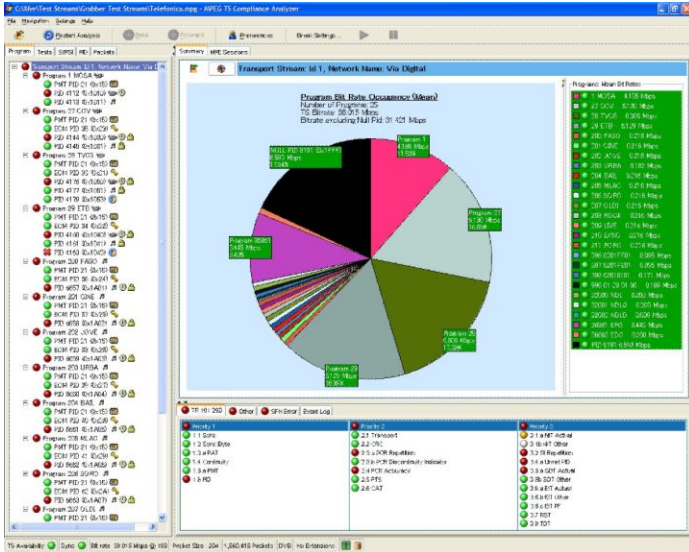


# MPEG Transport Stream Analyzer

## MTS4SAV3 Datasheet



The MTS4SAV3 Transport Stream 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 MTS4SAV3 software runs on computers with the Microsoft Windows 7 or Windows 8.1, 64-bit operating system
- 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, H.265 (HEVC), and VC-1

- H.264 and H.265 (HEVC) thumbnail decode, buffer analysis, and multiplexing provide the most powerful suite of tools for creation and analysis of transport streams containing H.264 and H.265 (HEVC) content, supporting the needs of customers transitioning from MPEG-2 to H.264 and H.265 technologies
- Customizable scripting supports the broadest range of ratified and evolving worldwide DTV standards
- Use the analysis software on multiple computers connected to your network (Option FLT)

### Applications

- **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
- **Equipment manufacturers – manufacturing test**
  - Equipment test is simplified and faster with CaptureVu® and the high-speed analysis engine of the MTS4SAV3 analyzer
  - Multiplexer/remultiplexer allows custom test stream creation for fast and flexible equipment stress testing
- **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
  - Encoder and other equipment fault diagnosis and evaluation
  - Analysis of transport streams to confirm correct system operation and isolate faults during installation and commissioning

## Product overview

The MTS4SAV3 Transport Stream 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 MTS4SAV3 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 MTS4SAV3 standalone software can be applied anywhere at any level, to diagnose and solve the most subtle, complex, and intermittent DTV problems in the minimum time.

The MTS4SAV3 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.

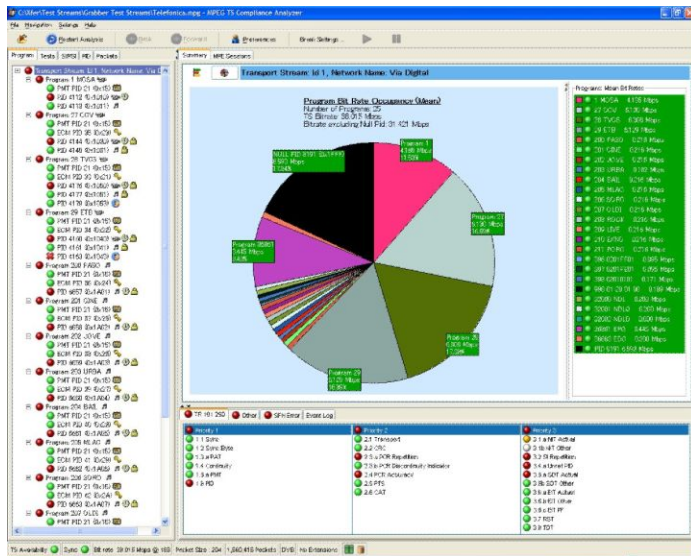
Standards compliance is ensured through built-in customizable scripting supporting the broadest ranges of ratified and evolving DTV standards, including ATSC, DVB-C, DVB-H, DVB-S, DVB-T, ISDB-S, ISDB-T, and MPEG. To keep analysis up to date, flexibility is the key. New standards and proprietary tables 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 tool both in real time (IP only) and deferred time
  - CaptureVu® technology captures and analyzes system events in real time 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, H.265 (HEVC), 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, H.265 (HEVC), 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.265 (HEVC), H.264, VC-1, MPEG-2, MPEG-4, and 3GPP)
- Buffer Analysis for testing T-STD buffer performance of H.265 (HEVC), H.264/AVC and MPEG-2 video codec streams
- Multiplexer application for creating and manipulating content into Transport Streams – the world's first offline multiplexer with support for manipulating H.265 (HEVC) and H.264/AVC 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 the Microsoft Windows 7 or Windows 8.1, 64-bit operating system. 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, H.265 (HEVC), and MPEG-2 supported
- Ability to recognize JPEG2K and HEVC video carried in Transport Stream
- 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

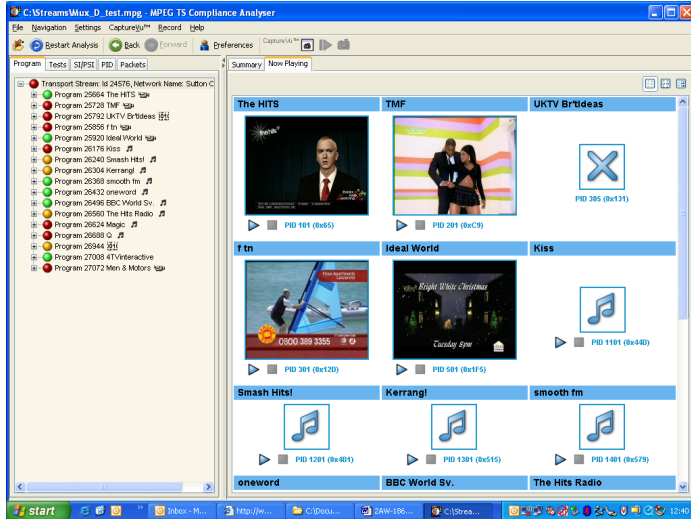
### Deferred- and real-time modes

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 enables a stored stream to be analyzed and viewed at any time and is available on any recommended platform.

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 user interface**

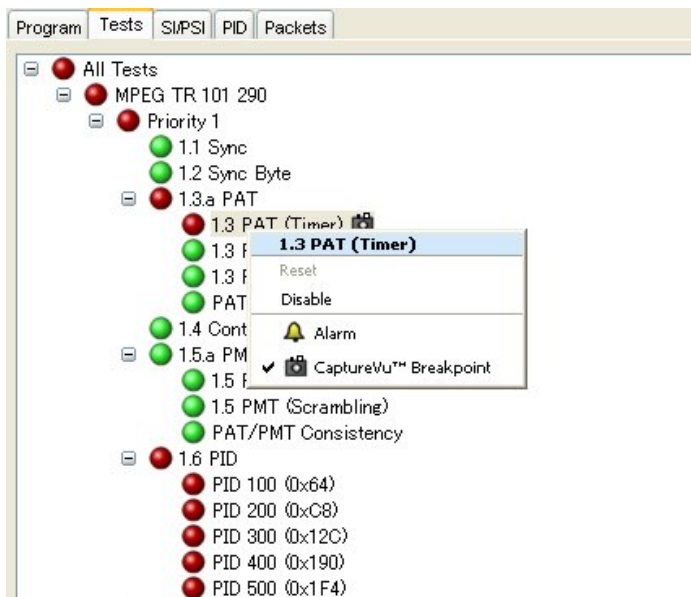
The TSCA software uses a single main program summary window with different context-sensitive views contained within tabbed frames. This provides the maximum amount of useful information while keeping the screen from appearing cluttered.



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

**CaptureVu® technology**

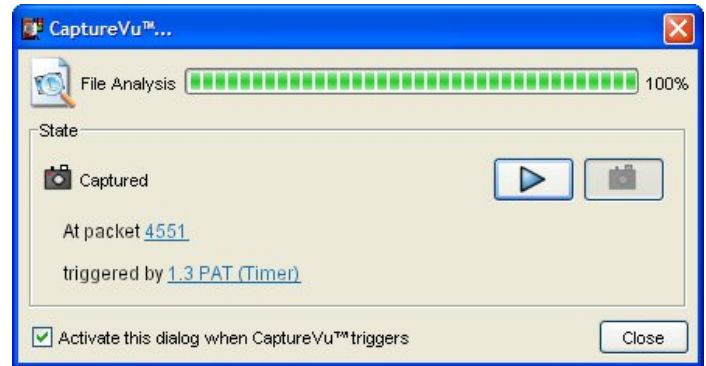
CaptureVu® technology captures and analyzes system events in real time and deferred time to debug the intermittent and complex problems that traditional analyzers miss. CaptureVu® technology lets the user set a breakpoint on a specific test or event and, when the breakpoint occurs, a dialog will show 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**

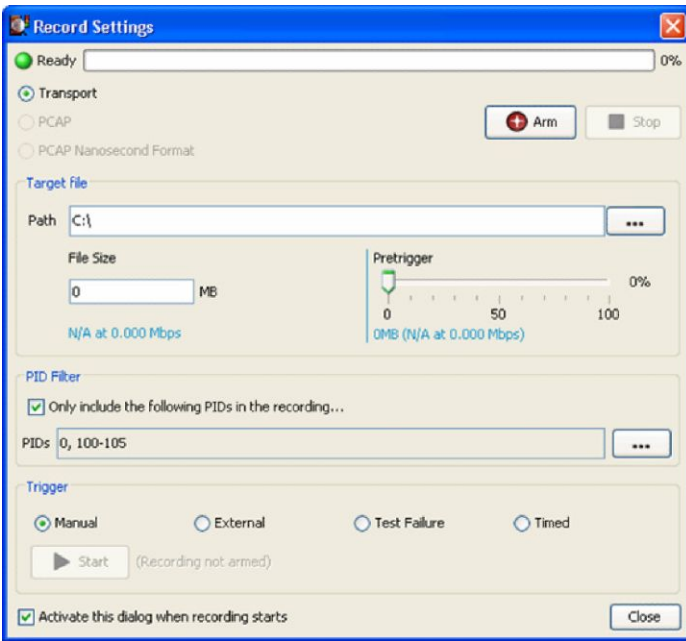
The TSCA supports triggered recording, allowing the user to set up a sophisticated trigger condition. When the trigger condition is met, the live input stream is captured to disk without stopping or pausing real-time analysis.



Trigger sources and conditions include:

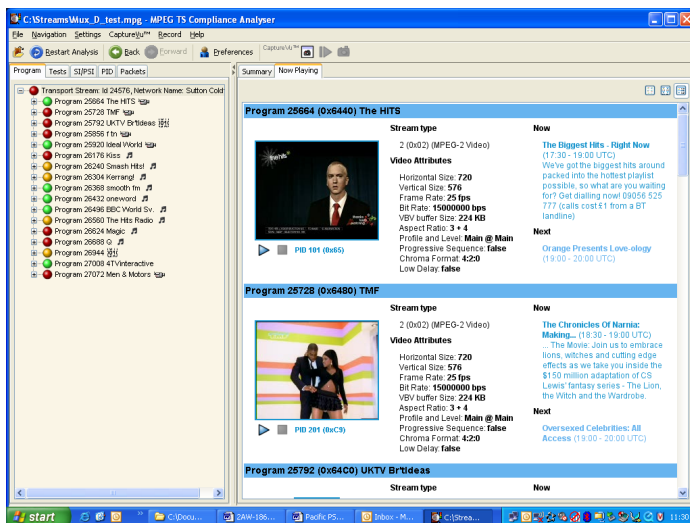
- DVB TR 101 290 1st, 2nd, 3rd priority tests, ATSC A/78, ISDB, or proprietary tests
- IP Layer measurements, including PIT tests, RTP dropped packet count and rate, out-of-order packets count and rate
- Multiplex occupancy outside user-defined bit rate limits
- Date and time
- In triggered recording 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.

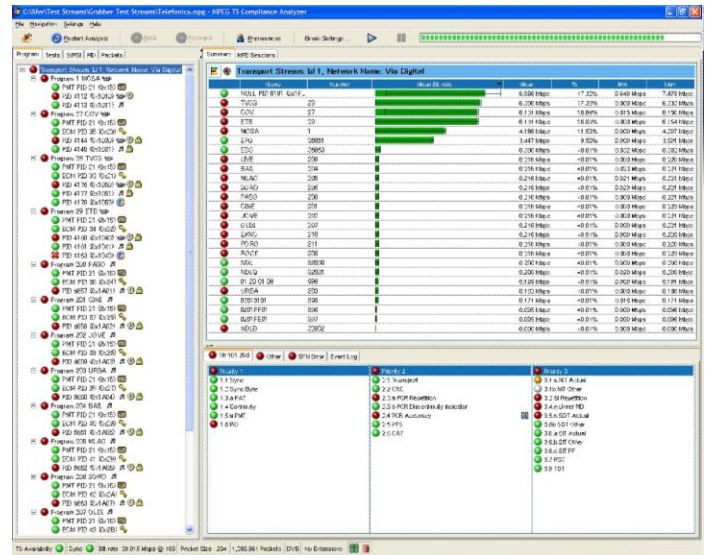


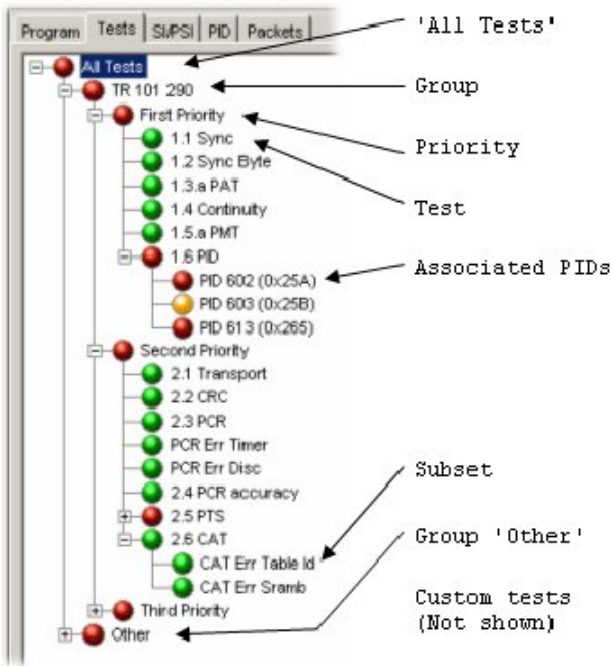
In addition to displaying a video thumbnail, the video format parameters from within ES headers are also displayed and can be checked for consistency with Transport Stream layer signaling of video parameters. This cross-check enables the operator to verify that the format of the content in the stream 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.

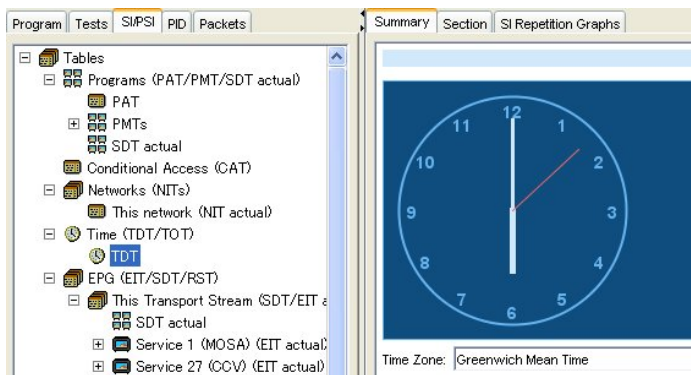




**SI/PSI and PSIP (tables) view**

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.



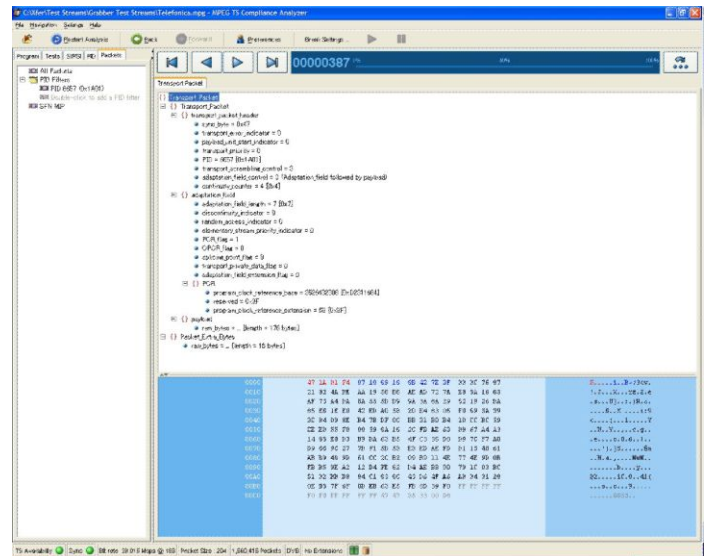
**PID view**

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**

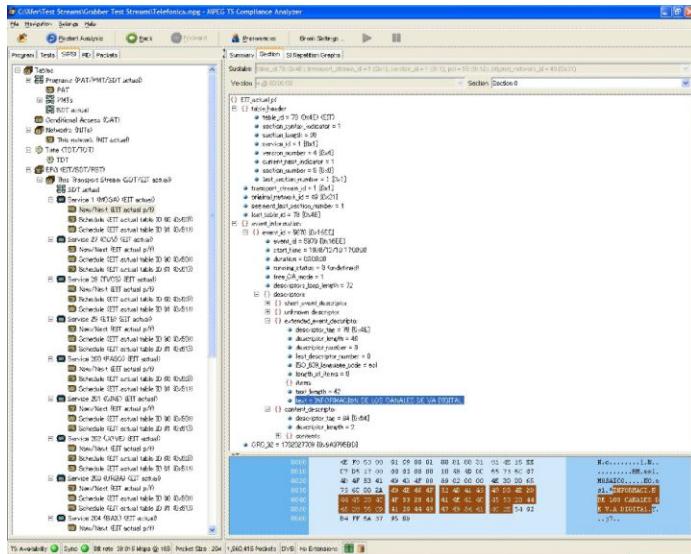
The Packet view displays information about all of the packets found in the Transport Stream grouped according to content or for IP streams, Ethernet Packets can be displayed for the session. These groups include PID value, SFN Megaframe Initialization Packets (MIPs – DVB only), Information Packets (IIPs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

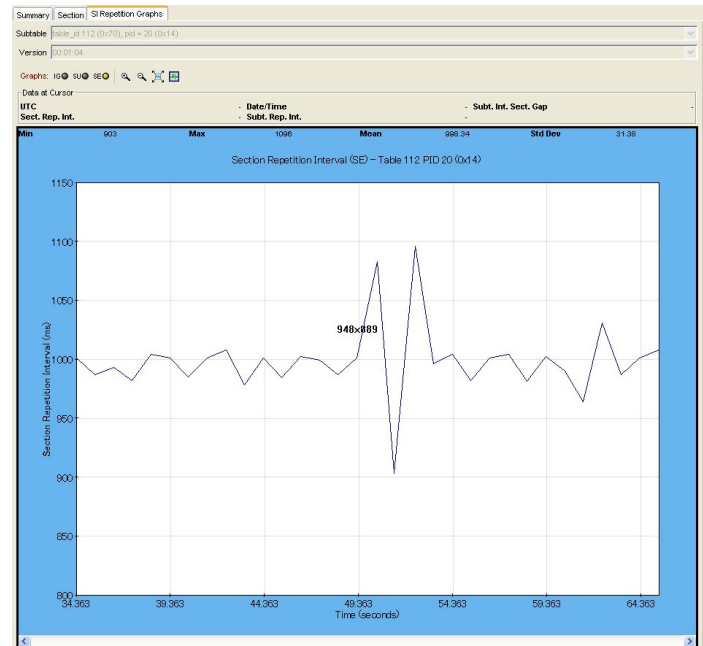
### Section view

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.

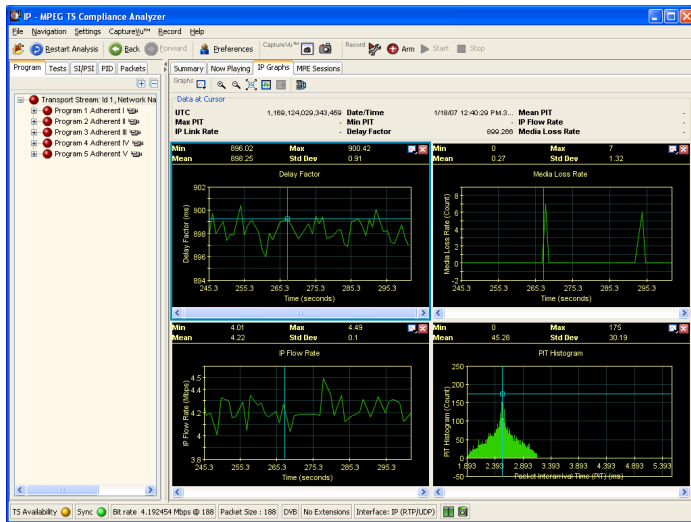
### Section graphing



- 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.

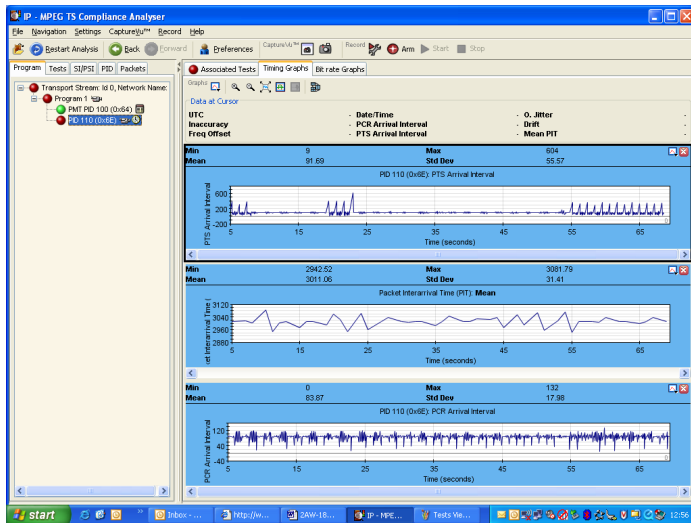


PCR graphs are available in real time and deferred time. Time stamping data makes sure that these can be captured and viewed on stream recordings. This time stamp is compatible with recordings from other Tektronix equipment including the MTM400 and MTM400A Transport Stream Monitors. Selectable MGF filters 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).

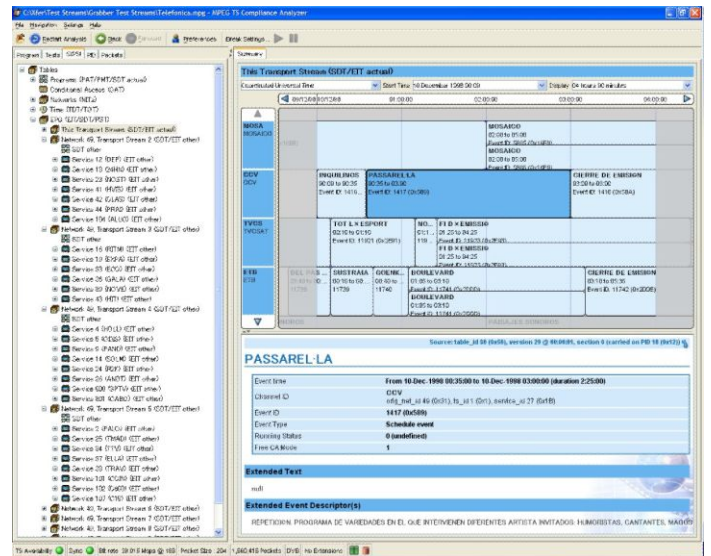
### Cross-layer timing

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.



### Event panel

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.

Events are color coded as follows:

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:

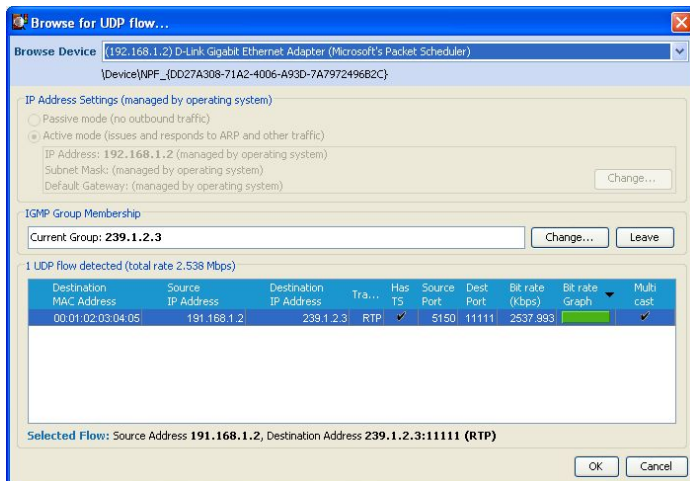
- PID
- MAC address
- Network Layer source and destination IP addresses
- Transport layer protocol and port numbers
- Total data transmitted by the session so far since monitoring commenced
- Instantaneous bit rate using MGB1 profile

### 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

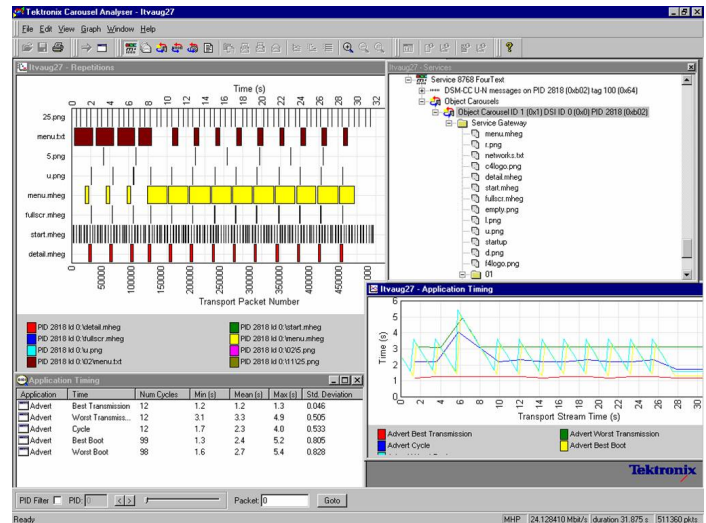
The Ethernet port (standard with most PCs running the MTS4SAV3 software) provides 10/100BASE-T or Gigabit Ethernet interfaces for monitoring IP streams carrying MPEG video. This allows connection to a streaming IP video source for Video over IP analysis with CaptureVu® technology. The analyzer allows 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.

<sup>1</sup> Network traffic loading is specified to 600 Mb/s maximum bit rate.

### 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

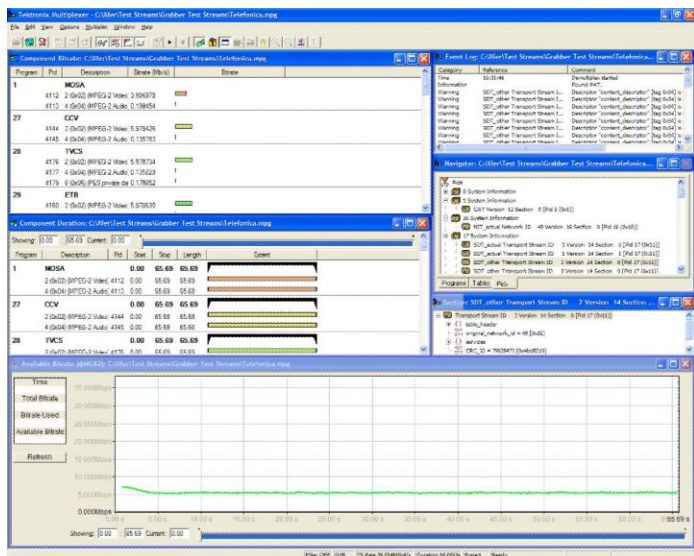
Drag and Zoom graphing:

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

Comprehensive error reporting

## TS and ISDB-T/Tb Multiplexer and SI Table Editor (Option GEN)

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.265 (HEVC) and H.264 Elementary Streams can also be multiplexed into a Transport Stream. 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, MPEG-4 (AVC) or HEVC (H.265) implementation.

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)
- H.265 (HEVC) elementary streams
- 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.





## 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

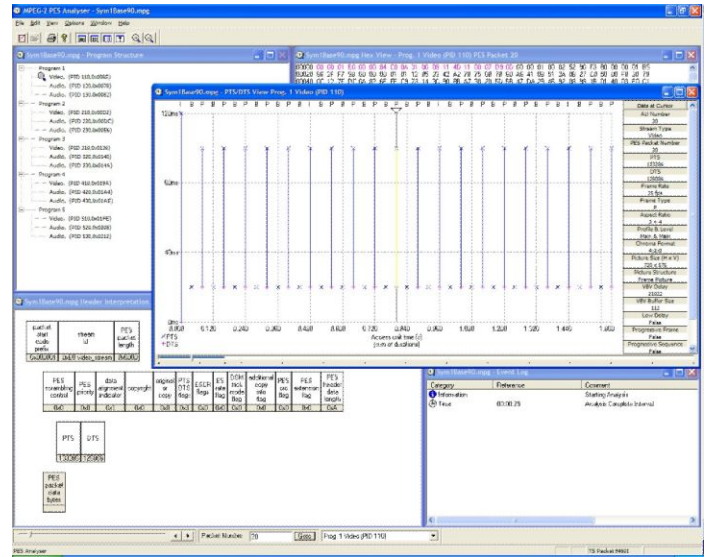
The analysis results are stored in a Buffer Model Results (BMR) file to save having to reanalyze the same file. Results files may be opened directly in the Buffer Analyzer, whereby logs, graphs, and Trace contents (maximum of 7000 entries) are repopulated. They are far smaller than the original TS files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

## Summary of other MTS4SAV3 optional tools

### Packetized Elementary Stream (PES) 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. The header associated with each PES packet is of particular interest, as it contains the decode and presentation time stamps (DTS and PTS) for the contained Elementary Stream.

Errors in these time stamps may cause resets or picture freeze problems at the receiver in extreme cases. They are more typically the cause of lip sync problems where the time stamps of associated video and audio streams are not synchronized. The PES Analyzer is designed to help address these problems and verify conformance of the PES header contents to the MPEG, DVB, and ATSC standards.

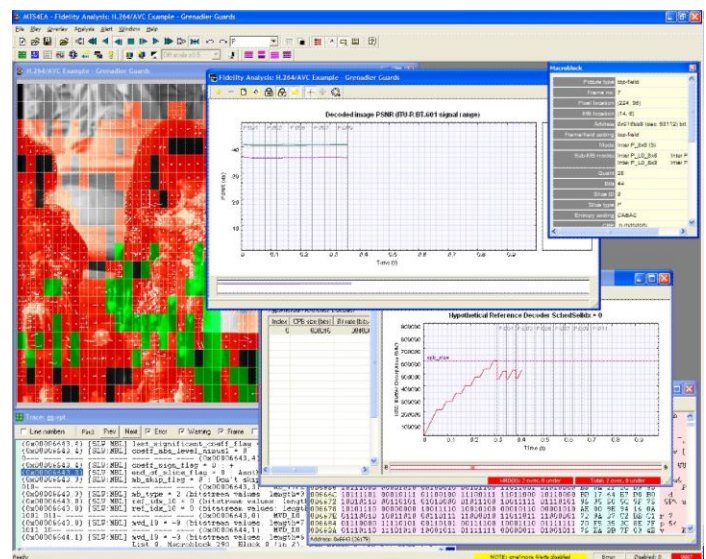


Packetized Elementary Stream (PES) Analyzer.

### MTS4EAV7 HEVC/AVC ES Analyzer

Whether developing a new codec chip, integrating a codec into professional or consumer equipment, or integrating different vendor's equipment when rolling out new services, the ability to verify the compliance of an Elementary Stream to either next-generation VC-1, HEVC/H.265, AVC/H.264, and MPEG-4 standards, or legacy MPEG-2 and H.263. Audio decode and waveform display of MPEG-2 audio (ISO/IEC 13818 parts 3 and 7), AC-3, and MPEG-4 AAC are also supported.

Comprehensive diagnostic capabilities including semantic trace view to determine Frame-by-Frame and Block-by-Block encoder decision making. Synchronized displays allow the user to quickly ascertain the details of each reported error. A bitstream editor allows the effects of planned encoder updates to be quickly understood.

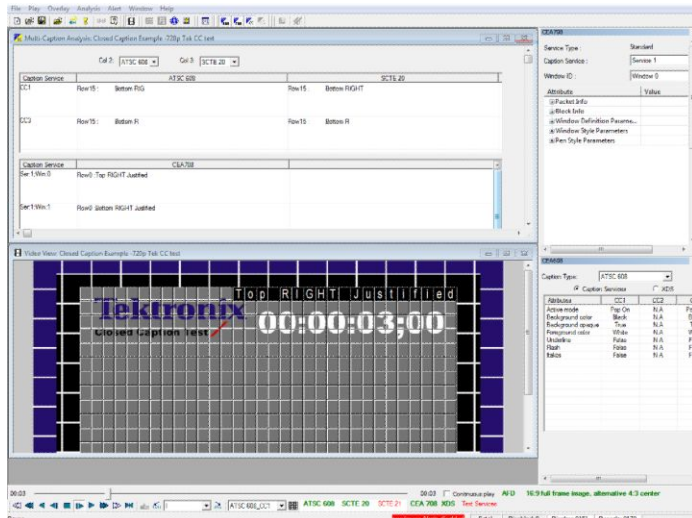


MTS4EAV7 HEVC/AVC ES Analyzer.



## MTS4EAV7 Closed Caption Analyzer

The MTS4EAV7 Closed Caption analyzer is intended for Closed Caption compliance testing and for debugging Closed Caption problems when captions do not appear over video. The analyzer allows you to extract the captions to SCC, MCC and SRT files and provides the ability to render captions over video and to align the CEA608, CEA708 and SCTE 20/21 control commands along side the video. MPEG-2 and AVC video with TS and MXF containers are supported.

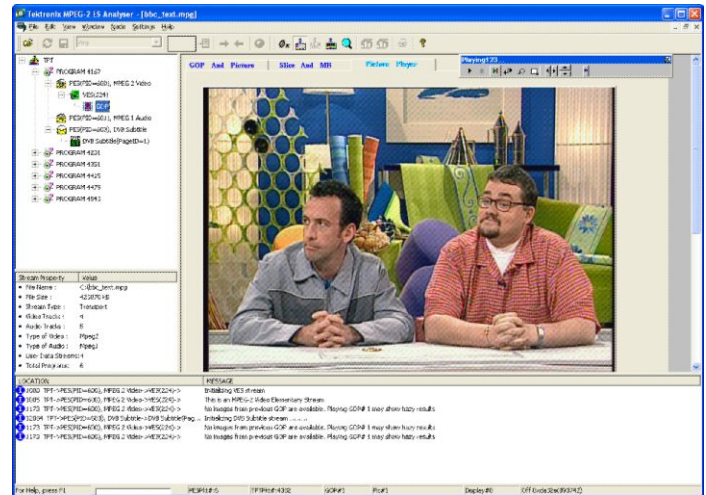


MTS4EAV7 Closed Caption Analyzer.

## Elementary Stream (ES) Analyzer

The ES Analyzer is intended for codec design, optimization, and conformance purposes. It provides the ability to view the moving picture from within a PES stream and carry out a whole range of sophisticated tests on the lower layers of an Elementary Stream within a Transport Stream. In addition, it both analyzes and displays a range of extended media formats, including ATSC Closed Captions, DVB Subtitles, and Teletext associated with video Elementary Streams.

For analysis of MPEG-4, HEVC/H.265, AVC/H.264, and VC-1 and MPEG-2 Elementary Streams, please refer to the MTS4EAV7 HEVC/AVC ES Analyzer.



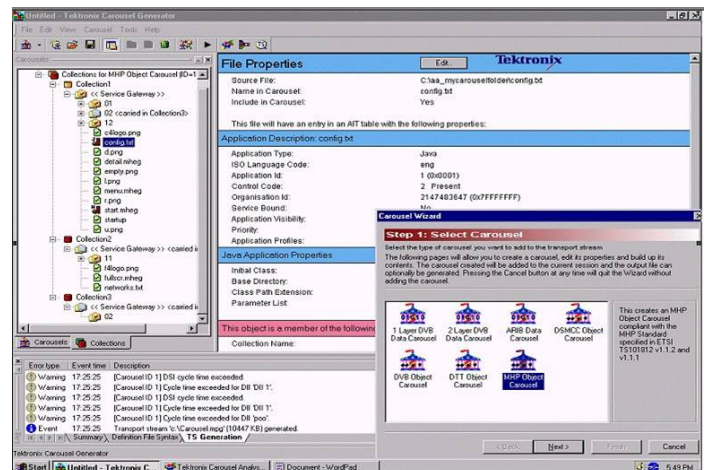
MPEG-2 ES Analyzer.

## Carousel Generator

The Carousel Generator is used for creating object carousel contents within an output Transport Stream. This is particularly useful in test situations where the effects of varying parameters, such as individual repetition intervals, may be quickly ascertained. The generator will create object carousels conforming to the MPEG-2 DSM-CC, DVB, DTT (MHEG-5), or MHP standards.

The Carousel Generator includes the following features:

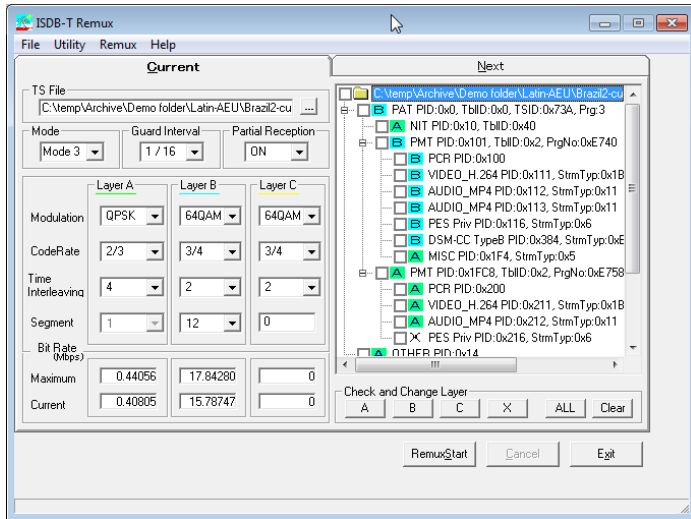
- Wizard helps easy stream generation
- Built-in multiplexer for easy video and audio insertion
- Variable delivery weightings to optimize carousel load times
- Generates all required SI tables for terrestrial, satellite, and cable applications
- Integrates with the Carousel Analyzer application for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



Carousel Generator.

### ISDB-T Remux

The ISDB-T Remux application shows each of the transport stream PIDs being dedicated to Layers A, B, or C. The remultiplexed .RMX file can be played over ASI to a ISDB-T/7b modulator.



ISDB-T Remux.

### VQS1000 Video Quality Software

VQS1000 video quality software enables QoE monitoring capabilities and real-time assessment of video impairments on MPEG-2 or H.264 encoded content, including stuck, black, blockiness, and compression artifacts for selected services. The VQS1000 performs a full decode on the video stream that allows operators to determine the source of a problem (content source, network distribution, etc.). Engineers can clearly see and validate the presence of impairments on the image using unique impairment displays that highlight the location and severity of video defects. In addition, audio diagnostics allow operators to analyze audio loudness related problems to the ITU-R BS.1770/1771 audio loudness standard.

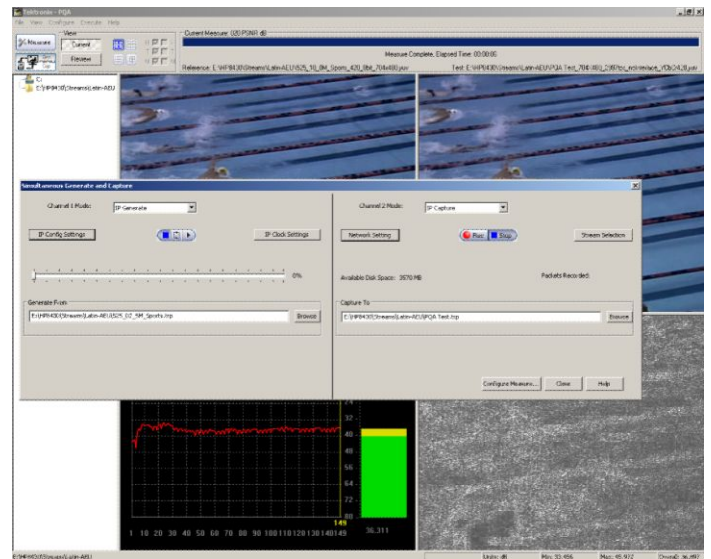


VQS1000 Video Quality Software.

### PQASW with IP Option

PQASW is picture quality analysis software based on the concepts of the human vision system which provides repeatable, objective quality measurements that closely correspond with subjective human visual assessment. These measurements provide valuable information to engineers working to optimize video compression and recovery, and maintain a level of common carrier and distribution transmission service to clients and viewers.

The IP interface enables both generation and capture of compressed video with two modes of simultaneous operation. Simultaneous generation and capture lets the user play out the reference video clips directly from an IP port in the PC into the device under test. The test output from the device can then be simultaneously captured by the PC. This saves the user from having to use an external video source to apply any required video input to the device under test. With this generation capability, files created by video editing software can be directly used as reference and test sequences for picture quality measurements.



PQASW Picture Quality Analyzer.

## Other applications

### Creating, editing, and resizing Transport Streams

The MTS4SAV3 provides 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

### 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.

## System requirements

The computer hosting the MTS4SAV3 software needs to meet the following requirements:

- Processor speed > 2.5GHz
- Intel or 100% compatible motherboard chipset
- Microsoft Windows 7 or Windows 8.1, 64-bit 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 (MTS4EAV7) require Microsoft Excel

## Ordering information

### Models

**MTS4SAV3** MPEG Transport Stream Analyzer standalone software, requires appropriate options to enable.

### Product options

At least one of the following options must be ordered.

<b>TCMP</b>	Add real time and deferred time Transport Stream Compliance Analyzer, Carousel Analyzer, TS Cutter, and MPEG Player
<b>PB</b>	Add PES and T-STD Buffer Analyzer; includes HEVC buffer analysis and PES with AVC, HEVC and AC-3 codec analysis
<b>CA</b>	Add Closed Caption Analyzer for CEA608, CEA708, SCTE20/21
<b>GEN</b>	Add stream generation capabilities – includes deferred time Multiplexer, Carousel Generator, ISDB-T Remux, and TS Editor; also includes HEVC stream generation capabilities
<b>ESB</b>	Add enhanced ES analysis – includes MTS4EAV7 base software (single user license only) and ES Analyzer
<b>ESE</b>	Add enhanced ES analysis – includes MTS4EAV7 software with all options including HEVC codec support (single user license only) and ES Analyzer
<b>VQ</b>	Add video quality monitoring software, single ended – includes VQS1000 software with all options
<b>PQ</b>	Add picture quality analysis, single and double ended – includes PQASW software with Option IP
<b>FLT</b>	Add floating license (all floating licenses include the same capabilities); for multiple licenses, order multiple Option FLT

### MTS4KUP field upgrade options

Upgrade options for existing MTS4SAV3 or MTS4SA software.

<b>TCMP</b>	Add real time and deferred time Transport Stream Compliance Analyzer, Carousel Analyzer, TS Cutter, and MPEG Player
<b>PB</b>	Add PES and T-STD Buffer Analyzer; includes HEVC buffer analysis and PES with AVC, HEVC and AC-3 codec analysis
<b>PBUP</b>	Upgrade Buffer Analyzer to include HEVC buffer analysis and upgrade PES Analyzer to include AVC, HEVC and AC-3 codec analysis
<b>CA</b>	Add Closed Caption Analyzer for CEA608, CEA708, SCTE20/21
<b>GEN</b>	Add stream generation capabilities – includes deferred time Multiplexer, Carousel Generator, ISDB-T Remux, and TS Editor; also includes HEVC stream generation capabilities
<b>MXUP</b>	Upgrade Multiplexer to include HEVC stream generation capabilities
<b>ESB</b>	Add enhanced ES analysis – includes MTS4EAV7 base software (single user license only) and ES Analyzer
<b>ESE</b>	Add enhanced ES analysis – includes MTS4EAV7 software with all options including HEVC codec support (single user license only) and ES Analyzer
<b>VQ</b>	Add video quality monitoring software, single ended – includes VQS1000 software with all options
<b>PQ</b>	Add picture quality analysis, single and double ended – includes PQASW software with Option IP
<b>FLT</b>	Add floating license (all floating licenses include the same capabilities); for multiple licenses, order multiple Option FLT
<b>V3</b>	Upgrade existing MTS4000 or MTS4SA version 2.x software to MTS4SAV3



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





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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.tek.com](http://www.tek.com).

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