TRAU Emulation and Analysis

(TRAU Toolbox™, TRAU Traffic Playback, and TRAU Analysis)

GL's TRAU Analyzer

GL's TRAU Emulator

BTS – Base Transceiver Station
BSC – Base Station Controller
MSC – Mobile Switching Center
TRAU – Transcoder and Rate Adapter Unit
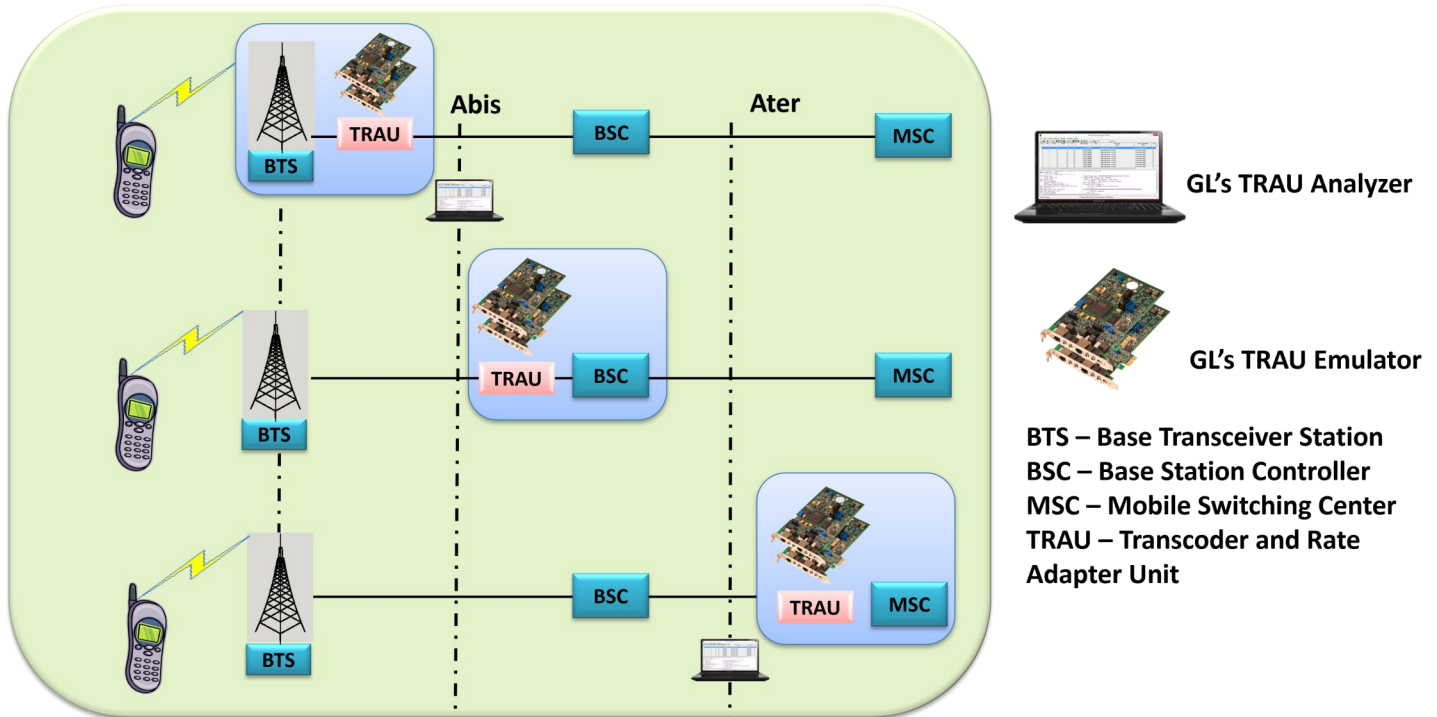
Overview

TRAU (Transcoder/Rate Adaptor Unit) frames at Abis or Ater interface perform compression/decompression of speech channels within the radio cellular network. TRAU carries speech, data, O&M frames at full rate (16Kbps) or half rate (8kbps), and control information in a GSM network. GL supports TRAU applications such as: **TRAU Toolbox™, TRAU Traffic Playback,** and **TRAU Analyzer** for emulation and analysis of GSM network. In addition, GL's T1 E1 Analyzer is also equipped with client server based TRAU Emulation applications, which includes WCS TRAU Tx/Rx Test (GUI as well as Command Line based) and TRAU Record/Playback (Command Line based).

TRAU Analyzer

The TRAU Analyzer is used to view and analyze TRAU frames at the Abis interface (between the BTS (CCU) and BSC) and the A-ter interface (between BSC to MSC links). Application can automatically detect and capture TRAU frames of half rate (HR-8 kbps) or full rate (FR-16 kbps). TRAU frames are decoded as per the specifications GSM 08.60 V 8.2.0 Release, GSM 08.61 V 8.1.0 Release, and 3GPP TS 48.060 V5.2.0 for AMR-WB. GL Communications supports the following types of TRAU analyzers:

- Real-time TRAU Analyzer- (Pre-requisites: T1 E1 cards, USB Portable units, licenses and Windows® Operating System)
- Offline TRAU Analyzer (Pre-requisites: Windows® Operating System)

Analysis of TRAU calls, including detail statistics, wave graph, oscilloscope, spectral display for various codecs can be done using TRAU Packet Data Analysis (PDA) feature. It also allows users to play voice files to speaker, write speech data to a file, filter calls, detect digits and view graphs such as **Active Calls**, and **Traffic Monitoring** to identify the frames and classify traffic.

For more details, visit TRAU Emulation and Analysis webpage.

TRAU Toolbox™

TRAU Toolbox™ is a GUI based application that can be used to create, monitor, and terminate TRAU/GSM traffic calls (termed as TRAU sessions in this document). Once the TRAU session is created, different kinds of audio/voice/digits can be generated and analyzed on GSM call for voice quality analysis. Various codecs such as FR, EFR, AMR, AMR-WB, HR, and Data up to 14.5kbps are used for compression/decompression of speech

TRAU Traffic Playback

The TRAU Traffic Playback application is used to playback/ transmits the recorded TRAU file(s) using TRAU Analyzer on selected/all sub-channels of T1 E1 lines. The application allows the user to transmit a single file or multiple files on the desired sub-channels at any given time.

Main Features

- Displays Summary, Detail, Hex-Dump, and Statistics Views
- Captures and decode TRAU frames such as GSM 6.10, HR, EFR, AMR-WB, AMR, O&M, and Data
- Supports filtering and search features based on various TRAU frame direction, type, time alignment, CRC, and more
- Extracts speech data from TRAU frames, play the speech data on PC soundcard, or, record voice to a file, after decompressing TRAU speech data to 16-bit linear PCM
- Exports Summary View information to a comma delimited file for subsequent import into a database or spreadsheet
- Capability to export detail decodes information to an ASCII file
- Remote monitoring capability using GL's Network Surveillance System

Summary, Detail, Hex dump, and Statistics Views

The analyzer displays Summary, Detail and Hex dump View in different panes. The Summary View displays Frame Number, Time, Length, Error, CRC, RIF, Frame Sync, Time Alignment, AMR mode, AMR-WB mode, and more. User can select a frame in Summary View to analyze and decode in the Detail View. The Hex dump View displays the frame information in HEX and ASCII format. Various statistics can be obtained to study the performance and trend in the TRAU network based on protocol fields and parameters.

Summary, Detail, Hex dump, and Statistics Views

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Real-time and Offline Analysis

Users can capture and analyze TRAU frames using either real-time or offline analyzers. All or filtered traffic can be recorded into a trace file. The recorded trace file can be used for offline analysis or exported to a comma-delimited file, or ASCII file. The raw data capturing requires user to specify timeslots, bit inversion, user/network side, and hyper channels. Recorded trace file can be played back on TRAU Traffic Playback.
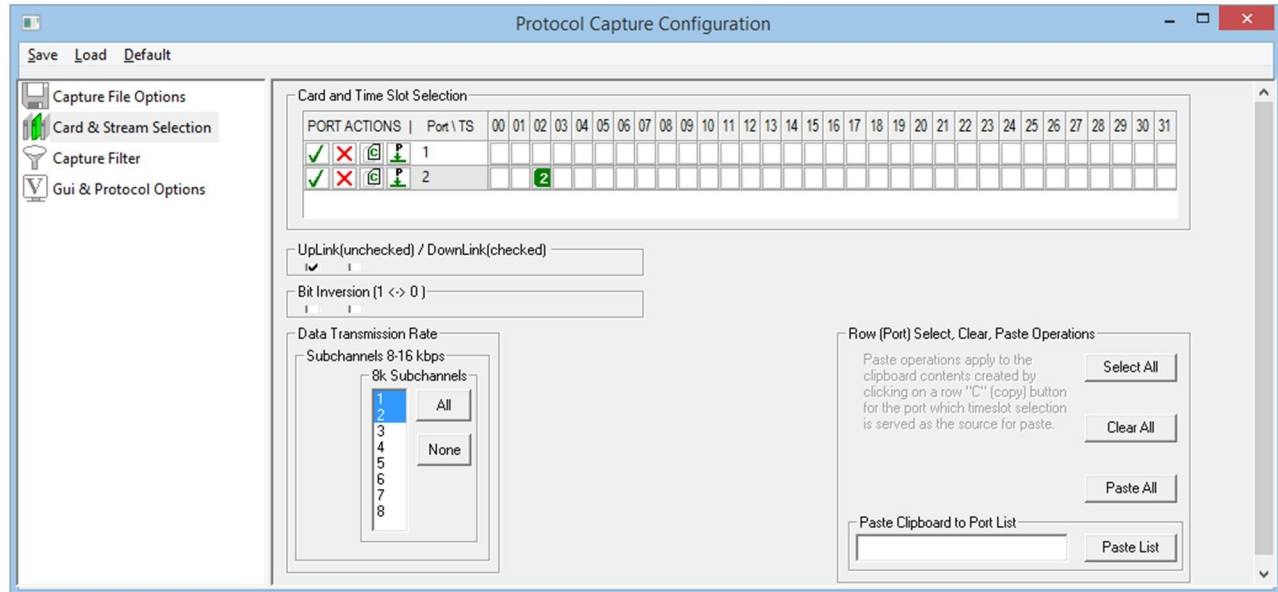
Stream / Interface Selection

Filtering and Search

Users can record all or filtered traffic into a trace file. Filter and search capabilities adds a powerful feature to the TRAU Analyzer. These features isolate required frames from captured frames in offline mode. The frames are filtered after completion of capture based on Frame Direction, Type, Speech Frame Classification, Time Alignment, RIF, AMR mode and so on. Similarly, search capability helps user to search for a particular frame based on specific search criteria.


Offline Filter

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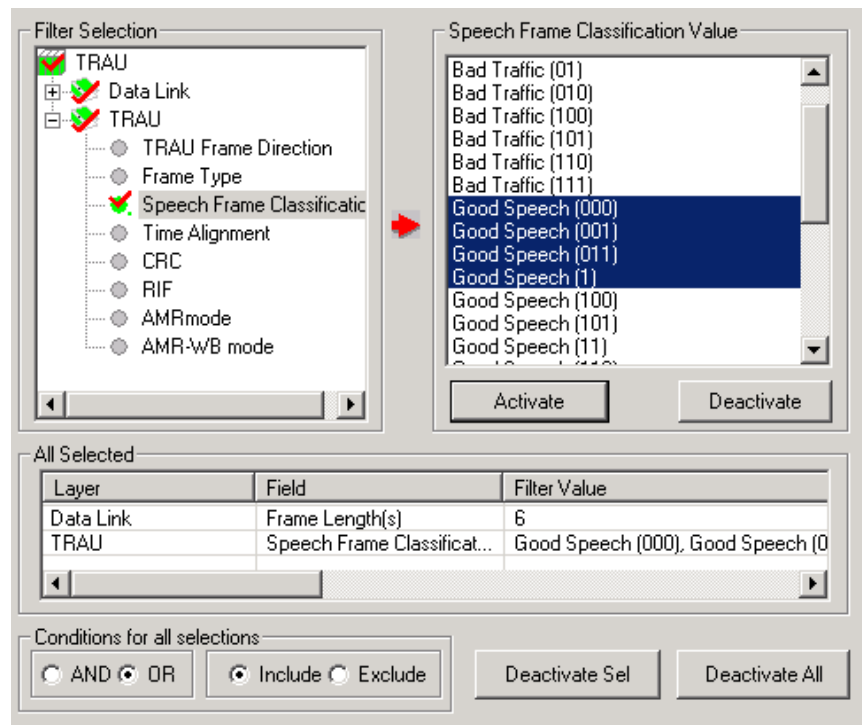
Packet Data Analysis in TRAU Analyzer

PDA - Summary View

TA Summary View displays summary of traffic in each direction including call identity, device number, channel number, start/end sub-channel, total packets, codec type, CRC errors and bad frames. Each call displays Call Header with Call Number, Call Start Time, and Call Duration of the call, below to which summary of two sessions (left and right) will be displayed. It includes separate statistical counts on total packets, calls, and captured frames, etc.
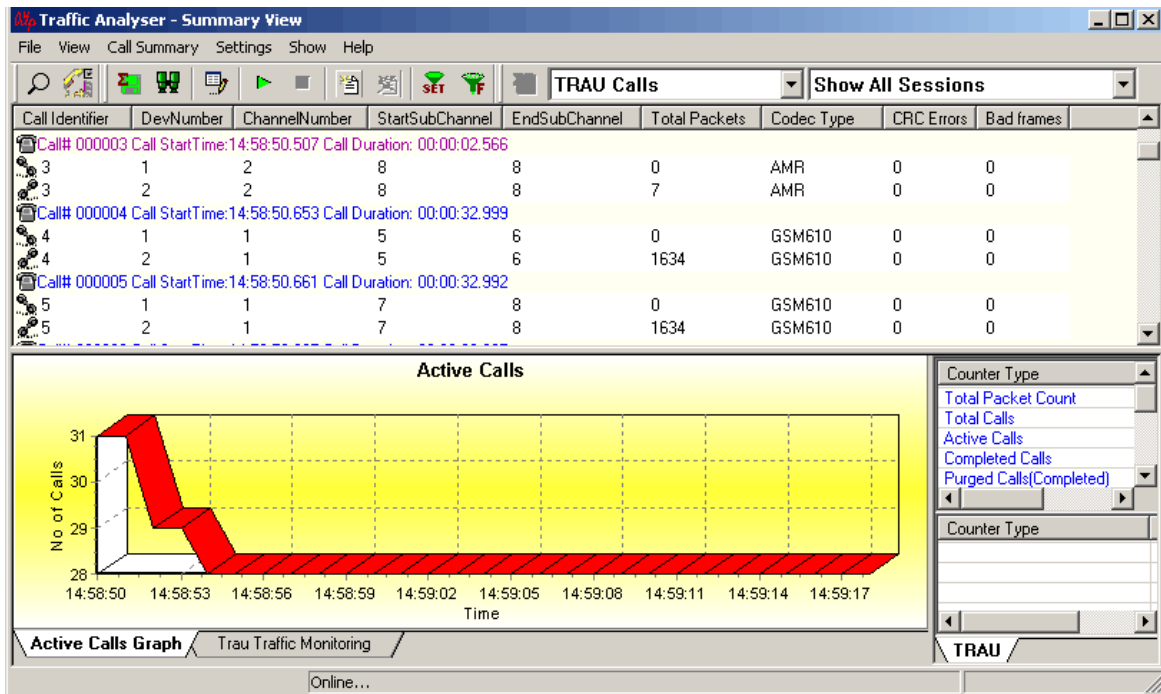
PDA Summary View

Graphs in Summary View

Packet Data Analysis provides Active Calls Graphs to view active calls over the duration of the capture and TRAU Traffic Monitoring graph to identify the frames and classify traffic. Active Calls Graphs is a simple line graph, depicting the Number of Calls Vs Time.

Play Audio and Write to File

The Play Audio extracts speech bits of each frame from the selected call and plays it to the PC speaker in Mix, Stereo, or Separate mode.

Write to File writes the speech data to a file and uses the files with voice quality analysis software to investigate more about the quality of voice in the network.

Save call

The Save Call feature enables the user to save a particular call as a separate HDL file. This is especially useful to get data from real-time traffic locations for detailed analysis of a flawed call. By using this option, user can save the call that needs to be analyzed as a HDL file and transport it using temporary media to the lab for detailed analysis.

Triggers and Action Settings

Triggers and Action Settings allow users to filter calls based on the criteria set for the completed calls for later analysis. The calls can be saved in *.hdl or in *.wav format (in Stereo or Mix mode) by checking "Save Call to HDL" and / or "Audio Recording" respectively.

PDA - Detail View

TA Detail View allows the user to have a detailed look at the two (or one) TRAU sessions that are part of a single call. The view is divided into two parts a left and a right pane to accommodate the two sessions. The data is updated in real-time, i.e., as and when new packets pertaining to the calls are received they are processed and added to the table(s).
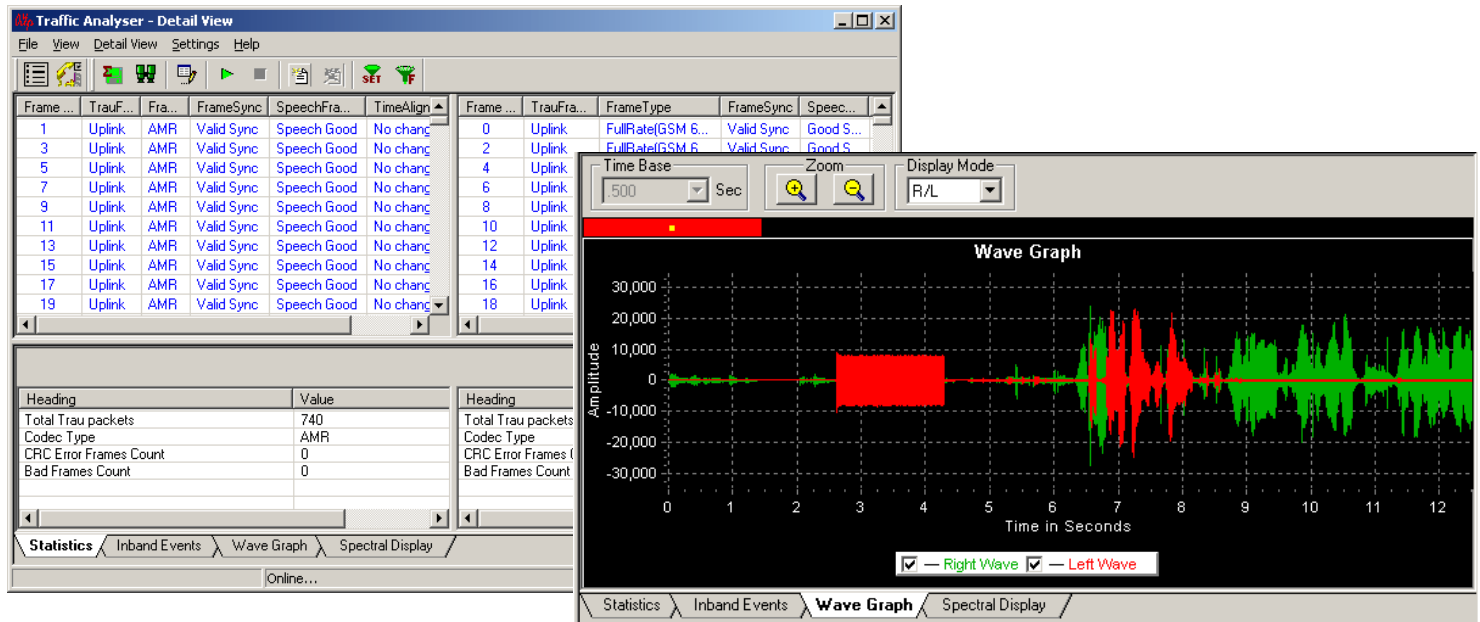
PDA Detail View

Statistics

The user can get the complete details of a single selected call. Details like Total TRAU packets, Codec Type, CRC Error Frame Count, and Bad Frames count are displayed.

Inband Events

It displays Inband DTMF and MF digits as they are received with details such as Timestamp, Type, Event, On-Time, Power, Freq1 / Power1, Freq2 / Power2.

Statistics and Inband Events

Graphs in Detail View

Wave Graph: The amplitude of the incoming signal in a selected call is displayed in real-time graphic form as a function of time. X-axis scale is set according to the selected time base and the user can have a comprehensive view on the wave graph.

Spectral Display: Spectral Display shows the power of incoming signal while the capturing is going on as a function of frequency. Also the user has a facility to observe the spectral graph of data flowing in only one direction.

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TRAU Emulation using TRAU ToolBox™ and Playback

Overview

The traffic generated by a BTS is transported to the corresponding BSC across a network is referred to as the backhaul network. TRAU Toolbox™ can emulate TRAU node at BSC/MSC end or CCU node at BTS end including the compression/decompression of speech that takes place at TRAU side or Mobile side.

Main Features

- Can create multiple sessions of Uplink or downlink in 8/16 Kbps
- Can be used to test the backhaul network. (traffic generated by BTS which is transported to the corresponding BSC)
- Supports all speech codec for verification of correct voice transmission which includes GSM 6.10(FR), Half Rate (HR), Enhanced full rate (EFR), Adaptive multi Rate (AMR –Rates 4.75, 5.15, 5.90, 6.70, 7.4, 7.95, 10.2, & 12.2 kbps), Adaptive Multi Rate-Wide Band (AMR-WB –Rates 6,60, 8,85, 12,65 kbps), and Data Codec
- Time Alignment Delay or advance can be inserted in the TRAU frames
- Can work in Tx, Rx, or Tx/Rx modes
- Phase Alignment can be applied to AMR or AMR-WB modes to change the mode to the requested modes
- RIF toggling has been implemented for AMR and AMR-WB modes
- Logical AND, OR, or XOR impairments can be applied to a TRAU frames
- Capability to apply DTX to EFR and AMR codec
- Idle speech frames can be generated in case of GSM and EFR downlink codec if there is no speech frames to transmit
- Supports Loopback and Pass Through modes
- Graphical display features include the ability to monitor TRAU stream contents using an oscilloscope and spectrum analyzer

TRAU ToolBox™

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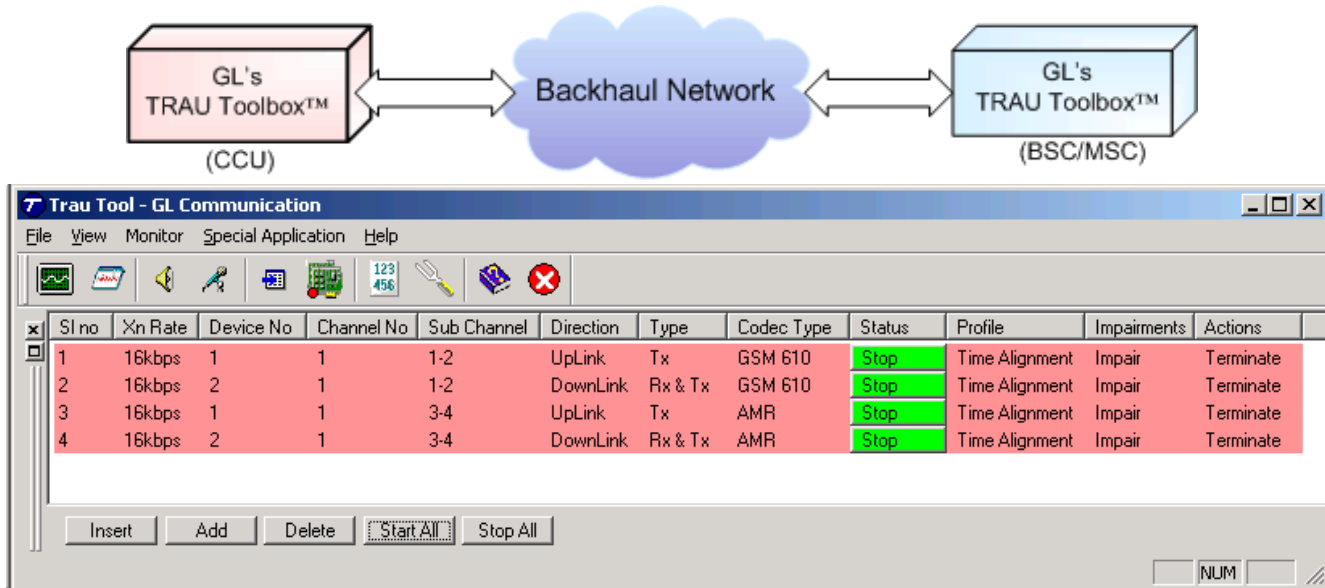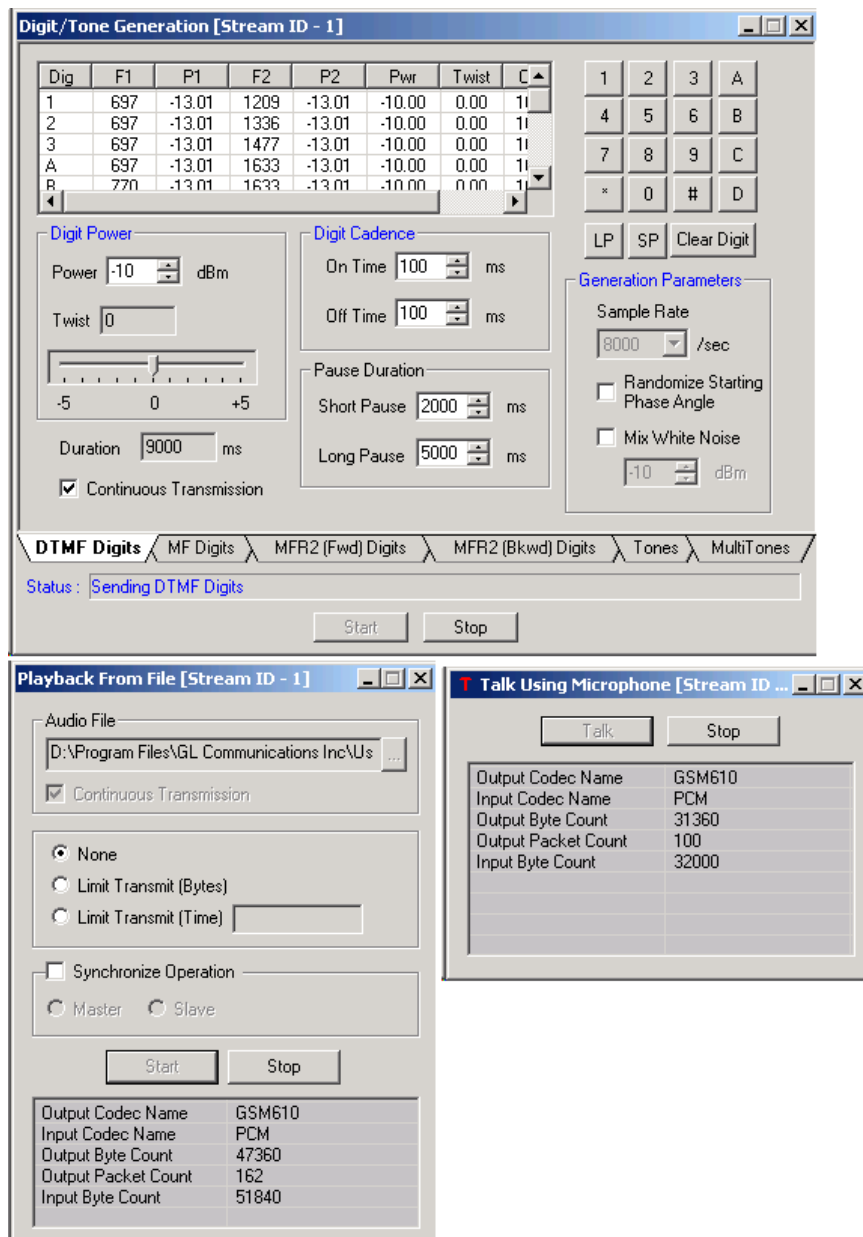
Applications for Traffic Generation

The following are the TRAU Toolbox™ applications that are used to transfer traffic on the specified TRAU sessions:

- Talk Using Microphone
- Playback from File
- Digit/Tone Generation

The **Talk using Microphone** application is used to transmit the real-time voice generated using the default audio device (microphone) on the selected TRAU session.

Similarly, the **Playback from File** applications allows the user to send voice files, *.WAV, and *.PCM files.

The **Digit/Tone Generation** application allows the user to send standard or user-defined tone or digits on a session.


Statistics and Inband Events

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Applications for Traffic Capture

The following are the TRAU Toolbox™ applications used to analyze received and/ or monitor TRAU frames on a session:

- **Play to Speaker** application will play the incoming voice directly to the system's speaker
- **Record Data to File** application can record the incoming data on a session to a file
- The recorded file will be in linear PCM (16-bit linear) format
- **Capture/Digits/ Tones** allow the user to detect digits and tones. It provides option to view all activities or just the captured digits
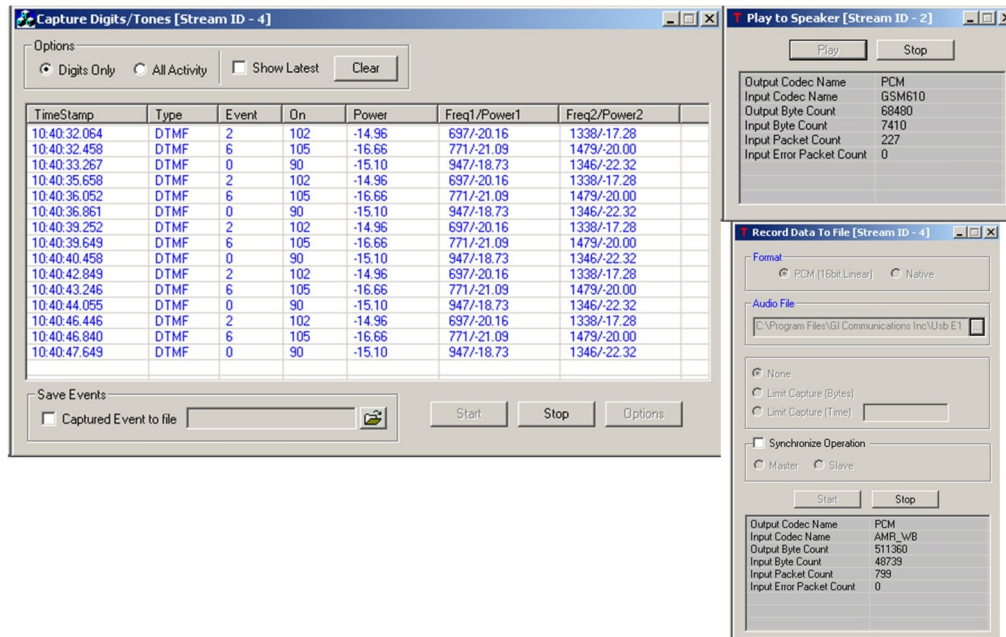
Traffic Capture

Oscilloscope and Spectral Display

- **Oscilloscope Display** the PCM codes (amplitude of the incoming signal) for any selected session graphically in real-time as a function of time
- **Spectral Display** the data received on a specified receive timeslot can be viewed in the spectral domain (spectral amplitude Vs frequency)

Oscilloscope and Spectral Display

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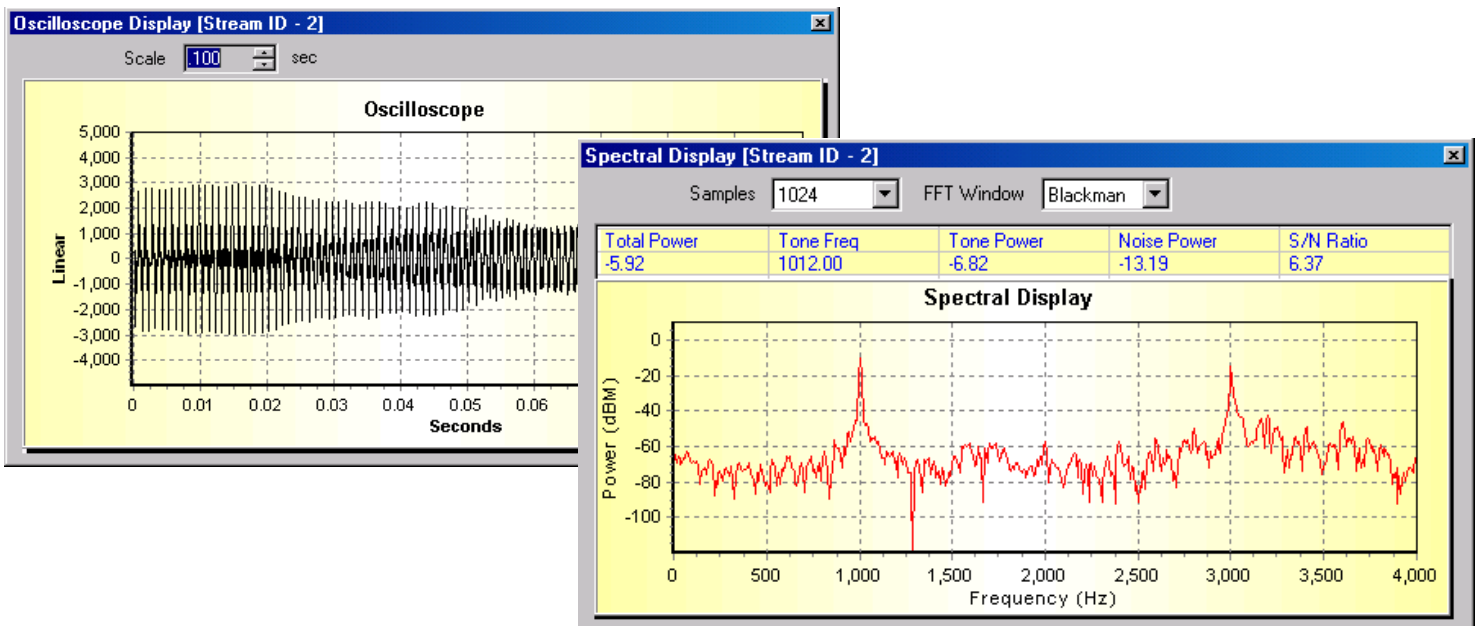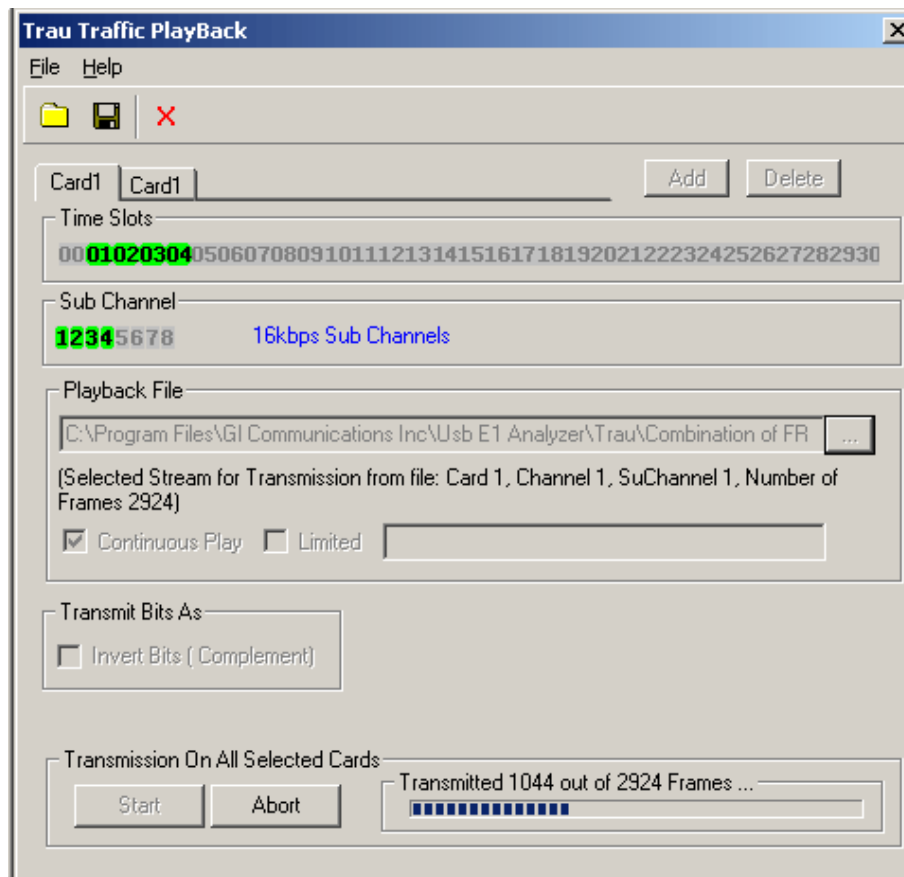
TRAU Traffic Playback

Main Features of TRAU Traffic Playback

- Recorded trace files can be transmitted on specific channels/sub-channels.
- Data transmission rates supported includes 16kbps and 8 kbps.
- Provides the option to inverse bits in the selected data during transmission.
- Trace files can include TRAU frames types such as EFR, FR (GSM 6.10), HR, RIF, AMR-WB, AMR, O&M, Data, Data 14.5 and Idle Speech frame types, which are stored in the recorded TRAU files, can be used for transmission

The application allows the user to transmit a single recorded trace file or multiple files on the desired sub-channels at any given time. TRAU frames are time-aligned as per the control information stored & transmitted on the selected sub channel.

Trace files can include TRAU frame types such as GSM 6.10, HR, EFR, AMR, O&M, and Data at 16 kbps (GSM 08.60), and Data at 8kbps (GSM 08.61).

TRAU frames can be manually generated using bin2frame application, which takes text file as input and convert it into *.hdl format. This file can be played in real time using TRAU Traffic Playback.


Traffic Playback

# TRAU Emulation using Client-Server TRAU Tx/Rx Test (GUI & CLI) (XX646)

The WCS TRAU Tx/Rx Emulation (TrauTerr) module allows testing of TRAU frames and is available as a GUI based client as well as command-line based client application, which simulate TRAU/CCU (BTS or BSC end) on GL's T1 E1 cards.

The application is capable of generating and receiving TRAU traffic (with or without impairments) based on the codec type, and time alignment (if specified). The frames are transmitted through the 16 or 8 kbps channels. Traffic source can be sequence number, HDL files (containing packets/frames), flat binary file, and user-defined frames (ASCII HEX string/file).

For more details, visit Multi-Channel TRAU Tx/Rx Emulation and Analysis webpage.
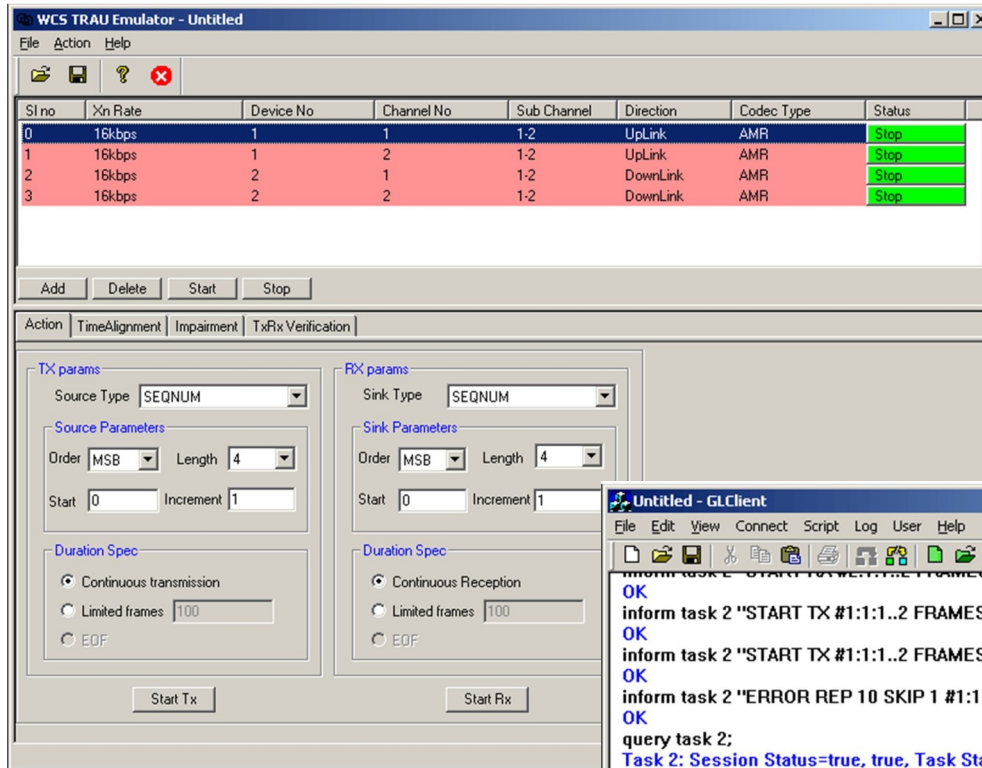
TRAU Emulation using GUI
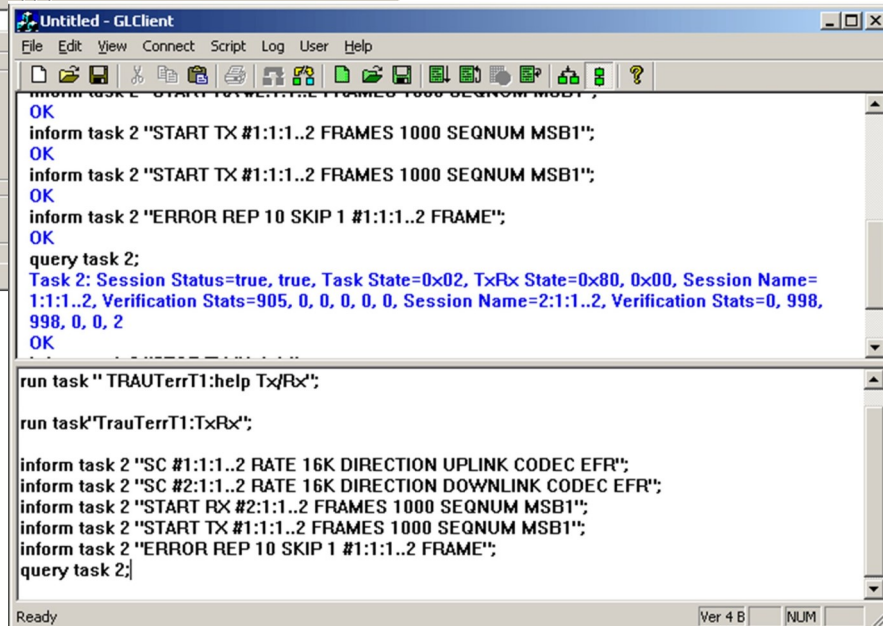
TRAU Traffic Tx Rx using Client-Server

Supported Protocols Standards and Specifications

Supported Protocols	Specification Used
TRAU	GSM 08.60 V 8.2.0 Release and GSM 08.61 V 8.1.0
	3GPP TS 48.060 V5.2.0 for AMR-WB

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Buyer's Guide

Item No	Product Description
XX153	T1 E1 TRAU Protocol Analyzer, Playback, and Toolbox™
OLV153	Offline TRAU Protocol Analyzer
XX646	Multi-Channel TRAU Tx/Rx Emulation and Analysis

Item No	Related Hardware
PTE001	tProbe™ Dual T1 E1 Laptop Analyzer (Require Basic Software)
FTE001	QuadXpress T1 E1 Main Board (Quad Port)
ETE001	OctalXpress T1 E1 Daughter boards (Octal Port)
XTE001	Dual Express (PCIe) T1 E1 Boards

Item No	Related Software
XX150	GSM Protocol Analyzer
XX155	GPRS Protocol Analyzer
XX165	T1 or E1 UMTS Protocol Analyzer
XX142	T1 or E1 CDMA Protocol Analyzer

Note: PCs which include GL hardware/software require Intel or AMD processors for compliance.

For more details, visit TRAU Emulation and Analysis webpage.

Document Number: XX153-01