QAM400A DTV Monitor

QAM400A Data Sheet

Features & Benefits

- Comprehensive confidence monitoring at the RF modulated layer with optional QAM Annex A, B, or C interfaces, as well as MER (up to 37 db typical), BER, and Constellation displays. These critical RF measurements provide early indication of signal degradation before any picture impairment is visible to the end customer without additional costly RF test equipment

- Unique dual-level alarming and seven-day trend information proactively identifies impending problems before they become visible to the viewer

- FlexVu™ uniquely empowers operations staff with the simplest information necessary to prove their service is delivering above their defined thresholds for superior Quality of Service (QoS)

- Powerful diagnostic user interface provides intelligent hierarchical views of network information, media, and data, allowing engineers to rapidly identify the root cause of underlying service problems

- Multilayer, multichannel, remote monitoring and measurement at RF and TS layers to DVB, ATSC, SCTE, DCII, and ISDB-T/Tb standards with content-checking support for both MPEG-2 and H.264/AVC

- Comprehensive user-defined template monitoring ensures right content at the right place at the right time while content-ratings checking ensures only appropriate content broadcast

- Simultaneous connection of multiple remote users and Network Management Systems (NMS) provides early visibility of problems to key individuals throughout the organization to support quicker corrective action

- Embedded architecture designed specifically for continuous 24×7 operation maximizes service assurance, thus minimizing cost of customer complaints and equipment maintenance (disk-free operation)

- Remote recording allows capture and analysis of stream events for expert offline analysis to diagnose difficult and intermittent problems, requiring no engineer site visits

- Highly scalable and field-upgradeable monitoring solution to tailor capital expenditure with operational growth

Applications

- Cable Headend Monitoring

- IPTV Ingest and Headend Monitoring

- Edge Network Monitoring
    - ASI to RF
    - IP to RF (Requires both IPM400A and QAM400A units)
    - IP to ASI

Deployed at key network nodes, the QAM400A provides an intuitive and simplified presentation of video quality and diagnostic information to support delivery of superior QoS levels in an increasingly complex broadcast environment.

Verify RF and TS integrity on a QAM channel with the ability to tune to any QAM channel for verification and diagnostics; ideal for monitoring output of headend SEM or Edge QAM devices at the RF combiner, with support for both MPEG-2 and H.264 at either Constant Bit Rate (CBR) or Variable Bit Rate (VBR).

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Introduction

The QAM400A provides a complete solution for real-time transmission monitoring of MPEG Transport Streams over RF and ASI interfaces. Powerful confidence monitoring capability and deep diagnostic measurements are both combined into a single integrated solution. This enables cable operators to deliver superior QoS levels with reduced operational expenditure. Deployed at key network nodes, the QAM400A provides an intuitive and simplified presentation of video quality and diagnostic information. This supports the delivery of superior Quality of Service (QoS) levels in an increasingly complex broadcast environment.

When used together with VQNet™, facility and network-wide views allow engineers to sectionalize network problems.

Technical Overview

The QAM400A provides a complete solution for real-time transmission monitoring of MPEG Transport Streams over RF and ASI interfaces. Powerful confidence monitoring capability and deep diagnostic measurements are both combined into a single integrated solution. The confidence monitoring capability uniquely simplifies DTV monitoring with the FlexVu™ summary displays, which include video thumbnail and Electronic Program Guide (EPG) views. This empowers operational staff with the simplest information necessary to ensure their service is delivering above their defined thresholds for superior QoS.

The deep diagnostic option provides engineers with intelligent hierarchical views of network information, media, and data to support rapidly identifying the root cause of underlying service problems. This diagnostic monitoring option provides more in-depth analysis of the MPEG Transport Stream including recording capability and a comprehensive range of TS testing including TR 101 290, A/65, A/78, SCTE-142 compliance testing.

The QAM400A provides a single Transport Stream processor platform packaged in a 1 RU rackmount chassis to provide monitoring of a Transport Stream at data rates up to 155 Mb/s[1]. The QAM interface allows the QAM400A to receive RF inputs and display key RF monitoring parameters including MER, BER, and Constellation displays before demodulating the signal to provide measurements on the health of the Transport Stream.

The channel polling capability for the QAM400A probe combined with the RF interface allows up to 200 RF channels to be monitored in a repeating cyclic measurement process. Control and configuration of the polling is undertaken using flexible XML scripting. This polling ability makes a single QAM400A probe a broader tool, monitoring large numbers of network points in a time-sampled measurement mode.

The remote user interface provides a highly simplified presentation of video quality and diagnostic information for operations and engineering teams.

For a fully integrated monitoring solution, network management platforms are supported with a full set of APIs to support wider distributed network intelligence. This also includes video walls that can display up to the full transmitted resolution of the video stream for network operation centers.

Flexible and Upgradeable

The QAM400A provides a highly scalable and field-upgradeable monitoring solution to tailor capital expenditure with operational growth. The extended confidence monitoring probes can be installed throughout the network and powerful diagnostic capability (Option DIAG) can be added to the key monitoring points where Transport Streams are manipulated.

- Triggered recording to be captured and rapidly analyzed in greater depth using powerful offline analysis tools such as the Tektronix MPEG Test System Stand-alone Software[2]

- PSI/SI/PSIP/ARIB SI analysis and repetition rate graphing allows broadcasters to determine that the system information is present and correct in the Transport Stream

- Exception monitoring with simple automated template generation from reference streams. Template testing checks a number of key parameters to ensure that the Transport Stream has been constructed as the broadcaster intended. These parameters include the Transport Stream ID and Network ID, the number of programs in the multiplex, that each program has all of its components (Video, Audio, Data, Teletext, Subtitles), and Conditional Access (CA) status

- Bit rate testing determines whether PIDs, programs, services, or user-defined groups of PIDs are within user-definable limits to ensure correct multiplex operation. Tektronix-proprietary PID variability test gives indication of PID bit rate variation to assess effects of statistical multiplexing

- In-depth PCR analysis with graphical results views enable timing and jitter measurements to be made to ensure correct operation of the network

- Comprehensive service logging enables verification of service level agreements to ensure that contractual obligations are met

- When used in conjunction with the VQS1000 Video Quality Software application, provides reliable and sophisticated analysis algorithms applied to decoded MPEG-2 or H.264 video to identify stuck, black, macro-blocking, and compression artifacts

[1] Maximum Transport Stream bit rate is dependent on Transport Stream content and depth of analysis being performed. Depth of stream analysis is handled gracefully if SI/PSIP max content is exceeded to ensure critical measurements continue to be performed.

[2] MTS400 Series MPEG Test System offline software tools are available for use with the MTM400A. These are stand-alone software applications intended to run on the customer's control PC. Separate data sheet is available.

Measurement Functions

QAM400A Extended Confidence Monitor in Standard Configuration

- MPEG-2, DVB (TR 101 290), ATSC, and ISDB supported

- TR 101 290 Priority 1, 2, and 3 measurements*3 in accordance with the techniques specified in TR 101 290

- Supports A/65, A/78, and SCTE-142 compliance testing

- Continuity count displayed on a per PID or per TS basis

- PSI/SI/PSIP/ARIB SI analysis and repetition rate graphing. Transport Stream structure view with ability to drill down to examine tables and service contents plus real-time graphical representation of table repetition rates

- Bit rate measurement in accordance with the methodology specified in TR 101 290 MGB2

- Packet size detection

- Comprehensive error logging that context filters with navigation

- Status of all tests and measurements is available through SNMP MIB with support for SNMP traps*4

Diagnostic Monitoring Options (Opt. DIAG)

- Triggered recording with user-definable pre-triggered buffering and up to 160 MB available storage

- Template testing (for user-defined service plan testing). User-definable tests with scheduled template updating

- Bit rate testing on a per PID, program, or user-defined groups of PIDs basis

- In-depth timing analysis with graphical results views of:
  - PCR_OJ (Overall Jitter)
  - PCR_AC (Accuracy)
  - PCR_FO (Frequency Offset)
  - PCR_DR (Drift Rate)
  - PTS Arrival Interval

- Service logging of user-selected PIDs to record packet rates at user-definable intervals

- Channel polling allows up to 200 channels to be polled sequentially from either the IP or the RF interface

Remote User Interface

The Remote User Interface (RUI) is capable of providing simultaneous measurement results to multiple key resources, supporting improved organizational efficiency and workflow to minimize network downtime. It is also capable of being integrated into wider network management platforms to support wider distributed network intelligence. The confidence monitoring capability uniquely simplifies DTV monitoring with the FlexVu™ summary panels. For diagnostic monitoring a context-sensitive analysis paradigm provides a rich multilayer environment that presents complex information with an intuitive hierarchical approach. The supporting extensive navigation options ensure that you can identify the root cause of error alarms with minimal mouse clicks.

Confidence Monitoring

- FlexVu™ uniquely presents simplified presentation of video quality and diagnostic information, to enable delivery of superior QoS levels in an increasingly complex broadcast environment

- At-a-glance service view with video thumbnails and interactive Electronic Programming Guide (EPG); empowering operations staff with the simplest information to monitor service delivery

- Comprehensive seven-day trending of IP and RF broadcast streams supports proactive network optimization to minimize downtime

Diagnostic Monitoring

- Powerful user interface provides intelligent hierarchical views of network information, media, and data allowing engineers to rapidly identify the root cause of underlying service problems

- Accelerate time-to-insight with context-sensitive navigation and filtered logging to isolate root cause of test failure

*1 Maximum Transport Stream bit rate is dependent on Transport Stream content and depth of analysis being performed. Depth of stream analysis is handled gracefully if SI/PSIP max content is exceeded to ensure critical measurements continue to be performed.

*3 Except T-STD buffer model analysis.

*4 Programmers Guide is available on request with full SNMP MIB and HTTP interface documentation.
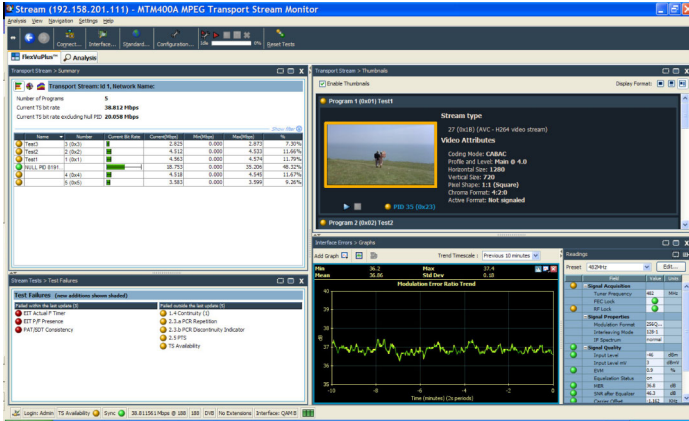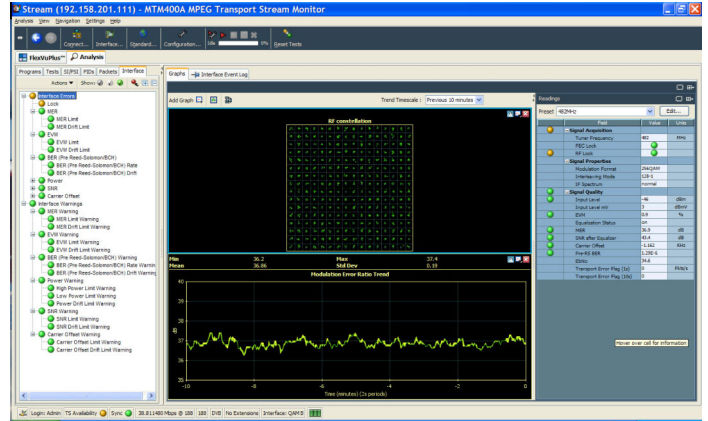
Figure 1: FlexVu™ Configurable Window

Figure 2: RF Trending QAM Interface (with dual alarming)

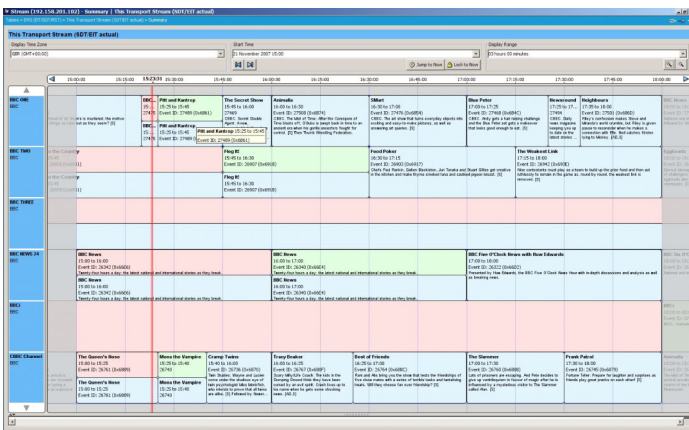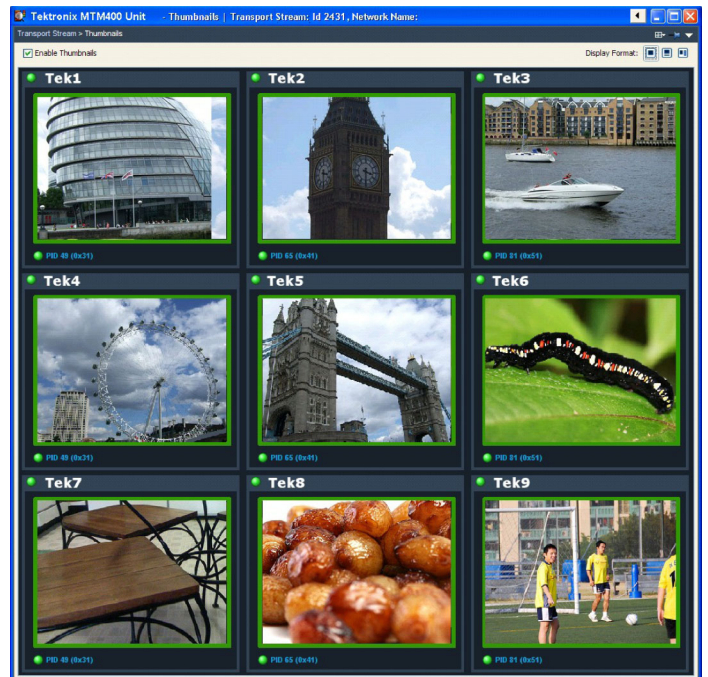Figure 3: EPG View

Figure 4: Video Thumbnails

Characteristics

Power Requirements

Power Consumption (Nominal) – 40 VA.

Voltage – 100 to 240 V.

Frequency – 50/60 Hz.

Monitoring

Maximum Data Rate – 155 Mb/s[1].

Minimum Data Rate – 250 Kb/s.

[1] Maximum Transport Stream bit rate is dependent on Transport Stream content and depth of analysis being performed. Depth of stream analysis is handled gracefully if SI/PSIP max content is exceeded to ensure critical measurements continue to be performed.

TR 101 290 Tests and Measurements

1st Priority Measurements	2nd Priority Measurements	3rd Priority Measurements
1.1 Ts_sync_loss	2.1 Transport_error	3.1a NIT_actual_error
1.2 Sync_byte_error	2.2 CRC_error	3.1b NIT_other_error
1.3a PAT_error_2	2.3a PCR_repetition_error	3.2 SI_repetition_error
1.4 Continuity_count_error	2.3b PCR_discontinuity_indicator_error	3.4a Unreferenced_PID
1.5a PMT_error_2	2.4 PCR_accuracy_error	3.5a SDT_actual_error
1.6 PID_error	2.5 PTS_error	3.5b SDT_other_error
	2.6 CAT_error	3.6a EIT_actual_error
		3.6b EIT_other_error
		3.6c EIT_PF_error
		3.7 RST_error
		3.8 TDT_error

QAM Interface Characteristics (Options QA, QB2, QC)

Characteristic	QAM Annex A	QAM Annex B	QAM Annex C
Input Frequency Range	51 MHz to 858 MHz, 62.5 kHz steps	88 MHz to 858 MHz, 62.5 kHz steps	
Modulation Format	16QAM, 64QAM, 256QAM compliant with ITU J-83 and DVB-C ETS 300 429	64QAM, 256QAM compliant with ITU J-83[5] SCTE07 Compliant	16QAM, 64QAM, 256QAM Compliant with ITU J-83
Modulation Baud Rate	5 Mbaud/s min 6.952 Mbaud/s max	5.057 Mbaud/s and 5.360 Mbaud/s	5 Mbaud/s min 5.5 Mbaud/s max
Input Signal Level	−59 dBm to −19 dBm (50 dBuV to 90 dBuV relative to 75 Ω), with a 16, 64, and 256 QAM input typical	−64 dBm to −19 dBm (45 dBuV to 90 dBuV relative to 75 Ω) with a 64 and 256 QAM input typical	−59 dBm to −19 dBm (50 dBuV to 90 dBuV relative to 75 Ω), with a 16, 64, and 256 QAM input typical
Ultimate Modulation Error Ratio	37 dB typical		
Receiver Bandwidth	8 MHz nominal	6 MHz nominal	
Input Termination Impedance	75 Ω nominal		
Input Return Loss	−6 dB min, −10 dB typical, 51 MHz to 858 MHz		
Loopthrough Power Gain	1.5 dB to 4 dB typical, 51 MHz to 858 MHz	N/A	N/A
Loopthrough Noise Figure	8 dB typical	N/A	N/A
Loopthrough Output Return Loss	>10 dB typical	N/A	N/A

[5] Level 1 and Level 2 interleaving support compliant with all ITU J-83 Annex B, excluding I,J = 128,7 and 128,8.

QAM Annex A/C Measurements (Option QA or QC)

Measurement	Description
RF Lock	RF lock is indicated by a LED on the rear panel and a status icon on UI
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
Ultimate MER (Modulation Error Ratio)	38 dB typical
Post RS BER and TEF (Transport Error Flag)	Post Reed Solomon Indicative BER (uncorrectable error count) and number of Transport Error Flags are displayed on the UI
Constellation	The RF constellation is displayed on the UI

QAM Annex B Measurements (Option QB2)

Measurement	Description
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 This includes the ability to set alarms and produce trend graphs over a seven-day period including min, max, and average
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 This includes the ability to set alarms and produce trend graphs over a seven-day period including min, max, and average

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
	This includes the ability to set alarms and produce trend graphs over a seven-day period including min, max, and average

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
	This includes the ability to set alarms and produce trend graphs over a seven-day period including min, max, and average

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

Environmental

Characteristic	Description
Temperature	
Operating	+5 °C to +40 °C
Nonoperating	–10 °C to +60 °C
Humidity	
Operating	Maximum relative humidity 80% for temperatures up to 31 °C decreasing linearly to 50% relative humidity at 40 °C
Nonoperating	10% to 95% relative humidity, noncondensing
Altitude	
Operating	0 to 3000 m (9800 ft.)
Nonoperating	0 to 12000 m (40000 ft.)
Random Vibration	
Operating	5 to 500 Hz, G_{RMS} = 2.28
Nonoperating	.5 to 500 Hz, G_{RMS} = 0.27
Functional Shock	
Operating	30 G, half sine, 11 ms duration
Regulatory	
Electromagnetic Compatibility	EC Declaration of Conformity: Meets EN55103. Electromagnetic environment E4 Australia / New Zealand Declaration of Conformity: Meets AS/NZS 2064 FCC: Emissions are within FCC CFR 47, Part 15, Subpart B, Class A limits
Safety	Meets 73/23/EEC, EN61010-1, UL3111-1 and CAN/CSA 22.2 No. 1010.1-92, IEC61010-1

Physical Characteristics

Dimension	mm	in.
Height	44	1.73
Width	430	17.13
Depth	600	23.62
Weight*6	**kg**	**lb.**
Net	6.0	13.3
Shipping	9.0	19.7

*6 Weight does not include optional interface cards.

Required Clearance

Dimension	mm	in.
Top	0	0
Bottom	0	0
Left Side	Standard 19 in. rackmount	
Right Side	Standard 19 in. rackmount	
Front	Clearance for handles required	
Rear	Clearance for connectors required	

Ordering Information

QAM400A

DTV monitor for TS and RF cable network monitoring.

Includes: 1RU chassis fitted with Transport Stream processor card, QAM Annex A, B, or C interface, manual, rack slides, power cord, and license key certificate.

Options

Option	Description
Opt. DIAG	Deep-dive MPEG diagnostic analysis Includes: Triggered recording capability up to 160 MB Template testing (for user-defined service plan testing) In-depth PCR analysis with graphical result views Bit rate testing functionality Service logging RF polling functionality
Opt. QA	QAM Annex A interface
Opt. QB2	QAM Annex B interface
Opt. QC	QAM Annex C interface

International Language Options

Option	Description
Opt. L0	English User Guide

Complementary Products

Item	Description
MTS4SA Opt. TSCL	Stand-alone Deferred Time Software package. DVB/ATSC/ARIB TS Compliance Analyzer Software (TS file size limited to 192 MB). For full details see separate data sheet
VQNet	Video Service Assurance Management System. For full details please see separate data sheet
VQS1000	Video Quality Software application for single-ended QoE analysis of video and audio content

Service

Option	Description
Opt. R3	Repair Service 3 Years (including warranty)
Opt. R5	Repair Service 5 Years (including warranty)

Power Connections

Option	Description
Opt. A0	North America power plug
Opt. A1	Universal EURO power plug
Opt. A2	United Kingdom power plug
Opt. A3	Australia power plug
Opt. A4	240 V North America power plug
Opt. A5	Switzerland power plug
Opt. A6	Japan power plug
Opt. A10	China power plug
Opt. A99	No power cord or AC adapter

Field Upgrade Kits

Option	Description
QAM4UP Opt. DIAG	Field upgrade kit to add deep-dive MPEG diagnostic analysis to an existing probe

CE

ISO 9001

Product(s) are manufactured in ISO registered facilities.

GPIB
IEEE-488

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**

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