

AT2500RQ CATV/QAM SPECTRUM ANALYZER



*The world's only spectrum analyzer with
combined CATV and QAM
measurement capabilities*

Sunrise Telecom Broadband is dedicated to providing our customers with the best test equipment possible. That is why our engineers have created a lightweight, battery powered analyzer designed for CATV headend and field portable applications. It features powerful modular options that allow you to expand measurement capabilities for future technology or individual requirements. Integrating QAM digital measurements into an affordable portable spectrum analyzer such as the Sunrise AT2500RQ is truly a breakthrough from both a cost and performance point of view.

**JUST ANOTHER WAY
WE'RE UNCOMPLICATING CABLE**


SUNRISE TELECOM
B R O A D B A N D

...with high sensitivity and the fastest scan speed of any CATV spectrum analyzer, the AT2500RQ catches ingress others miss

DESIGNED SPECIFICALLY FOR CATV



Easy access to all modes from the Main Menu

Today's broadband network technicians face the challenge of keeping the cable plant operating at peak performance at all times. To diagnose and correct problems, they need to be able to perform sophisticated tests and get accurate results quickly, so an instrument has to be reliable and easy to use.

Designed with PC technology in mind, the Sunrise AT2500RQ is a lightweight, full featured 1.5 GHz spectrum analyzer. This unit is built to withstand the rigors of field use. With its durable, water-resistant ABS plastic housing and wide temperature range, you can use the analyzer in all weather conditions.

The built-in battery with over 2-hour continuous operating time makes working in the field easier. You can also use Sunrise's Windows-based software packages to remotely access the AT2500RQ via Ethernet over any TCP/IP network.

SPECTRUM ANALYZER



Reverse path ingress is easily captured with high speed scan

The 1.5 GHz AT2500RQ has intelligent band select filters that can automatically filter the input signal to prevent overloading, allowing this high sensitivity analyzer to be used to measure low level signals in a fully loaded cable system.

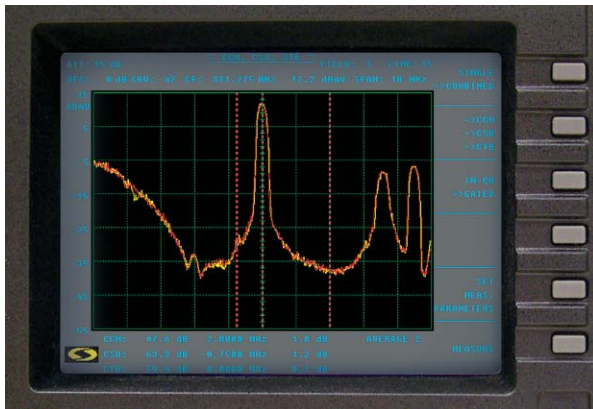
Finding ingress on the reverse path can be a challenge, especially since much of the ingress is either fast transients, lasting only fractions of a second, or system noise. With the fastest scan speed of any CATV spectrum analyzer the AT2500RQ can scan a 50 MHz span in only 2 ms, ensuring all the transient ingress is caught.

The technician never has to worry about calibration because an intelligent AUTO-CALIBRATION system maintains specified accuracy throughout the operating temperature range. Full auto-calibration is achieved within a minute of turning the unit on.

MARK

.....measure CCN, CSO & CTB accurately and in-service.

CATV PACKAGE



Combined CCN, CSO and CTB Tests

All CATV tests, including complete in-service RF testing for Proof-of-Performance, can be executed quickly and accurately and without customer service interruptions:

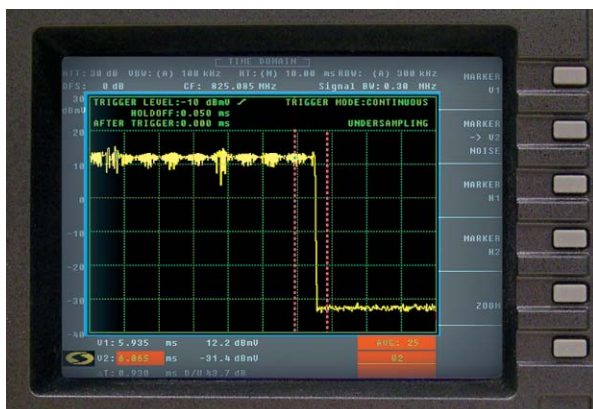
- Carrier Level
- Carrier Frequency
- Hum
- CCN (Carrier to Composite Noise)
- CSO (Composite Second Order)
- CTB (Composite Triple Beat) In-Service Measurement available
- DFI (Discrete Frequency Interference) Measurement Mode
- ICR (In-Channel Response)
- DOM (Depth of Modulation)
- Digital Channel Power

All these tests are easily performed by using the icons shown on the main menu.

CCN, CSO, CTB, DFI, Hum, In-Channel Frequency Response and Depth of Modulation can all be performed in-service with the proper VITS test signal inserter in the very accurate and reliable Gated Mode. With its high sensitivity, the Sunrise AT2500RQ can measure CCN ratios of better than 60 dB with only a 5 dBmV carrier level, eliminating the need for an external amplifier even at test points or subscriber drop levels.

The internal high/low pass preselection filters automatically filter out-of-band energy to provide improved dynamic range for measurements in a fully loaded cable system.

TIME DOMAIN MODULE



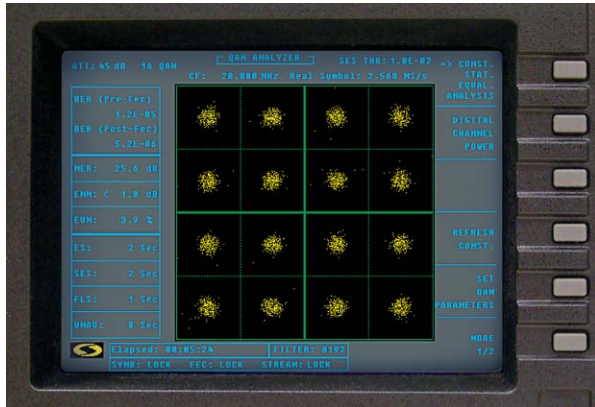
Time Domain Measurement

TDM mode simplifies analysis of upstream cable modem bursty signals and intermittent ingress for quick and accurate measurements. Because today's advanced services can have many different TDMA (Time-Division Multiple- Access) signals assigned to a particular frequency, the TDM module is standard on Sunrise AT2500 Series spectrum analyzers. This Time Domain Module eliminates the guesswork by providing quick and accurate analysis of complex upstream FSK, QPSK, and 16 QAM pulsed amplitude RF signals.

The comprehensive Time Domain Measurement mode fully utilizes the power of the Sunrise AT2500RQ's built-in triggered gating hardware capabilities to capture and isolate a signal source. Each packet of data from a cable modem's TDMA upstream signal can be captured, seen, and measured thanks to flexible control settings such as Trigger Level, Holdoff, Horizontal Sweep Time, delay after trigger, bandwidth correction, averaging, etc. The TDM mode allows fast, simple, and accurate in-service measurements, including an estimated channel power of the upstream DOCSIS channel, S/N of the burst (or D/U), and the burst level of the modems.

...the AT2500RQ QAM Analyzer is an essential tool for ensuring that revenue generating digital services remain operational.

QAM DEMODULATOR OPTION



Constellation display of 16 QAM signal



Measure and characterize a network's return path performance using the AT2500RQ with a CM1000-USG unit



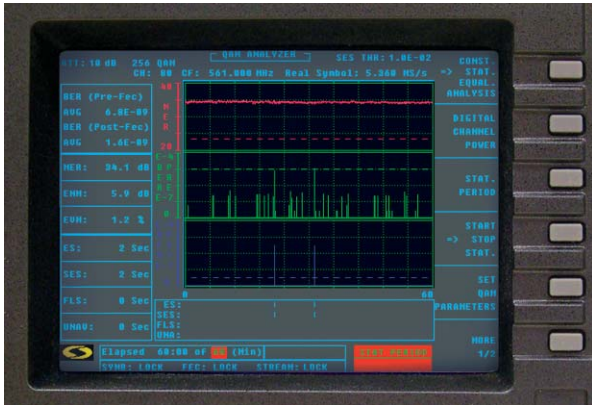
Zoomed Group Delay screen with Δ nsec per MHz measurements

As digital signals become part of our every day routine, performing accurate digital cable measurements is essential to efficiently install and maintain high quality level of service for your customers. Unlike analog pictures, digital video can appear to operate normally and yet it may be very close to failing. Digital measurements can be the only way to ensure that the system is operating well within limits. The digital channel power measurement allows accurate digital carrier power measurements over a desired bandwidth anywhere between 200 kHz and 1.5 GHz.

The Sunrise AT2500RQ QAM Analyzer demodulates and accurately measures the QAM signals carried through the cable system. It provides the measurement power the field technicians need for the latest 64/256 QAM digital technologies and is very simple to use, making the transition from analog to digital testing a breeze. The AT2500RQ displays Modulation Error Ratio (MER), pre and post Bit Error Rate (BER) and Error Vector Magnitude (EVM).

UPSTREAM SIGNAL GENERATOR MODULE

When paired with the CM1000-USG unit, an Upstream Signal Generator module and base unit, the AT2500 can demodulate a continuous 16 QAM in order to measure and characterize a network's return path performance. MER, Pre/Post BER, microreflections, linear and nonlinear distortions, as well as the reverse channel's frequency response and group delay characteristics can be precisely measured.



60 minute statistics screen showing signal impairments over time



QAM Impairment Analysis (QIA) displays 14 performance measurements on one screen

STATISTICS LOGGING

A statistics logging function is also included to test between 1–60 minutes with date/time reference, storing events of MER, Pre & Post BER, errored seconds, severely errored seconds, frame loss, and system unavailability. Up to 7 days of data can be captured with date/time reference using the WinQAM PC software.

QAM IMPAIRMENT ANALYSIS - *UNIQUE!*

MER measures the ratio of the average signal power in the ideal constellation to the average error power, and provides a good measure of signal quality. While MER is well established as the best overall “figure of merit” measurement to determine QAM signal quality, it does not indicate the type of impairment affecting a signal. For more in depth analysis to determine the cause of signal impairments, Sunrise developed the patent pending QAM Impairment Analysis (QIA) mode.

QIA mode calculates and displays:

- MER
- EVM
- C/I (Carrier to Interference)
- Echo margin
- Compression
- I/Q gain difference
- I/Q phase difference
- Phase noise
- Noise margin
- System noise ratio
- Frequency response
- Symbol rate error
- Hum
- Carrier offset

...QIA provides important insight into the source of digital impairments.

DIGITAL FEATURES

- 16/64/256 QAM DIGITAL MEASUREMENTS
- ITU-T J.83 ANNEX A, B & C COMPLIANT (DVS, DVB, DOCSIS, EURODOCSIS)
- HIGH RESOLUTION CONSTELLATION DISPLAY WITH ZOOM
- DATA LOGGING MODE OVER 1-60 MINUTES
- ADAPTIVE EQUALIZER DISPLAY WITH IN CHANNEL FREQUENCY RESPONSE AND GROUP DELAY
- RETURN PATH TESTING AND QUALIFICATION FOR VoIP
- MODULATION ERROR RATIO (MER) MEASUREMENT
- PRE AND POST BIT ERROR RATE TESTING (BER), REAL TIME AND AVERAGE
- AUTO ATTENUATOR SEARCH TO INSURE OPTIMUM QAM MEASUREMENTS
- POLARITY AUTO SEARCH FOR IF OR UP CONVERTED CARRIER FREQUENCIES
- QAM IMPAIRMENT ANALYSIS MODE
- DUAL BAND 6 & 8 MHZ IF FILTERS AVAILABLE
- ASI MPEG TRANSPORT STREAM OUTPUT AVAILABLE

SPECIFICATIONS

FREQUENCY

Frequency range: 0 MHz–1.5 GHz
Calibrated frequency range: 5 MHz–1.5 GHz
Frequency Reference:
Aging: ± 1 PPM/Yr
Temperature Stability: ± 1 PPM (0°C to 50°C)
Frequency counter:
Accuracy: ± 1 PPM ± 1 count
Resolution: 10 Hz
Stability (Noise sidebands offset from CW signal):
-85 dBc / Hz @ ± 10 kHz offset typical

SPAN

Frequency Span:
Range: Variable from Max Span 1500 MHz to 100 kHz & Zero Span
Accuracy: < 2 PPM
Sweep Time:
Range: 2ms, 4ms, 10ms, 20ms, 50ms, 100ms, 200ms, 500ms, 1000ms,
2000ms, 5000ms
Stability: < 2 PPM
Sweep Trigger: Free Run, Pwr Lock and TV Frame
Resolution Bandwidth:
Range: 1 MHz, 300 kHz, 30 kHz & 10 kHz
Selectivity (60 dB / 3 dB Ratio): 5.3:1, 3:1, 2:1, 2:1
Accuracy: $\pm 5\%$
Video Bandwidth:
Range: 1 MHz, 100 kHz & 10 kHz

AMPLITUDE

Response Flatness: ± 0.75 dB (5–1500 MHz)
Sensitivity: -65 dBmV (300 kHz RBW) to +65 dBmV
Level accuracy: ± 0.75 dB @ 25°C
Level resolution: 0.1 dB

Impedance at RF input: 75 ohm
Input Return Loss: > 20 dB typical (> 5 dB attenuation)
Maximum safe input: +68 dBmV
Spurious free dynamic range: > 70 dB
Internal calibrator: 48 MHz @ -5 dBmV
Up to 4 simultaneous traces on screen with Avg, Peak & Min Hold
Selectable Positive, Negative or Sample detector
Vertical, Horizontal & Tilt Markers
Peak Search, Next Peak & Tracking on Vertical Markers
Vertical scale: 10, 5, 2 dB/Division
BAND SELECT FILTERS (Auto or Manual) :
7 high pass filters, 7 low pass filters and 21 bandpass filter combinations.
High Pass Cutoff Frequencies: 35, 78, 164, 270, 360, 450, 540 MHz
Low Pass Cutoff Frequencies: 45, 88, 174, 280, 370, 460, 550 MHz

MECHANICAL

Size: 304 x 177 x 355 mm (12"W x 7"H x 14"D)
Weight: 10 Kg (22 pounds)
Temperature
Operating: 0 to 50°C (32 to 122°F)
Storage: -20 to 55°C (-4 to 131°F)
Display type: TFT Active Matrix Color LCD
Display size: 162.5 mm (6.4 inches)

POWER

Battery Type: Rechargeable lead acid, 12 Volt 7 Ah
Internal Battery Charger: Automatic Fast / Slow / Floating
Power Supply: PSU2065 100V/250V, 50/60 Hz,
16 VDC, 4.06 A
Charge Time: < 4 hours
Operating Time: > 2 hours

CATV MEASUREMENT SPECIFICATIONS

Channel Selection:

Frequency, Channel Video, Channel Audio

Channel Plans:

Custom plans, NTSC (EIA, HRC, IRC), PAL (B/G, I, D) or other. Maximum of 350 signals (analog, digital, FM, upstream, test, etc.). PC-based and internal complete channel plan editor

TV Channel Amplitude Range:

-40 dBmV to +65 dBmV ± 0.75 dB for
S/N > 30 dB

TV Visual Frequency:

Accuracy: Carrier Frequency, ± 1 PPM
Resolution: 10 Hz

Visual/Aural Delta Frequency:

Range: 1 - 10 MHz
Accuracy: ± 200 Hz
Resolution: 10 Hz

Visual/Aural Delta Amplitude: ± 0.75 dB

for S/N > 30 dB

FM Deviation

Range: ± 150 kHz, de-emphasis 75 μ sec
Accuracy: ± 2 kHz, 1-75 kHz, ± 5 kHz to 150 kHz

HUM/LOW FREQ. DISTURBANCES

Modes: CW or Video (In-Service)

Range: 1-10%

Accuracy: $\pm 0.5\%$ from 1 to 5%, $\pm 1\%$ from 5 to 10%

MODULATION DEPTH

AM Range: 40 to 95%

Resolution: 0.1%

Accuracy: $\pm 1.5\%$ (CCN > 40 dB)

Signal type: VITS line with white reference

IN-CHANNEL RESPONSE

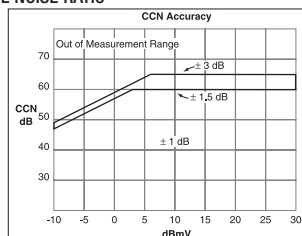
Range: ± 10 dB

Resolution: 0.1 dB

Accuracy: ± 0.25 dB

Signal type: VITS line with full amplitude CATV Multiburst signal, Video sweep or Ghost Canceling Reference signal

CARRIER-TO-COMPOSITE NOISE RATIO



Note: CCN specifications with band select filters on auto and 77 channel loading

Optimum Signal Range: +3 dBmV to +10 dBmV, noise measured with 0 dB Attenuation

CCN range: 60 dB with ± 1 dB accuracy, 65 dB with ± 3 dB accuracy

Resolution: 0.1 dB

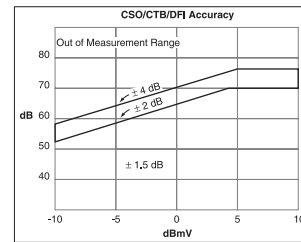
CSO/CTB/DFI

Optimum Signal Range: 0 dBmV to +4 dBmV,
beat measured with 0 dB Attenuation

CSO/CTB/DFI Range: 64 dB with ± 1.5 dB

71 dB with ± 4 dB accuracy

Resolution 0.1 dB



Note: CSO, CTB and DFI specifications with band select filters on auto and 77 channel loading

TDM MEASUREMENT

Frequency Span: Zero Span

Horizontal Time: 50 μ sec to 500 msec
(1, 2, 5 settings)

Resolution Bandwidth: 1 MHz, 300 kHz, 30 kHz, 10 kHz

Video Bandwidth: 1 MHz, 100 kHz, 10 kHz

Bandwidth Correction Range: 10 kHz to 9.9 MHz

Pulse Level Accuracy: ± 0.75 dB in 5 μ sec, 1 MHz RBW

Trigger Modes: Free run, Continuous, Single

Trigger Level Range: -70 dBmV to +65 dBmV

Trigger Delay Range: 0 to 100 msec, in 1 μ sec steps

Trigger Holdoff Range: 50 μ sec to 100 msec,
in 1 μ sec steps

DIGITAL MEASUREMENT QAM 16/64/256 SPECIFICATIONS

Modulation Type: 16/64/256 QAM ITU-T J.83 Annex A, B & C (DVS, DVB, DOCSIS, EuroDOCSIS)

Constellation Display Size: 16, 64 and 256 QAM

Full constellation with zoom capability

Adaptive Equalizer Display - Number of Taps:
8 feed-forward; 24 feedback

Scale: +10 to -80 dBc

Mask: DOCSIS

Frequency response, over signal BW: +5 to -5 dB

Group Delay, over signal BW: -1000 to +1000 nsec

Digital Carrier Average Power Measurement

Amplitude Range: -30 to +65 dBmV

Resolution: 0.1 dB

Absolute Accuracy: ± 1.5 dB

Bandwidth Range: 200 kHz to 1.5 GHz

Modulation Error Ratio (MER)

Range: 22 to 40 dB

Accuracy: ± 1 dB typical

Error Vector Magnitude (EVM)

Range: 0.65% to 4.1%

Bit Error Rate (BER), Before and After R-S Decoding, per 1 second period

Range: 0 to 1.0×10^{-4}

Average Bit Error Rate (BER), Before and After R-S Decoding

Range: 0 to 1.0×10^{-4}

Estimated Noise Margin

Range: 1 to 12 dB

Accuracy: ± 1 dB typical

Statistics Logging

User-selectable Test Period: 1 to 60 minutes, up to 7 days with WinQAM

MER, Pre and Post BER, Errored Seconds, Severely Errored Seconds, Frame Loss, System Unavailability time

Symbol Rate

Range: 1.28 to 7 MS / s

(Continuous QAM measurements at $< 30^\circ\text{C}$)

Note: All specifications apply over the standard 0°C to $+50^\circ\text{C}$ operating temperature range, after a minimum of 2 hours of storage within the operating temperature range, if the unit is not fully at ambient temperature. The AT2500RQ meets all its specifications within 1 minute after it is turned on, providing that the AT2500RQ is within the one year calibration cycle. Sunrise Telecom Broadband's unique AutoCal feature assures accuracy by periodically self-testing and triggering a non-obstructive calibration, as required.

Specifications subject to change without notice.

FIELD-PROVEN SOLUTIONS

For detailed information on the AT2500R, visit our website at www.sunrisetelecom.com for the name of your local Sunrise representative. Or telephone us at 1.514.725.6652.

Sunrise Telecom Broadband is a leader in digital broadband and DOCSIS & EuroDOCSIS test instruments for the broadband industry. As part of the Sunrise Telecom family, we leverage the strength of one of the world's largest communications test and measurement companies.

Sunrise Telecom Broadband's field-proven solutions include installation and maintenance instruments; portable headend analyzers; and network test systems and software. Our goal is to enable service providers to rapidly deploy television, high-speed Internet, and digital video applications.

Based on our core strength in RF testing, we have established a successful track record as a provider of leading edge solutions that incorporate innovative test methods, intuitive user interfaces, and thorough product training. At Sunrise Telecom Broadband, we uncomplicate the cable broadband engineer's and field technician's day.

JUST ANOTHER WAY WE'RE UNCOMPLICATING CABLE



North American Toll-Free: 1.800.297.9726
International: 1.514.725.6652

www.sunrisetelecom.com
catv@sunrisetelecom.com

U.S. Office
Sunrise Telecom Broadband, Inc.
3250-D Peachtree Corners Circle
Norcross, GA U.S.A. 30092

Canada & International Office
Sunrise Telecom Broadband Corp.
10281 Renaude-Lapointe
Anjou, QC Canada H1J 2T4

Corporate Head Office
Sunrise Telecom
302 Enzo Drive
San Jose, CA 95138 U.S.A.
1.408.363.8000
Fax: 1.408.363.8313

ORDERING INFORMATION

AT2500R 1.5 GHz PORTABLE CATV SPECTRUM ANALYZER

Includes:

PSU2065 Power Supply, Rechargeable lead acid battery,
User Manual, 2-Year Warranty, Padded Protective Soft Case
AT2VIDOUT Baseband NTSC video output
AT2VGAOUT VGA Output (15 Pin D Connector)
10Base-T Network connection (RJ45)
High/Low preselection filters
AT2CATVPAK CATV Measurement package
Carrier measurement, Precision frequency counter,
In-service Hum, CCN, CSO and CTB, Digital Channel Power
AT2TDM Time Domain Measurement package
A99026010 WinCom II Data Management Software (license for 1 PC)

AT2500RQ 1.5 GHZ PORTABLE CATV/QAM SPECTRUM ANALYZER

Includes all AT2500R features plus:

16/64/256 QAM Digital Measurement Analyzer
(Constellation, BER, MER Adaptive EQ, Data Logging)
AT2Q+QIA QAM+ Impairment Analysis Mode

OPTIONS AND ACCESSORIES

HARDWARE OPTIONS

These options are factory installed and must be ordered with product—requires AT2500RQ

AT2Q6-8 64/256 QAM RQ+ Euro/Annex A/B/C, Dual 6 - 8 MHz band width (Required for Annex A)
AT2Q-ASI MPEG ASI Output through BNC Connector

WINDOWS PC SOFTWARE FOR SUNRISE AT2500RQ (1 LICENSE PER PC)

Includes: CD, User Manual, A65000909 Serial Cable and A65000945 RJ-45 Ethernet Crossover Cable

A99026010 WinCom II - Data Management Software (licenses for additional PCs)
A99026020 WinRemote - Remote Control Spectrum Analyzer Software
A99026050 WinQAM - Remote Control QAM Digital Measurements Software (Requires AT2500RQ)

ACCESSORIES

A99025600 Padded Protective Soft Case for Sunrise AT2500RQ
A90093030 Model BTA Bucket Truck Adapter

CALIBRATION OPTIONS

AT-W32 3-Year Calibration Program
AT-W52 5-Year Calibration Program
AT2-CC Certificate of Calibration/compliance (N/C when requested at time of purchase)
AT2-CCM Certificate of Calibration/compliance with measurement data (requested at the time of purchase only)



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