About The Company

Established in 2009 by experts in broadcasting engineering, Avateq Corp. has been specializing in the following technologies and solutions:

- DSP, signal synthesis, acquisition and analysis
- Adaptive processing: digital pre- and post-correction, dynamic range reduction, equalization and distortion removal
- Signal modulation and demodulation techniques
- Data coding/decoding, FEC and ciphering solutions
- Transmitting and receiving systems design

Our mission is to meet the most demanding requirements at every stage – from conceptual design to prototyping and production.

Avateq Corp. is experienced in delivering and managing high-cost and long-terms projects. The company provides a whole development cycle – from defining project goals to delivering the final project or technology transferring.
Engineering Projects

- Exciters with Digital Adaptive Pre-correction of non- and linear imperfections of High Power amplification and filtering chains
- Single carrier and COFDM modulators and demodulators with adaptive compensation of the signal distortions
- Transmitter system design and integration
- Signal analyzers for Echo profiling
- SFN Synchronization for hybrid “Terrestrial Repeater – Satellite” signal distribution systems
- Signal Analyzers for terrestrial broadcasting and satellite communication systems
AVATEQ Products and IP Cores

- Signal Analyzers and RF Layer Monitoring Receivers for broadcast industry standards and proprietary modulation schemes;
- Digital Adaptive Pre-corrector and Signal Analyzer for enhancing transmitter system efficiency and the system performance monitoring;
- Adaptive Echo and Feedback Interference Canceller;
- Calibration Unit for transmitting chain calibration, testing and verification;
- System and methods for Synthesis, Generation and Analysis of arbitrary and proprietary signal structure;
- Methods and Algorithms for Digital Adaptive Pre- and Post-correction of wideband signals.
Signal Analyzers and Transmitter System Calibration Products
Introduction

Avateq’s Signal Analyzers and RF Layer Monitoring Receivers are based on ActiveCore® platform and address satellite and terrestrial broadcasting, data transferring and signal distribution industry today’s the most demanding needs:

- Transmitter System Performance monitoring: critical RF parameter variations due to power, temperature, frequency range changing, system component aging, etc.
- Transmitted Signal Quality monitoring and estimation: MER/SNR/EVM/Eb/No, carrier and sampling rate frequency shifts, modulation and signal structure specific parameters, signal statistical and spectral analysis, non- and linear distortions
- Transmitter or Receiver system Calibration and Verification: numerical estimation of Amplitude and Phase Errors as an affect of the amplification and filtering chains imperfections, sampling or symbol data rate variations, etc.

* ActiveCore® is Avateq Corp. registered trade mark.
Avateq’s Signal Analyzers can be used for single carrier and multicarrier signals and modulation techniques.

For broadcast industry, Avateq Corp. offers RF Layer Monitoring Receivers supporting virtually all industry standards:

- DVB-T/T2
- DVB-S/S2
- ISDB-T/Tb
- ATSC/MH
- DAB/DAB+/T-DMB
- CMMB
- DTMB
- DVB-SH
- HD Radio
- DRM+
- Proprietary modulation schemes including hybrid “satellite-terrestrial” architectures and communication applications

Avateq’s **Signal Analyzer and RF Layer Monitoring Receiver** performs critical RF estimations of MER, SNR, EVM and signal spectrum in order to provide early diagnostic of the signal degradation before any impairment affects the application targets or become noticeable to the end Customer. The device provides an early diagnostic of the transmitted signal quality and allows localization of the reason of possible degradation.
The receiver provides 24/7 “day-by-day” monitoring capabilities with automatic notification about changing the signal parameters.

Primarily targeted to embedded applications the receivers have been designed as an easy-to-use and cost-effective solution. They can be integrated into the transmitter system for remote monitoring applications or used as a stand alone unit during the system calibration, in-field and production tests.

Being integrated into a transmitter system the receiver can also be used as the **Transmitter Site Monitoring and Controlling platform**.

The Analyzer and Monitoring Receiver is designed to perform continuous monitoring of the transmitted signal and report comprehensive set of critical parameters based on the signal quality analysis. The reported values can be used also for monitoring, diagnosing and troubleshooting transmitter system performance - reported by the Receiver signal amplitude and phase errors might indicate the transmitter linearity issue, etc.

A sophisticated **Alarm Management System** is designed and tuned to timely inform an operator about potential changes in signal quality and to perform preventive actions without the need for the operator's immediate involvement.

The device also provides a comprehensive set of plots allowing the operator to visually analyze monitored and estimated parameters.
Signal Analyzers and RF Layer Monitoring Receivers

Application Block-Diagram
Signal Spectral and Statistical Analysis

Signal Statistics

Signal CCDF

CIR/Echo Profile
# 32PSK Signal Analysis

## Modulation Parameters:
- **Modulation**: 32APSK 9/10
- **FECFRAME**: 64800 / Normal
- **Pilots**: Present
- **Inversion**: Inverted
- **MER, dB**: 40
- **SNR, dB**: 41
- **EVM, %**: 0.8
- **Eb/No, dB**: 34.1
- **STEM**: 0.0016
- **STED**: 0.0007

## Spectrum Mask

<table>
<thead>
<tr>
<th>Offset, MHz</th>
<th>Power L, dB</th>
<th>Power R, dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.1</td>
<td>-0.1</td>
</tr>
<tr>
<td>2</td>
<td>0.2</td>
<td>0</td>
</tr>
<tr>
<td>4.3</td>
<td>-0.8</td>
<td>-0.8</td>
</tr>
<tr>
<td>4.6</td>
<td>-2.3</td>
<td>-2.4</td>
</tr>
</tbody>
</table>

## Graphs:
- **Spectrum**
- **Constellation**
nVSB Signal Analysis
OFDM Constellation

MER/SNR Variation

<table>
<thead>
<tr>
<th>Symbol</th>
<th>MER Per Symbol, dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Symbol 1</td>
<td>49.0, 41.5, 42.8, 40.7, 41.2, 42.6, 40.4, 40.2, 41.2, 42.8, 41.6, 39.0, 41.5</td>
</tr>
<tr>
<td>Symbol 2</td>
<td>48.1, 42.1, 38.7, 40.6, 49.4, 42.2, 39.9, 40.2, 40.5, 46.3, 46.8, 39.2, 37.4</td>
</tr>
<tr>
<td>Symbol 3</td>
<td>46.8, 41.4, 41.8, 42.7, 41.7, 41.4, 41.6, 41.3, 41.2, 41.0, 42.6, 41.8, 39.7</td>
</tr>
<tr>
<td>Symbol 4</td>
<td>42.9, 42.9, 42.6, 42.9, 43.4, 42.5, 43.2, 43.7, 44.5, 43.7, 43.7, 44.7</td>
</tr>
<tr>
<td>Symbol 6</td>
<td>42.2, 41.9, 42.6, 42.6, 42.1, 42.8, 42.0, 43.3, 42.6, 42.6, 42.2, 42.5, 42.4</td>
</tr>
<tr>
<td>Symbol 7</td>
<td>41.8, 41.2, 40.7, 41.5, 39.8, 39.5, 40.3, 41.9, 41.0, 41.1, 41.4, 40.2</td>
</tr>
<tr>
<td>Symbol 8</td>
<td>42.2, 42.9, 42.6, 41.1, 42.0, 42.1, 42.2, 42.3, 42.7, 42.0, 42.9, 42.1, 41.4</td>
</tr>
</tbody>
</table>

Inversion: Inverted
MER/SNR, dB: 41.9/41.9
Residual Group Delay, usec: 0.030
Amplitude Error, dB: 0.03
Phase Error, degree: 0.07

Scale: 0.65
PAPR, dB: 6.12
Shoulder attenuation: 46.4
R, dB: 46.0
Frequency Offset, Hz: 0.5

Reference 10 MHz Source: Internal
Transmitter System Calibration and Verification

Non-linear Distortions

Linear Distortions

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inversion</td>
<td></td>
</tr>
<tr>
<td>MER / SNR, dB</td>
<td>41.9</td>
</tr>
<tr>
<td>Residual Group Delay, usec</td>
<td>0.035</td>
</tr>
<tr>
<td>Amplitude Error, dB</td>
<td>0.03</td>
</tr>
<tr>
<td>Phase Error, degree</td>
<td>0.77</td>
</tr>
</tbody>
</table>
Analyzed Parameters

- Modulation parameters and error metrics – MER/SNR/EVM;
- Signal Statistics – RMS, PAPR, Max, CCDF;
- Spectral measurements – signal bandwidth, central frequency shift, shoulder attenuation, etc.;
- Effects of imperfections of the amplification chain – Amplitude and Phase imbalance amplification modules and combining circuitry, Am-Am/Am-Pm with real signal, Amplitude and Phase Errors in the signal amplitude and frequency range, feedback interference, etc.;
- Linear Distortions – Amplitude and Phase Responses, Group Delay across the signal bandwidth;
- Echo profile and matching issues;
- Modulation scheme or application specific parameters – Eb/No, STED, STEM, signal «fine» and frame structure, etc.
Contact Information

AVATEQ CORP.
3555 – 14th Ave., Unit 18
Markham, ON L3R 0H5
Canada

Phone: 416-342-0761
Fax: 416-342-0608
Email: info@avateq.com

WWW.AVATEQ.COM

Copyright 2013 © Avateq Corp. All rights reserved.