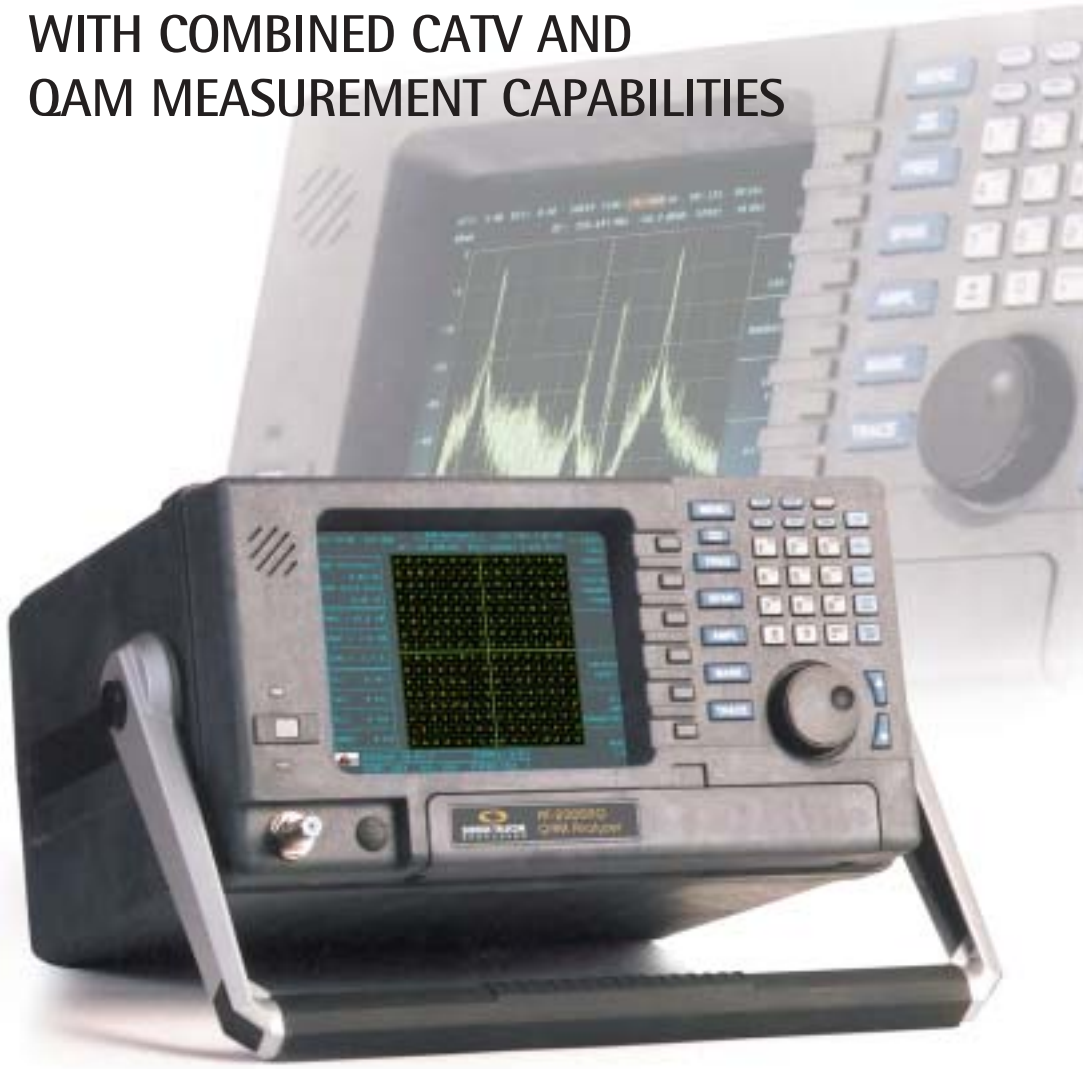
Avantron AT-2000RQ QAM ANALYZER

WORLD'S ONLY TRUE SPECTRUM ANALYZER WITH COMBINED CATV AND QAM MEASUREMENT CAPABILITIES



SUNRISE TELECOM
BROADBAND

. . . a step ahead

Sunrise Telecom Broadband is dedicated to ensuring that our customers get the best return on their test and measurement dollars. That is why our engineers have created a unique combination of field portable spectrum analyzer and modular options that allow you to expand measurement capabilities for future technology or individual requirements.

Integrating the QAM digital measurements into an affordable field spectrum analyzer such as the Avantron AT-2000RQ is truly a breakthrough from both a cost and performance point of view.

AVANTRON AT-2000RQ

SPECTRUM ANALYZER

Easy access to all modes from the Main Menu

Today's broadband networks face several challenges including the shortage of skilled technicians. The need to make sophisticated test instruments easier to use, while still providing accurate measurement results, is necessary to quickly analyze a signal problem.

Designed with PC technology in mind, the Avantron AT-2000RQ is a lightweight, full featured 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 2.5 hour continuous operating time makes working in the field easier. You can also use Avantron's WinRemote, a Windows-based software to access remotely the AT-2000RQ via Ethernet using TCP/IP connectivity over LAN, WAN, Intranet and Internet.

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. Having the fastest scan speed of any CATV spectrum analyzer and remarkably high sensitivity, the Avantron AT-2000RQ can scan a 100 MHz span in only 3 ms, ensuring you catch all the transient ingress.

Reverse Path Ingress

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.

DIGITAL MEASUREMENTS

As digital signals become part of our every day routines, 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. A digital channel power option allows accurate digital carrier power measurements over a desired bandwidth anywhere between 200 kHz and 200 MHz.

256 QAM Constellation

The Avantron AT-2000RQ 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 built-in digital demodulator makes it possible to measure:

- Modulation error ratio (MER)
- Pre and post bit error rate (BER)
- Error vector magnitude (EVM)

A Data Logging function is also included to test between 1-60 minutes with date/time reference, storing events of MER, Pre & Post BER, errored, severely errored seconds, frame loss, and system unavailability. Up to 48 hours of data can be captured with date/time reference using the WinQam PC software.

60 Minute Statistics Screen

Avantron AT-2000RQ makes QAM signal testing easy to understand and perform with the QIA advanced patent pending QAM signal Impairment Analysis mode. MER (expressed in DB) is well established as the best overall "figure of merit" measurement to determine 64/256 QAM signal quality. MER is analogous to a composite ratio of signal to noise and distortion for an analog CATV measurement. It takes into account the amplitude, phase noise and other impairments.

MER is the ratio of the average signal power in the ideal constellation to the average error power.

Understanding digital signal impairments will help you quickly trouble-shoot problems. Typical transmission disturbances are characterized by visual effects like noise, coherent distortion, CW interference, and amplifier compression. The Avantron AT-2000RQ QIA advanced mode QAM signal impairment analysis allows the operator to quickly identify the type of impairment and isolate its source.

Different types of impairments contributing to the total MER figure are

- 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

QAM Impairment Analysis (QIA)

DIGITAL FEATURES

- 64/256 QAM digital measurements
- ITU-T J.83 Annex A, B & C compliant (DVS, DVB, DOCSIS, EuroDOCSIS)
- Integrates 6 & 8 MHz IF filters
- ASI, MPEG transport stream output available
- High resolution constellation display with zoom
- Data logging mode; 1-60+ minutes with MER, average & real time BER information
- Adaptive equalizer display with high dynamic range
- QAM Impairment Analysis mode available
- Modulation error ratio (MER)
- 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 upconverted carrier frequencies
- High sensitivity for accurate test point measurements
- Digital channel power

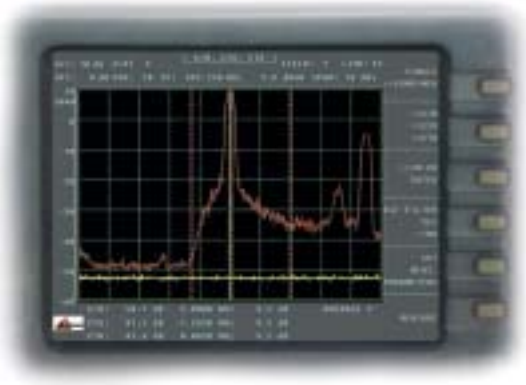
CATV PACKAGE

All CATV tests, including complete in-service RF testing for Proof-of-Performance can be executed quickly and accurately:

- Carrier Level
- Carrier Frequency
- HUM
- C/N (Carrier-to-Noise)
- CSO (Composite Second Order)
- CTB (Composite Triple Beat)
  In-Service Measurement available
- ICR (In-Channel Response)
- DOM (Depth of Modulation)

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

Carrier Level & Frequency, C/N, CSO, CTB, 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 Avantron AT-2000RQ can measure C/N 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 low drop levels.



Combined test

TIME DOMAIN MEASUREMENT

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 AT2-TDM option is available for the Avantron AT-2000 Series spectrum analyzers. This Time Domain Measurement mode eliminates the guesswork by providing quick and accurate analysis of complex upstream FSK, QPSK, and QAM 16 pulsed amplitude signals.

The comprehensive Time Domain Measurement mode fully utilizes the power of the Avantron AT-2000RQ 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 using various time domain settings such as Trigger Level, Hold off, 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 modem.

AVANTRON AT-2000RQ SPECIFICATIONS

Frequency
Frequency range: 1 MHz - 1 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 @ ±10 kHz

Span
Frequency Span:
Range Variable from Max Span:
1000 MHz to 100 kHz & Zero Span
Accuracy: <2 PPM
Sweep Time:
Range: 3 ms, 6 ms, 15 ms, 30 ms,
100 ms, 300 ms, 1 Sec, 3 Sec
Stability: <2 PPM
Sweep Trigger:
Automatic only
Resolution Bandwidth Range:
1 MHz, 300 kHz, 30 kHz & 10 kHz
Accuracy: ±5%
Selectivity (60 dB/3dB Ratio):
5.3:1, 3:1, 2:1, 2:1
Video Bandwidth Range:
1 MHz, 100 kHz & 10 kHz

Amplitude
Response Flatness: ±0.75 dB (1 - 1000 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:
>16 dB (>10 dB attenuation)
Maximum safe input: + 68 dBmV
Noise figure: 10 dB max. 0 dB attenuation
Spurious free dynamic range: > 70 dB
Vertical scale: 10, 5, 2 dB/Division
Input attenuator: 0 - 65 dB in 5 dB steps
Internal calibrator:
38.5 MHz @ -5 dBmV (autocal)
Temperature Readout Range:
-40°C to 100°C ±1.5°C

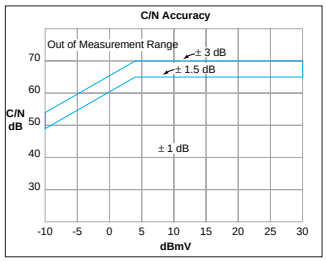
Power
Battery type:
Rechargeable lead acid, 12 Volt 5 Ah
Charger type:
Battery Charger with auto float,
12 Volt 4 Amp
Charge time: Approx. 3 hours
Operating time: Approx. 2.5 hours, Nominal between charges

Temperature range
Operating: 0°C to +50°C
Non-operating: -20°C to +55°C

Mechanical
Size: 304.8 mm x 177.8 mm x 355.6 mm (12"W x 7"H x 14"D)
Weight:
8.6 Kg (19.6 pounds) min. with battery
Display type: TFT Active Matrix Color LCD
Display size: 162.5 mm (6.4 inches)

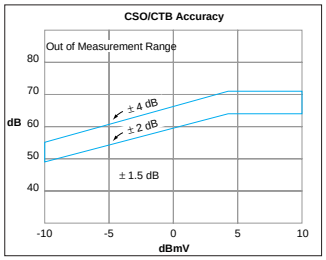
CATV MEASUREMENT PAK OPTIONS
Channel Selection: Frequency, Channel
Video or Channel Audio
Channel Plans:
Custom plans, NTSC, PAL or other
Maximum of 250 positions
Tuning Range: 1 MHz to 1 GHz
TV Channel amplitude range:
-40 dBmV to +65 dBmV
±0.75dB for S/N > 30dB
TV Visual Frequency:
Accuracy Carrier 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: ±100 kHz
Accuracy:
±2 kHz, 1 - 60 kHz, ±5 kHz to 100 kHz
HUM/Low Freq. Disturbances
Modes CW or Video (In-Service)
Range: 0 - 10 %
Accuracy: ±0.5 % from 0 to 5 %, ±1 % from 5 to 10 %

Carrier-to-Noise Ratio



Note: Specification Without Preselector & 77 Channel Loading
Optimum Range:
-5 dBmV to +5 dBmV for
0 dB Attenuation
C/N 65 dB with ±1 dB accuracy, 70 dB with ±3 dB accuracy
Resolution 0.1 dB

CSO/CTB



Note: Specification Without Preselector & 77 Channel Loading
Optimum Range: -4 dBmV to +4 dBmV for 0 dB Attenuation
Maximum CSO/CTB
64 dB with ±1.5 dB accuracy
71dB with ±4 dB accuracy
Resolution: 0.1 dB

Modulation Depth:
AM Range: 40 to 95%
Resolution: 0.1%
Accuracy: ±1.5% (C/N > 40 dB)
Signal: Use VITS line with white reference
Digital Carrier Measurement
Amplitude Range: -30 to +65 dBmV
Resolution: 0.1 dB
Absolute Accuracy: ±1.5 dB
Bandwidth Range: 200 kHz to 200 MHz

In-Channel Response
Range: ±10 dB
Resolution: 0.1 dB
Accuracy: ±0.25 dB
Signal: Use VITS line with full amplitude multiburst signal

TDM Measurement Option
Frequency Span: Zero span
Horizontal Time:
Range 50 µsec to 500 ms (1, 2, 5 settings)
Resolution Bandwidth:
Range 1 MHz, 300 kHz, 30 kHz & 10 kHz
Video Bandwidth:
Range 1 MHz, 100 kHz & 10 kHz
BW Compensation: Range 10 kHz to 9.9 MHz
Pulse Level Accuracy: ±0.75 dB in 5 µsec
Trigger Modes:
Free Run, Continuous or Single
Trigger LevelRange: -70 dBmV to +65 dBmV
Trigger Slope: +(rising edge) or -(falling edge)
Trigger DelayRange: 0 to 100 ms (in 1 µsec steps)
Trigger Holdoff: Range 50 µsec to 700 ms (in 1 µsec steps)

Digital Measurement Options

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

Constellation Display:
- Size: 64 and 256 QAM
- Full constellation with zoom capability

Adaptive Equalizer Display:
- Number of Taps:
- 8 feed-forward; 24 feedback
- Scale: +10 to -80 dB
- Mask: DVB

Digital Carrier Measurement:
- Amplitude Range -30 to +65 dBmV
- Resolution 0.1 dB
- Absolute Accuracy ±1.5 dB
- Bandwidth Range 200 kHz to 200 MHz

Modulation Error Ratio (MER):
- Range: 20 to 38+ dB
- Accuracy: ±1.5 dB

Error Vector Magnitude (EVM):
- Range: .08% to 6.3%.
- Accuracy:
  - ±0.4% over 0.8 to 2.0% range;
  - ±0.8% over 2.1 to 6.3% range

Average Bit Error Rate (BER), before R-S Decoding:
- Range: 10^{-4} to 10^{-12}
- User-selectable Time Period: 1 to 60 min.

Estimated Average Bit Error Rate (BER), after R-S Decoding:
- Range: 10^{-4} to 10^{-12}
- User-selectable Time Period: 1 to 60 min.

Estimated Noise Margin:
- Range: 1 to 12 dB
- Accuracy: ±-1.5 dB

Data Logging
- User-selectable Time Period:
  - 1-60 minutes (48 hours with PC software)
- Errored Seconds - Severely Errored Seconds-Frame Loss Seconds - Unavailability Time

Symbol Rate
- Range: 5 to 7 MS/s

Specifications subject to change without notice.

Back view of AT-2000RQ

Cable ports for printer and software

ORDERING INFORMATION

Avantron AT-2000RQ 1GHz Portable QAM Analyzer
Includes: PSC2004-4 Amp Battery Charger, AT2HCBAT-High Capacity Battery, User Manual. 2-Year Warranty.
Standard Feature: 64/256 QAM Digital Measurement Analyzer (Constellation, BER, MER Adaptive EQ, Data Logging)

Hardware Options (Factory installed - Must be ordered with product)

AT2Q6-8	64/256 QAM RQ+ Euro/Annex A/B/C, Dual 6 - 8 MHz bandwidth
AT2Q-ASI	MPEG ASI Output (BNC Connector)(AT2Q6-8 required)
AT2VIDOUT	Baseband NTSC video output
AT2VGAOUT	VGA Output (15 Pin D Connector)
AT2NETR	10Base-T Network connection (RJ45) for AT-2000RQ

Firmware Options

AT2Q+QIA	QAM+ Impairment Analysis Mode
AT2CATVPAK	CATV Measurement Option Carrier measurement, Precision frequency counter, In-service HUM, C/N, CSO and CTB, Digital Channel Power
AT2TDM	Time Domain Measurement option

Windows PC Software for Avantron AT-2000RQ (1 license per PC)

Includes:	CD, User Manual, A65000909 Serial Cable and A65000945 RJ-45 Ethernet Crossover Cable
A99026010	WinCom - Data Management Software
A99026020	WinRemote - Remote Control Spectrum Analyzer Software
A99026050	WinQAM - Remote Control QAM Digital Measurements Software

Accessories

A99025600	Padded Protective Soft Case for Avantron AT-2000RQ
A90093030	Model BTA Bucket Truck Adapter

Calibration Options

AT2CAL3YR	3-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)

Padded Protective Soft Case

Windows PC Software

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