

# MPEG TEST SYSTEMS

## MTS430 Data Sheet



### Features & Benefits

- 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
- A wide range of DTV standards are supported, including MPEG, DVB, ATSC, ISDB, and ISDB-TB (Brazil). Specific SI for Terrestrial, Cable, and Satellite, plus regional variations of these standards are also supported
- Range of interfaces and analysis capabilities provide the necessary connectivity to diagnose problems anywhere in the network environment, whether that be transmission links (RF or IP layer) or content processing (TS layer)
- Connect to both IP version 4 and 6 networks, including those using IGMP and MLD multicast protocols respectively
- Analyze both constant and variable bit rate streams (CBR and VBR)\*1

- Integrated cross-layer fault analysis and logging provides one box solution for fault diagnosis, reducing time to insight when troubleshooting
- Playout functionality provides stimulus with parametric capabilities and IP multisession replication to characterize behavior of network or device under test
- CaptureVu™ technology captures and analyzes system events in real time 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
- H.264 Buffer Analysis, Multiplexing, and ES Compliance Checking provide the most powerful suite of tools for creation and analysis of Transport Streams containing H.264 content
- Both Buffer Analysis and Multiplexing are now available for MPEG-4 AAC, a mandatory ISDB-TB audio CODEC. These compliment the existing MPEG-4 AAC ES Compliance Checking
- **Try before you buy:** Demo versions of the TSCA, Multiplexer, and Buffer Analyzer are available to download

### Applications

#### Equipment Manufacturers - Research & Development

- CaptureVu™ technology allows rapid isolation and debugging of equipment and system faults
- High-performance line rate Gigabit Ethernet (GbE) IP connectivity and integrated cross-layer analysis enable diagnosis of complex timing problems in video over IP and IPTV network equipment
- 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 option for codec design and optimization

\*1 Some timing related measurements are not possible with VBR streams.

**Summary of MTS430 Standard Tools**

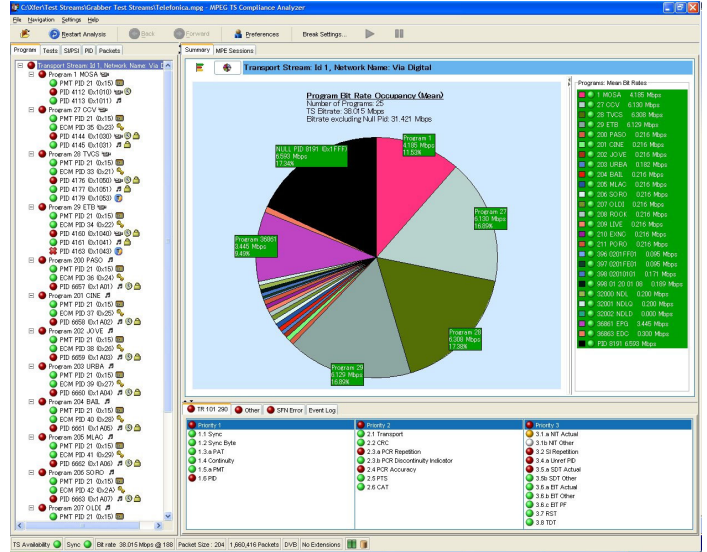
Standard Tools	Optional Tools
Real and Deferred Time Transport Stream Compliance Analyzer (TSCA)	Carousel Analyzer
Player	Carousel Generator
T-STD Buffer Analyzer	MPEG-2 ES Analyzer
PES Analyzer	MTS4EA ES Analyzer
T-clips Test Streams	
TS Editor and Cutter	
Multiplexer	
Additional software license with either TS or ES package	
Standard Interfaces	Optional Interfaces
ASI	IP Video (10/100/1000 Base-T, 1000Base-SX, LX, ZX)
LVDS (DVP Parallel)	DVB-S: QPSK (L-Band) and Turbo 8PSK
SMPTE 310M	DVB-T: COFDM
Ethernet IP (10/100/1000 Base-T) Use with Player only	DVB-C: QAM
	ATSC-T: 8VSB

Further details of individual tools are available within the Additional Resources.

**Transport Stream Compliance Analyzer (TSCA)**

The TSCA offers significant enhancements over traditional softwarebased deferred-time (stored streams) MPEG analyzers. 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 used in next-generation DTV and IPTV systems and services.

The TSCA also provides real-time analysis of Transport Streams received through the MTS430's stream interfaces, including IP and RF. The real-time analysis includes Cross Layer time-correlated IP and TS measurements, alarms, and error logging together with stream recording.



Transport Stream Compliance Analyzer

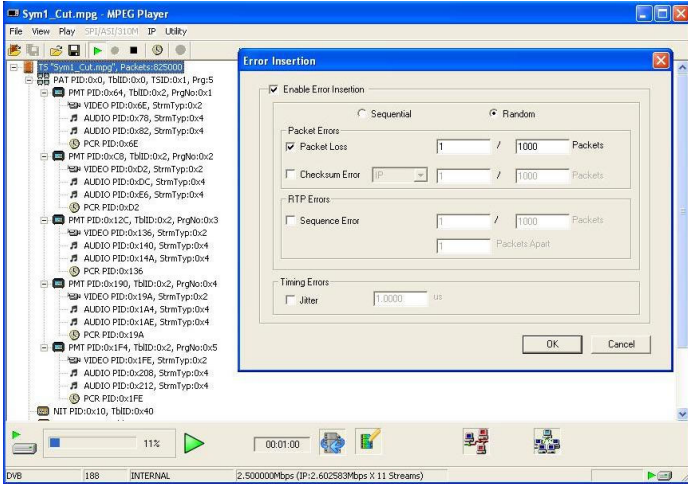
The TSCA includes the CaptureVu™ technology and PCR measurement and graphing capabilities. CaptureVu™ technology captures and analyzes system events in real time and deferred time to debug the intermittent and complex problems that traditional analyzers miss.

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, ISDB-TB, and MPEG. To maintain compatibility with the latest standards, 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.

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.

Duplex operation of the real-time TSCA and Player allows end-to-end system test (maximum aggregate bit rate is 214 Mbit/s for simultaneous input and output operation)\*2

\*2 Duplex is not available for Transport Streams over IP.



MPEG Player

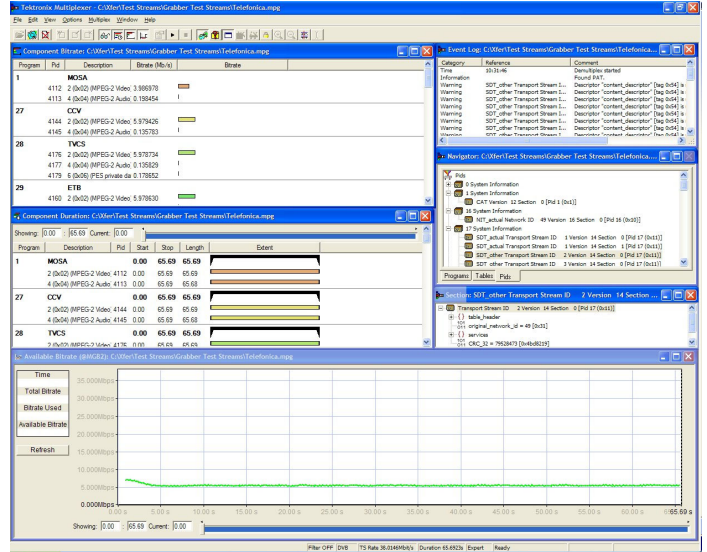
## Playout (Transport Stream Generation) and Recording

The Player tool provides a Transport Stream stimulus for a device under test through the ASI, SMPTE310, LVDS (DVB Parallel), or IP stream interfaces. Continuous playout of looped streams is possible at up to maximum ASI rate of 214 Mbps with automatic updating of time stamps. Playout rate can be automatically determined from file PCRs or manually set. Simultaneous playout and recording (duplex operation) for end-to-end system test is supported with the ASI/SMPTE310M and LVDS interfaces.

Playout through the IP interface provides stimulus with parametric capabilities and multisession replication to characterize behavior of a network or device under test. This capability enables equipment manufacturers developing hardware or software solutions for video distribution over IP and IPTV to ensure quality and performance of products, resulting in reduced development costs and accelerated roll out of next-generation IP broadcast services.

## 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



Multiplexer

(Service Information) or other tables, or are multiplexed to the incorrect transport stream rate for the application.

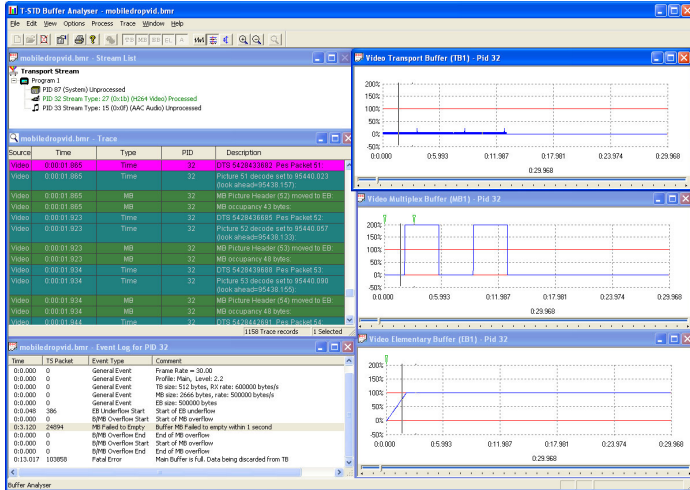
Use the Multiplexer/Remultiplexer/Demultiplexer application to create and modify multiprogram Transport Streams with custom SI/PSI/PSIP information for DVB, ATSC, ISDB\*3, and MPEG-compliant Transport Streams.

Video and audio Elementary Streams may also be multiplexed into a Transport Stream. H.264 streams both with and without SEI timing messages are supported. Bit rate and frame rate auto-detection features aid the import process.

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 robustness and quality of their MPEG-2 or H.264 implementation.

The **Make Seamless** wizard is provided with the Multiplexer. 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 wizard provides the opportunity of creating a seamless version of a Transport Stream file by adjusting SI and ES components within the stream.

\*3 This includes ISDB-TB (Brazil) and Single Segment mode.

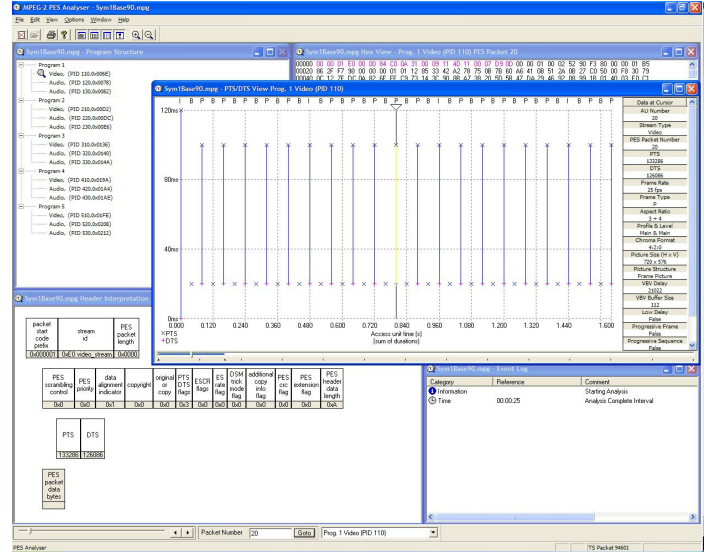


Buffer Analyzer

## 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 amongst 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 will be 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.



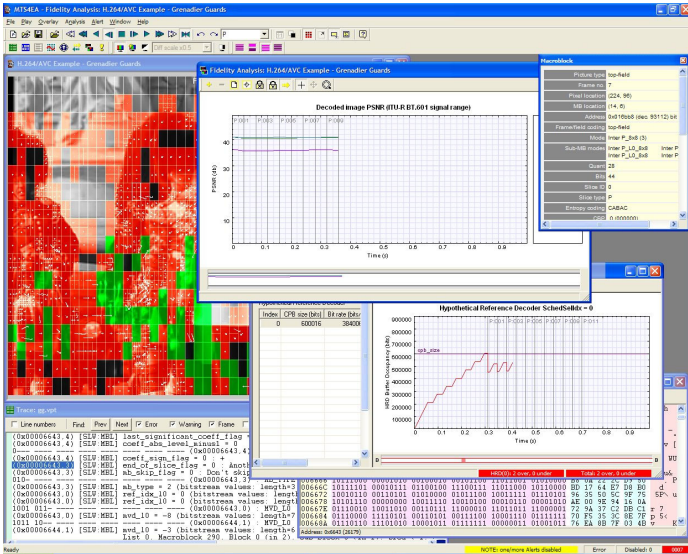
Packetized Elementary Stream Analyzer

## 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 as well as verify conformance of the PES header contents to the MPEG, DVB, and ATSC standards.

## Creating, Editing, and Resizing Transport Streams

Two direct stream manipulation packages are supplied as standard with the MTS430. TS Cutter allows resizing of Transport Streams. TS Editor allows direct editing of Transport Streams using a hexadecimal view as well as a header interpretation guide.



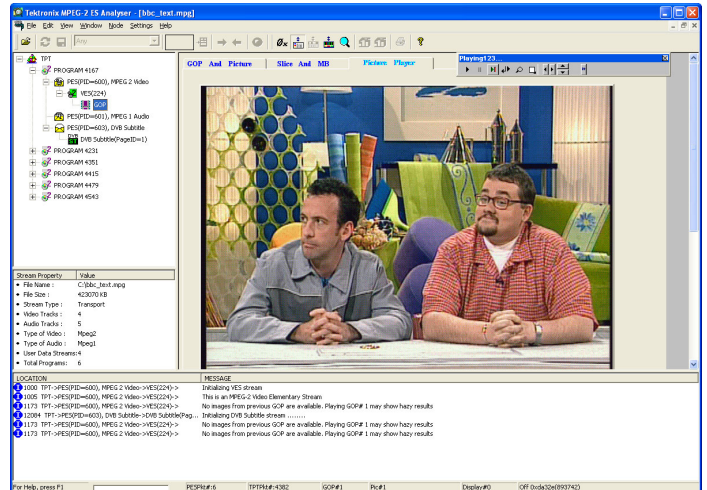
MTS4EA

## Summary of MTS430 Optional Tools

### MTS4EA 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 is crucial. This tool checks for compliance of an Elementary Stream to either next-generation VC-1, 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.



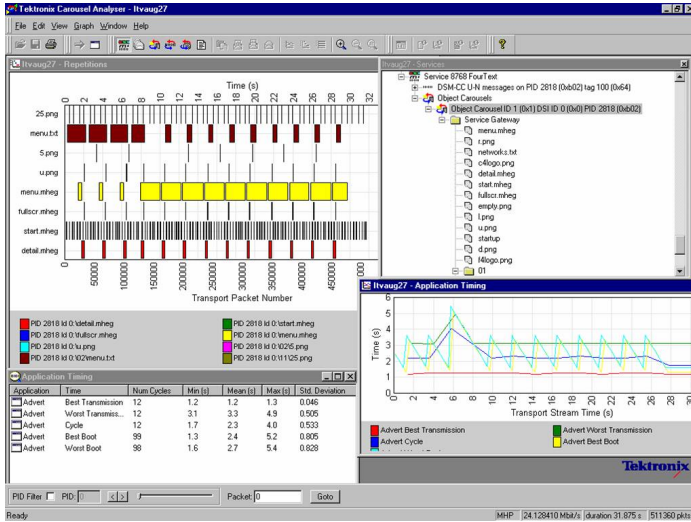
MPEG-2 ES Analyzer

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.

### 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 ITSC Closed Captions, DVB Subtitles, and Teletext associated with video Elementary Streams.

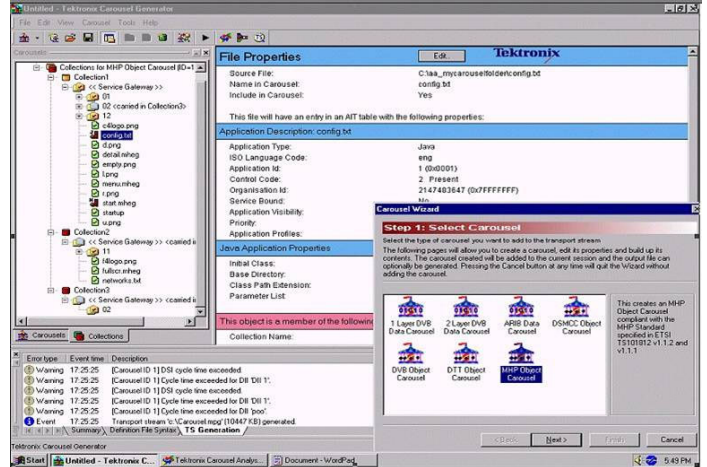
For analysis of MPEG-4, AVC/H.264, and VC-1 as well as MPEG-2 Elementary Streams, please refer to the MTS4EA.



Carousel Analyzer

### Carousel Analyzer

When developing either data or object carousels for interactive applications, designers not only need to verify the content of carousels, but also whether they are compliant with the relevant standards, and to optimize the settings between transmission bandwidth and responsiveness of the user experience. These settings are mainly concerned with the repetition rates of the various carousel groups. The Carousel Analyzer is designed to address all of these needs for a Transport Stream file containing carousel



Carousel Generator

components. It analyzes carousels compliant with MPEG-2 DSM-CC, DVB (including MHP), DTT (MHEG-5), or ARIB standards.

### Carousel Generator

The Carousel Generator product 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.

## Characteristics

### Platform Characteristics

Characteristic	Description
Operating System	Microsoft Windows XP Pro
Processor	Intel Pentium P4, 2.8 GHz minimum
Disk Storage For Operating System And Software Applications	80 GB, Ultra ATA100 IDE Hard Drive
Disk Storage For Captured Video Streams	144 GB (two × 72GB SCSI Hard Disk Drives)
Video Stream Storage Disk I/O Port	SCSI-3 (Ultra 160), Micro D68 connector, 68 Pin,
RAM	1 GB (one SIM of DDRS memory)
Optical Storage Drive	CD-R/W / DVD-R/RW / DVD+R/RW
Display	LCD, 1024×768, 10.4 inch
External VGA Output	15-pin, High density, D-sub. Resolution needs to be set to the same as the integral LCD display
Ethernet	One 10/100 Base-T; RJ45 connector One 10/100/1000 Base-T; RJ45 connector
Keyboard port	Mini DIN, PS-2, one at the rear and one at left front side (Not hot pluggable)
Mouse port	Mini DIN, PS-2, one at the rear and one at left front side (Not hot pluggable)
Printer Port	IEEE P1284
COM Port	RS-232
USB Port	2 × USB 2.0

### Instrument Characteristics

#### External Reference/Clock Input

Characteristic	Description
Input Connector Type	50 Ω, BNC, AC Coupled
Frequency	8.12698 MHz, 10 MHz, 27 MHz (<1 ppm recommended)
Amplitude	0 ±6 dBm (Peak-to-Peak, Sine Wave), 0.5 V to 3.0 V (Square Wave)
Clock Inputs	
Frequency	160 kHz to 25 MHz (Parallel Clock), 1.28 MHz to 32 MHz (Serial Clock)
Amplitude	0.5 V to 3.0 V (Square Wave)

#### External Trigger Input

Characteristic	Description
Input Connector Type	1 kΩ, BNC
Threshold Level	Rising/Falling Edge programmable
High Level	>3.5 V (The maximum limit voltage is 7 V)
Low Level	<0.8 V

#### SPI I/O

Characteristic	Description
SPI Input Connector Type	D-sub 25 pin
Output Amplitude	240 mV to 550 mV BUS LVDS with 100 Ω termination
Data Rate	250 kbps to 108 Mbps (in accordance DVB specification maximum)
Output Impedance	100 Ω between differential outputs with "Output Off"
Data Delay	±5 ns from DCLK rising edge
Input level	>200 mV <sub>p-p</sub> (RI+)-(RI-) with 100 Ω Termination
Input Impedance	100 Ω between differential inputs

#### ASI

Characteristic	Description
Connector	BNC (uses a common connector with the SMPTE 310M interface) 75 Ω transformer coupled input & output 800 mV ±10% into 75 Ω load output 200 mV to 880 mV input Return loss less than -17 dB (5 MHz to 270 MHz) into a 75 Ω load
Bit Rate	250 kbps to 214 Mbps (in accordance DVB specification maximum) Input and output aggregate bit rate (simplex or duplex operation)

#### SMPTE310M

Characteristic	Description
Connector	BNC (uses a common connector with the ASI interface) 75 Ω transformer coupled input & output 800 mV ±10% into 75 Ω load output 200 mV to 880 mV input Return loss < -17 dB (5 MHz to 38.785316 MHz) at 75 Ω load
Bit Rate	19,392,658.5 b/s

### Standalone Software System Requirements

**Note:** Required when software is purchased to be installed on a user's own PC.

- PC with Genuine Intel Pentium class 1.2 GHz processor
- Intel or 100% compatible motherboard chipset
- Windows 2000 or Windows XP Operating System
- Internet Explorer 5.0 or above
- 256 MB of RAM
- 500 MB of available hard disk space for the applications and documentation
- Additional space will be 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) require Microsoft Excel

### Interface Options Characteristics

#### IP Video Interface (Option IPTVD)

Characteristic	Description
Ethernet Ports	10/100/1000 Base-T, 1000Base-SX, LX, ZX
Port Options	Opt. IPTVD Gigabit Ethernet Interface with 10/100/1000 Base-T RJ45 electrical port Optical SFP modules which plug into IP Video card GE to provide optical connectivity Opt. SX 1000Base-SX Short Wavelength Optical port with LC connector for Gigabit Ethernet Interface (Multi Mode 850 nm) Opt. LX 1000Base-LX Long Wavelength Optical port with LC connector for Gigabit Ethernet Interface (Single Mode 1310 nm) Opt. ZX 1000Base-ZX Optical port with LC connector for Gigabit Ethernet Interface (Single Mode 1550 nm)
Maximum Data Rate	Line rate
ASI Output	ASI compliant with specification EN 50083-9 ASI smoothing can be activated to compensate for bursty IP traffic
Protocol Stack Support	IPv4 and v6 support UDP/IP/Ethernet UDP/IP/VLAN/Ethernet RTP/UDP/IP/Ethernet RTP/UDP/IP/VLAN/Ethernet
Multicast and Control Support	IGMP v2 and v3 MLD v1 and v2 ARP ICMP (Inbound and Outbound ping)
IP Packet Support	7 transport stream packets per IP packet (188 byte packets) FEC (FEC is parsed but is not processed)
IP Video Metrics	Session Support Discovery of up to 500 IP sessions Simultaneous monitoring of key parameters including Continuity Count and Sync Byte Packet Interarrival Time (PIT) for all sessions RTP sessions are monitored for Out of Order and Dropped Packets

### COFDM Interface Characteristics (Option CF)

Characteristic	Description
Input Frequency Range	50 MHz to 858 MHz
Channel Bandwidth	6 MHz, 7 MHz, and 8 MHz (SW selectable)
Connector Style	F-type with BNC adaptor
Input Termination Impedance	75 Ω nominal
Input Return Loss	7 dB typical 50 MHz to 858 MHz
Rx Lock Status	Indicated by LED on rear panel and by the UI
Modulation Scheme Supported	QPSK (4QAM), 16QAM, and 64QAM modulation
Transmission Modes	2K carriers and 8K carriers
Hierarchical Modes	All hierarchies are supported, including no hierarchy, and alpha = 1, 2, and 4
Viterbi puncture rates	1/2, 2/3, 3/4, 5/6, 7/8
Guard interval	1/32, 1/16, 1/8, 1/4
Spectrum Polarity	The receiver will operate with both inverted and normal spectral polarity
Input Signal Amplitude Range*4	QPSK (4QAM): -85 dBm to -15 dBm (24 dBuV to 94 dBuV) typical 16QAM: -80 dBm to -15 dBm (29 dBuV to 94 dBuV) typical 64QAM: -72 dBm to -15 dBm (37 dBuV to 94 dBuV) typical

#### RF Measurements

Carrier Offset	Carrier offset is measured from the tuned channel frequency to a accuracy of ±50 ppm typical
Signal-to-Noise Ratio (SNR)	Display Range: 6 dB to 40 dB for QPSK (4QAM): 11 dB to 40 dB for 16QAM 16 dB to 40 dB for 64QAM Resolution: 1 dB Accuracy: ±1 dB to 30 dB SNR (measured at -30 dBm in high-resolution mode) typical
EVM (Error Vector Magnitude)	Display Range: 1% to 30% rms, for QPSK 1% to 20% rms, 16QAM 1% to 8.5% rms, 64QAM Resolution: 0.1%
Modulation Error Ratio (MER) with Equalizer	Both MER Peak and MER Average are displayed as measured across all carriers Display Range: 6 dB to 37 dB for QPSK (4QAM) 11 dB to 37 dB for 16QAM 16 dB to 37 dB for 64QAM Resolution: 0.1 dB Accuracy: ±1 dB to 30 dB (measured at -30 dBm in high-resolution mode) typical
Constellation	The RF constellation is displayed on the UI
Channel Impulse Response	Measurement of channel impulse response and SFN delay
Channel Spectral Response	Active receive channel spectrum, RF level vs. frequency
Bit Error Ratio (BER)	Pre FEC, BER, and Error Sec BER values are displayed
Post Reed Solomon BER	Post RS BER (Uncorrectable Error Count) displayed
Transport Error Flag (TEF)	Alarm generated on detection of a TEF

\*4 For compliance with IEC61000-4-3 (Immunity) the Input Signal Amplitude must be ≥ -40 dBm.



**8VSB Interface Characteristics (Option VS)**

Characteristic	Description
Input Frequency Range	54 MHz to 860 MHz, VHF/UHF channels 2 to 69 (to include low VHF frequencies)
Input Signal Level	-72 dBm to -6 dBm (-23 dBmV to +43 dBmV) typical
Modulation Format	8VSB in accordance with ATSC A/53B
Receiver Bandwidth	6 MHz
Input Termination Impedance	75 Ω nominal
Connector Type	F-type Connector
Input Return Loss	5 dB typical
<b>RF Measurements</b>	
RF Lock	RF lock is indicated by a LED on the rear panel and a status indicator on the UI
Input Level	Range: -72 dBm to -2 dBm -23 dBmV to +47 dBmV relative to 75 Ω Resolution: 1 dB Accuracy: ±3 dB up to -6 dBm input level typical ≥ -50 dBm to ensure compliance to IEC 61000-4-3 immunity
Error Vector Magnitude (EVM)	Display Range: 3% to 12.5% rms Resolution: 0.1% typical
Equivalent Modulation Error Ratio (MER)	Display Range: 15 dB to 36 dB Resolution: 1 dB Accuracy: ±1 dB for MER <25 dB typical ±3 dB for MER 25 dB to 31 dB typical
Signal-to-Noise Ratio (SNR)	Display Range: 15 dB to 35 dB Resolution: 1 dB Accuracy: ±1 dB for SNR <25 dB ±3 dB for SNR 25 dB to 35 dB typical
Bit Error Ratio (BER)	Pre FEC, SER, and Error Sec BER values displayed on UI

**QPSK (L-Band) and Turbo 8PSK Interface Card (Option EP)**

Interface option EP provides both QPSK (L-Band) and Turbo 8PSK interface and measurement capability

Characteristic	Description
Input Frequency Range	950 MHz to 2150 MHz step size of 1 MHz
Input Signal Amplitude Range	-60 dBm to -30 dBm for CBER < 1e-6
Modulation Format	QPSK in accordance with ETSI EN 300 421
Modulated Baud Rate	1 MBaud min, 30 MBaud max
Viterbi Values Supported	1/2, 2/3, 3/4, 5/6, 6/7, 7/8
FEC	In accordance with ETSI EN 300 421
Turbo Viterbi Values Supported	1/2, 2/3, 3/4, 5/6, 7/8
Turbo FEC	Turbo Code
Connector Style	F-style
Input Termination Impedance	75 Ω nominal
LNB Supply Voltage	Selectable; 13.0 V ±1.5 V or 18.0 V ±1.5 V
LNB Supply Maximum Current	200 mA maximum
LNB 22 kHz Signaling Frequency	17.6 kHz min, 26.4 kHz max (22 kHz ±20%)
LNB 22 kHz Signaling Amplitude	600 mV <sub>p-p</sub> nominal with 100 Ω load
Modes Supported	Turbo QPSK, QPSK DSS, QPSK DCII, QPSK DVB

**RF Measurements**

RF Lock	RF lock is indicated to the user by an LED on the rear panel and a status icon on the UI
Input Level (Signal Strength)	Range: -60 dBm to -30 dBm Resolution: 1 dBm Accuracy: ±5 dBm typical
EVM (Error Vector Magnitude)	Display Range: ≤4.0% to ≥30.0% rms Resolution: 0.1%
MER (Modulation Error Ratio) with Equalizer	Display Range: 10 to 26 dB with Equalizer Resolution: 1 dB Accuracy: ±2 dB typical for range 10 to 20 dB
SNR (Signal-to-Noise Ratio)	Display Range: 5 to 35 dB Resolution: 1 dB Accuracy: ±2 dB typical for range from 5 to 30 dB
Pre Reed Solomon (RS) BER	Pre RS BER is displayed on the UI
Post RS BER and TEF (Transport Error Flag)	Post Reed Solomon BER (TEF ratio), TEF rate, and number of Transport Error Flags (TEF count) are displayed on the UI.
Constellation	The RF constellation is displayed on the UI

**Turbo 8PSK Interface Characteristics (Option EP)**

Characteristic	Description
Input Frequency Range	950 MHz to 2150 MHz in 100 kHz steps
Modulation Format	Turbo 8PSK*5
Modulated Baud Rate	1 MBaud min, 30 MBaud max
Turbo Viterbi Values Supported	2/3, 3/4 (2.05), 3/4 (2.1) 5/6, 8/9
Turbo FEC	Turbo Code
Connector Style	F-style
Input Termination Impedance	75 Ω nominal
LNB Supply Voltage	Selectable; 13.0 V ±1.5 V or 18.0 V ±1.5 V
LNB Supply Maximum Current	200 mA maximum
LNB 22 kHz Signaling Frequency	17.6 kHz min, 26.4 kHz max (22 kHz ±20%)
LNB 22 kHz Signaling Amplitude	600 mV <sub>p-p</sub> with 100 Ω load
Modes Supported	Turbo 8PSK

**RF Measurements**

RF Lock	RF lock is indicated to the user by an LED on the rear panel and a status icon on the UI
Input Level (Signal Strength)	Range: -60 dBm to -30 dBm Resolution: 1 dBm Accuracy: ±5 dBm typical
EVM (Error Vector Magnitude)	Display Range: ≤4.0% to ≥30.0% rms Resolution: 0.1%
MER (Modulation Error Ratio) with Equalizer	Display Range: 10 to 26 dB with Equalizer Resolution: 1 dB Accuracy: ±2 dB typical for range 10 to 20 dB
SNR (Signal-to-Noise Ratio)	Display Range: 5 to 35 dB Resolution: 1 dB Accuracy: ±2 dB typical for range from 5 to 30 dB
Pre Reed Solomon (RS) BER	Pre RS BER is displayed on the UI
Post RS BER and TEF (Transport Error Flag)	Post Reed Solomon BER (TEF ratio), TEF rate, and number of Transport Error Flags (TEF count) are displayed on the UI
Constellation	The RF constellation is displayed on the UI

\*5 Please note that the Turbo 8PSK option does not support nonturbo 8PSK (DVB-DSNG), or DVB-S2. For information, please contact Tektronix.

**QAM Interface Characteristics (Option QB2)**

Characteristic	Description
Input Frequency Range	88 MHz to 858 MHz , 62.5 kHz steps
Modulation Format	64QAM, 256QAM compliant with ITU J-83*6 SCTE07 Compliant
Modulation Baud Rate	5.057 Mbaud/s and 5.360 Mbaud/s
Input Signal Level	-64 dBm to -19 dBm (45 dBuV to 90 dBuV relative to 75 Ω) with a 64 and 256 QAM input typical
Ultimate Modulation Error Ratio	37 dB typical
Receiver Bandwidth	6 MHz nominal
Input Termination Impedance	75 Ω nominal
Input Return Loss	-6 dB min, -10 dB typical, 51 MHz to 858 MHz

**RF Measurements**

RF Lock	RF lock is indicated by a LED on the rear panel and a status icon on UI
Input Level (Signal Strength)	Range: -64 dBm to -19 dBm Resolution: 1 dBm Accuracy: ±3 dBm Typical
EVM (Error Vector Magnitude)	Display Range for 64 QAM: ≤1% to ≥5% rms Display Range for 256 QAM: ≤1% to ≥2.5% rms Resolution: 0.1% Accuracy: within 20% of reading for S/N >25 dB Typical
MER (Modulation Error Ratio) with Equalizer	Display Range for 64 QAM: 22 dB to 37 dB Display Range for 256 QAM: 28 dB to 37 dB Resolution: 0.1 dB Accuracy: ±1 dB for MER <25 dB ±3 dB for MER 25 dB to 34 dB Typical
SNR	Display Range for 64 QAM: 22 dB to 37 dB Display Range for 256 QAM: 28 dB to 37 dB Resolution: 1 dB Accuracy: ±1 dB for MER <25 dB ±3 dB for MER 25 dB to 34 dB Typical
BER	Pre FEC, SER, and Error Sec BER values are displayed
Post RS BER and TEF (Transport Error Flag)	Post Reed Solomon BER (uncorrectable error count) and number of Transport Error Flags are displayed on the UI
Constellation	The RF constellation is displayed on the UI

\*6 Level 1 and Level 2 interleaving support compliant with all ITU J-83 Annex B, excluding I, J = 128, 7 and 128, 8 for 64QAM and in 256QAM excluding I,J = 8, 16 and 16, 8.

## Ordering Information

### MTS430 (Equipment Manufacturers) Base System

#### MTS430 MPEG Test System

**Includes:** Real-time and Deferred-time Transport Stream Compliance Analyzer with CaptureVu™ technology, Realtime Video over IP Analysis, Simultaneous Play/Record on one channel, Multiplexer, PES Analyzer, Buffer Analyzer, TS Editor, TS Cutter, and Make Seamless Applications

#### MTS430 Standard Options

Opt.	Description
<b>Option to Add</b>	
ES	ES Analyzer
DB	Carousel Analyzer
CG	Carousel Generator
DBCG	Carousel Analyzer and Carousel Generator
IPTVD	IP Video Gigabit Ethernet Interface with 10/100/1000 Base-T RJ45 electrical port. For optical interface, SFP required (options SX, LX, and ZX)
VS	8VSB interface
QB2	QAM Annex b interface
CF	COFDM DVB-T interface
EP	QPSK/8PSK interface
LX	1000Base-LX Long Wavelength optical port with LC connector for Gigabit Ethernet Interface (Single Mode 1310 NM)
SX	1000Base-SX Short Wavelength optical port with LC connector for Gigabit Ethernet Interface (Multi Mode 850 NM)
ZX	1000Base-ZX Long Wavelength optical port with LC connector for Gigabit Ethernet Interface (Single Mode 1550 NM)

#### MTS430 Package Options

MTS4USB P430TS	Additional TS package license. Contains Real- and Deferred-time TS Compliance Analyzer, Multiplexer, PES Analyzer, Buffer Analyzer, TS Editor, and Make Seamless applications
MTS4USB P430ES	Additional ES package license. Contains MTS4EA with all CODEC plus AVDM options
MTS4USB SWS	First 12 months subscription on the MTS4EA supplied with Option P430ES.

Opt.	Description
<b>Repair Service</b>	
R3	3 years
R5	5 years
<b>Documentation</b>	
L0	English
L5	Japanese
<b>Power Cord/Adapter</b>	
A0	North American
A1	Universal Euro
A2	United Kingdom
A3	Australia
A4	240 V North America
A5	Switzerland
A6	Japan
A10	China
A11	India
A99	No Power cord or AC adapter

#### Add MTS4EA Compressed Video ES Analyzer onto MTS430 System at Initial Time of Ordering

Opt.	Description
4EAB	Base software with video standard package including: MPEG-2 Main Profile (Main, High, and High 1440 Levels), MPEG-4 Simple Profile, H.263, TS Extraction, CD, and Manual
M4SP	MPEG-4 Advanced Simple Profile (Levels 0 -5)
AVC	H.264/AVC Baseline, Extended and Main Profiles (Levels 1 - 5), and High Profile with FRExT (10 bit, 4:2:2, 4:4:4)
AVDM	Audio/Visual Delay Measurement
VC1	VC-1 (all Profiles, all Levels) and Windows Media V9 (ASF)
AUD	Audio (incl. AAC, HE AAC)
SWSE	First 12 months software subscription on the MTS4EA software and its options purchased with a new MTS430. (Does not cover the MTS430 base software and standard options)

**Upgrade or Add Standard Options after Initial Purchase of MTS430**

Item	Opt	Description
MTS4UP		MTS400 Series Field Upgrade Kit
	ES	ES Analyzer to any MTS400 Series product
	DB	Carousel Analyzer to any MTS400 Series product
	CG	Carousel Generator to MTS400 Series
	DBC	Carousel Analyzer and Carousel Generator to MTS400 Series

**Upgrade kit to add**

MTS4UP	IPTVD	IP Video Gigabit Ethernet Interface with 10/100/1000 Base-T RJ45 electrical port. For optical interface, SFP required (options SX, LX, or ZX)
	LX	1000Base-LX Long Wavelength optical port with LC connector for GIGE interface (Single Mode 1310 NM)
	SX	1000Base-SX Short Wavelength optical port with LC connector for GIGE interface (Multi Mode 850 NM)
	ZX	1000Base-ZX Long Wavelength optical port with LC connector for GIGE interface (Multi Mode 1550 NM)
	VS	8VSB interface. Includes upgrade to latest software
	QB2	QAM Annex B interface. Includes upgrade to latest software
	CF	COFDM DVB-T interface. Includes upgrade to latest software
	EP	QPSK/8PSK interface. Includes upgrade to latest software

**Other**

MTS4UP	UPG	Upgrade to latest version of MTS400 Series base software and installed options. Includes CD and Manual (does not include upgrades to MTS4EA software)
	IF	Return to Depot installation of MTS4UP on an MTS430 only (not available with MTS4SA software installed on a user's own PC)

**Note:** To upgrade or add MTS4EA compressed video ES Analyzer options after initial purchase of MTS430 instruments, please see specific MTS4EA Ordering Information.



Product(s) are manufactured in ISO registered facilities.



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

**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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