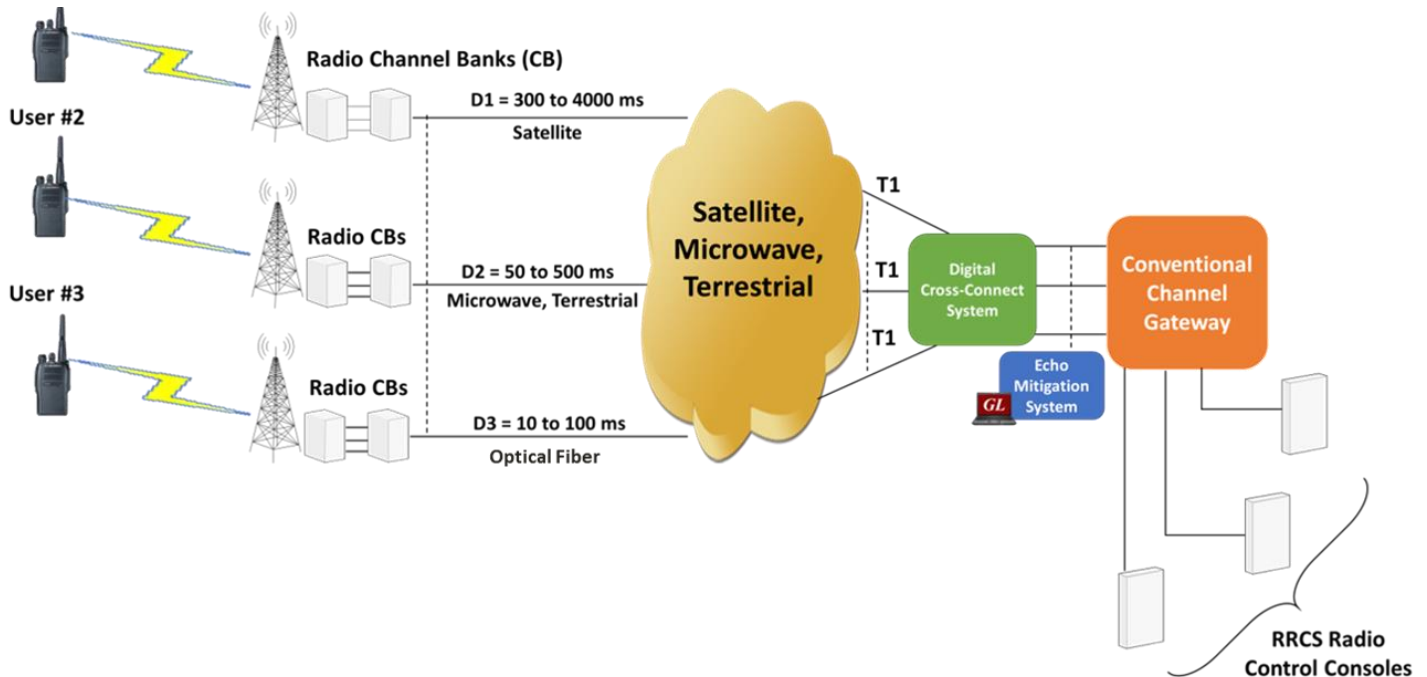# Echo Mitigation System (EMS)

Overview

Often, multiple Radio Frequency (RF) sites receive the same radio transmission from users in remote locations. When two or more RF sites receive the transmission, they will forward the audio streams to a central dispatch location. The operator at dispatch will therefore hear multiple audio streams arriving out of phase, resulting in an echo effect. The audio streams arrive out of phase because each RF site uses independent backhaul networks for transmission. These networks include satellite, microwave and terrestrial (wired) based networks. Typically, satellite networks introduce the most latency and terrestrial networks introduce the least. The echo drastically reduces audio quality and can result in life threatening situations for people in remote locations.

GL Communications has developed an Echo Mitigation System (EMS) which works by aligning the out of phase redundant audio streams. The EMS adds precise delay to the stream that arrives first, so that it aligns with the stream that arrives later. This ensures that the two audio streams are in phase at dispatch and eliminates echo. These delays are added on T1 networks where each stream is carried on a different DS0. A user configurable delay is applied independently to each DS0 in the T1. This solution scales to larger TDM networks as well. For example, GL's Octal Cards have 8 T1 ports. All 192 DS0s (8 T1s * 24 DS0s per T1) can experience different user configurable delays.

For more information, please visit Echo Mitigation System webpage.

Main Features

- The EMS software can process 96 DS0 circuits (i.e., four DS1 circuits) per Octal T1 Analyzer and each of the 96 DS0s can be individually assigned their own delay parameters
- Maximum of four (4) seconds of delay can be applied on any DS0
- The system will be able to inject circuit delays without degrading or disrupting communications using the standard timings of 3.0 ms on a D4 format circuit, and 6.0 ms on ESF format
- The system will be able to add circuit delays independently in the transmitting and receiving paths of a DS0
- Each DS-0 configuration provides details such as Channel ID, Auxiliary Information, Receive Side Delay, Send Side Delay, Enable Status, Circuit Enable or Disable, and Notes
- The system will be configurable locally or remotely via the user network
- The system will be able to print all system and circuit information to a printer

Hardware Platform and Specification

Octal T1 Card (EMS)
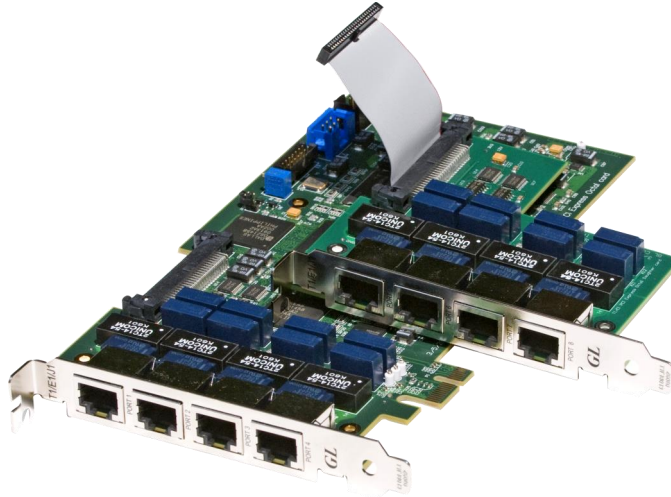
Main Board	7.7" x 4.4" 1xPCIe Connector
Daughter Board	3.8" x 4.2" Without PC Interface (Occupies 1x PCIe Space)

Intel® Server System R2208WT2YS

Form Factor	2U Rack
Dimension	16.93" x 27.95" x 3.44"
Expansion Slots (PCI-Express)	1x PCIe x4 Gen 3
	7x PCIe x8 Gen 3
	1x PCIe x4 Gen 2
	1x Connector for Intel I/O Expansion Module
	1x Connector for Intel Integrated RAID Module

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EMS Interface

The EMS GUI will run as a module of the GL Octal T1 Analyzer package to provide delegating maintenance functions to PC software such as Microsoft Excel.

- Delay is implemented via a delay buffer scheme with separate delays in transmit and receive directions
- The EMS software contains a configuration utility through which users specify delay values
- EMS Software performs round-trip delay measurements. One-Way delay measurement available using companion equipment
- EMS software translates DS1 and DS0 configuration data into settings appropriate for the Octal T1 hardware
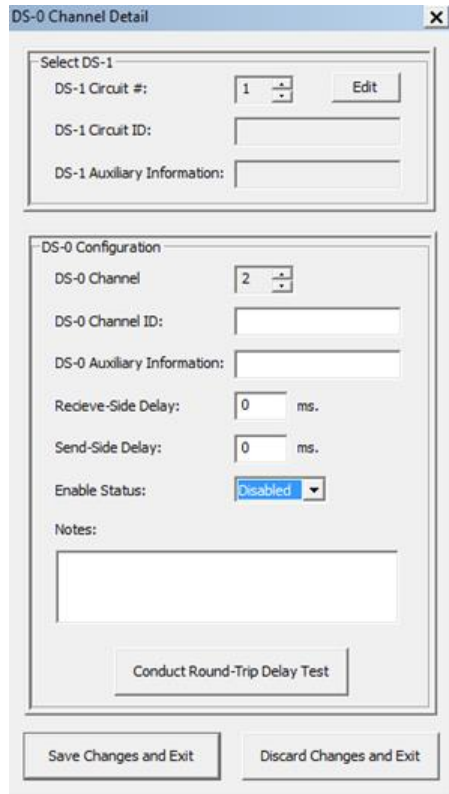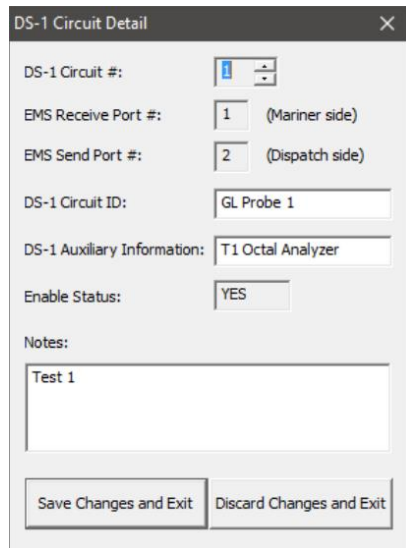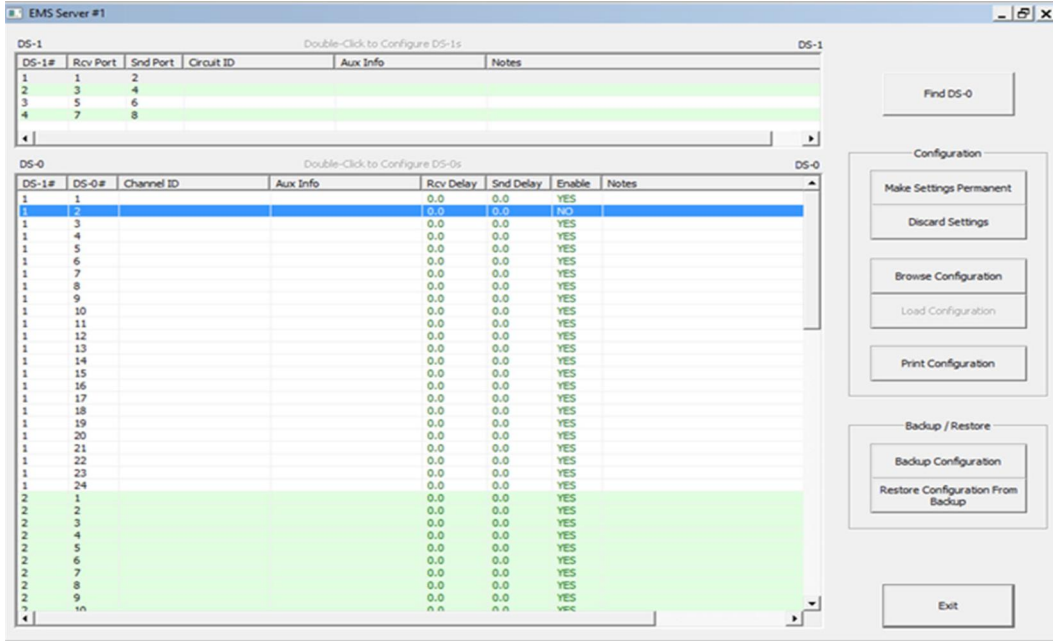

Figure: EMS Graphic User Interface

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Working Principle

- Initially, a delay measurement is performed
- A signal (noise) is transmitted towards the remote end point, and with the loopback in place, the signal is returned and measured for delay
- The delay measurement is almost instantaneous, but 3 or 4 measurements should suffice to confirm stability
- Each direction of a duplex T1 is demultiplexed into its individual DS0s. The delay can vary on each DS0. To align these signals at the remote end point
- Users must determine the difference in the delay values that must be applied to synchronize the signals and then configure these delay compensation values in the EMS software accordingly
- The EMS software contains a configuration utility through which users specify delay values. The application then allows to simulate the delay values in accordance to the user "configuration file" and then loopback at the remote endpoint
- The EMS software in Octal T1 board can implement delay compensation for 4 bi-directional DS1s
- Delay is implemented via a delay buffer scheme with separate delays in transmit and receive directions
- EMS software translates DS1 and DS0 configuration data into settings appropriate for the T1 hardware. The T1 Configuration should be: ESF Framing, No Loopback, Terminate, Recovered Clock, B8ZS Line Coding, Cross Port Transmit
- DS0 and DS1 configuration data is retained in a database. Multiple configurations may be saved
- EMS Software performs round-trip delay measurements. One-Way delay measurement available using companion equipment
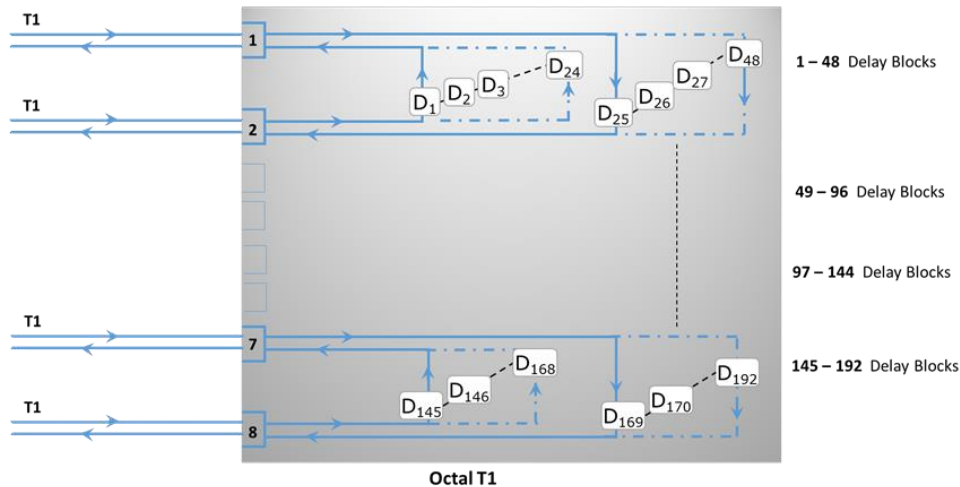

Figure: Theory of Operation

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Buyer's Guide

Item No	Product Description
XX003	Timeslot Delay Loopback for T1/E1 (Currently implemented in Octal T1/E1 Analyzer)
XX063	Echo Path Delay/Loss Measurement Software
XX062	Echo Path Delay/Loss Simulation Software
XX065	G.168 Echo Canceller Test Suite
XX066	Digital Echo Canceller
XX068	Semi-automated Scripted EC Testing
PKB081	Automated Acoustic Echo Cancellation (AEC) Compliance Test Software

Item No	Related Hardware
	*Specifications and features subject to change without notice.
XTE001	Dual T1 E1 Express (PCIe) Boards (requires additional licenses)
FTE001	QuadXpress T1E1 Main Board (Quad Port– requires additional licenses)
ETE001	OctalXpress T1E1 Main Board plus Daughter Board (Octal Port– requires additional licenses)
PTE001	tProbe™ T1 E1 Base Unit
PTE015	w/ 2Wire FXO and FXS Optional Board
PTE025	Data Communications Board for Interfaces RS-232, RS-449, EIA-530, V.35, and many others

For more information, please visit Echo Mitigation System webpage.