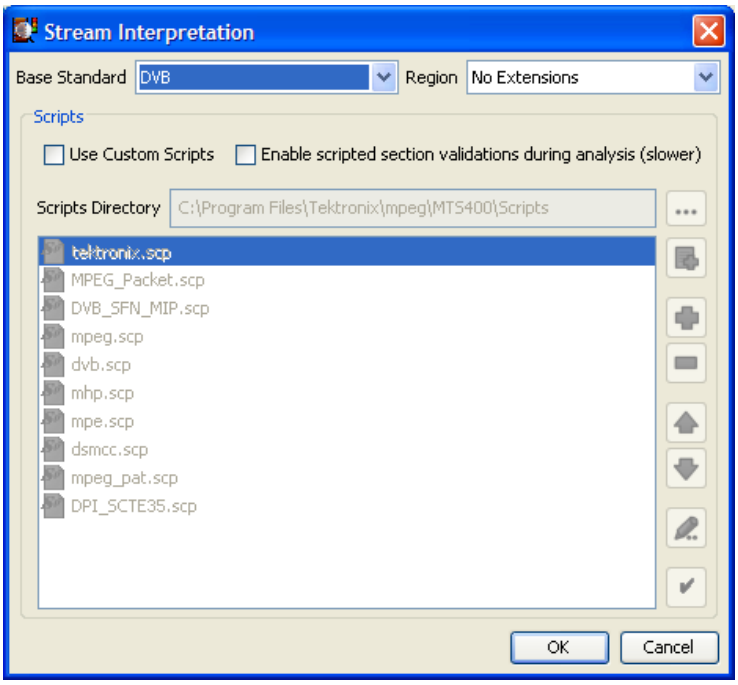
Scripts can be customized or new scripts can be written to analyze private data. With the Custom Scripts checkbox enabled, if a suitably configured script is selected and enabled before a stream is analyzed, custom data will also be analyzed when the stream is opened.

Scripts can be selected and enabled when files are open; analysis will restart as soon as any changes as accepted.

A script file will not be used for analysis until it is present in the Script Files panel of the Open Transport Stream dialog box.

Setting Stream Interpretation

Set the stream interpretation as follows:



1. From the Base Standard drop-down list, select the required base standard.

   The selected standard will dictate the availability of options that are available in the Regions drop-down list.

2. From the Region drop-down list, select the required region.

   The regions list allows country-specific extensions to be added to the base standard scripts. If No Extensions is selected, only the standard scripts are listed in the script list. The remaining country-specific extensions add extra scripts to the current listing. Scripts that will be used are listed in the main pane.

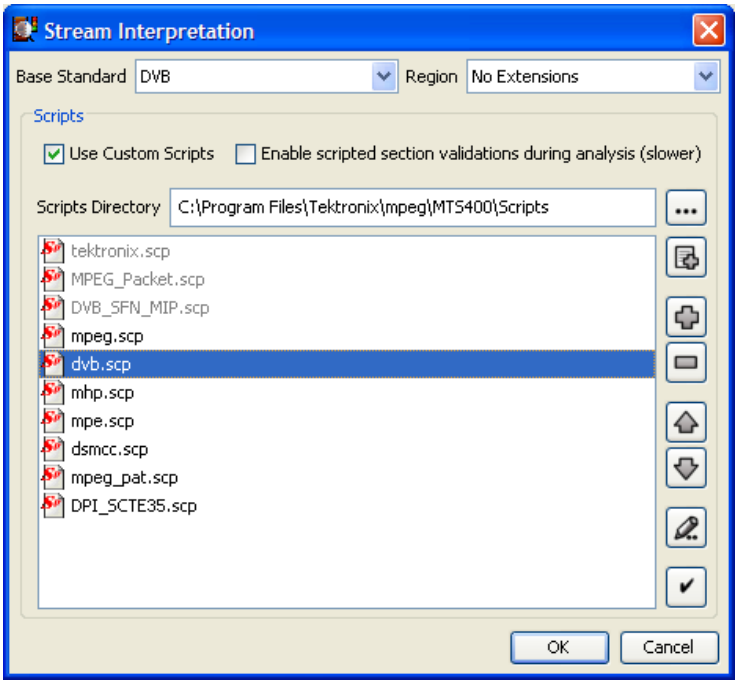
   Scripts listed by default are resident in the default installation directory (program files\tektronix\mpeg\mts400\scripts). Other directory locations can be specified in the custom script selection mode. All selections will be retained between TSCA sessions.

3. Select OK to confirm changes.

Scripts are syntactically analyzed when the OK button is selected. A fault in the syntax of a script will not necessarily prevent a stream from being analyzed, but it may also result in an incomplete analysis of the stream. Errors in the script syntax will be noted in the stream log.

Custom Script Selection

When the Custom Scripts checkbox is enabled, the buttons beside the script listing become active and custom scripts can be selected in addition to the standard scripts. Some script names in the listing are dimmed; these are considered to be essential and cannot be removed.



The buttons operate as follows:

Resets the script list to the default list for the standard and region.

Opens the script selection dialog box. You can highlight the required script and select OK. Note that the script name is added to the Script Files list.

Removes any script name highlighted in the Script Files list.

Scripts are applied to streams in the order that they are listed in the Script Files list. Use these buttons to move a highlighted script up and down in the list.

Opens the highlighted script in ScriptPad (the Tektronix script editor).

Verifies the syntax of the scripts listed in the Script Files pane. A message window lists any errors found.

If the standard script list has been changed and you want to return to the default list of scripts, highlight the Base Standard and Region required, and select the default script button. The list will be overwritten with the default list.

(More information about ScriptPad can be found in the *MTS400 MPEG Test System User Manual*.)

Scripts Directory

The Scripts Directory field indicates the root directory for scripts named in the Script Files list when analysis starts. If scripts are not present in the scripts directory, the interpretation and validation of the SI will be incomplete.

***NOTE**. If the script list is modified in any way, always use the ✓ button to verify the changes.*

Scripts can be selected from any directory (using the + button). If the directory is not the same as that identified in the Scripts Directory field, the path (either relative or absolute) will be displayed with the script name in the Script Files list.

***NOTE**. The Scripts Directory browse button allows you to specify a default directory for script selection. The browse window does not display the scripts available. If you need to see the scripts available, use the Windows Explorer.*

If the standard script list has been customized and you want to return to the default list of scripts, highlight the required Base Standard and Region and select the default script button. The list will be overwritten with the default list.

***NOTE**. Each Base Standard and Region combination can be individually customized.*

Script Validation

Validating scripts checks the syntax of the listed scripts.

If the “Enable scripted section validations during analysis” check box is enabled, the scripts are checked during analysis to ensure that the data as defined by the scripts is as expected (for example, values are within specified ranges). A fault in the syntax of a script will not necessarily prevent a stream from being analyzed, but it may also result in an incomplete analysis of the stream. Errors in script validation will be logged in the stream error log. Enabling this check box can have an impact on real-time analysis.

Task Examples

The examples in this section describe how to locate a fault or information using the analyzer.

The examples assume a basic understanding of the analyzer user interface and that you are familiar with the more important aspects of digital television transport stream structure and interpretation standards.

The MPEG Test System is a tool which allows you to analyze a transport stream and then examine it in detail. Errors in the content can be identified and examined to byte level.

Because of the comprehensive nature of the analyzer, there are a number of ways of achieving your objective. In these examples, one or more ways are described to achieve the objective.

Error Status

LED icons are used throughout the analyzer interface to represent the status of the tests applied to associated items, for example, programs. Colors used are as follows:


(Red) Error; test failed


(Yellow) Transient error (error not currently being detected but has been seen since last reset)


(Green) No error; test passed


(Dark Blue) Warning (Interface tab only)


(Light Blue) Transient warning (warning not current, but has been detected since last reset) (Interface tab only)


(Gray): Test disabled


(White) Test not applicable or unknown state


(Red) PID referenced but not found in the stream


(Green) PID referenced but not found in the stream; applicable test disabled.

When an LED represents a parent node in a tree (for example, a program node is the parent of elementary stream nodes) or a navigation tab, the color represents the worst case of all of its tests and the worst case of all of the tests represented by its child nodes.

Similarly, when an LED representing a parent node in a tree is disabled or enabled, all subsidiary (or child) nodes are also disabled or enabled to reflect the state of the parent node. When an LED representing a parent node is reset, all the child nodes are also reset.

Which tests have failed in an analyzed stream?

In this example, the analyzer has just finished analyzing a stream. The Program navigation view is initially displayed with the transport stream tree collapsed. The transport stream error LED is red, indicating that one or more tests have failed (see also page 41).

Method With the Program tab still selected, view the tests summary view (bottom right).

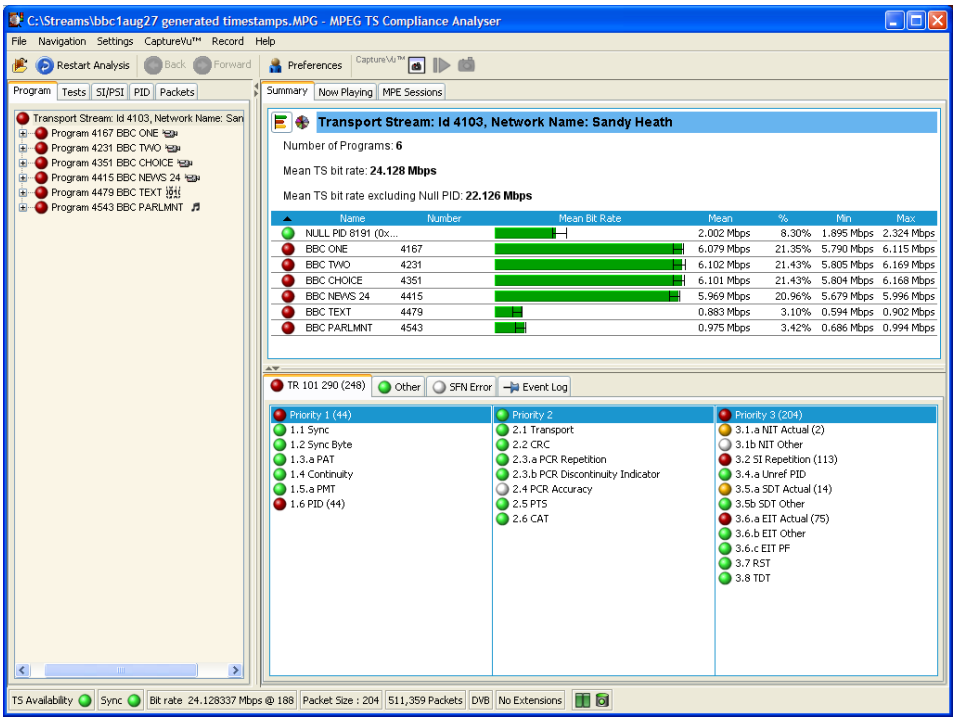


Figure 80: Failed tests - example

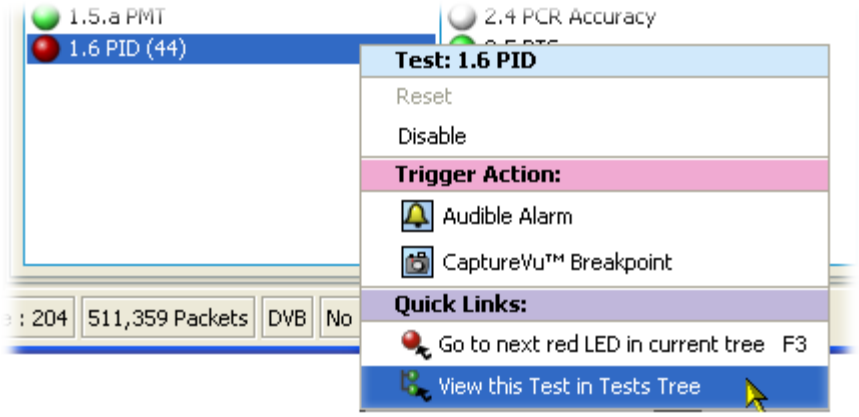
Identify the tests that have failed (red LED). As shown in Figure 80, in test summary view (TR 101 290 tab), the following tests have failed:

- First Priority: 1.6 PID

- Third Priority: 3.1a NIT Actual; 3.2 SI Repetition; 3.5a SDT Actual; 3.6a EIT Actual

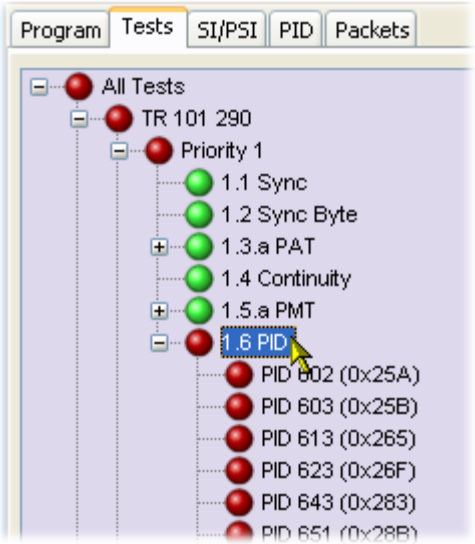
Remember that the tests may be distributed over more than one tab in the test summary view; the color of the LED on the tab helps you locate the failed tests (for example, the Other tab in Figure 80).

You can view a test (and see other PIDs that it has failed on) by highlighting a test and selecting “View this Test in Tests Tree” from the shortcut menu:



You can also display the fault by expanding the tree in the Tests navigation view until the fault is revealed.

Expanding the test itself reveals the PIDs that have failed the test.

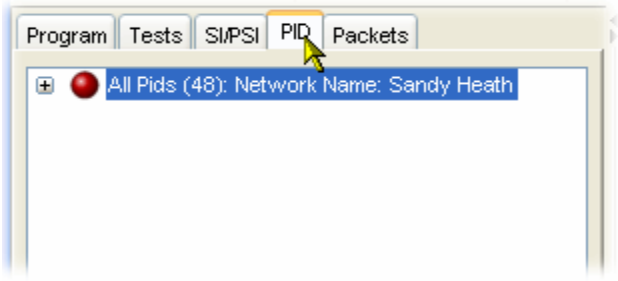


How many PIDs are there in a stream?
How many PIDs are referenced?
How many are unreferenced?

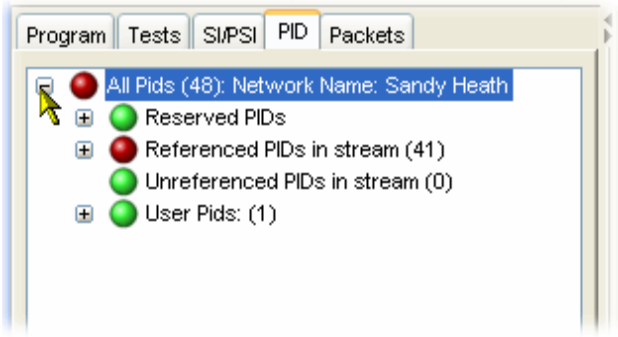
For this task, the PID navigation view is used to view information about individual PIDs in the transport stream. Under the All PIDs node, which displays all of the PIDs in the summary view, there are four subgroup nodes: Reserved PIDs, Referenced PIDs, Unreferenced PIDs, and User PIDs. The number (in parenthesis) in each node gives the number of PIDs found during analysis.

Method

1. Select the PID navigation view.

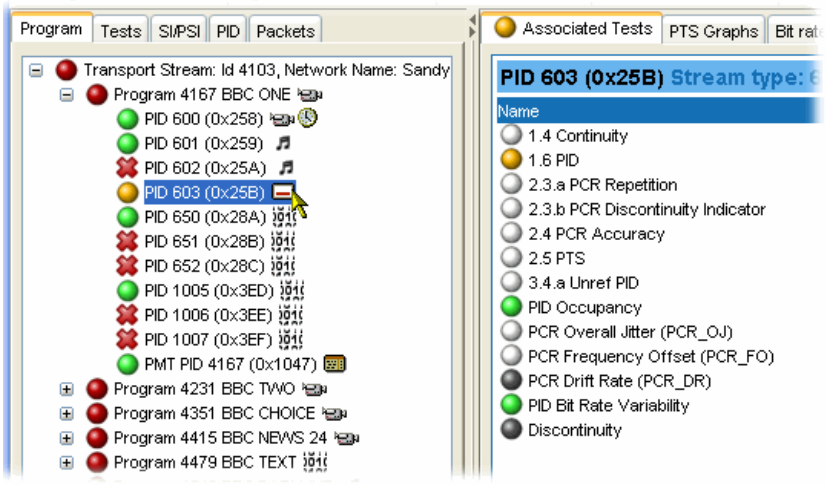


2. Expand the All PIDs node to display the subgroups (and their quantities).



What tests have been applied to a program PID?

1. Select the Program navigation view.



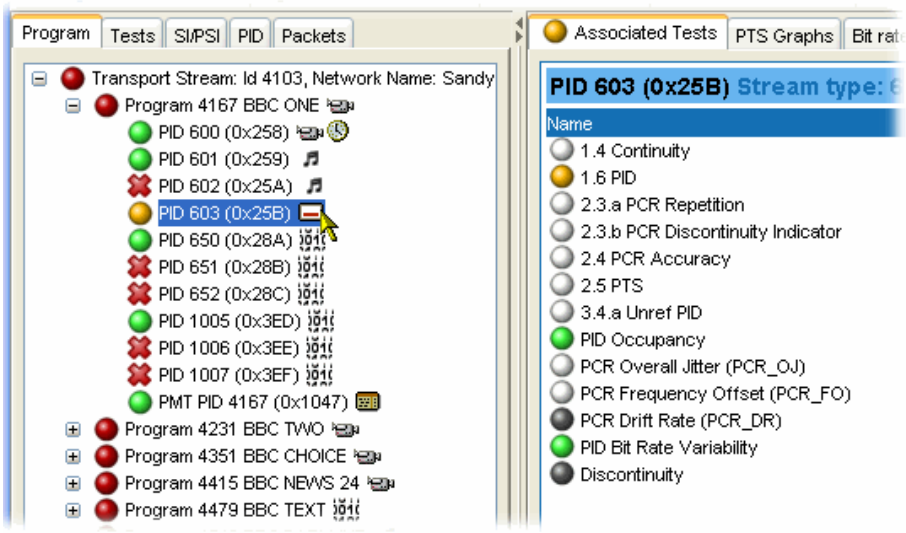
2. Expand the Transport Stream tree until the required PID can be highlighted.

In the Associated Tests view, note the tests that are enabled. Gray LEDs indicate tests that have been disabled, and white LEDs indicate tests that are not applicable to the selected PID.

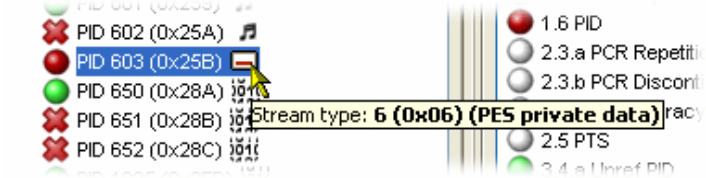
Establish the Stream Type of a PID

Method 1

1. Select the Program navigation view.



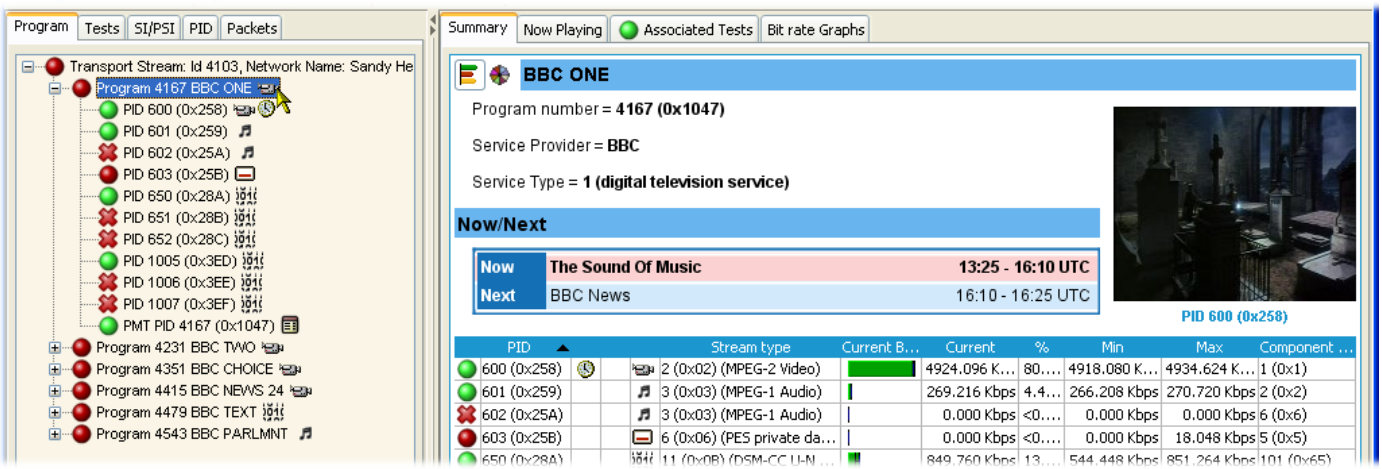
2. Expand the Transport Stream tree until the required PID can be highlighted.
3. Keep the cursor over the PID. A tooltip will display the stream type.



The tooltip is available wherever the selected PID node is displayed (for example, in the PID navigation view).

Method 2

1. Select the Program navigation view.
2. Select the program node.
3. In the summary view, select the Summary tab.



Note the Stream Type column in the display. The stream type is given for each PID in the selected program.

How many programs are there in the stream?

1. Select the Program navigation view.
2. Expand the Transport Stream tree and note the number of program nodes (see Figure 81).
3. The Summary view (bar chart or pie chart) also displays a program count.

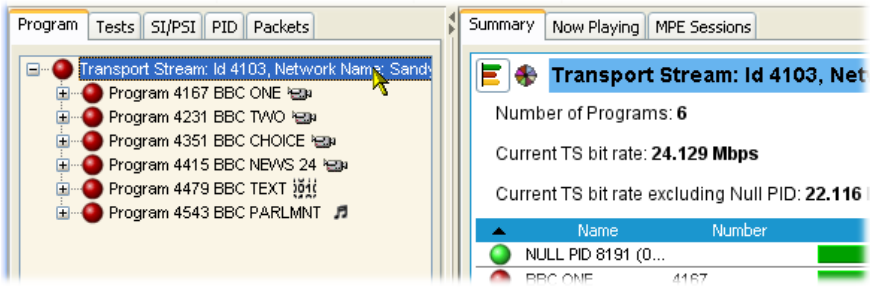


Figure 81: Program count

What are the contents of the programs? And what PIDs are they on?

1. Select the Program navigation view.
2. Expand the Transport Stream tree and a program node (see Figure 82).
3. Note the number of program PIDs. Note also that each PID is accompanied by an icon indicating the stream type. Hover the cursor over a PID node to display more information.
4. The Summary and the PID Information views also display the program PIDs.

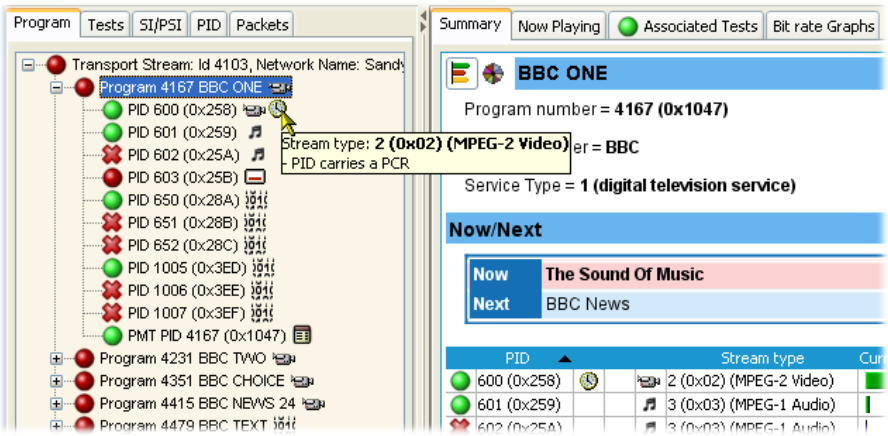


Figure 82: PID count

What is the bit rate of each PID in a program?

Bit rates are displayed in the Program and PID summary views. The bit rates displayed depend on the node highlighted in the navigation view.

Table 15: Bit rate views

Navigation view	Node	Bit rates displayed in Summary view
Program	Transport Stream	All programs
Program	Program	Program PIDs
PID	All PIDs	All PIDs
PID	Secondary nodes (Reserved, Referenced, Unreferenced, and User)	PIDs in secondary groups PIDs

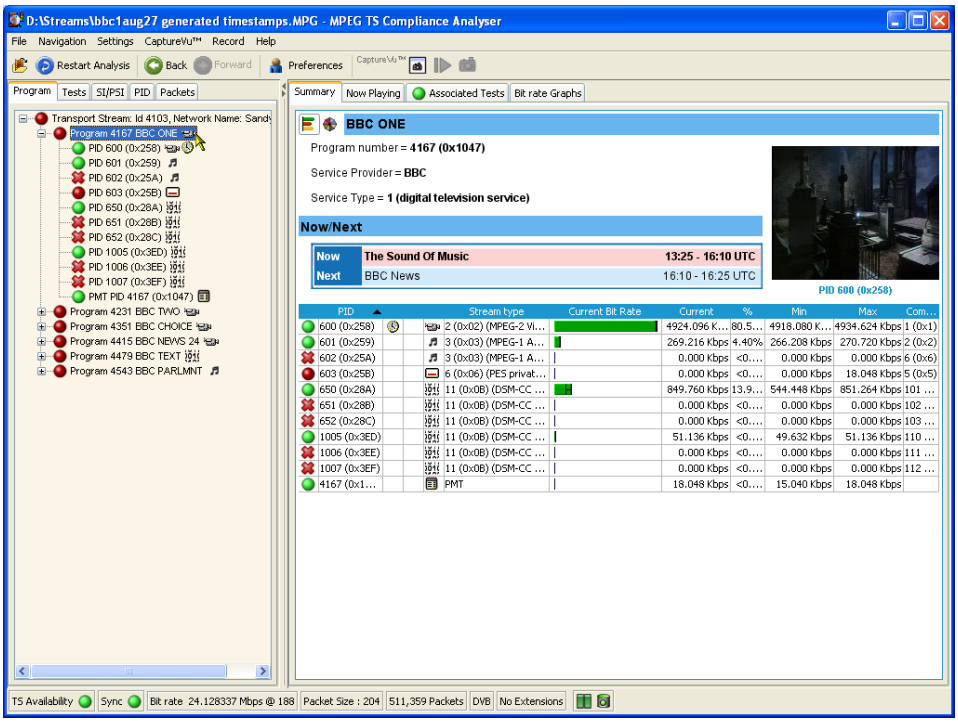


Figure 83: Program PID bit rate - bar chart

The PID bit rate summaries can be displayed as either bar charts or pie charts by selecting the appropriate icon at the top left of the Summary view.

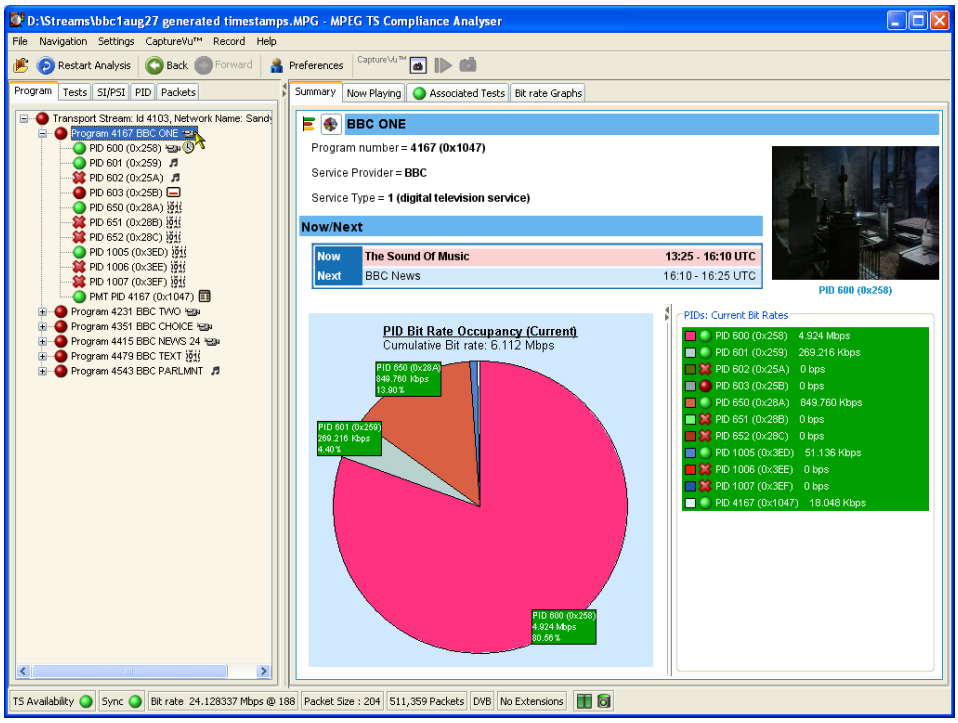


Figure 84: Program PID bit rate - pie chart

A selection of statistics for each program or PID is shown in the charts. Either current or mean bit rates can be shown by selecting the Show Mean Values option from the Summary view shortcut menu. For deferred analysis, the current bit rate is the final bit rate.

You can also display a bit rate graph for the highlighted node by selecting the Bit Rate Graphs tab.

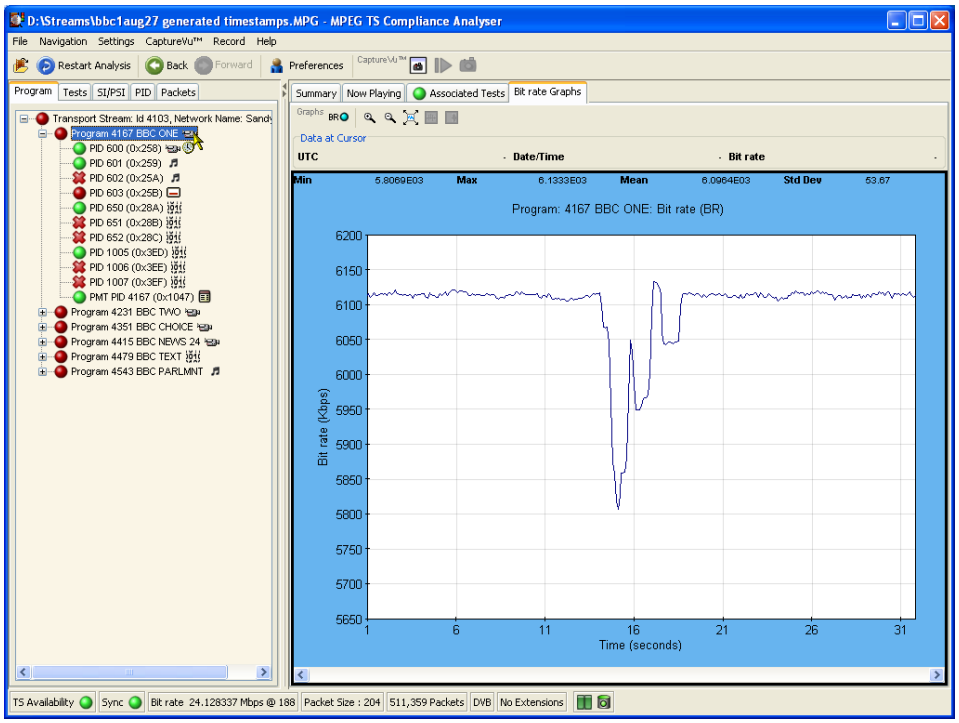


Figure 85: Bit rate graph

What is the latest version number of the Program Association Table (PAT) in the SI?

Tables and their versions can be found in the Tables (SI/PSI) view. When a node representing a table is selected in the navigation view, the table identity and the version are displayed in summary view (top right) as shown in Figure 86.

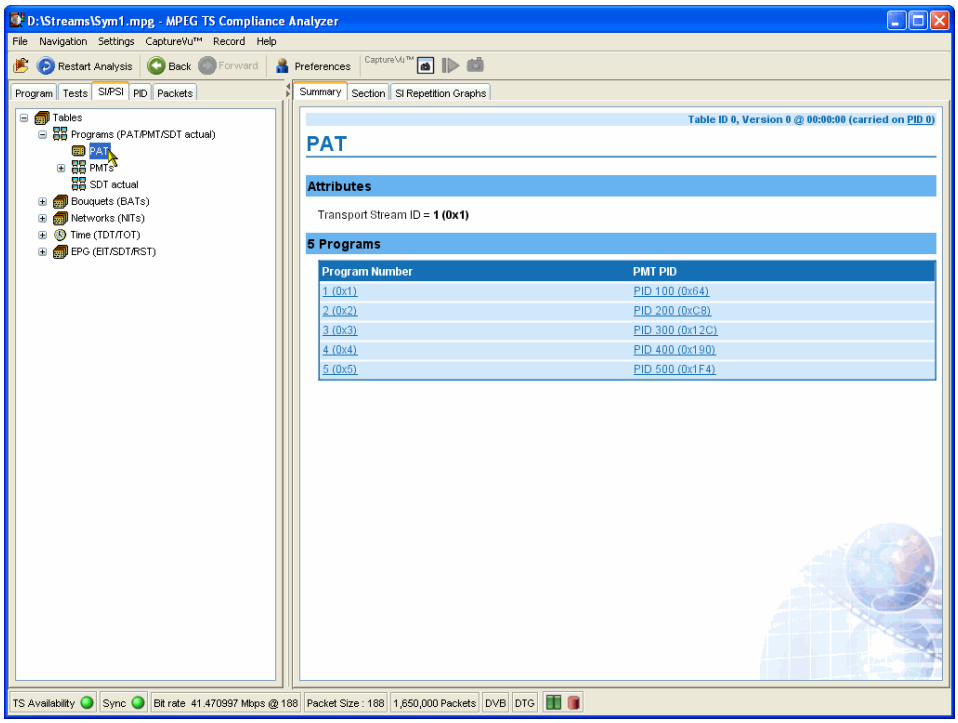


Figure 86: Table Identity and Version (summary view)

The table identity and version can also be seen in the table header using the Tables (SI/PSI) section view as shown in Figure 87.

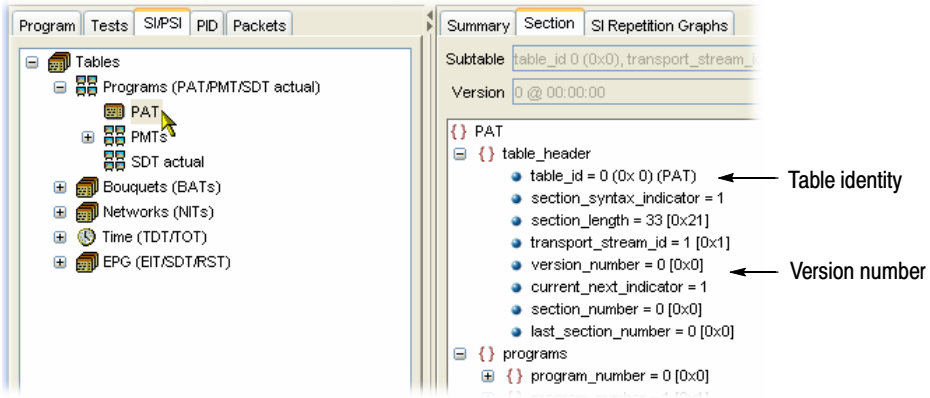


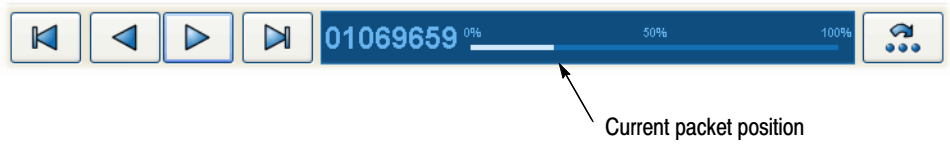
Figure 87: Table Identity and Version (section view)

Examine a Transport Packet

A transport stream packet is a unit of data that contains a header and a payload. The Packets view allows individual transport stream packets to be identified and examined.

Navigating around the Packets

The navigation bar at the top of the Packet summary view is used to move between packets. How the controls work depends on the selection in the Packets navigation view. If All Packets is highlighted, the controls will operate on all packets. If a PID has been identified, added to the PIDs node and highlighted, the controls will operate only on packets carrying the selected PID.



The packet position bar shows the position of the selected packet in the stream.

The controls work as follows:

	Selects the first available packet (in the stream or carrying the selected PID).
	Selects the previous available packet (in the stream or carrying the selected PID).
	Selects the next available packet (in the stream or carrying the selected PID).

	Selects the last available packet (in the stream or carrying the selected PID).
	Opens the Go to packet... dialog box.

The packet position bar can also be used to navigate through the stream. You can use the cursor to point to and click the next packet to be displayed. Similarly, double-click the packet number in the bar and enter the required packet number in the Go to packet... dialog box.

Looking at the Packet

Having identified and selected a packet, the Packets summary view displays the interpreted code and the raw data in hexadecimal and ASCII format.

SI/PSI Nodes

The Tables view (SI/PSI tab) displays the service information in tree form. The tree represents all of the service information tables found in the analyzed stream that comply with the selected digital video standard (including MPEG program specific information, DVB service information, and ATSC and ISDB program and system information protocol). The tree contains nodes for each table found; tables and nodes are grouped together functionally.

This section identifies the nodes that may be present for each standard.

Figure 88 shows an example of Table navigation view with DVB stream interpretation selected.

Tables 16 to 20 show the nodes that may be displayed in the SI/PSI navigation view depending on the selected interpretation standard and the content of the stream.

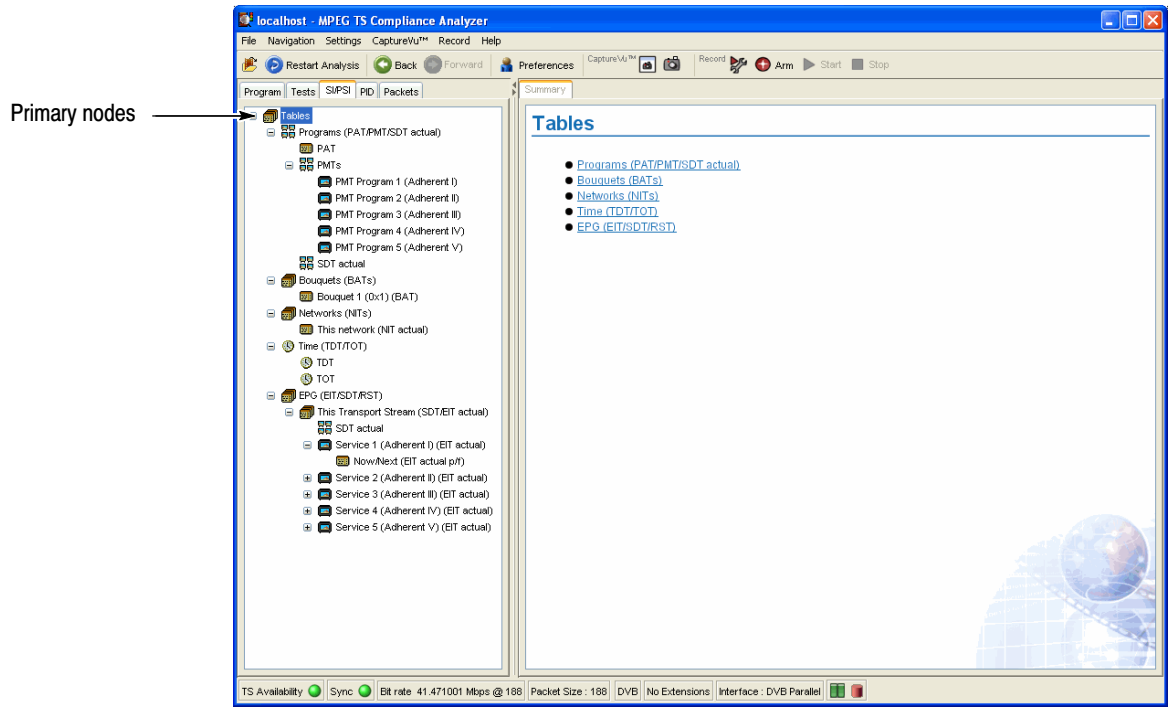


Figure 88: Primary SI/PSI nodes (DVB example)

Table 16: MPEG SI/PSI

Primary node	Subsidiary node
TS info	
	TSDT
Programs	
	PAT
	PMT PIDs
Conditional access	
	CAT
Other Tables	

Table 17: DVB SI/PSI

Primary node	Subsidiary node 1	Subsidiary node 2	Subsidiary node 3
TS info			
	Partial TS		
		DIT	
		SIT	
	BIT		
Programs			
	PAT		
	PMT PIDs		
		PMT PID +	
	SDT		
Bouquets			
	BAT		
Conditional access			
	CAT		
Networks			
	NIT - This		
	NIT - Other		
Time			
	TOT		

Table 17: DVB SI/PSI (Cont.)

Primary node	Subsidiary node 1	Subsidiary node 2	Subsidiary node 3
	TDT		
EPG			
	This TS		
		SDT Actual	
		Service (number, name)	
			Now/Next (EIT P/F)
			Schedule (EIT schedule)
	Other TS		
		SDT Other	
		Service (number, name)	
			Now/Next (EIT P/F)
	RST		
MHP apps			
Other tables			

Table 18: ATSC SI/PSI

Primary node	Subsidiary node 1	Subsidiary node 2	Subsidiary node 3	Subsidiary node 4
TS info				
	MGT			
Programs				
	PAT			
	PMT PIDs			
	VCT C/T			
	ETT-V			
Conditional access				
	CAT			
Ratings				
	RRT+			
Time				

Table 18: ATSC SI/PSI (Cont.)

Primary node	Subsidiary node 1	Subsidiary node 2	Subsidiary node 3	Subsidiary node 4
	STT			
EPG				
	Source/Services			
		EIT0 > EIT127		
Directed channel change				
	DCCT id +			
	DCCSCT			
Other tables				

Table 19: ISDB-S SI/PSI nodes

Primary node	Subsidiary node 1	Subsidiary node 2	Subsidiary node 3	Subsidiary node 4
TS info				
	Partial TS			
		DIT		
		SIT		
	BIT			
Programs				
	PAT			
	PMT PIDs			
	SDT			
Conditional access				
	CAT			
Networks				
	NIT - This			
	NIT - Other			
Time				
	TOT			
EPG				
	This TS			
		SDT Actual		
		Service (number, name)		

Table 19: ISDB-S SI/PSI nodes (Cont.)

Primary node	Subsidiary node 1	Subsidiary node 2	Subsidiary node 3	Subsidiary node 4
			Now/Next (EIT P/F)	
			Basic Schedule (EIT schedule)	
			Extended Schedule (EIT schedule)	
	Other TS			
		SDT Other		
		Service (number, name)		
			Now/Next (EIT P/F)	
			Basic Schedule (EIT schedule)	
			Extended Schedule (EIT schedule)	
	Maker id/model id +			
Other tables				

Table 20: ISDB-T SI/PSI nodes

Primary node	Subsidiary node 1	Subsidiary node 2	Subsidiary node 3	Subsidiary node 4
TS info				
	Partial TS			
		DIT		
		SIT		
	BIT			
Programs				
	PAT			
	PMT PIDs			
	SDT			
Conditional access				
	CAT			
Networks				
	NIT - This			
	NIT - Other			
Time				

Table 20: ISDB-T SI/PSI nodes (Cont.)

Primary node	Subsidiary node 1	Subsidiary node 2	Subsidiary node 3	Subsidiary node 4
	TOT			
EPG				
	This TS			
		SDT Actual		
		H		
			Service (number, name)	
				Now/Next (EIT P/F)
				Basic Schedule (EIT schedule)
				Extended Schedule (EIT schedule)
		M		
			Service (number, name)	
				Now/Next (EIT P/F)
				Basic Schedule (EIT schedule)
				Extended Schedule (EIT schedule)
		L		
			Service (number, name)	
				Now/Next (EIT P/F)
				Basic Schedule (EIT schedule)
				Extended Schedule (EIT schedule)
SDTT				
	SDTT(H)			
		Maker id/model id +		
	SDTT(L)			
		Maker id/model id +		
Other tables				