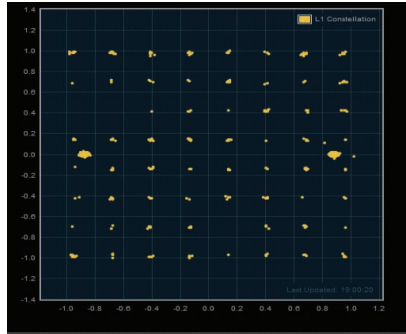


AVQ1020 ActiveCore® RF Layer Monitoring Receiver and Signal Analyzer

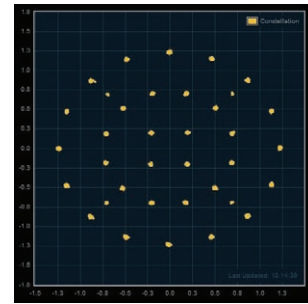
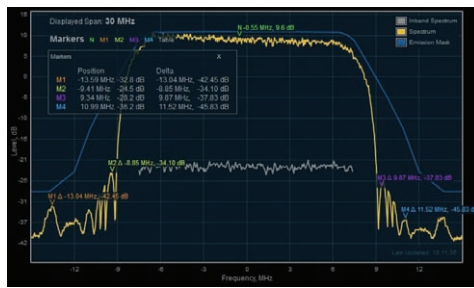
OFDM Constellation:



Scale: 0.65
 PAPR, dB: 8.12
 Shoulder attenuation:
 L, dB: 46.4
 R, dB: 46.0
 Frequency Offset, Hz: 0.5
 Reference 10 MHz Source: Internal

Inversion: Inverted
 MER / SNR, dB: 41.9 / 41.9
 Residual Group Delay, usec: 0.039
 Amplitude Error, dB: 0.03
 Phase Error, degree: 0.77

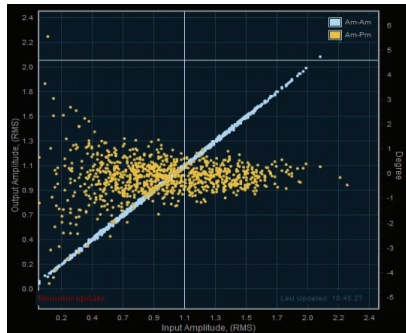
32PSK Signal Analysis:



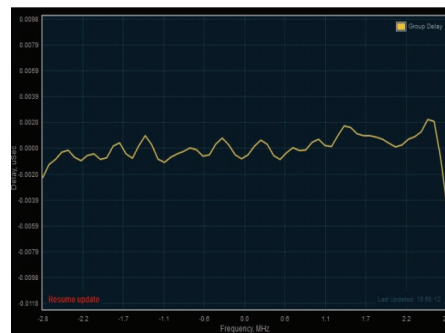
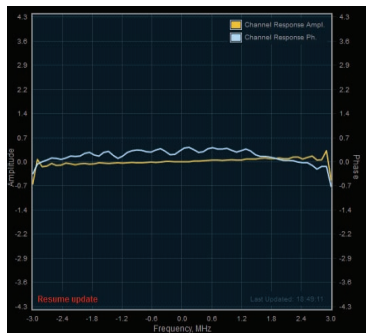
Standard Specific Statistics:
 Format: DVBS2
 Modulation: 32APSK 9/10
 FECFRAME: 64800 / Normal
 Bandwidth, MHz: 18
 Pilots: Present
 Inversion: Inverted
 MER, dB: 34.7
 SNR, dB: 38.9
 EVM, %: 1.47
 E_b/N₀, dB: 31.9
 STED: 0.0013
 STEM: 0.0058
 Group Delay, us: 0.033

Transmitter System Calibration and Verification:

Non-linear distortions:



Linear distortions:



Inversion: Inverted
 MER / SNR, dB: 41.9 / 41.9
 Residual Group Delay, usec: 0.039
 Amplitude Error, dB: 0.03
 Phase Error, degree: 0.77

AVQ1020 Implementation for Digital TV and Radio Broadcasting Standards:

Standard specific measurements:

Model:	Standards:	Additional Standard-specific parameters
AVQ1020ATSC	ATSC A/53 and ATSC A/153	- spectral mask compliance to FCC - ATSC pilot Amplitude and Phase Errors - Eye diagram plot
AVQ1020DVBT	DVB-T, DVB-H, and DVB-T2	- DVB-T2 L1 Signaling and Frame Structure
AVQ1020ISDBT	ISDB-T and ISDB-Tb	- MER per Symbol per Slot - Constellation per Slot
AVQ1020DAB	DAB, DAB+, and D-TMB	- TII decoding
AVQ1020CMMB	CMMB	- Scrambling option
AVQ1020DTMB	DTMB	- OFDM & single carrier modes
AVQ1020DVBS	DVB-S/S2	- In-band interference

Contact Information:

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SIGNAL RF LAYER MONITORING RECEIVER
Delivering services at the highest QoS

TRANSMITTER SITE MONITORING PLATFORM
Real performance measurements

SUPPORTS ALL MAJOR BROADCASTING STANDARDS
 (ATSC, ISDB-T, DVB-T/T2, CMMB, etc)

AVQ1020 ActiveCore® RF Layer Monitoring Receiver and Signal Analyzer



Features:

- ▶ Monitoring and measurement of RF Modulated Layer at the transmitter output;
- ▶ Real performance metrics of the transmitter system;
- ▶ Combination of functional and measurement capabilities with cost effectiveness of the Receiver/Analyzer guarantees the ideal solution for monitoring RF signal quality of remote transposers, re-broadcast links, repeaters, and unmanned sites without additional costly RF test equipment;
- ▶ Comprehensive set of critical RF measurements including

signal MER/SNR, frequency spectrum, shoulder attenuation, frequency shift, etc.

- ▶ Estimation of signal distortions at the transmitter system output caused by the system non-linearity - AM-AM/AM-PM curves and band-path filtering - group delay, amplitude and phase responses with an ability to use the estimated numbers in a form of complex LUT and FIR for non- and linear pre-correction;
- ▶ Early indication of signal degradation as a result of the transmitter system components aging or operational parameters variations;
- ▶ An embedded solution for remote applications, in-field diagnostics, production testing and design verification;
- ▶ Flexible solution with the in-field upgrade capability including diagnostic and monitoring features that can be tuned to meet the most demanding requirements of customer's application;
- ▶ Rich plotting capabilities for data visualization;
- ▶ Transmitter site monitoring device with rich set of hardware interfaces;
- ▶ Event log.

Introduction

Based on ActiveCore® Platform, AVQ1020 is a monitoring receiver and signal analyzer for all major digital broadcasting standards including proprietary modulation schemes. It has been designed as an easy-to-use and cost-effective solution for monitoring digital transmitter systems performance. The receiver can be integrated into a transmitter system for remote monitoring applications or used as a stand-alone unit during design verification, production tests and system calibration.

In the context where broadcasters are more and more concerned about reducing their network OPEX costs and at the same time limiting impact on the environ-

ment, it becomes important for the transmitter systems and repeater networks to be designed as reliable as possible in terms of the QoS provided to the service subscribers.

The receiver allows not only monitoring signal parameters but it also can be used for estimation and characterization of the transmitter system performance - distortions introduced by the amplification and filtering chains. The unique functionality allows the receiver to be also used for estimation of critical RF parameters of high power amplifier performance using real broadcasting signals.

The ActiveCore® monitoring receiver is available as a stand-alone unit (1U) or OEM module.

AVQ1020 ActiveCore® RF Layer Monitoring Receiver and Signal Analyzer

Technical specification:

Main signal input "RF in":	
Connector:	50Ω, SMA(OEM)/N-type(1U)
Input level:	0..-50 dBm; -20 dBm optimum
Frequency range:	50..1000 MHz / 950..3000 MHz
Frequency tuning step:	10 Hz
Analyzed bandwidth:	≥ 50 MHz
Reference frequency:	
1 PPS:	LVTTL, SMA(OEM)/BNC(1U)
10 MHz:	50Ω, 1Vp-p, sine, SMA(OEM)/BNC(1U)
Control and monitor ports:	
Ethernet:	10/100/1000 Fast Ethernet, RJ45
Serial:	RS232, Molex(OEM)/DB9M(1U)
Relay control (x2):	Dry contacts, Molex(OEM)/DB9F(1U)
Power supply:	2A@12V DC (OEM) 110-250V, 50/60Hz AC (1U)
Operating temperature:	0..50, °C
Form factor:	
OEM module:	37cm x 14cm x 4.3cm (14.5" x 5.5" x 1.7")
1U stand-alone unit:	48.3cm x 33cm x 4.3cm (19" x 13" x 1.7")

Measurements and Metrics

- ▶ RF signal level and its variations;
- ▶ Signal statistic: MER/SNR, signal RMS, PAR, maximum peak value, signal CCDF, peak compression ratio;
- ▶ Frequency spectrum including the spectrum tilt, amplitude ripple, shoulder attenuation;
- ▶ Signal bandwidth and standard specific parameters;
- ▶ Effects of the transmission system non-linearity in terms of AM-AM/AM-PM curves measured on the broadcasted signal;
- ▶ Linear distortions found in the output RF signal - signal-group delay and frequency response;
- ▶ Results of the non-linearity and linearity measurements recalculated in a form of complex LUT and FIR suitable for pre-correction;
- ▶ Complex channel estimation for re-broadcasting applications;
- ▶ Multipath echo and feedback interference detection, estimation and visualization;

Applications:

- ▶ Digital transmitter/repeater performance 24/7 monitor;
- ▶ Remote monitoring for broadcasting repeater system network;
- ▶ Test and design verification equipment;
- ▶ Signal analyzer for a wide variety of applications;
- ▶ R & D;
- ▶ In-field and production testing.

Monitored Parameters:

General:	
Signal:	PAR, RMS
Spectral:	Bandwidth, Frequency shift, Peak-to-Average Power, Shoulder Attenuation
Modulation:	
	- Spectral mask compliance; - SNR/EVM/MER; - Eb/No, STED, STEM; - Signal Amplitude/Phase errors; - Group Delay.
Distortions:	
Non-linear:	- AM-AM, AM-PM curves; - Output complex LUT array is available for DAP.
Linear:	- Amplitude and Phase response; - Output complex FIR coefficients are available for DAP.
Default set of alarms:	
	- Spectrum shoulder levels/mask; - Signal MER/SNR/EVM; - Frequency shift.
Application-specific alarm events*:	
	User-defined set of parameters and their thresholds
Parameter update rate:	
	≤ 60 sec
Available plots and log data:	
	- Spectrum; - Constellation; - AM-AM, AM-PM; - Channel Amplitude and Phase responses; - CCDF; - SFN impulse response/CIR; - SNR/MER/EVM variation history; - Shoulder attenuation history; - Event and Alarm log.
Software interfaces:	
	- WEB GUI; - host based GUI (PC GUI); - SNMP agent; - Email.

AVQ1020 Versions:



AVQ1020 1U Front Panel:

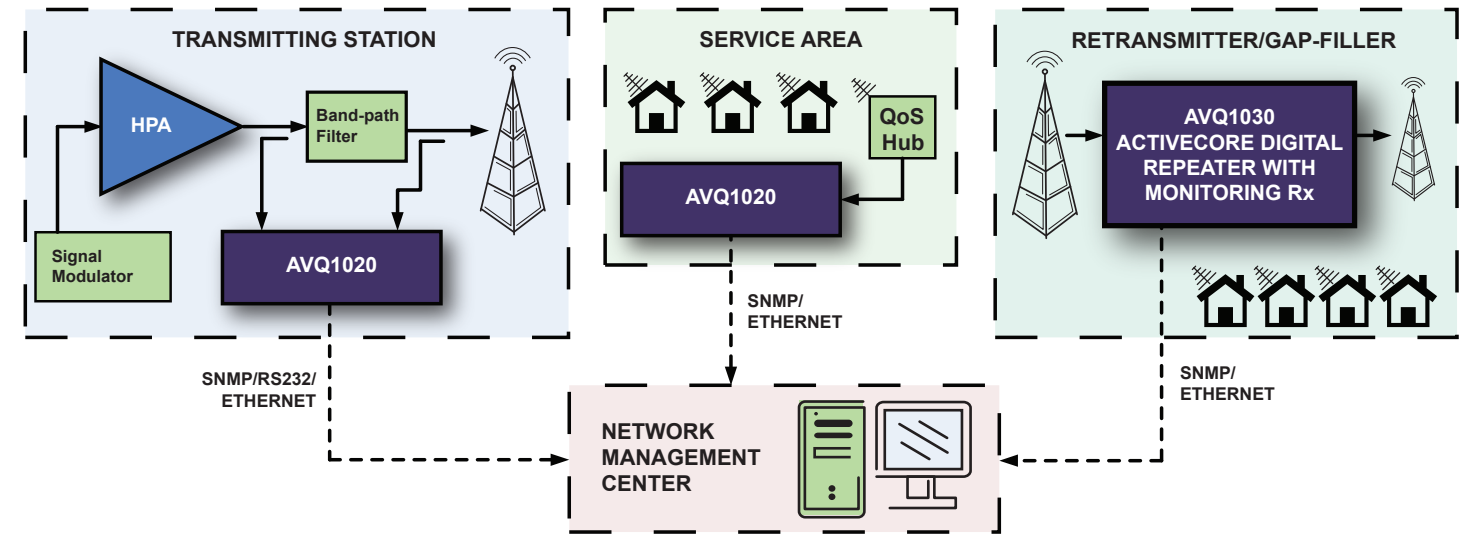


AVQ1020 1U Rear Panel:



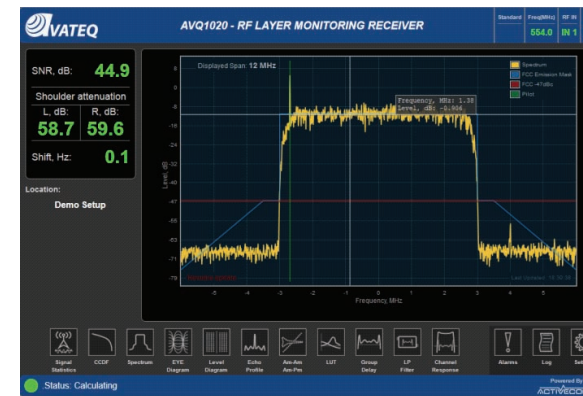
AVQ1020 ActiveCore® RF Layer Monitoring Receiver and Signal Analyzer

Application Block Diagram:

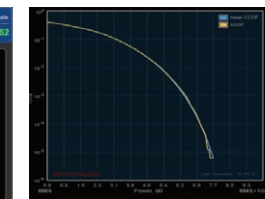


Signal Spectral and Statistical Analysis:

Spectral Analysis (Web GUI):



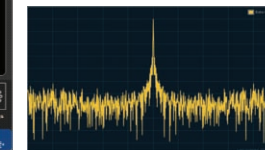
Signal CCDF:



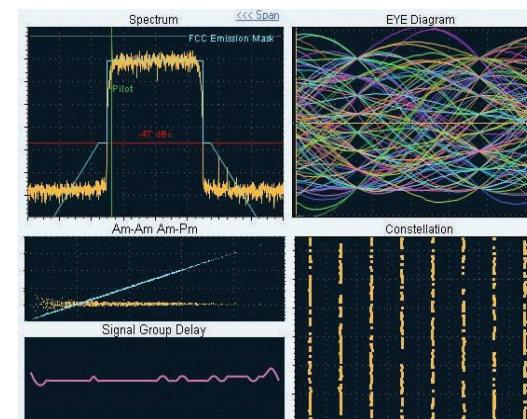
Signal Statistics:

Scale:	0.60	MER, dB: Before EQ / After EQ:	37.2 / 44.6
PAR, dB:	7.78	SNR, dB: Before EQ / After EQ:	38.4 / 45.6
Shoulder attenuation:		EVM, %: Before EQ / After EQ:	0.79 / 0.35
L, dB:	59.0	Pilot Amplitude Error, dB:	-0.077
R, dB:	59.8	Pilot Phase Error, degree:	0.158
Frequency Offset, Hz:	0.0	Residual Group Delay, usec:	0.007
		Inversion:	Not Inverted
		Bandwidth, MHz:	6.0

CIR/Echo profile:

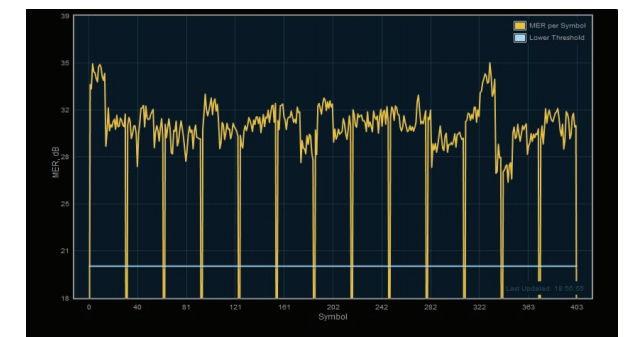


nVSB Signal Analysis:



MER, dB: Before EQ / After EQ:	37.2 / 44.6
SNR, dB: Before EQ / After EQ:	38.4 / 45.6
EVM, %: Before EQ / After EQ:	0.79 / 0.35
Pilot Amplitude Error, dB:	-0.077
Pilot Phase Error, degree:	0.158
Residual Group Delay, usec:	0.007
Inversion:	Not Inverted
Bandwidth, MHz:	6.0

MER/SNR Variations:



Symbol	1	2	3	4	5	6	7	8	9	10	11	12	13
MER, dB	40.0	41.5	40.8	40.7	41.2	40.4	40.4	41.2	39.8	41.0	39.7	41.8	41.8
SNR, dB	40.1	42.1	39.7	40.6	40.4	40.2	39.9	40.2	40.5	40.3	40.0	39.2	37.4
EVM, %	40.6	41.4	41.8	40.7	41.7	41.4	41.8	41.3	41.5	41.9	42.6	41.8	38.7
PAE, dB	42.9	42.8	42.9	42.9	43.4	43.8	43.2	43.7	44.6	43.7	43.3	43.7	44.7
PPE, degree	42.2	41.9	42.0	42.6	42.1	42.8	42.0	43.3	42.8	43.8	42.2	42.6	42.4
RGD, usec	41.8	41.2	40.7	41.5	39.8	39.5	40.3	41.9	41.0	41.1	41.4	41.4	40.2
Bandwidth, MHz	42.2	42.9	42.9	41.1	42.0	42.1	42.2	42.3	42.7	43.0	42.0	42.1	41.4