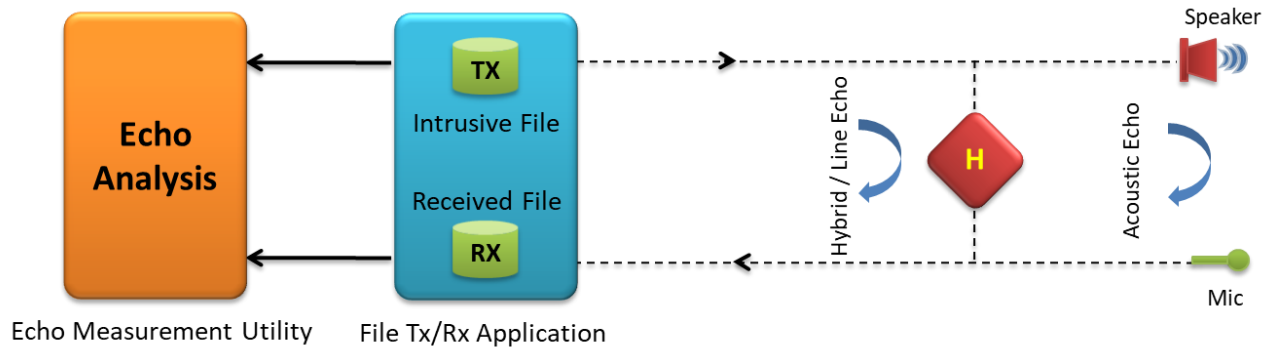# Echo Measurement Utility (EMU)

Overview

GL's Echo Measurement Utility (EMU) software is an offline adjunct analysis application (under control of VQuad™) that compares the source and received files to determine echoes and delay of echoes. EMU software assesses sidetone, line, and acoustic echo and the corresponding delays.

Echo Measurement Utility Software (EMU) measures Echo Path Delay (EPD) and Echo Return Loss (ERL) of voice calls. Echo can be as simple as sidetone, or more complex such as line, and acoustic echo. The EMU can work seamlessly with other GL's intrusive capture tools such as VQuad™, Dual UTA HD, T1 E1 Analyzers, RTP Toolbox™ or Voiceband Analyzer, additional voice quality metrics such as round trip delay (RTD), voice quality, and noise can also be measured.

To provide a comprehensive assessment of voice quality irrespective of network type, GL has combined various tools together into one platform consisting of VQuad™, Dual UTA HD, T1 E1 Analyzers and WebViewer™. This platform provides the ability to make VoIP, TDM, and Mobile calls from any fixed or mobile location. All interface flexibility is provided (2-Wire, 4-Wire, VoIP, TDM, and Mobile) within the Dual UTA HD. In addition, VQuad™ provides algorithms for signaling, voice transmission, and voice quality assessment. WebViewer™ provides the central point where voice metrics are stored and displayed through a WEB interface.

Echo Measurement Utility also includes Audio Processing Utility (APU - PKB070) to produce a specific configurable degraded voice file for a given input file.

For more details, please visit Echo Measurement Utility (EMU) webpage.

Main Features

- Detect Acoustic/Line (Hybrid) echoes and evaluate intermittent echoes
- Echo, Delay, and Voice Quality Analysis of Voice Calls in VoIP, TDM, 2Wire, and Mobile Networks
- Measures EPD in msec and ERL in dB
- Compares source and received files to detect echo (maximum of four instances)
- Ability to automate the entire test process using VQuad™ scripting; including sending the results to the central database for access via GL's WebViewer™
- EMU uses EMU Client software to automatically detect the incoming degraded voice files and send the measurements to database after analysis
- Detailed offline analysis
- Supports Manual Method and Auto Method of operation
- Graphically displays source signal, received signal, error signal, and adaptive filter coefficients
- Allows zoom-in on each graph, exporting snapshots of these graphs to files for later analysis
- Calculates adaptive filter coefficients and echo characteristics for the error signal
- Speaker option to play the audio files (intrusive and non-intrusive)

EMU User Interface

As shown below, the EMU provides delay and ERL measurements for all detected echoes, along with an 'ERL vs Delay' plot where each echo is depicted within the plot. One can zoom-in on a particular echo to gauge overall echo impairments. In addition, the application includes signal graphs for source signal, received signal, error signal, and adaptive filter coefficients in the detail analysis mode.
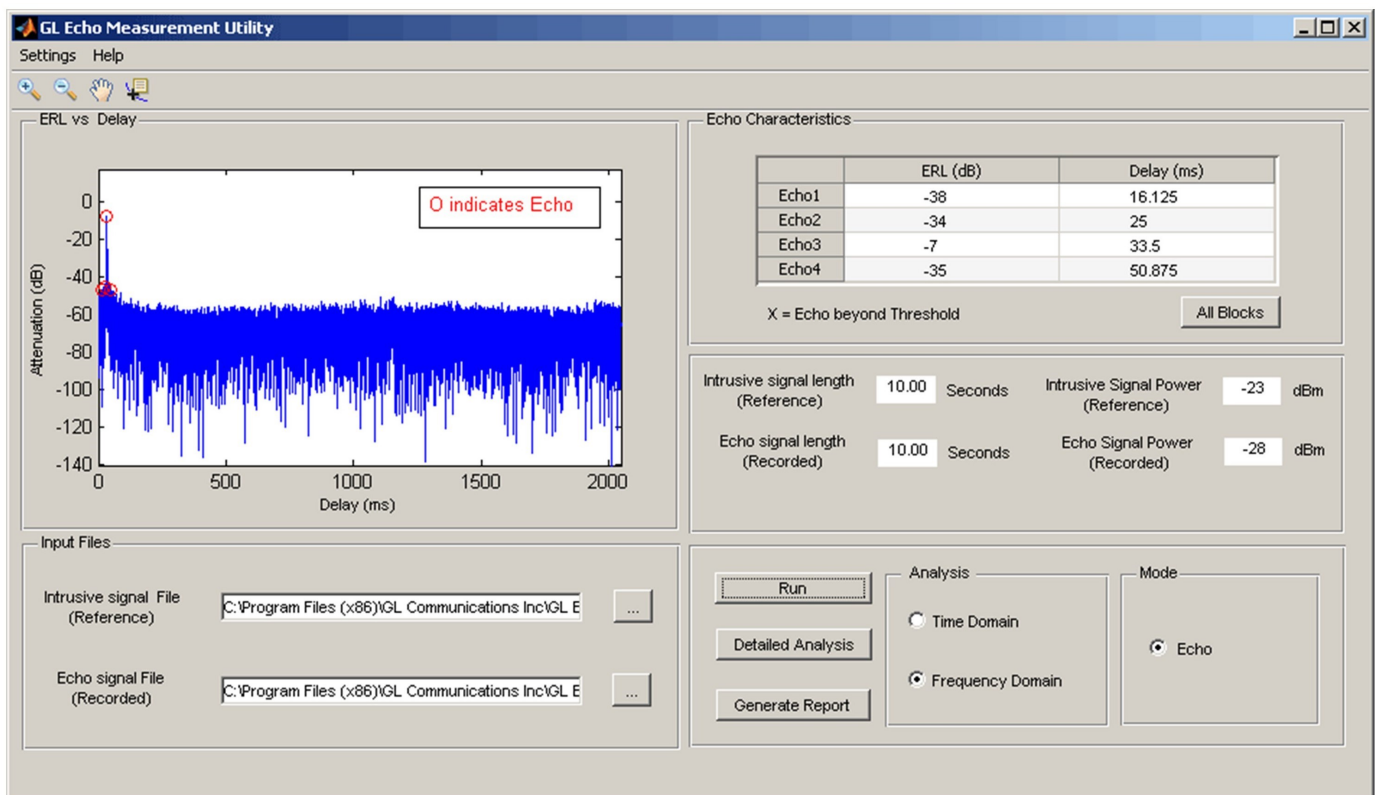

Figure: EMU - ERL Vs Delay Measurements

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EMU in Acoustic Mode

The configuration at computer 2 is such that the file received at computer 2 is played to the speaker and the audio is sent back to source using the microphone. The intrusive and received files at computer 1 are compared for echo measurement. The path of acoustic echo is depicted in dotted lines, which is the leak between the speaker and mic of computer 2.
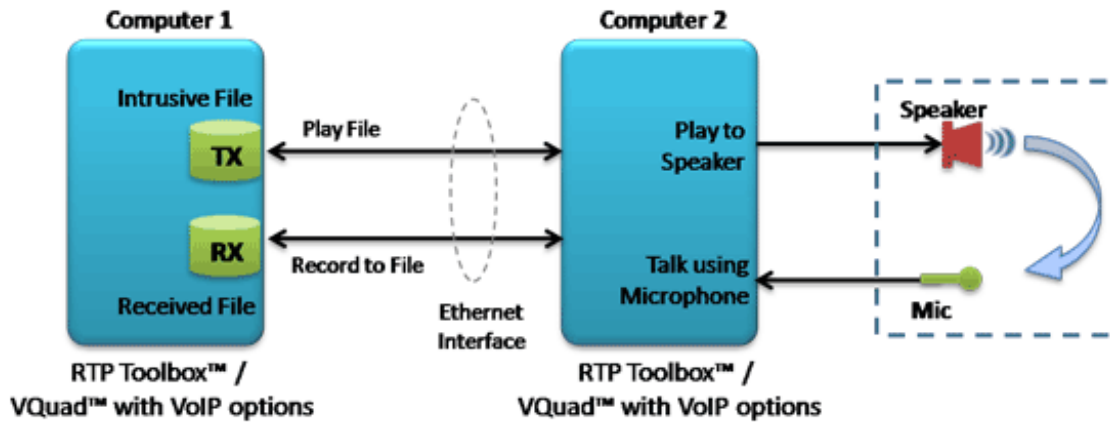
Figure: EMU in Acoustic Mode

EMU in Line (Hybrid) Mode

The following outlines the line echo scenarios.

- Two wire – Two wire Setup
- Two wire – Mobile Setup
- Two wire (direct to gateway) to VoIP Phone Setup
- Two wire (through Class 5 T1 E1 Switch) to VOIP phone setup
- Two wire (through Class 5 T1 E1 Switch) to VQuad™ software (Ethernet Interface) Setup
- Two wire (direct to gateway) to VQuad™ software (Ethernet Interface) Setup
- Mobile phone to Mobile phone Setup
- Mobile phone to VoIP phone Setup
- VQuad™ (Ethernet Interface) to IP PBX to two-wire Setup
- VoIP phone to IP PBX to Two-wire Setup

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Measurement Parameters

As shown below, the **Settings** option can be used to modify or view the various settings parameters. A dialog with various settings is displayed as shown below.

The following parameters can be customized to control the EMU input and output –

- Filter Coefficients Length
- Step Size
- Double talk Detector Threshold
- Double talk Detector Hangover Time
- Echo power window length
- Single talk Threshold
- ERL threshold
- Minimum Single talk length
- Maximum Single talk length
- Sampling rate

Figure: Auto and Manual Method Settings

Operating Modes

There are two options to measure the echo characteristics in EMU:

- **Auto Method** - the input files are analyzed and the echo characteristics are given as blocks (Blocks are divided based on time duration of input files and parameter settings).
- **Manual Method** – after analyzing the input files, the users have to manually select a region of Input / Output stereo signal plot to obtain the echo characteristics results.
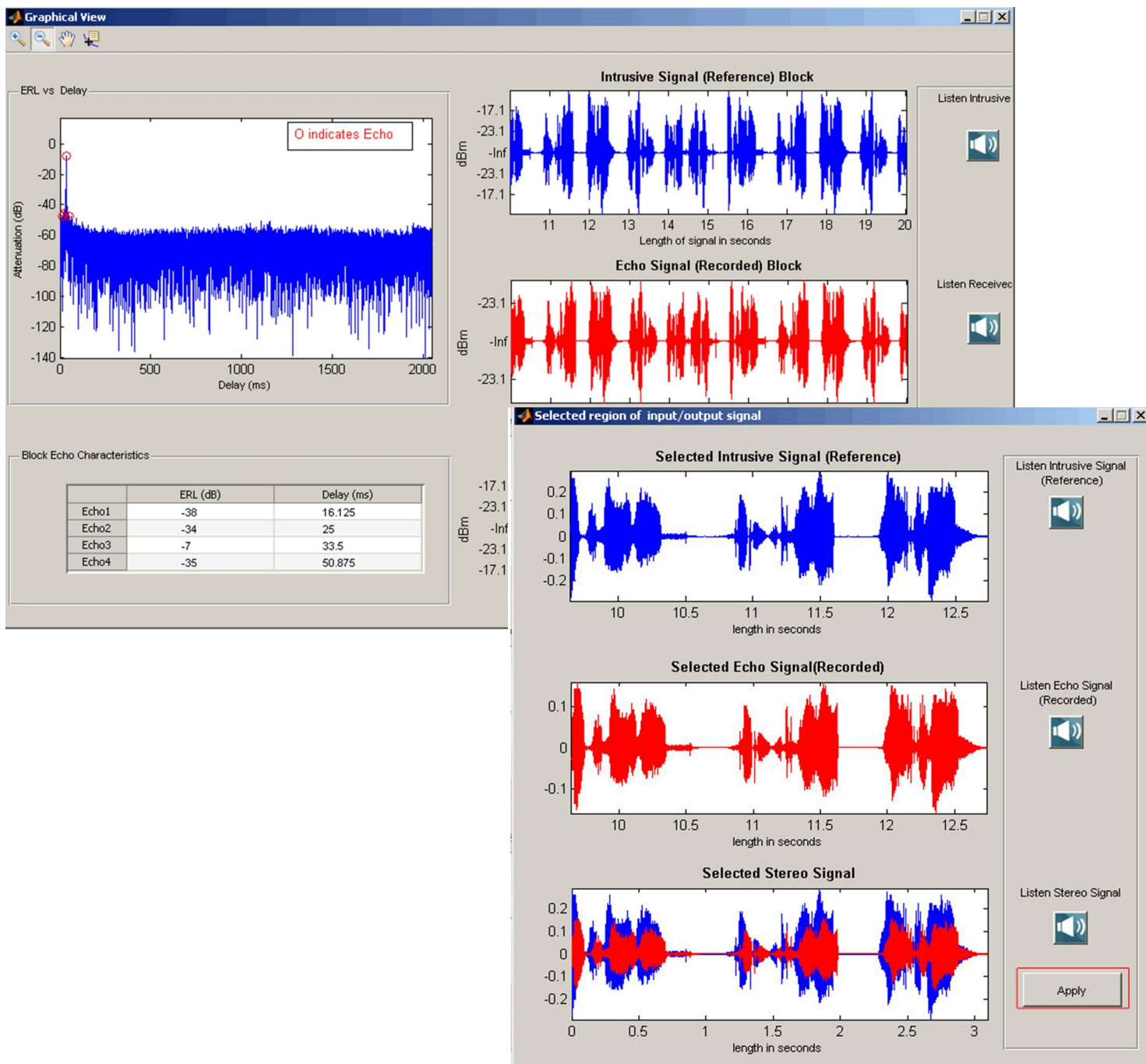

Figure: Manual Method - Input/ Output Signal Graph

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Detail Analysis

The "Detailed Analysis" GUI displays intrusive and received signal display (in dBm format), error signal display (in seconds), adaptive filter coefficients display and the table of echo characteristics. Speaker option in detailed analysis allows playing audio files and to gauge overall performance of the echo.
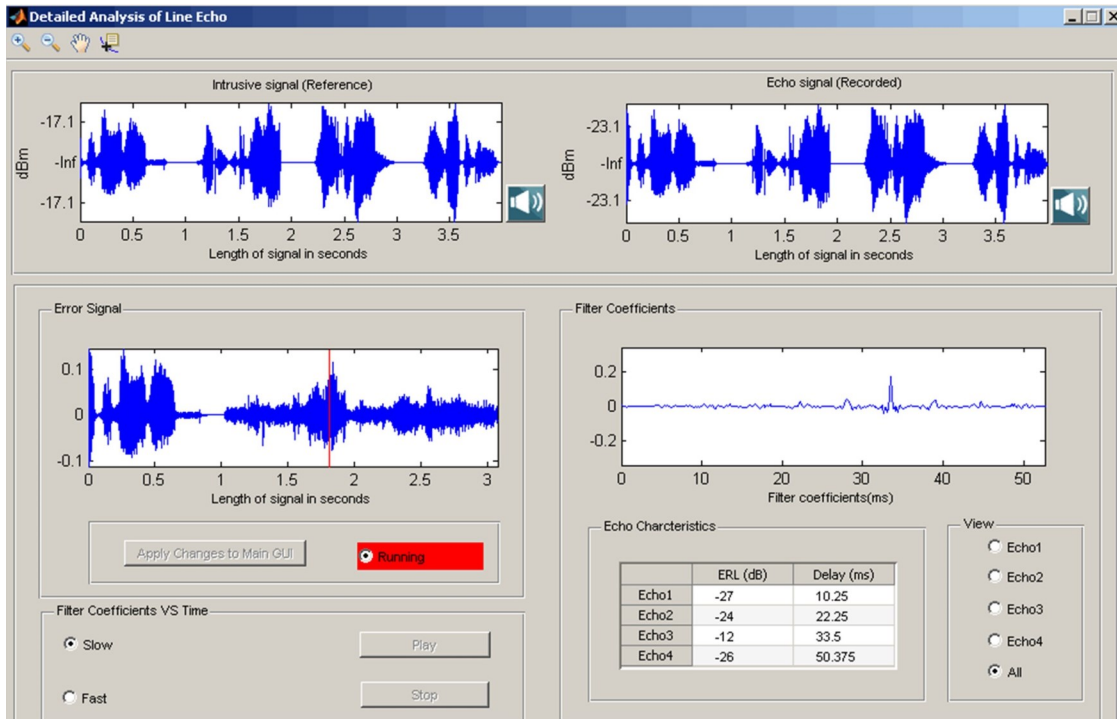

Figure: Detailed Analysis

Results

The Operator information option is used to print the result in spread sheet. The generated "Result" spread sheet includes operator information, file information, echo characteristics, and snapshots of all the signal graphs. Each echo result includes the ERL in dB and delay in msec.
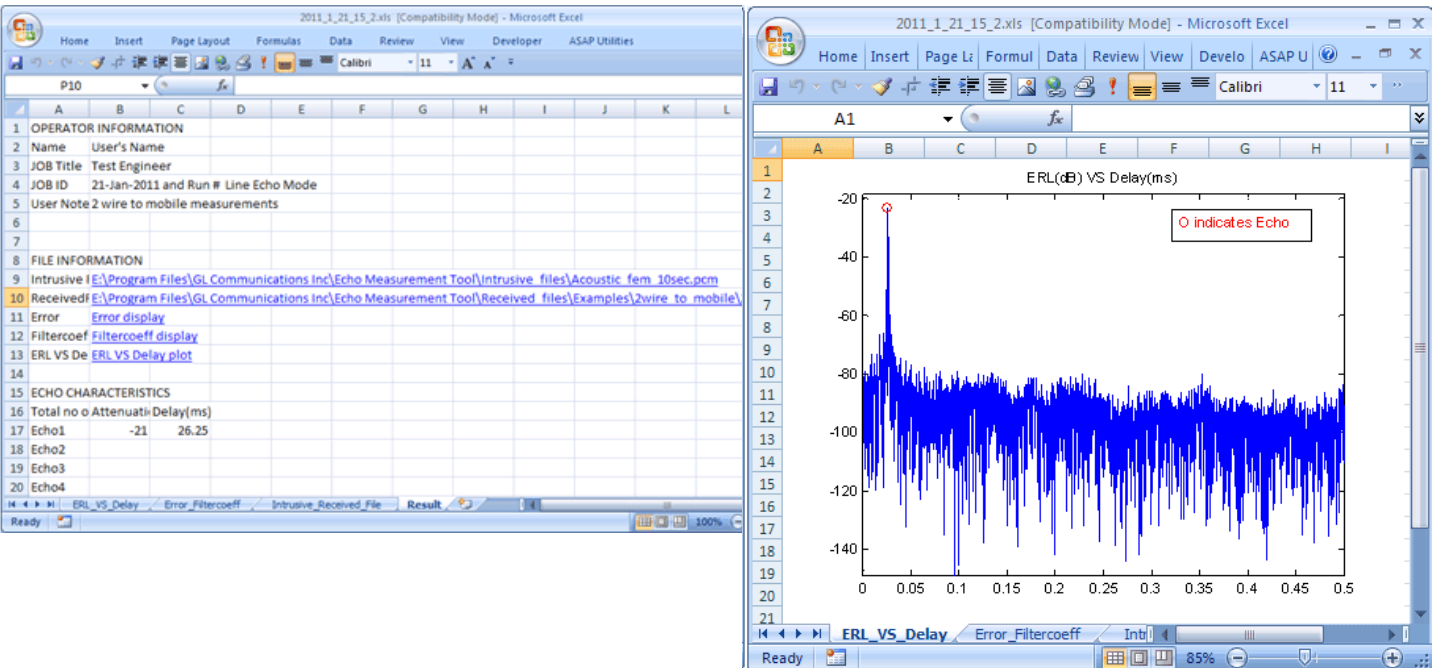

Figure: EMU Results

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EMU Client

The VQuad™ along with the File Monitor Utility forms a system, which generates and terminates a variety of connections including 2-wire Analog (FXO), 4-wire Analog, T1 E1, and SIP VoIP. The recorded files on this system will be automatically transferred to the EMU system for analysis.

The EMU Client (running on same system as EMU) monitors the incoming degraded voice files and informs the EMU to analyze these files based on parameters associated with the degraded voice filename. These parameters indicate the Intrusive Reference Voice File to be used, Line or Acoustic Echo mode, Time or Frequency Domain.
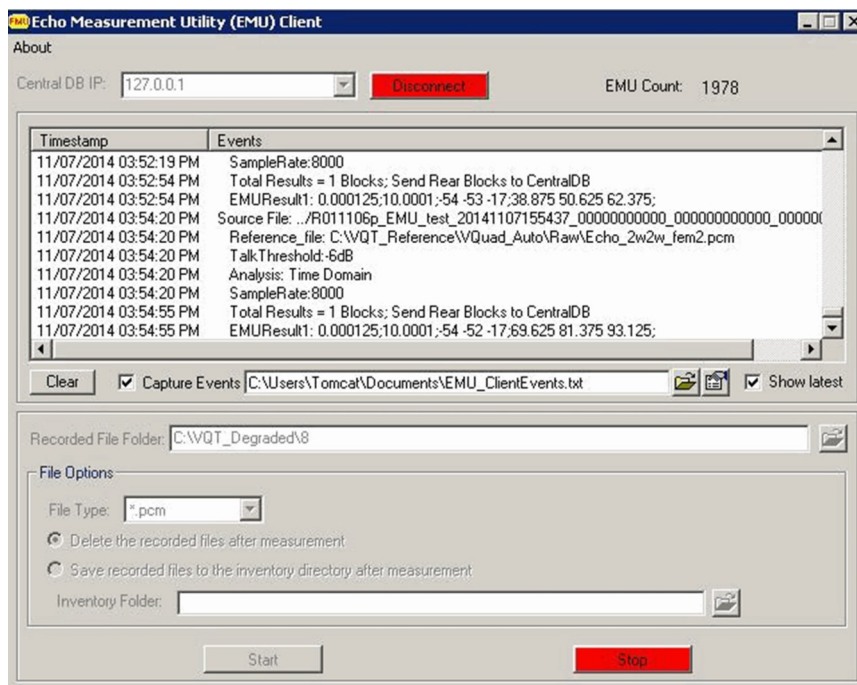

Figure: EMU Client

EMU Results in Webviewer

The EMU results are sent to Central Database system. The results include Echo Path Delay (EPD) and Echo Return Loss (ERL) of calls. With this, the remote users can access the EMU results using WebViewer™.

Figure: EMU Results in WebViewer™

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EMU with GL Tools

The EMU requires only two files to function – the 'sent' file and simultaneously recorded 'received' file. Any tool that achieves this can be used with EMU. GL offers various emulation and capture tools that are compatible with the EMU:

- For VoIP: **VQuad™** or **RTP Toolbox™**

- For Mobile Phones: **VQuad™** with **Dual UTA HD**

- For TDM: **VQuad™** with **USB T1 E1 unit**, or **tProbe™ T1 E1 unit** alone, or **Universal T1 E1 Card** alone

- For 2-Wire: **VQuad™** with **Dual UTA HD**

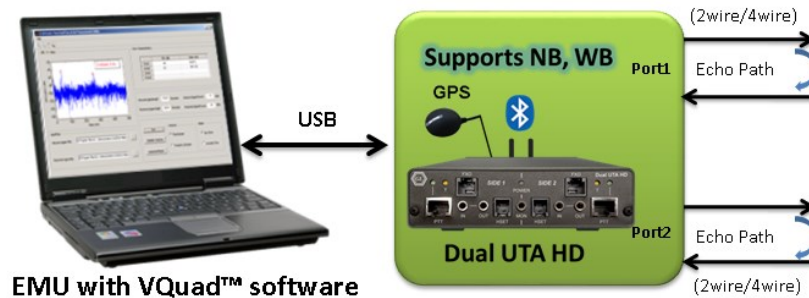- For 4-Wire: **VQuad™** with **Dual UTA HD**

Figure: EMU with VQuad™ and Dual UTA HD

Audio Processing Utility (PKB070)

Audio processing utility is a pre-processing utility available as a part of Echo Measurement Utility. It can be used for manipulating the input audio (tones, and voice) files with impairments such as delay, noise, acoustic echo, line echo, and double talk. APU (Audio Processing Utility) is designed to produce a specific configurable degraded file for a given input file. An echo file can also be generated if a corresponding line or acoustic echo filter is specified.

For more details, please visit Audio Processing Utility webpage.

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Buyer's Guide

Item No	Product Description
EMU037	Echo Measurement Utility (EMU) Software
PKB070	Audio Processing Utility

Item No	Related Software
VBA032	Near Real-time Voice-band Analyzer
VQT002	Voice Quality Testing (PESQ only)
VQT006	Voice Quality Testing (POLQA only)
VQT010	VQuad™ Software (Stand Alone)
VQT015	VQuad™ with T1 E1 Call Control
VQT013	VQuad™ with SIP (VoIP) Call Control
VQT040	WebViewer
PKB100	RTP ToolBox™ Application

Buyer's Guide (*Contd.*)

Item No	Related Hardware
VQT251	Dual UTA HD Next generation Dual UTA with FXO Wideband support
VQT252	Dual UTA HD – Bluetooth Option
VQT280	Voice Quality Testing (POLQA only)
HTE001	Universal HD T1 E1 Cards
FTE001	QuadXpress T1 E1 Main Board (Quad Port– requires additional licenses)
ETE001	OctalXpress T1 E1 Main Board plus Daughter Board (Octal Port– requires additional licenses)
UTE001	Dual Laptop T1 E1 Hardware USB Base Unit
PTE001	tProbe™ Dual T1 E1 Laptop Analyzer
XTE001	Dual Express (PCIe) T1 E1 Boards
TTE001	tScan16™ T1 E1 Boards

For more details, please visit Echo Measurement Utility (EMU) webpage.