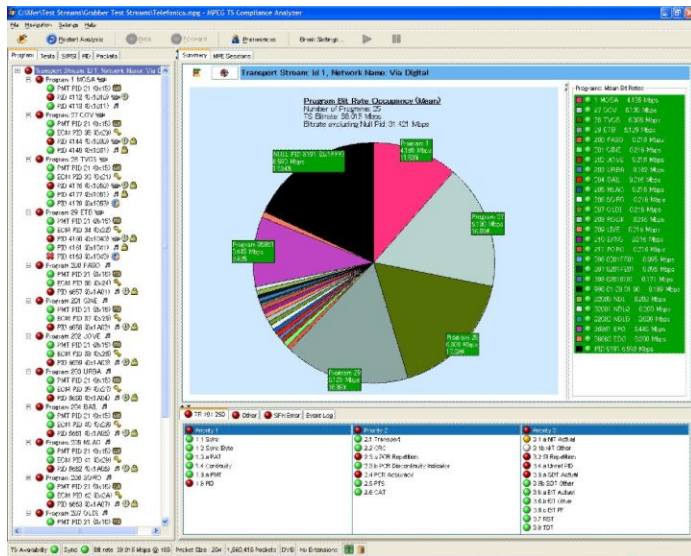


# MPEG Test Systems

## MTS4SA Datasheet



The MTS4SA Transport Stream Compliance Analyzer is a new class of analysis tool, the world's first Compressed Digital Video Debugger/Analyzer that includes Tektronix CaptureVu® technology, a capability that captures and analyzes system events in real time to debug the intermittent and complex problems that traditional analyzers miss.

### Key features

- The MTS4SA software is purchased to run stand-alone on computers with Microsoft Windows 7, XP, or Vista operating systems
- Separate packages are available for Deferred-time Transport Stream Compliance Analysis, Real-time Video over IP Transport Stream Compliance Analysis, Transport Stream Multiplexing, Elementary Stream Analysis, PES and Buffer Analysis, Data Broadcast Carousel Analysis, and Data Broadcast Carousel Generation
- The industry's fastest analysis engine enables reduced time to insight, rapid development, evaluation, deployment, and diagnostics of next-generation DTV and IPTV systems and services
- Both Transport Stream Compliance Analyzer packages offer the CaptureVu technology and PCR measurement and graphing capabilities. CaptureVu technology captures and analyzes system events in real time (IP only) and deferred time to debug the intermittent and complex problems that traditional analyzers miss
- Innovative **program-centric** user interface brings expert power to the novice user
- Broadest and deepest range of analysis for legacy and next-generation compressed standards including MPEG-2, MPEG-4, H.264, and VC-1
- H.264 Thumbnail Decode, Buffer Analysis, and Multiplexing provide the most powerful suite of tools for creation and analysis of Transport

Streams containing H.264 content, supporting the needs of customers transitioning from MPEG-2 to H.264 technologies

- Customizable scripting supports the broadest range of ratified and evolving worldwide DTV standards

### Applications

- **Solution for equipment manufacturers - research and development**
  - CaptureVu technology allows rapid isolation and debugging of equipment and system faults
  - Multiplexer/Remultiplexer allows flexible test stream creation and modification
  - Rapid and in-depth analysis of selected elements of transport streams to confirm functionality and compliance to standards
  - Set-top box buffer testing and verification
  - Elementary stream analysis for codec design and optimization
- **Solution for equipment manufacturers – manufacturing test**
  - Equipment test is simplified and faster with CaptureVu and the high-speed analysis engine of the MTS4SA transport stream compliance analyzer
  - Multiplexer/Remultiplexer allows custom test stream creation for fast and flexible equipment stress testing
- **Solution for broadcasters and network operators**
  - CaptureVu technology allows isolation of intermittent network problems that other analyzers are not capable of isolating
  - Tests contribution feeds or encoder outputs, multiplexer inputs/outputs (IP only), and IP encapsulators
  - Tests PCR insertion, recovery, and regeneration equipment (IP only)
  - Encoder and other equipment fault diagnosis and evaluation (IP only)
  - Analysis of transport streams to confirm correct system operation and isolate faults during installation and commissioning

## Introduction and overview

The MTS4SA Transport Stream Compliance Analyzer offers significant enhancements over traditional software-based MPEG analyzers when operating in deferred time (stored streams). The combination of an innovative high-speed analysis engine and built-in intelligence allows ultra-fast pinpointing and debugging of intermittent faults in MPEG Transport Streams.

The MTS4SA Series also introduces real-time Video over IP analysis and recording with the users' own Microsoft Windows PCs equipped with a standard 10/100 or Gigabit Ethernet Network Interface Card (NIC).

Tektronix industry leadership offers the broadest (across multiple standards and video layers) and deepest (in-depth of generation and analysis) solution for compressed video test. The MTS4SA Series of stand-alone software products can be applied anywhere at any level, to diagnose and solve the most subtle, complex, and intermittent DTV problems in the minimum time.

The MTS4SA provides a comprehensive suite of analysis tools including Transport Stream (TS) compliance, buffer, PES, compressed video and audio Elementary Stream analyzers, together with TS Editor, Multiplexer, and Data Broadcast applications for stream creation, analysis, and error injection.

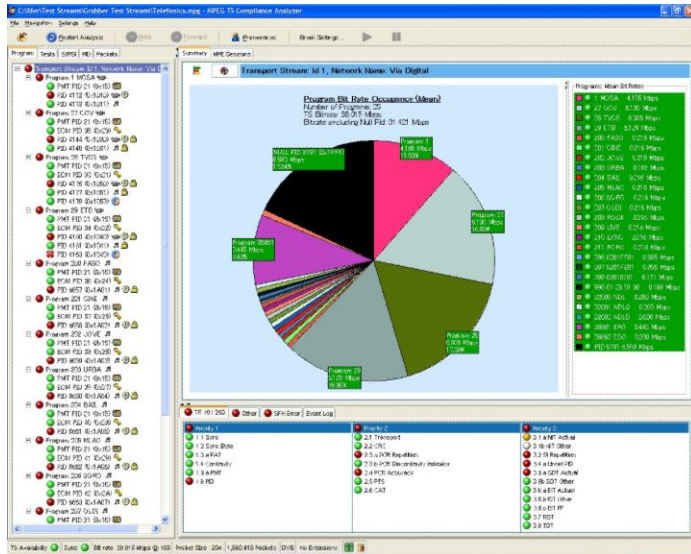
Standards compliance is ensured through built-in customizable scripting supporting the broadest ranges of ratified and evolving DTV standards, including ATSC, DVB-C, DVB-H, DVB-S, DVB-T, ISDB-S, ISDB-T, and MPEG. To keep analysis up to date, flexibility is the key. New standards and proprietary tables can easily be catered for by loading Tektronix-supplied updates or creating your own custom scripts.

## Technical features

- Powerful **TS Compliance Analyzer** with **CaptureVu** technology – integrated CaptureVu tool captures and analyzes system events both in real time (IP only) and deferred time
- Analysis engine that can analyze at up to 400 Mb/s offers greatly reduced deferred analysis time (up to 90% reduction compared with traditional analyzers)
- Video over IP and IPTV real- and deferred-time analysis and capture through the PC's Network Interface card (NIC):
  - Time-stamp information retained during IP session analysis provides deferred-time IP timing diagnostic capability
  - The world's most comprehensive suite of deferred-time analysis tools for compressed video can now be used with captures of complete IP sessions
  - IP diagnostic capabilities on the Transport Stream Compliance Analyzer for cross-layer diagnostics in systems where compressed content is carried over IP networks
  - IP diagnostic capabilities on the Transport Stream Compliance Analyzer for cross-layer diagnostics in systems where compressed content is carried over IP networks
  - IP and TS cross-layer timing graphing and measurement (Mean IP Packet Interarrival Time (PIT) statistical graphing, IP Packet Inspector, PCR Accuracy, PCR Arrival Interval, and PTS Arrival)
  - IGMP support – automatically issues an IGMP join command when connecting to multicast IP sessions and will issue IGMP leave when analysis is stopped
- Worldwide DTV standards (ATSC, DVB, and ISDB) supported through powerful user-definable scripting – offers flexibility to adapt product for customer's own protocols:
  - MPE, SFN, H.264, VC-1, MPEG-2, MPEG-4, and DVB-H table support
  - ATSC Closed Caption checking gives a visual indication to the user of whether closed captioning is signaled and/or present in a stream and tests whether PMT and EIT signaling are consistent with the actual Closed Captioning present within the video signal
  - SD and HD H.264 and MPEG2 video thumbnails with real-time video and audio decode available for unscrambled services
  - Bit rate measurements to TR 101 290 MGB2 Profile
- **Elementary Stream Analysis** support (including H.264, VC-1, MPEG-2, MPEG-4, and 3GPP)
- **Buffer Analysis** for testing T-STD buffer performance of AVC/H.264 and MPEG2 video CODEC streams
- **Multiplexer** application for creating and manipulating content into Transport Streams – the world's first offline multiplexer with support for manipulating H.264 Advanced Video Codec content into Transport Streams
- **Data Broadcast Generation and Analysis** packages for validating data broadcast products and services
- Unicode support displays service information in the user's local language (including double-byte character sets such as Chinese and Japanese)
- Error logs can be output in CSV or XML formats for compatibility with office applications supplied as standard

## Transport Stream Compliance Analyzer

The MPEG Transport Stream Compliance Analyzer (TSCA) enables monitoring and interpretation of the contents of real-time, previously recorded, or synthesized Transport Streams using the latest ATSC, DVB, ISDB, and MPEG standards.



The analyzer is specifically designed to enable quick location and identification of 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.

Users 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 can be purchased to run stand-alone on computers with Microsoft Windows 7, XP, or Vista operating systems. Separate packages are available for Deferred-time Analysis and Real-time Video over IP Analysis. Both packages offer CaptureVu technology plus IP and TS measurement, logging, and graphing capabilities.

### TSCA displays

- Program-centric summary screen with go/no-go error indication of user-specified tests
- SD and HD video thumbnails and real-time video and audio decode – H.264 and MPEG-2 supported
- CaptureVu technology/trigger views
- Hierarchical Tests display
- PCR, PTS, and Mean IP Packet Interarrival Time (PIT) graphing and measurement display
- SI/PSI/PSIP display
- Real-time and deferred-time EPG display
- Packet view for TS Packets, TS Sections, and IP Packets

- IP interface displays
- Real- and deferred-time analysis share the same displays and user interface

### TSCA features

- Easy program-centric UI 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
- Data summaries and automated filters simplify the analysis of complex Transport Streams
- TR 101 290 Priority 1, 2, and 3 tests
- Cross-layer Timing provides user with “at-a-glance” view of timing across multiple layers, enabling rapid time to insight when used with IP interfaces to diagnose at which layer a fault was introduced
- Statistical display of mean IP Packet Interarrival Time (histograms)
- IP real- or deferred-time inspection and analysis down to the IP Packet level – uses industry-standard PCAP file format for use with files captured using Wireshark (Ethereal)
- Syntax analysis and display supported for ISDB-T, TMCC, and IIP data, including One Seg support
- Consistency checks performed between SI, TMCC, and IIP data
- ATSC Closed Caption support and consistency checking
- Proprietary PSI/SI syntax section rate error testing
- Informational logging of detected events
- Unicode support enables service information to be displayed in Japanese, Chinese, or other languages
- Batch mode for integration into automated regression test systems

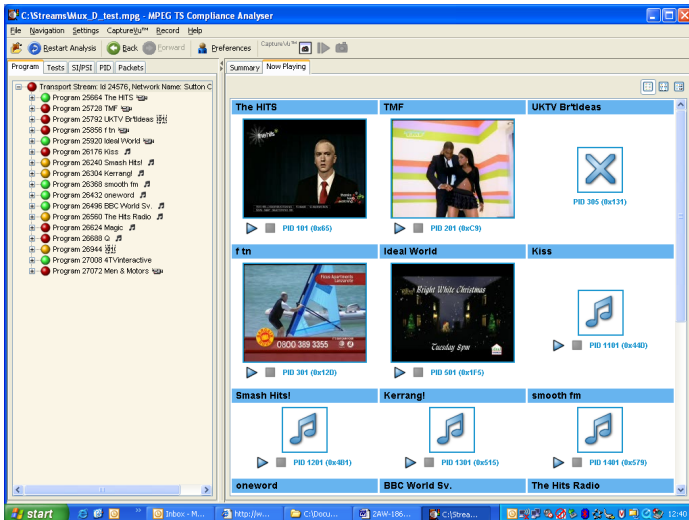
### Deferred- and real-time modes

The TSCA can be run in deferred-time or real-time for analysis of compressed video streams carried over an IP interface. Deferred-time analysis mode is available on any recommended platform. In deferred-time analysis mode, a stored stream can be analyzed and viewed at any time.

Using real-time analysis, live streams can be monitored on a continuous basis and can also be paused for more detailed deferred-time analysis. Real-time analysis can be resumed at any time. Real-time video and audio decode enables the user of the analyzer to select a program from within a Transport Stream and display the decoded video for viewing or listen to the audio. Video thumbnails with video wall, summary, and ES header information views enable users to choose whether to see many channels' thumbnails simultaneously or view detailed descriptions of one at a time.

## TSCA UI

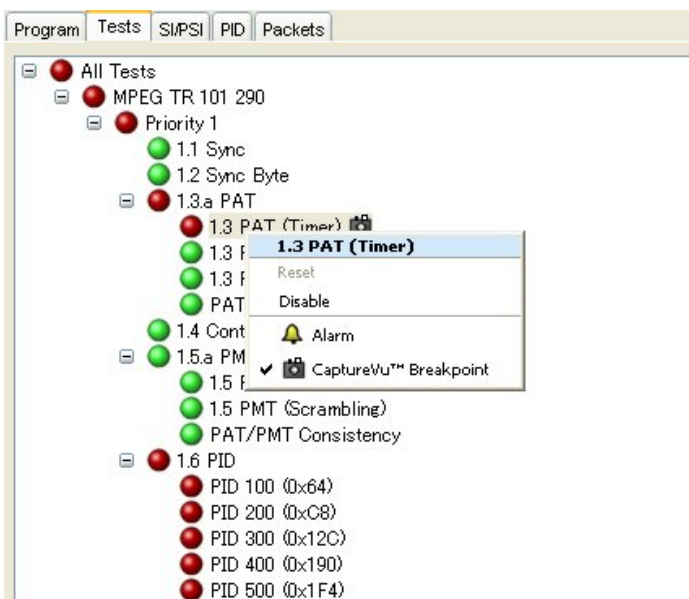
The TSCA software uses a single main program summary window with different context-sensitive views contained within tabbed frames. This provides the maximum amount of useful information while keeping the screen from appearing cluttered.



From the main window, you can access the following views:

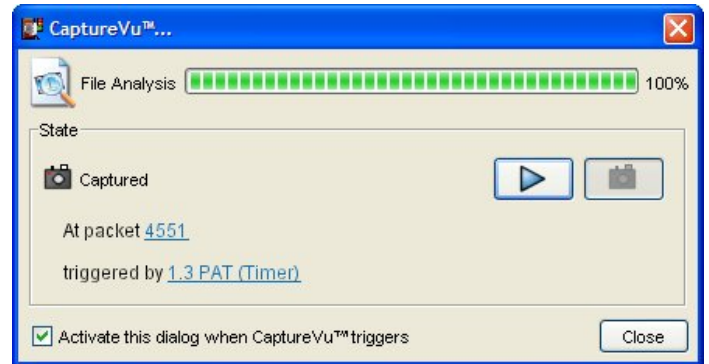
## CaptureVu technology

**CaptureVu** technology captures and analyzes system events in real time and deferred time to debug the intermittent and complex problems that traditional analyzers miss. CaptureVu technology lets the user set a **breakpoint** on a specific test or event and, when the breakpoint occurs, a dialog will show the breakpoint condition and exact location of the packet within the Transport Stream. CaptureVu technology automatically prebuffers the last 200 MB of the signal, pauses the analysis, and launches an in-depth deferred-time analysis that lets the user drill down into the problem.



The captured stream can also be permanently stored on the hard disk for subsequent reanalysis with the deferred-time TSCA application. This powerful debug mode enables fast debugging of troublesome intermittent problems. CaptureVu technology also supports triggering events based upon IP Layer measurements providing integrated cross-layer fault analysis and logging in a single box solution for network fault diagnosis.

## Triggered recording

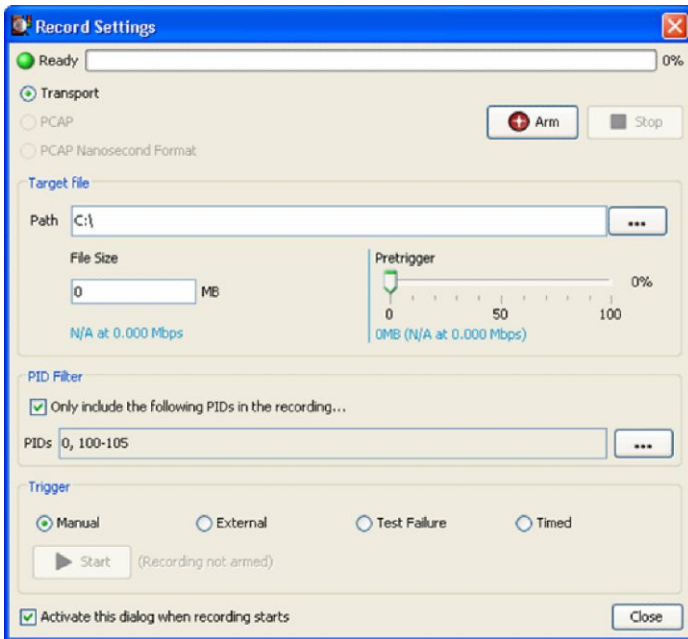


The TSCA supports triggered recording, allowing the user to set up a sophisticated trigger condition. When the trigger condition is met, the live input stream is captured to disk without stopping or pausing real-time analysis.

Trigger sources and conditions include:

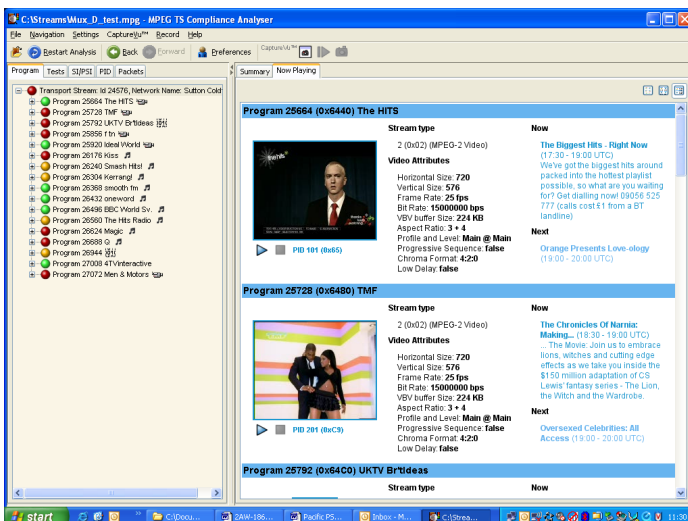
- DVB TR 101 290 1st, 2nd, 3rd priority tests, ATSC A/78, ISDB, or proprietary tests
- IP Layer measurements, including PIT tests, RTP dropped packet count and rate, out-of-order packets count and rate
- Multiplex occupancy outside user-defined bit rate limits
- Date and time
- In triggered recording mode, the size of the pretrigger buffer can be specified as a percentage of the overall file size range from 0 to 100%





## 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 DVB TR 101 290, ATSC A/78, or ISDB test results. Red, amber, and green LEDs highlight errors associated with each program or element. Video wall, summary, and detail views enable the user to choose whether to see many channels' thumbnails simultaneously or view detailed info of one at a time. Real-time video and audio decode enables the user of the analyzer to select a program from within a Transport Stream and display the decoded video for viewing or listen to the audio.

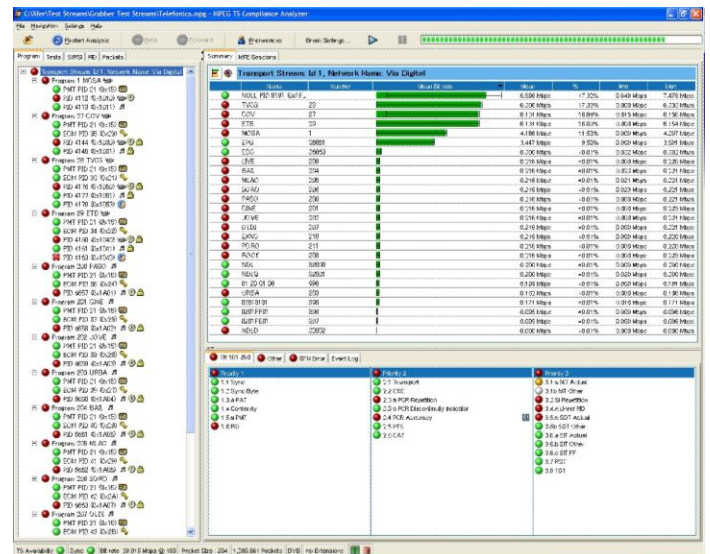


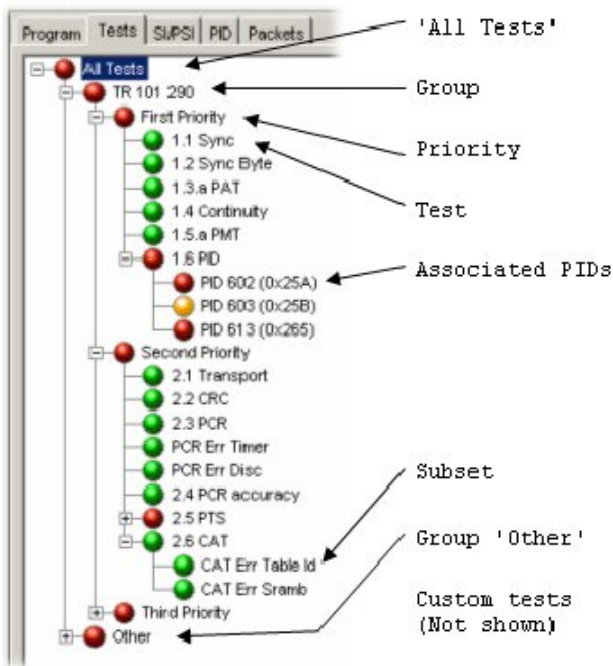
In addition to displaying a video thumbnail, the video format parameters from within ES headers are also displayed and can be checked for consistency with Transport Stream layer signaling of video parameters. This cross-check enables the operator to verify that the format of the content in the stream matches the format that they have signaled. An inconsistency could cause the STB to be unable to decode video and the viewers to lose their pictures.

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

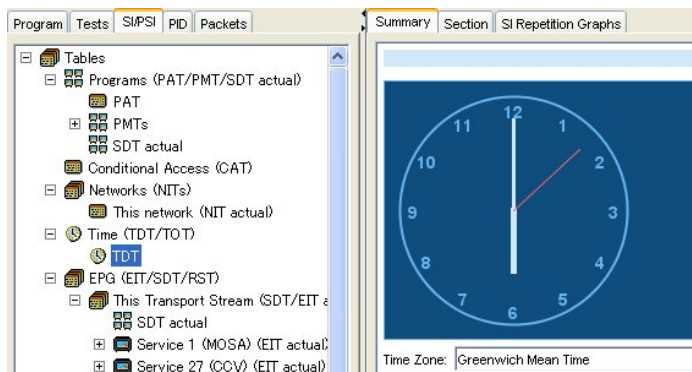
The Tests view enables you to isolate errors to the specific tests that have been applied to the Transport Stream. The error log is automatically filtered by the selected test, and can also be filtered by PID. In addition to the standard 1st, 2nd, and 3rd priority tests included in TR 101 290 standard, tests are available for PCR timing, IP Layer measurements, and program/PID bit rate. A variability test enables you to test the changes in the bit rate of a specific PID. In addition to TR 101 290, there are many tests that are specific to ATSC A/78, ISDB-T, and ISDB-S streams.





## SI/PSI and PSIP (tables) view

The SI/PSI and PSIP tables view displays the service information tables contained in the analyzed stream which comply with the selected digital video standard. This includes ATSC PSIP, DVB, and ISDB service information and MPEG program-specific information. A summary view displays key values for each table in a meaningful way. The view includes hyperlinks enabling you to quickly access related information within other tables and views.



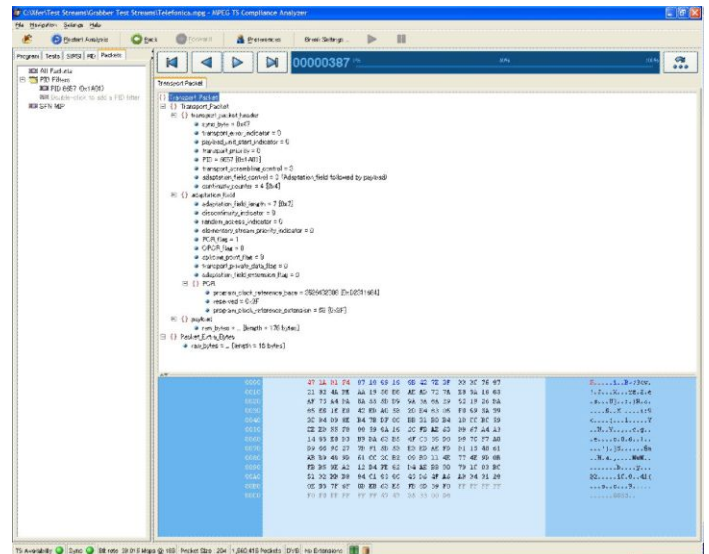
## PID view

The Packet Identifier (PID) view displays information about all of the PIDs found in the Transport Stream. When you select a PID, 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.

When one or more tests fail, each failed test is listed under the relevant PID. Specific PIDs can be selected to display a summary of all the associated tests. A specific test can be selected to display its event log and parameters.

## Packet view

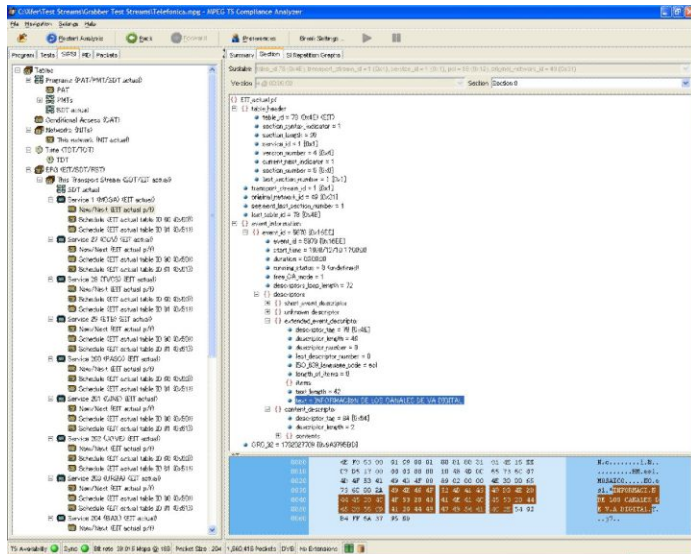
The Packet view displays information about all of the packets found in the Transport Stream grouped according to content or for IP streams, Ethernet Packets can be displayed for the session. These groups include PID value, SFN Megaframe Initialization Packets (MIPs – DVB only), Information Packets (IIPs – ISDB-T only), RTP or UDP IP Packet contents.



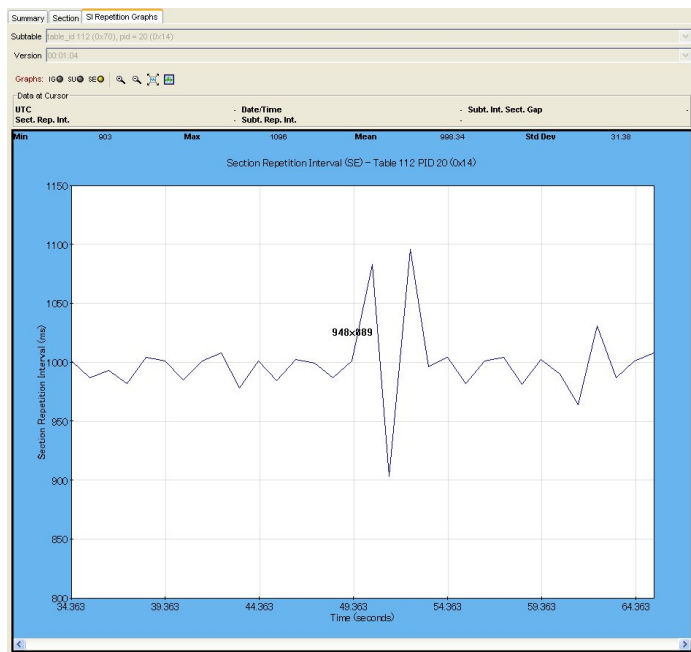
When you select a specific PID, MIP, or IP, session-only packets carrying that particular PID, MIP, or session are displayed. For Ethernet Packets, the RTP/UDP header information is displayed in both real and deferred time and can be used to display packet header information and payload.

## Section view

The Section view uses customizable script files, which allow you to specify and view proprietary information.



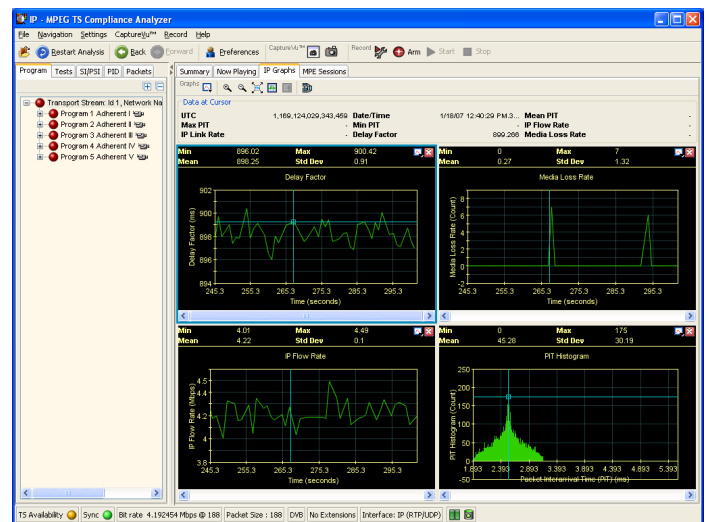
Tables and their data source are displayed. This shows the data bytes (in both hexadecimal number format and ASCII character format), for the selected table, version, and section. Tables and subtables are easily analyzed and directly traceable to packet data.



- Section Repetition Interval graph – Displays the interval between two sections of a table on a particular PID.
- Subtable Intersection Gap graph – Displays the interval between sections in a particular subtable.
- Subtable Repetition Interval graph – Displays the time between receiving one complete subtable and receiving the next complete subtable.

## Timing analysis

The TSCA supports comprehensive PCR measurements to the TR 101 290 and A/78 standard. When the selected Elementary Stream PID contains PCR information, PCR trend analysis views are available, displaying graphs of: PCR accuracy, PCR arrival interval, PCR overall jitter, PCR frequency offset, and PCR drift rate.



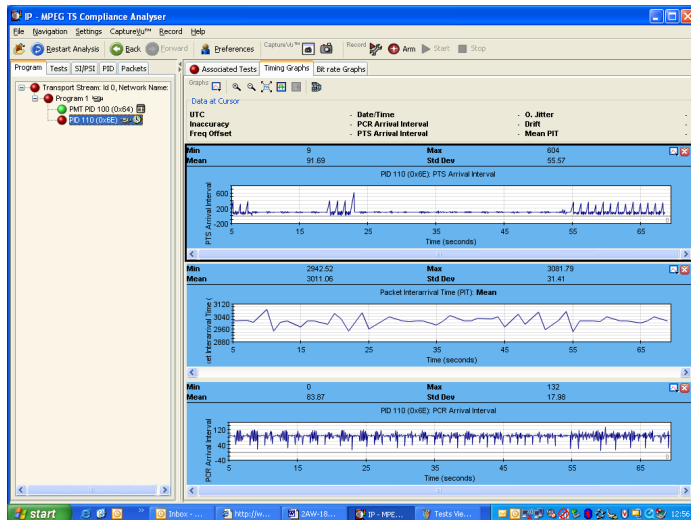
PCR graphs are available in real time and deferred time. Time stamping data makes sure that these can be captured and viewed on stream recordings. This time stamp is compatible with recordings from other Tektronix equipment including the MTM400 Transport Stream Monitor. Selectable MGF filters provide maximum flexibility and compatibility in these important PCR measurements. The TSCA is also able to display PTS Arrival Interval graphing in real time or deferred time, and includes PTS-PCR and DTS-PCR graphs to detect possible Receiver buffer under- and overflow problems.

IP Layer timing can be analyzed using statistical display of mean IP Packet Interarrival Time (histograms).



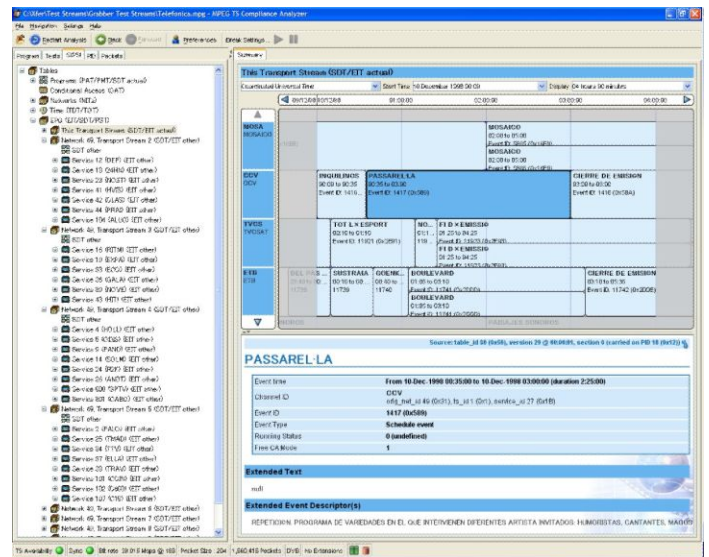
## Cross-layer timing

Cross-layer timing provides the user with an **at-a-glance** view of timing at IP, TS, and PES Layers. This functionality addresses tough unsolved timing problems introduced by the use of Video and Audio over IP technologies. Enables rapid time to insight when diagnosing at which layer a fault was introduced.



## Real-time and deferred-time electronic program guide (EPG) view

The EPG view allows at-a-glance checking across many EIT tables and can be set to any time zone from local time, UTC, or the Transport Stream time itself. The number of days of EPG events displayed are broadcaster dependent, but are not limited by the analyzer. When a Transport Stream EPG is selected, a panel shows the names of the services listed in the Event panel. The services displayed will depend on the node selected in the navigation view. ATSC, DVB, and ISDB EPGs are supported. ATSC Rating and Closed Caption signaling information are also displayed in this view.



The Event panel shows the events for one or more services, depending on the node selected. Individual events are color coded and shown as blocks; each block (and its associated tooltip) displays event information 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.

| Color  | Description             |
|--------|-------------------------|
| Red    | Present event           |
| Green  | Following event         |
| Blue   | Schedule event          |
| Yellow | (ISDB only) After event |

## MPE/IP view data broadcast

MPE data (internet IP sessions over MPEG TS) can be viewed as a separate entry for each MPE session either detected within the TS, or manually signaled since the view became active.

Information displayed for each session includes:

- PID
- MAC address
- Network Layer source and destination IP addresses
- Transport layer protocol and port numbers
- Total data transmitted by the session so far since monitoring commenced
- Instantaneous bit rate using MGB1 profile

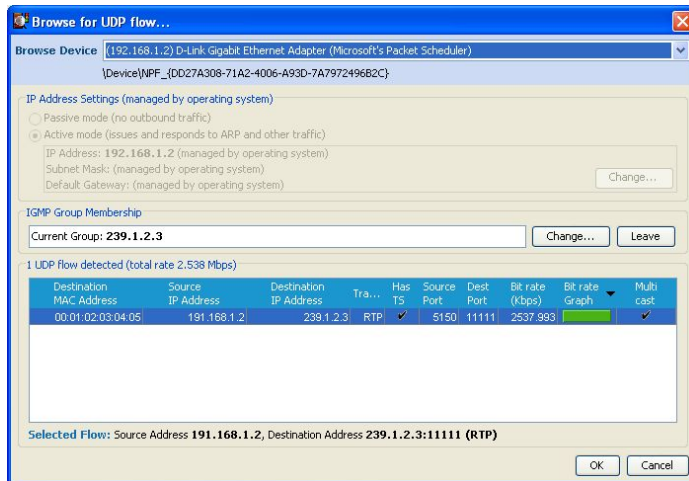


## DVB SFN

For real time, data contained in the most recently received MIP is interpreted and displayed in a view depicting each field value. TPS MIP, STS time stamps, and other detailed information are available in navigator views.

## Video over IP analysis and recording

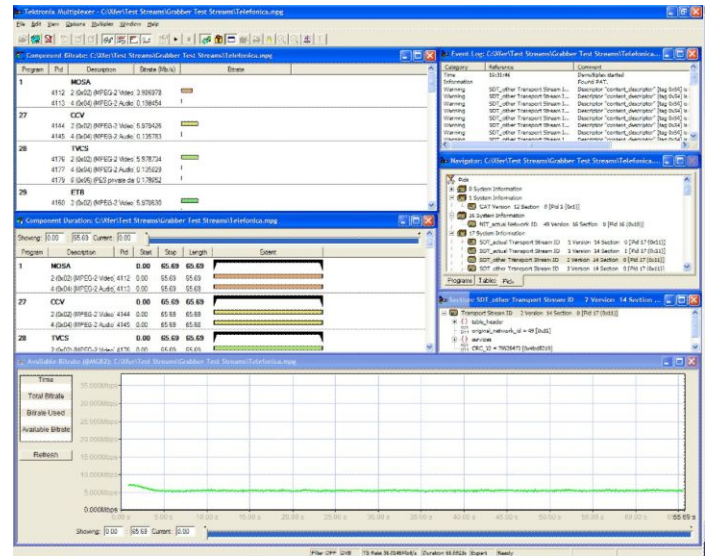
The Ethernet port (standard with most PCs running the MTS4SA analyzer) provides 10/100BASE-T or Gigabit Ethernet interfaces for monitoring IP streams carrying MPEG video. This allows connection to a streaming IP video source for Video over IP analysis with CaptureVu technology. The analyzer allows the selection of any current UDP session on a LAN segment for subsequent analysis.<sup>1</sup>



UDP sessions carrying MPEG TS traffic are indicated and may be selected for analysis and recording. Transport Stream packets are time stamped as they are received from any Network Interface Card, allowing PCR measurements and graphing to be supported. In addition, a display of the mean IP Packet Interarrival Time (PIT) histogram is available.

## Multiplexer and SI table editor

When testing network elements or set-top boxes, a Transport Stream of the representative type needed is often not available. Even if there is a similar one, vital components within it may be missing or suffer from a lack of SI (system information) or other tables, or are multiplexed to the incorrect Transport Stream rate for the application.



Use the Multiplexer/Remultiplexer/Demultiplexer application to create multi program Transport Streams with custom SI/PSI/PSIP information for DVB (including Annex A string support), ATSC, ISDB, and MPEG compliant Transport Streams. A new ISDB-T Single Segment mode is added in version 3.1.

H.264 Elementary Streams may also be multiplexed into a Transport Stream. H.264 streams both with and without SEI timing messages are supported. The PTS and DTS generated for non-SEI streams are based upon the POC (Picture Order Count) information. PTS/DTS generation may be suppressed for SEI streams. Bit rate and frame rate auto-detection features aid the import process. These may be overridden for non-SEI streams.

This enables the user to create their own test streams that they can use to validate and debug their designs more quickly, and also to create errored streams to perform parametric stress testing and ensure the robustness and quality of their MPEG-2 or H.264 implementation.

<sup>1</sup> Network traffic loading is specified to 400 Mb/s maximum bit rate.

The Tektronix Multiplexer/Remultiplexer/Demultiplexer application supports:

- MPEG-1 video
- MPEG-1 audio
- MPEG-2 video
- MPEG-2 audio
- MPEG-2 AAC audio
- AC-3 audio
- H.264 ES (both with and without optional SEI timing messages)
- MPEG-2 Video PES (Packetized Elementary Streams)
- MPEG-2 Audio PES
- AC-3 Audio PES
- All the above are supported in Elementary and PES formats
- PIDs from other Transport Streams can be imported including any format including H.264 and VC-1
- Other data – the bit rate must be specified

### The multiplexer solution

The multiplexer allows the user to collect together components from streams recorded off hard disk or CD/DVD-ROM, manipulate them in an unlimited manner, and then rebuild a fully compliant output stream. The software's built-in knowledge of table syntax and descriptors ensures compliance and high-quality output of the final multiplexed Transport Stream.

### Demultiplex existing streams

The multiplexer accepts any recorded Transport Stream as an input source. The user can then demultiplex this Transport Stream into its component PES. The user can then save the resulting PES and ES streams to disk. The demultiplexer is an Elementary Stream diagnostic and can be used to extract H.264 and VC-1 Elementary Streams from a Transport Stream.

### Regroup PES with stored streams

These PES, or elementary video and audio streams, can be grouped together into logical groups – Programs of video, audio, and other associated data (such as Teletext / Closed Caption and MHP applications) with the original timing preserved. PIDs can be remapped as required.

### Component views and Available Bandwidth view

The Component Bit Durations view graphically displays the durations and start and stop times for each video or audio content PID. Duration and start/stop times can be changed by "drag and drop" or numerical entry. The Available Bandwidth view clearly shows the user how much content can be added into a Transport Stream so the user can expand or optimize.

### Map, check, and rebuild your own multiplex

Streams can be rebuilt into a larger multiplex stream and new SI/PSIP tables can be customized and added safely with built-in compliance checks.

### Generate compliant timing and output bit rates as required

The multiplexer can insert PCRs at the correct repetition rate and lets the user specify the PCR repetition rate, if required.

### Create, add, or modify PSIP/SI/PSI flexibility

The multiplexer allows all the standard ATSC/DVB/ISDB and MPEG PSIP/SI and PSI tables and descriptors to be added or edited. Scripting allows new or custom tables to be added. The user is permitted to generate illegal conditions that allow stress of decoder or transmission chain equipment to verify its robustness.

### Standard and Expert modes

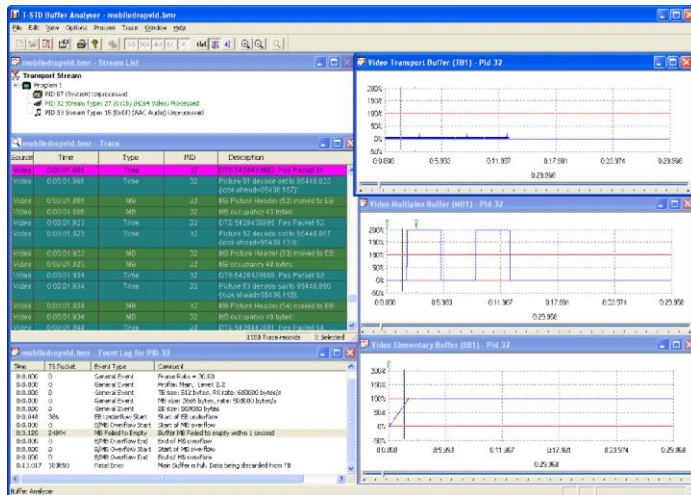
Standard mode will calculate related fields and table pointers. Expert mode lets the user set fields and table pointers to illegal conditions for stress and robustness test of network elements and STB decoders.

### Wizards for common tasks

- Create new Transport Streams
- Specify ATSC, DVB, ISDB, and MPEG standards
- Add programs
- Add events

## Buffer Analyzer

When developing professional and consumer equipment, particularly encoders and set-top boxes, the characteristics of the test streams being either generated or used as stimulus need to be ascertained. Of critical importance among these characteristics is adherence to the buffer model. That is, when the stream is processed by a receiver, will any of the internal buffers be caused to either under- or overflow. Consequences of these conditions are freeze frames and receiver resets.



There are two types of buffer model. The one to use by the receiver is signaled within the Elementary Stream itself. The T-STD method is based upon the DTS values within the PES header and can be used for any contained CODEC type. Additionally, certain video CODECs such as MPEG-2 and H.264/AVC may contain buffer parameters within the ES itself. The Buffer Analyzer verifies conformance of a stream to the T-STD model. Verification of the H.264/AVC HRD method is covered by the MTS4EA product.

The Tektronix Buffer Analyzer application supports:

- MPEG-2 Video
- H.264/AVC (MPEG-4 part 10)
- MPEG-2 Audio
- MPEG-2 AAC Audio
- AC-3 Audio
- PSI (ISO/IEC 13818 parts 1)

## The Buffer Analyzer solution

The Buffer Analyzer accepts any recorded Transport Stream as an input source. The TS is then demultiplexed into its component PES, grouped by program. The user can select one or more PES to analyze for conformance to the T-STD model according to the buffer parameters for the CODEC type in question. General information such as profile and level together with any buffer errors are recorded in a log.

The user can manually set buffer sizes and other parameters before analysis, rather than use those specified by the standard or signaled within the stream.

## Buffer graphs

The occupancy level for each buffer within the model (3 for video, 2 for audio, and 2 for PSI) is plotted on a graph for each PES being analyzed. Graphs may be zoomed for ease of use. A Synchronization feature allows for comparisons at a particular point in time between each of the graphs and individual log entries.

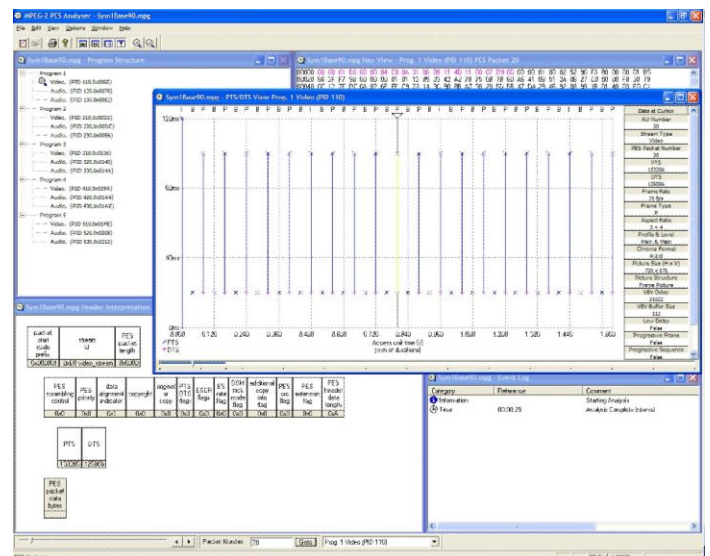
## Trace view

Version 8.0 enhancements have integrated the previously separate Tracer utility into the Buffer Analyzer application. The Trace view provides details of the buffer movements for in-depth analysis of the results. Trace entries are included in the Synchronization feature for ease of diagnosis.

## Buffer Model Results (BMR) files

The analysis results are stored in a Buffer Model Results (BMR) file to save having to reanalyze the same file. Results files may be opened directly in the Buffer Analyzer, whereby logs, graphs, and Trace contents (maximum of 7000 entries) are repopulated. They are far smaller than the original TS files and thus useful to add as e-mail attachments.

## Packetized Elementary Stream (PES) analyzer

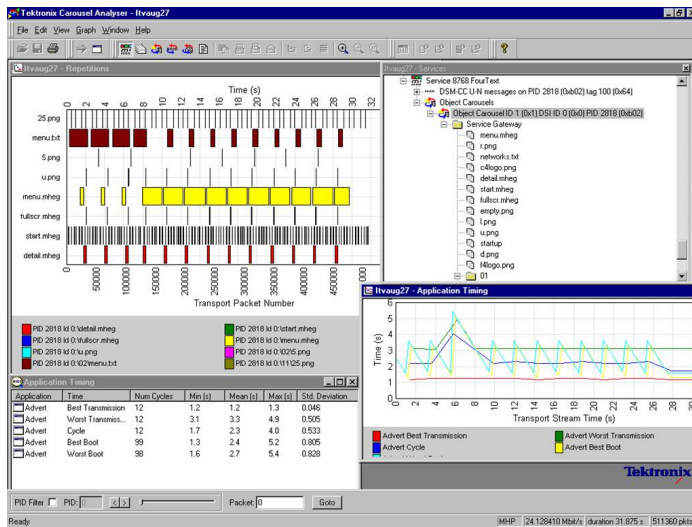




## Datasheet

- Analyzes PES headers
- Analyzes presentation and decode time stamps (PTS/DTS)
- Detects encoder drift against real-time errors
- Analyzes stored Transport Streams

## Carousel analyzer



Provides analysis and display of:

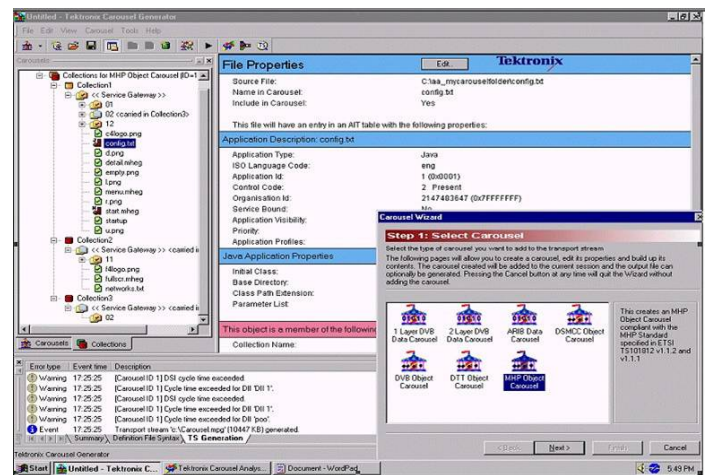
- Carousel Signaling
- Carousel Transport
- Data Carousels (MPEG, DVB, and ARIB B24)
- Object Carousels (MHP and MHEG-5)
- View Objects (including GIF, JPEG, PCX, PNG,txt and MPEG "I" frame backdrops)
- Extract and Save Objects

Drag and Zoom graphing:

- Repetition Rates
- Carousel Cycle Times
- Entity Cycle Times
- PID and Component Bit Rates
- Bandwidth
- Application Load Timing Statistics

Comprehensive error reporting

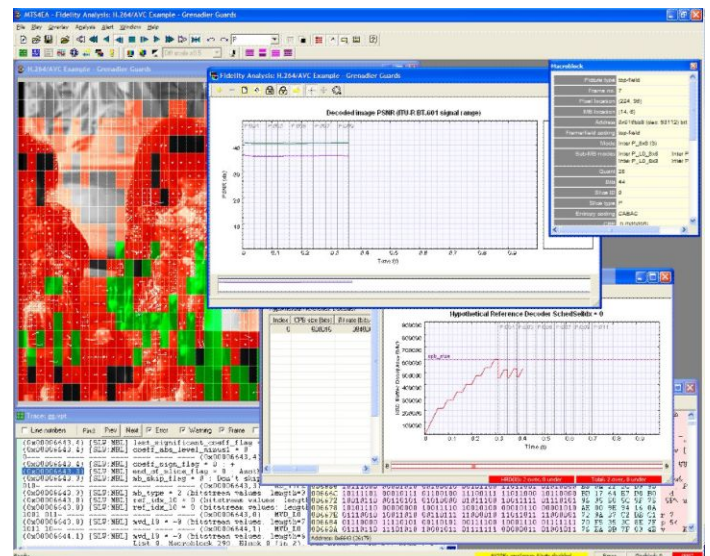
## Carousel Generator



- Wizard helps easy stream generation
- Built-in multiplexer for easy video and audio insertion
- Variable delivery weightings to optimize carousel load times
- Generates all required SI tables for terrestrial, satellite, and cable applications
- Integrates with the Tektronix Carousel Analyzer for load time optimization

## Next-generation Video Elementary Stream Analyzer

(Order as MTS4EA V7)





**Applications:**

- Semiconductor manufacturers
- Developers of set-top boxes, encoders, and decoders
- Broadcasters, mobile and fixed network operators

**Features:**

- Next-generation (H.265/HEVC, VC-1, H.264/AVC and MPEG-4) and Legacy (MPEG-2 and H.263) CODEC support
- Frame-by-frame and block-by-block analysis to allow easy CODEC comparison
- Easy-to-interpret detailed graphical displays (requires user-installed Microsoft Excel)
- Comprehensive semantic trace file output to determine block-by-block encoder decision making
- AV delay measurement
- Audio decode and analysis
- Synchronized audio and video analysis
- Real-time and nonreal-time decoding and analysis of compressed video streams (dependent on PC performance)
- Elementary Stream editing
- Batch mode to allow automated testing
- YUV decoded video output for baseband video analysis
- Extraction of Elementary Stream from Transport Stream

**Other applications**

All MTS4SA products provide two direct stream manipulation applications for creating, editing, and resizing Transport Streams:

- TS Cutter allows resizing of Transport Streams
- TS Editor allows direct editing of Transport Streams using a hexadecimal view and a header interpretation guide

**Make Seamless module:** When looping a Transport Stream to simulate continuous playout, errors can be generated at the loop point caused by discontinuities in timing information. The Make Seamless module provides the opportunity of creating seamless Transport Streams.

**Stream creation and manipulation:** Use the Multiplexer/Remultiplexer/Demultiplexer application to create multiprogram Transport Streams with custom SI/PSI/PSIP information for DVB, ATSC, ISDB, and MPEG compliant Transport Streams (see details below).

**Transport Stream Generation:** One or more MPEG Player applications can be open to stream TS file over the PC NIC. Additional features include address/port replication, dropped TS packets, error insertion, and IP packet jitter creation.

**Stand-alone software system requirements**

- Processor speed > 2.5GHz
- Intel or 100% compatible motherboard chipset
- Microsoft Windows 7, XP or Vista operating system
- 4 GB of RAM
- 250 GB of available hard disk space for the applications and documentation
- Additional space is required for storage of captured video streams
- SVGA (800×600) resolution video adapter and monitor (XVGA (1024×768) or higher resolution recommended)
- CD-ROM or DVD drive
- Keyboard and Microsoft mouse or compatible pointing device
- Video over IP Analysis option requires a standard Network Interface Card (NIC)
- Detailed graphical displays provided by the next-generation compressed video analyzer (MTS4EA V7) require Microsoft Excel

## Ordering information

### MTS4SA: Options for installing MTS4SA stand-alone software on a user's own PC

MTS4SA is the base stand-alone Deferred-time Software Package for installing MTS4SA on a user's own PC (see minimum system requirements). Order MTS4SA with the following option(s):

|             |   |
|-------------|---|
| <b>USB</b>  | USB security dongle supplied with Stand-alone Software Package  |
| <b>PPD</b>  | Parallel port security dongle supplied with Stand-alone Software Package  |
| <b>TSCA</b> | Security dongle key to add Deferred-time Transport Stream Compliance Analyzer with CaptureVu technology   |
| <b>TSCL</b> | Security dongle key to add Deferred-time Transport Stream Compliance Analyzer with CaptureVu™ technology (file size limited to 200 MB)                              |
| <b>TSCR</b> | Security dongle key to add Real-time Video over IP Transport Stream Compliance Analyzer with CaptureVu™ technology (for use with a standard network interface card) |
| <b>MX</b>   | Security dongle key to add Deferred-time Multiplexer  |
| <b>ES</b>   | Security dongle key to add ES Analyzer  |
| <b>PA</b>   | Security dongle key to add PES Analyzer   |
| <b>BA</b>   | Security dongle key to add Buffer Analyzer  |
| <b>DB</b>   | Security dongle key to add Carousel Analyzer  |
| <b>CG</b>   | Security dongle key to add Carousel Generator   |
| <b>DBCG</b> | Security dongle key to add Carousel Analyzer and Carousel Generator   |
| <b>L0</b>   | English Documentation   |
| <b>L5</b>   | Japanese Documentation  |
| <b>L99</b>  | Electronic User Documentation supplied only (no printed documents)  |

### MTS4UP: Options to upgrade or add standard options after initial purchase of MTS4SA

MTS4UP is the base MTS4SA Series Field Upgrade Kit. Order MTS4UP with the following option(s):

|             |   |
|-------------|---|
| <b>TSCA</b> | Upgrade to add Deferred-time Transport Stream Compliance Analyzer   |
| <b>TSCL</b> | Upgrade to add Deferred-time Transport Stream Compliance Analyzer (file size limited to 200 MB)   |
| <b>TSCR</b> | Upgrade to add Real-time Video over IP Transport Stream Compliance Analyzer (available for MTS4SA only)   |
| <b>MX</b>   | Upgrade to add Deferred-time Multiplexer (available for MTS4SA only)  |
| <b>PA</b>   | Upgrade to add PES Analyzer (available for MTS4SA only)   |
| <b>BA</b>   | Upgrade to add Buffer Analyzer (available for MTS4SA only)  |
| <b>ES</b>   | Upgrade to add ES Analyzer to any MTS4SA Series product   |
| <b>DB</b>   | Upgrade to add Carousel Analyzer to any MTS4SA Series product   |
| <b>CG</b>   | Upgrade to add Carousel Generator to MTS4SA Series  |
| <b>DBCG</b> | Upgrade to add Carousel Analyzer and Carousel Generator to MTS4SA Series  |
| <b>UPG</b>  | Upgrade to latest version of MTS4SA Series base software and installed options. Includes CD and manual (does not include upgrades to MTS4EA software) |



Tektronix is registered to ISO 9001 and ISO 14001 by SRI Quality System Registrar.



Product(s) complies with IEEE Standard 488.1-1987, RS-232-C, and with Tektronix Standard Codes and Formats.

|  |  |  |
|--|--|--|
| <b>ASEAN / Australasia</b> (65) 6356 3900                  | <b>Austria</b> 00800 2255 4835*                      | <b>Balkans, Israel, South Africa and other ISE Countries</b> +41 52 675 3777 |
| <b>Belgium</b> 00800 2255 4835*                            | <b>Brazil</b> +55 (11) 3759 7627                     | <b>Canada</b> 1 800 833 9200   |
| <b>Central East Europe and the Baltics</b> +41 52 675 3777 | <b>Central Europe &amp; Greece</b> +41 52 675 3777   | <b>Denmark</b> +45 80 88 1401  |
| <b>Finland</b> +41 52 675 3777                             | <b>France</b> 00800 2255 4835*                       | <b>Germany</b> 00800 2255 4835*  |
| <b>Hong Kong</b> 400 820 5835                              | <b>India</b> 000 800 650 1835                        | <b>Italy</b> 00800 2255 4835*  |
| <b>Japan</b> 81 (3) 6714 3010                              | <b>Luxembourg</b> +41 52 675 3777                    | <b>Mexico, Central/South America &amp; Caribbean</b> 52 (55) 56 04 50 90     |
| <b>Middle East, Asia, and North Africa</b> +41 52 675 3777 | <b>The Netherlands</b> 00800 2255 4835*              | <b>Norway</b> 800 16098  |
| <b>People's Republic of China</b> 400 820 5835             | <b>Poland</b> +41 52 675 3777                        | <b>Portugal</b> 80 08 12370  |
| <b>Republic of Korea</b> 001 800 8255 2835                 | <b>Russia &amp; CIS</b> +7 (495) 6647564             | <b>South Africa</b> +41 52 675 3777  |
| <b>Spain</b> 00800 2255 4835*                              | <b>Sweden</b> 00800 2255 4835*                       | <b>Switzerland</b> 00800 2255 4835*  |
| <b>Taiwan</b> 886 (2) 2722 9622                            | <b>United Kingdom &amp; Ireland</b> 00800 2255 4835* | <b>USA</b> 1 800 833 9200  |

\* European toll-free number. If not accessible, call: +41 52 675 3777

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For Further Information. Tektronix maintains a comprehensive, constantly expanding collection of application notes, technical briefs and other resources to help engineers working on the cutting edge of technology. Please visit [www.tektronix.com](http://www.tektronix.com).

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