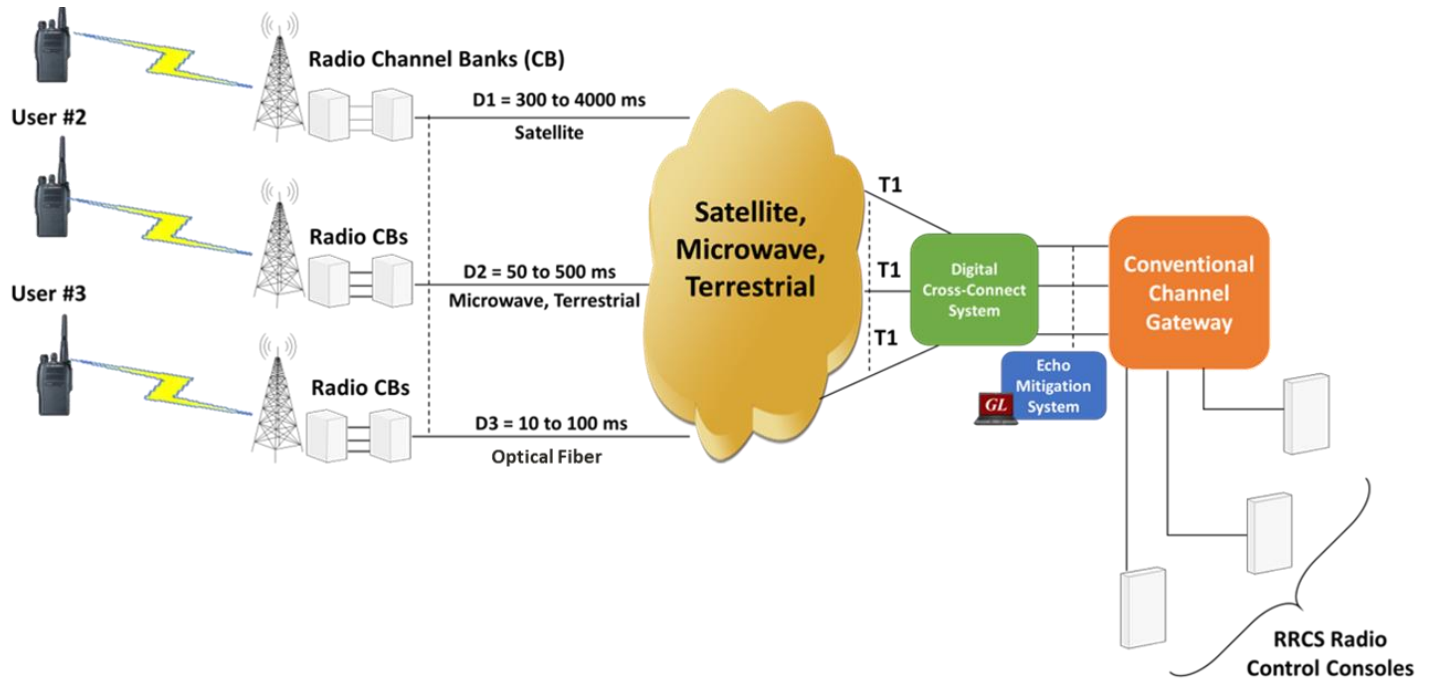


Echo Mitigation System (EMS)



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



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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 |
| 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 |

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

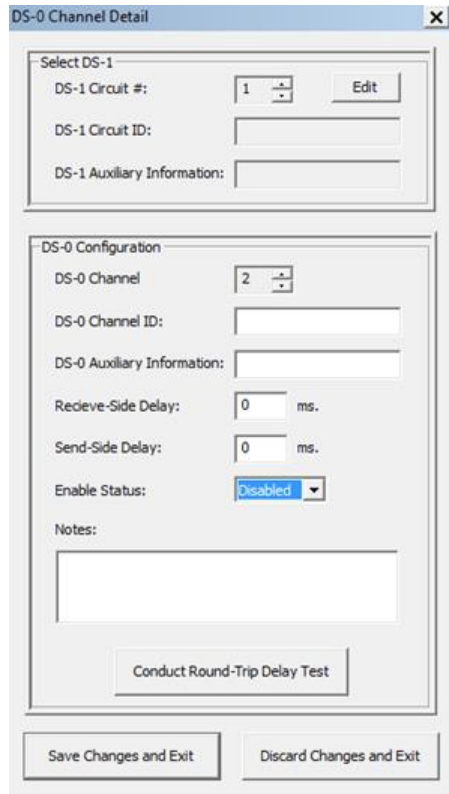
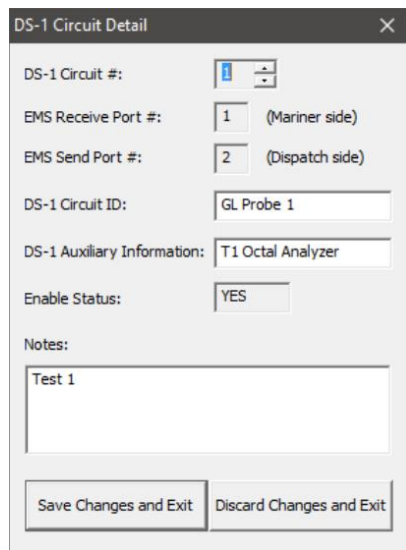
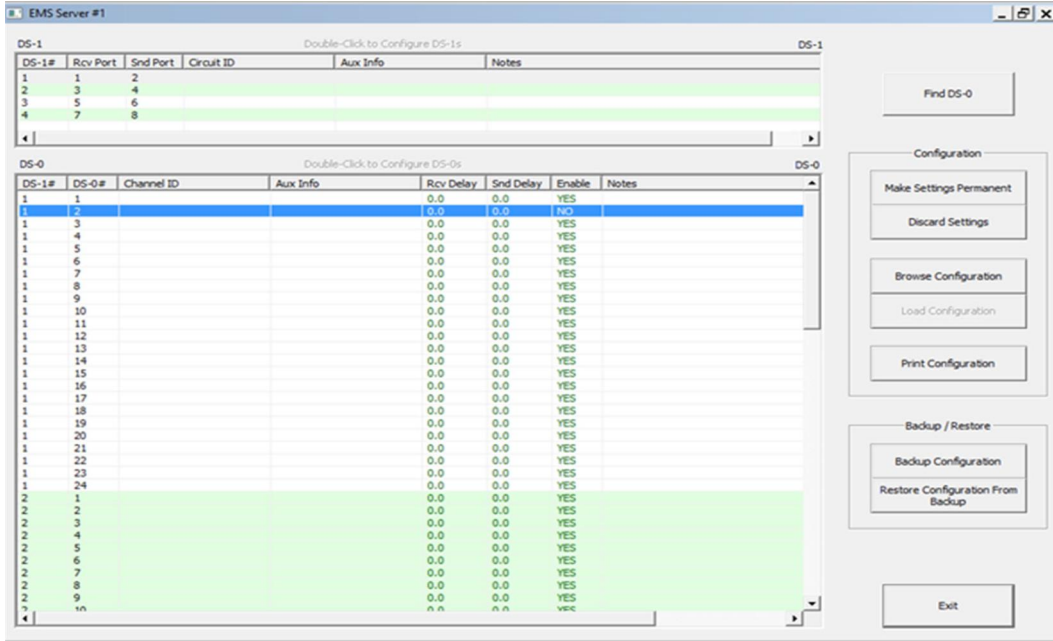


Figure: EMS Graphic User Interface

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

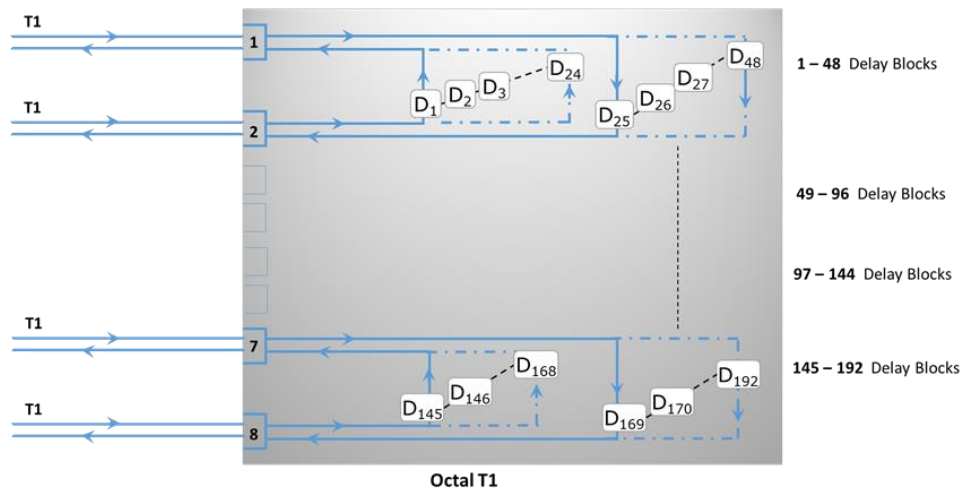


Figure: Theory of Operation

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) |
| UTE001 | Dual Laptop T1/E1 Hardware USB Base Unit |
| HTE001 | HD Universal Dual T1/E1 Card |
| 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 |

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