Protocol Analysis and Emulation

T1 E1 T3 E3 Optical

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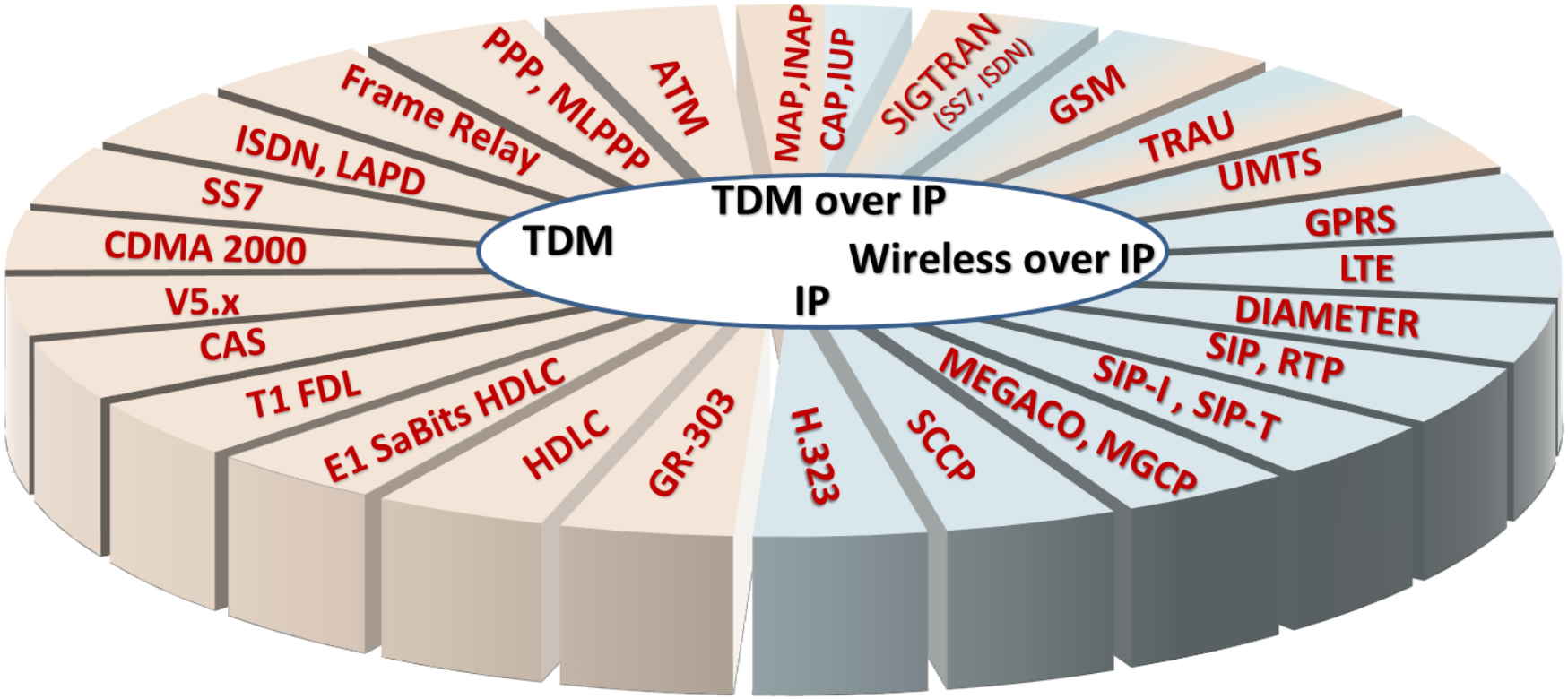
Website: https://www.gl.com

Index

TDM, Wireless, and VoIP Protocols



- GL Communications provides a host of analyzers and simulators for testing a variety of protocols
- Analysis can be done both in real-time and off-line

Protocol Analysis over T1 E1

- Physical Layer Analyzer
- ATM with Inverse Multiplexing
- Multilink PPP
- Multilink Frame Relay
- SS7
- ISDN
- HDLC
- E1 Maintenance Data Link Playback
- T1 Facility Data Link Playback
- CAS

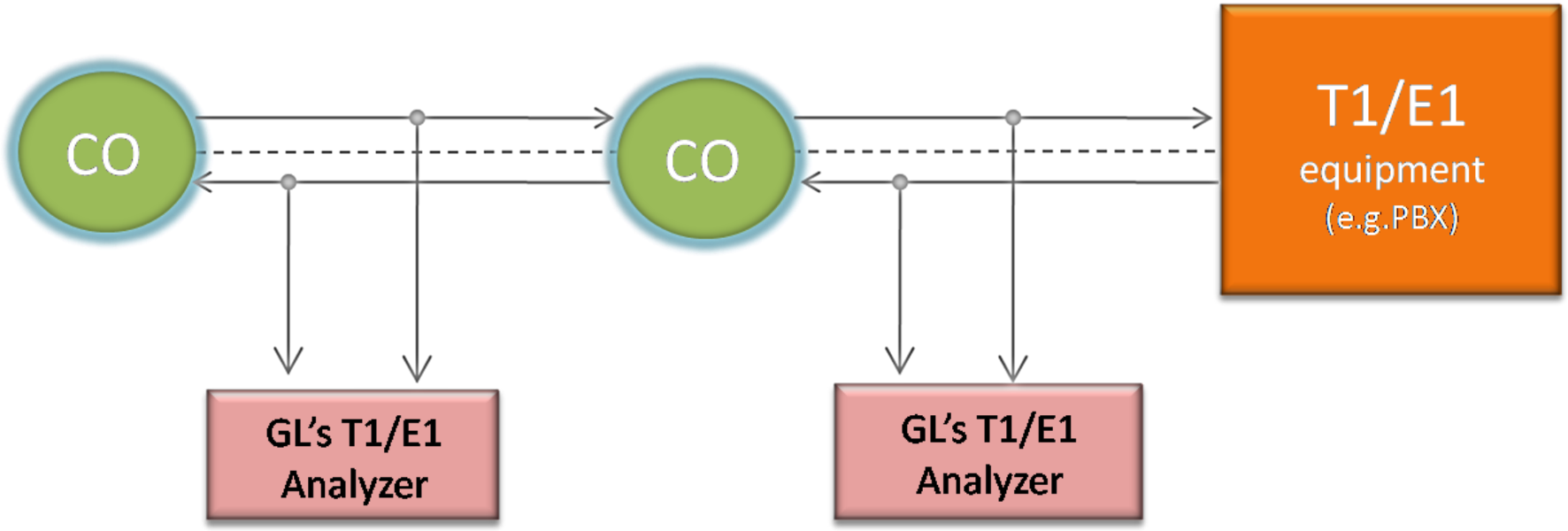
Protocol Analysis over T3 E3

- ATM with Inverse Multiplexing
- Multilink PPP
- Multilink Frame Relay
- HDLC

Protocol Analysis over Optical

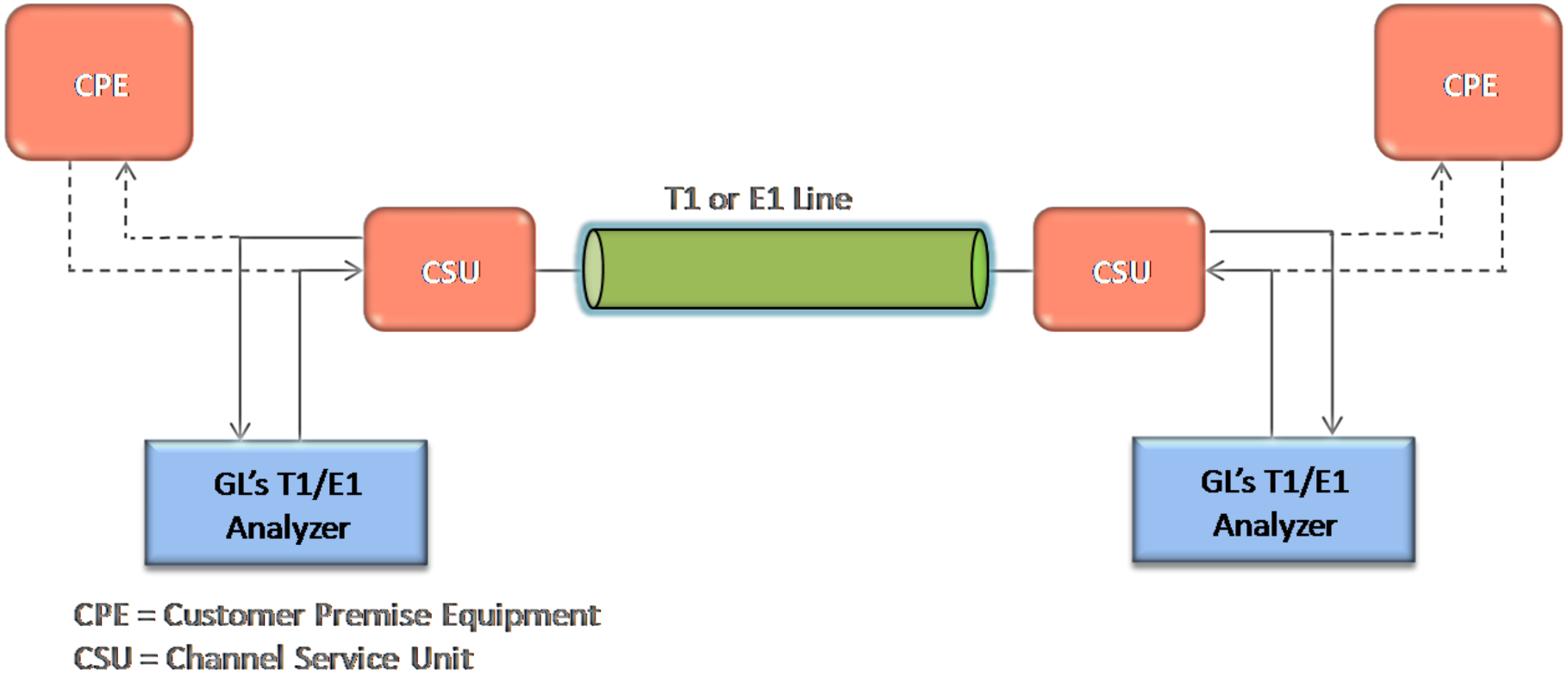
- ATM
- PPP over SONET (PoS)
- OC-3/OC-12/STM-1/STM-4 Transparent Payload
- Channelized access for T1 E1 T3 E3
- (For processing ISDN, SS7, CAS and other channelized protocols)

Non-Intrusive Line Monitoring (Monitor and Bridge Modes)



- Bridge and Monitor modes are used for non-intrusive monitoring on T1/E1 connection
- Example Applications : Capture and Dialed digits, Call Capture & Analysis, Automated record playback, Playback from file, Protocol Analysis, and many more

Intrusive Line Monitoring



Example Applications:

- BER Testing, Transmit Tone, Gaussian Noise, Transmit Multi frames, Signaling Bits, Error Insertion, Delay Measurement, Protocol Emulation

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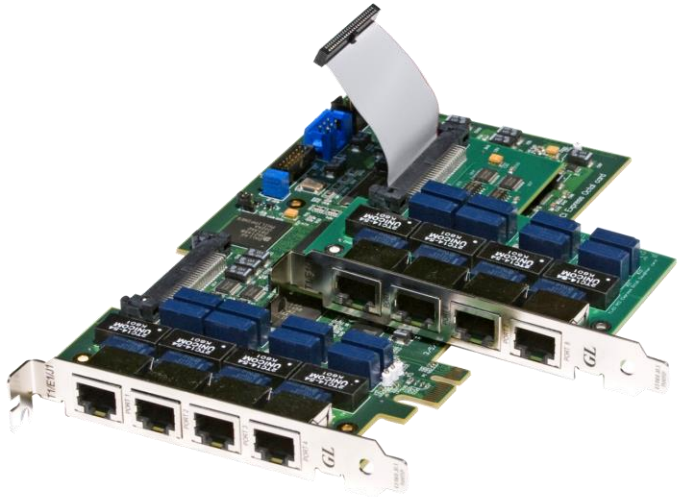
T1 E1 Platforms

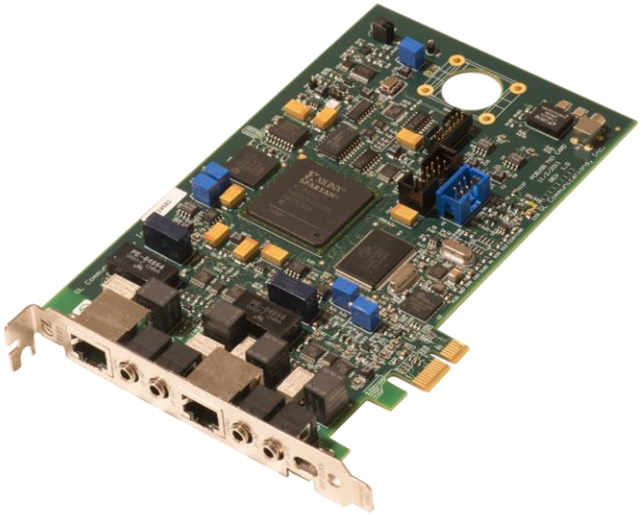
Front Panel

Back Panel

tProbe™ - Portable USB based T1 E1 VF FXO FXS and Serial Datacom Analyzer

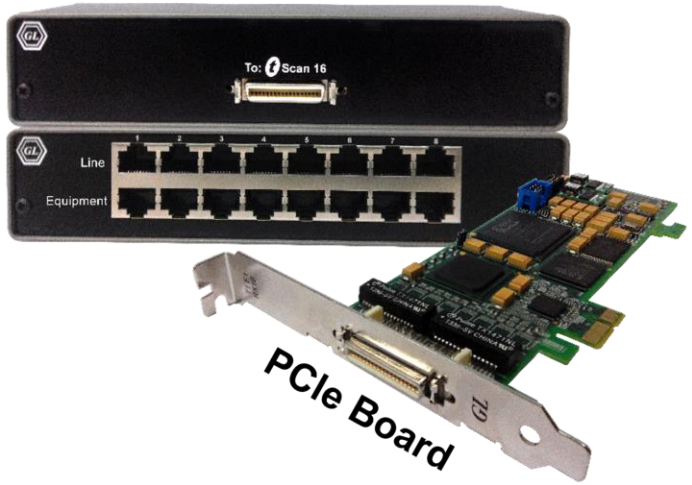


Quad / Octal T1 E1 PCIe Card



Dual T1 E1 Express (PCIe) Board

tScan16™ with
16-port T1 E1 Breakout Box



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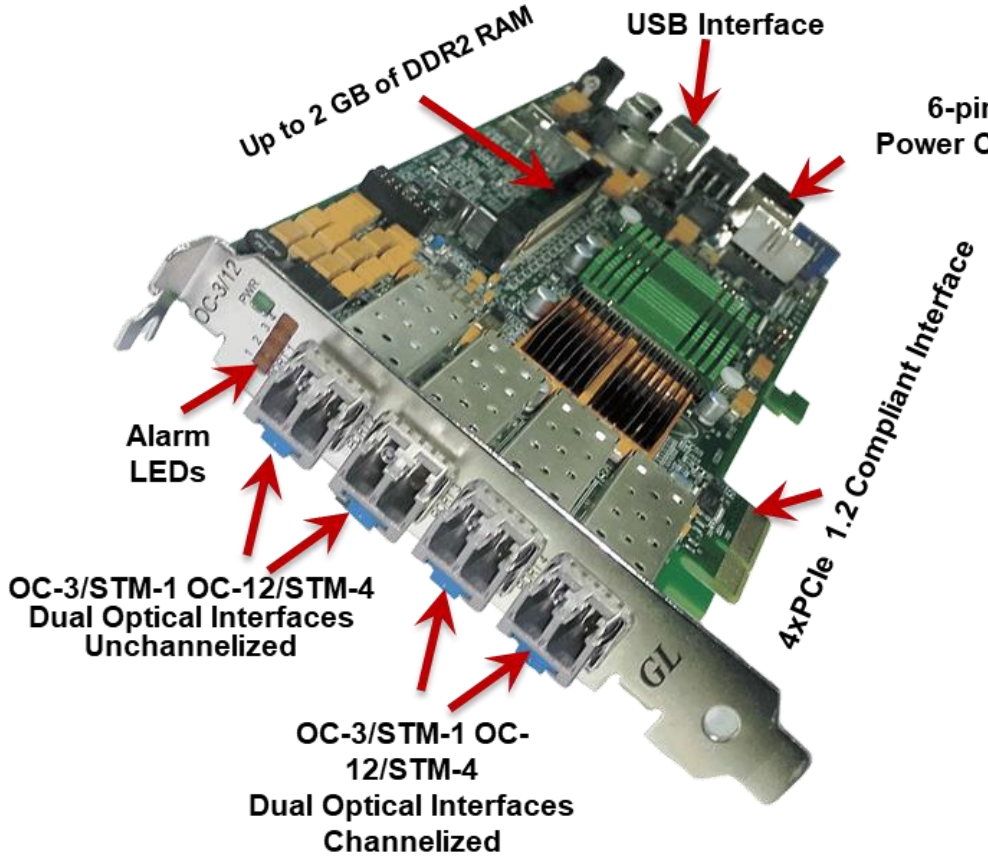
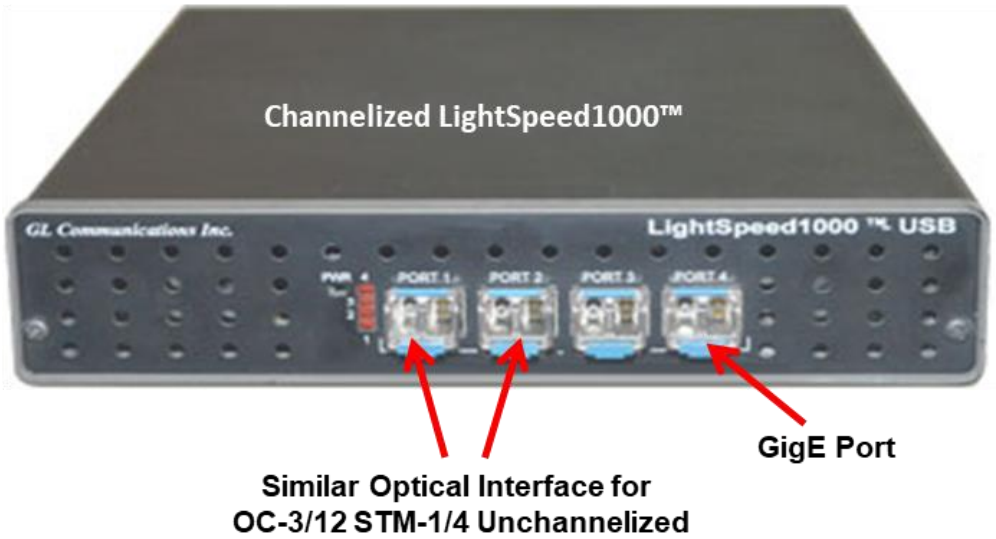
LightSpeed1000™ Platform



OC3 / OC12 PCIe Card LightSpeed1000 ™



USB T3 E3 Platform

Portable T3 E3 Analyzer Unit

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Protocol Analysis and Emulation

- ATM Analysis and Emulation
  - ATM IMA Analysis
  - ATM IMA Emulator (GUI Based)
  - Client-Server based ATM IMA Emulation module
- Multilink Frame Relay Analysis and Emulation
  - Frame Relay Analysis
  - Multilink Frame Relay Emulator (GUI Based)
  - Client-Server based MFR Emulation module
- Multilink PPP Analysis and Emulation
  - MLPPP Analysis
  - MC-MLPPP Emulator (GUI Based)
  - Client-Server based MLPPP Emulation module
  - MLPPP Conformance using MAPS™
- SS1 Analysis and Emulation
  - SS1 Signaling Analysis
  - SS1 Emulator (Dialer)

Protocol Analysis and Emulation

- SS7 Analysis and Emulation
  - SS7 (ISUP, MAP, INAP, CAP) Analysis
  - ISUP, MAP, INAP, CAP, IUP Emulator using MAPS™
  - SS7 Conformance using MAPS™

- ISDN Analysis and Emulation
  - ISDN and LAPD Analysis
  - ISDN Emulator (GUI)
  - Client-Server based ISDN Emulation module
  - ISDN and LAPD Emulator using MAPS™
  - ISDN and LAPD Conformance using MAPS™

- HDLC Analysis and Emulation
  - HDLC Analysis, Playback, Impairment, Tx and Rx Utility
  - Client –Server based HDLC Emulation modules

- CAS Analysis and Emulation
  - CAS Analysis
  - CAS Emulation using (GUI Based)
  - DTMF, MF, MFC-R2 Emulation using GUI and Client-server

Protocol Analysis and Emulation

- GSM Analysis and Emulation
  - GSM Analysis
  - GSM A Emulator using MAPS™
  - GSM Abis Emulator using MAPS™
- TRAU Analysis and Emulation
  - TRAU Analysis,
  - Traffic Playback, TRAU ToolBox
  - TRAU Tx/Rx Test (GUI Based)
  - Client-Server based TRAU Emulation modules
- T1 Facility Data Link
  - Facility Data Link Analysis
  - Facility Data Link Playback
  - Client-Server based FDL Emulation module
- E1 Maintenance Data Link
  - E1 Maintenance Data Link Analysis and Playback
  - Client-Server based SaBits HDLC Emulation module
- Other Protocol Analyzers
  - GPRS, UMTS, ATM, CDMA 2000
  - GR-303, V5.X, DCME
  - Protocol Identifier
  - Traffic Classifier

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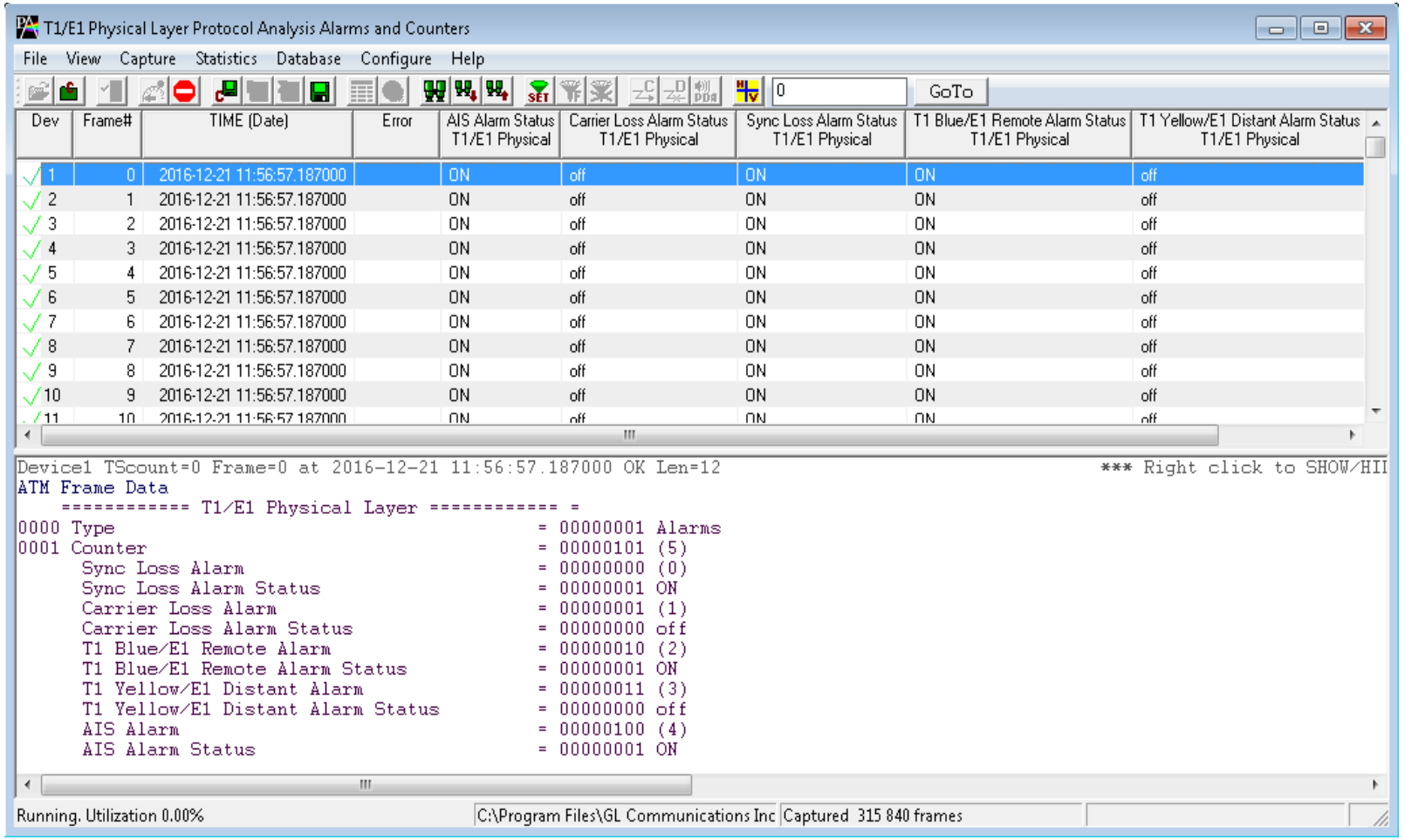
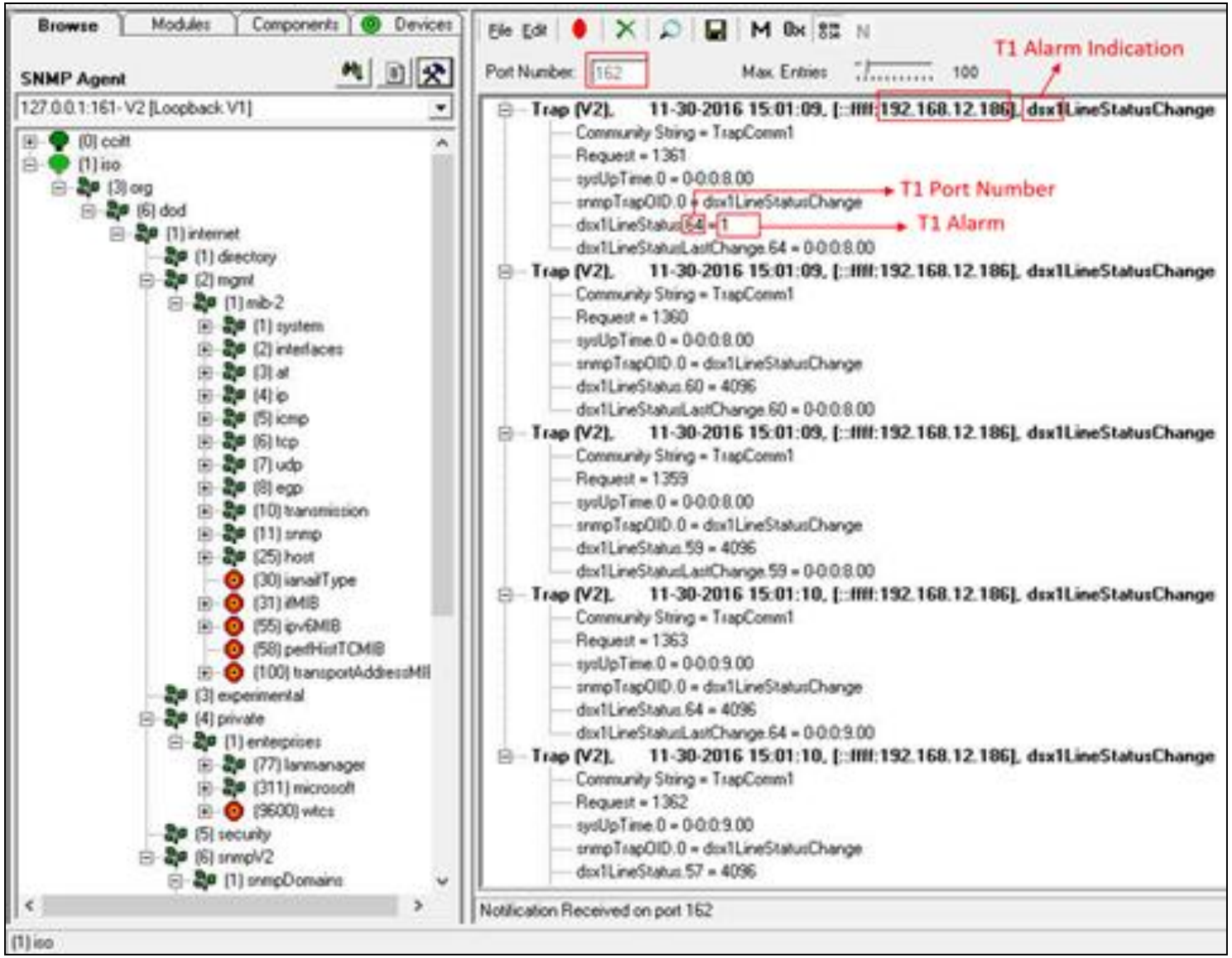
T1 E1 Physical Layer Analysis



- The T1 E1 Physical Layer App monitors the T1 E1 Alarms in real-time, converts them to SNMP messages and sends them to the NOC. ON/OFF status in the Physical Layer Analyzer depicts the Alarm/No Alarm state respectively

T1 SNMP Message Generation

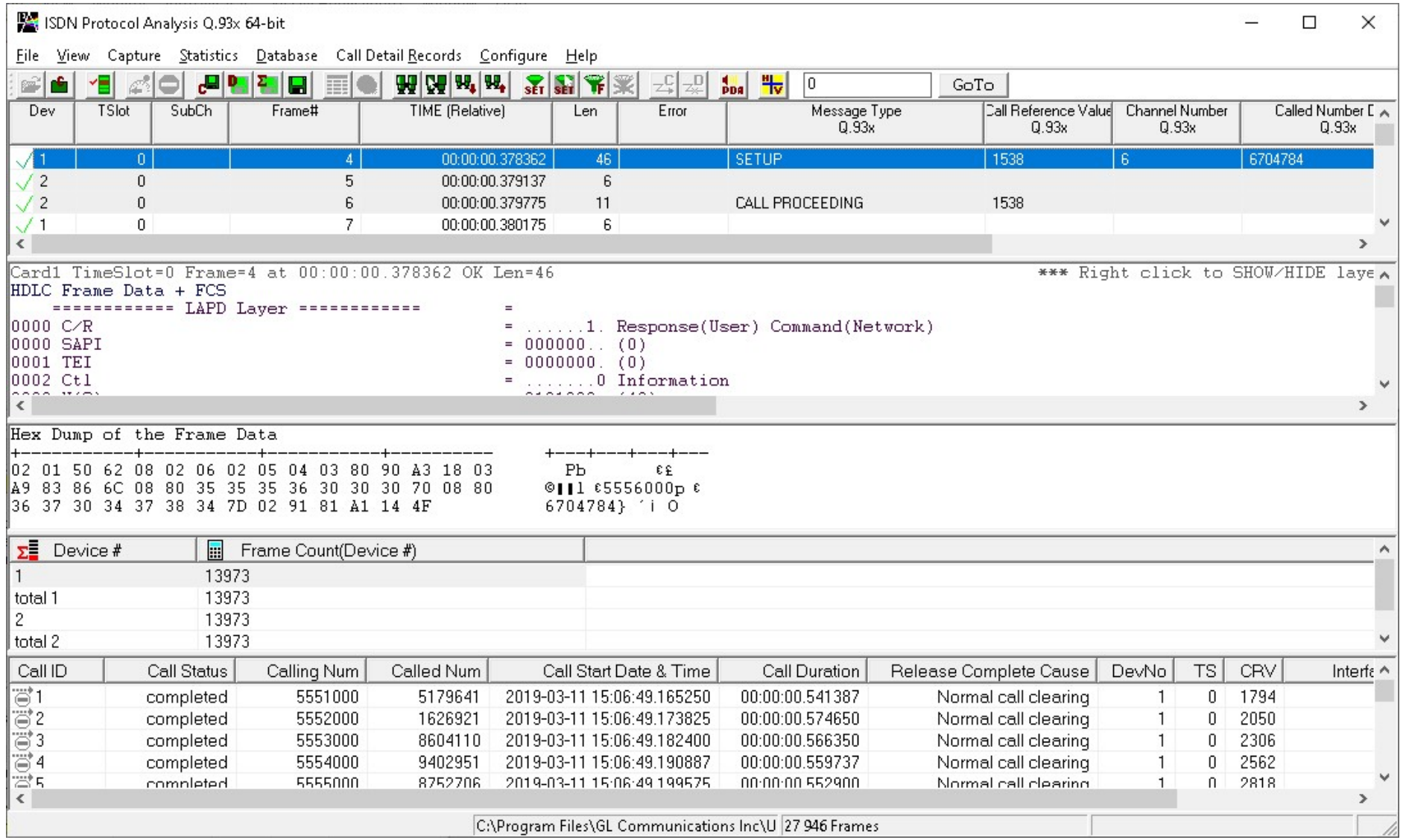


Protocol Analyzers

Key Features

- Consolidated GUI – displays summary of all decodes, detail & hex-dump view of each frame, statistics view, & call detail record views
- Perform real-time / offline / remote analysis
- Supports various protocol standards for proper decode
- Fine tune results with filtering and search capability
- Export decode results to ASCII or CSV files
- Trace File Saving Options
- Statistics Computation
- Call Detail Records
- Advanced capture options (channel selection, CRC, bit reversion, bit inversion, scrambler,…)
- Flexibility to add any protocol fields to the summary view, filtering, and search features
- Network Monitoring
- Remote access capability

Different Views

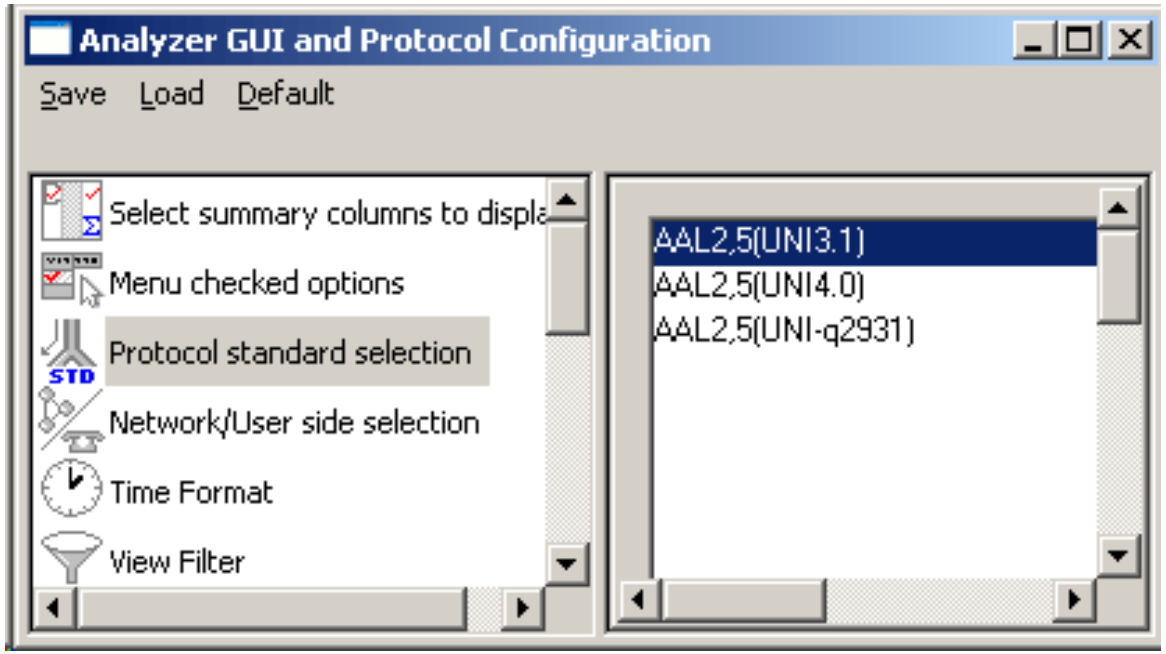


Different Views

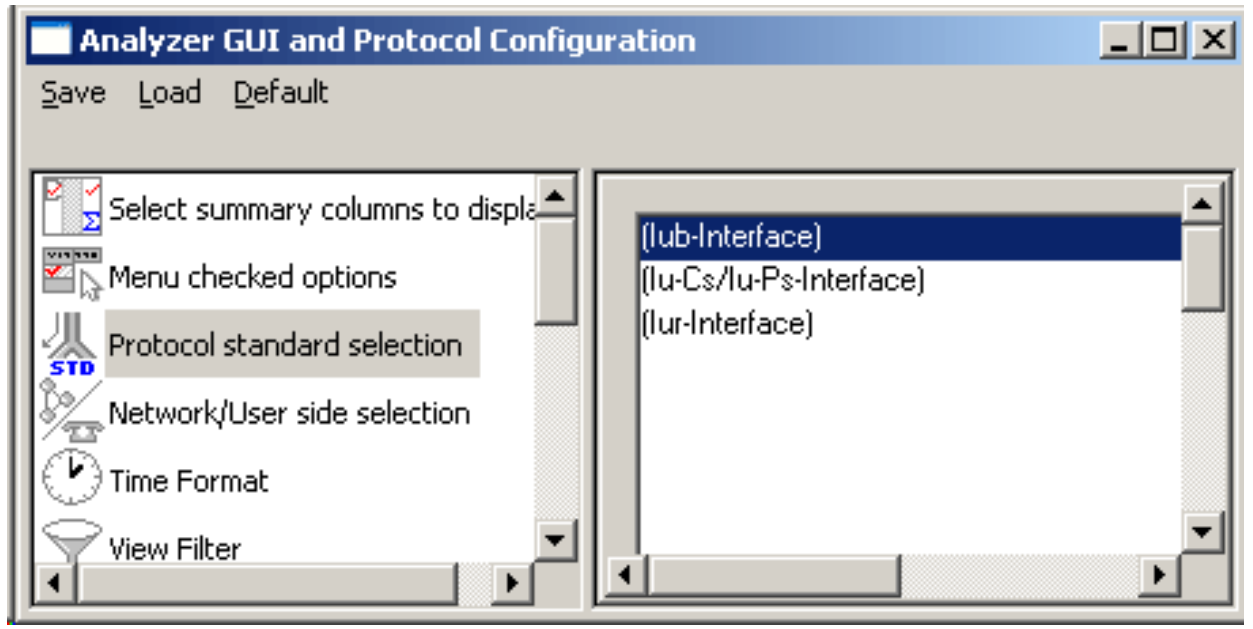
- Summary View: This pane displays the columns that contain Card Number, Timeslots, Frame Number, Time, Frame Error Status, Command/Response, Length, Error, C/R, SAPI, CTL, P/F, FUNC, and more in a tabular format
- Detail View: This pane displays in detail about a frame in order to analyze and decode by selecting it in the summary view, the contents of this view can also be copied to clipboard
- Hex Dump View: This pane displays the frame information in HEX and ASCII format, the contents of this view can also be copied to clipboard
- Statistics View: This pane displays the statistics that are calculated based on the protocol fields
- Call Trace View (Optional): This pane displays the call specific information for each individual call from the captured data and display the information in an organized fashion

Protocols Standards

ATM Analyzer



UMTS Analyzer



- ATM
  - Please visit http://www.gl.com/atmanalyzer.html for a list of supported protocols & specifications for ATM
- UMTS
  - Please visit http://www.gl.com/umtsanalyzer.html for a list of supported protocols & specifications for UMTS

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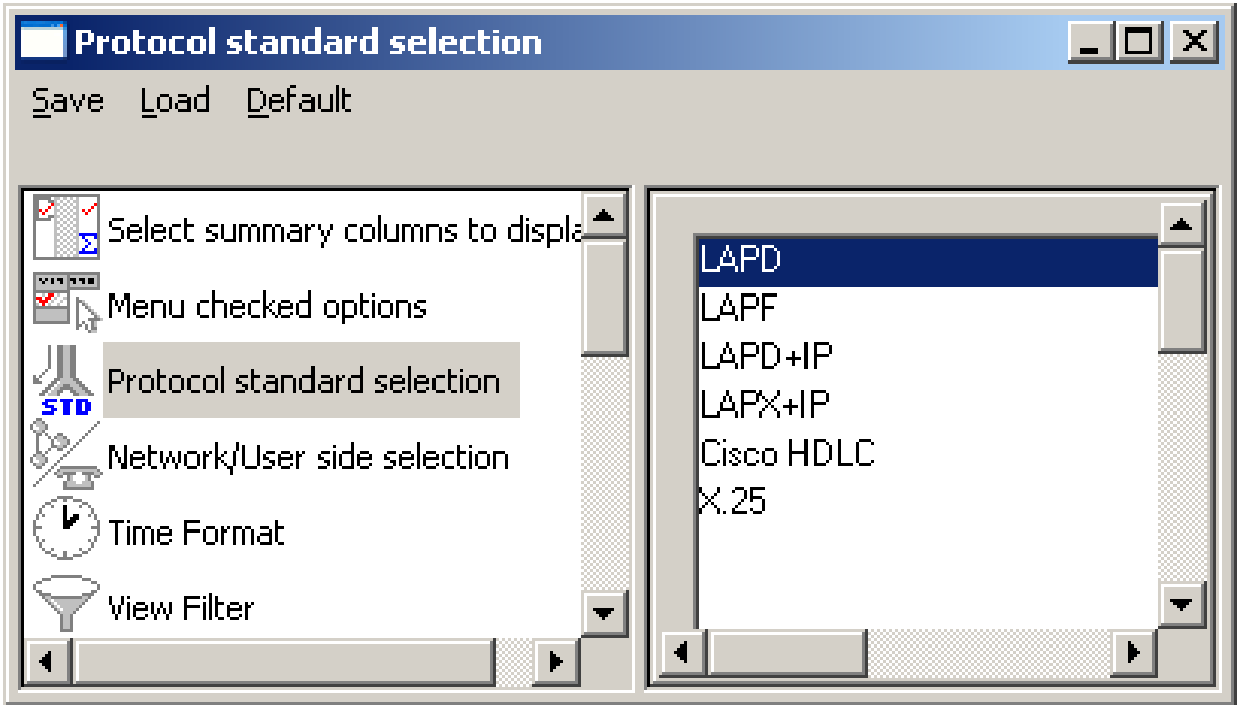
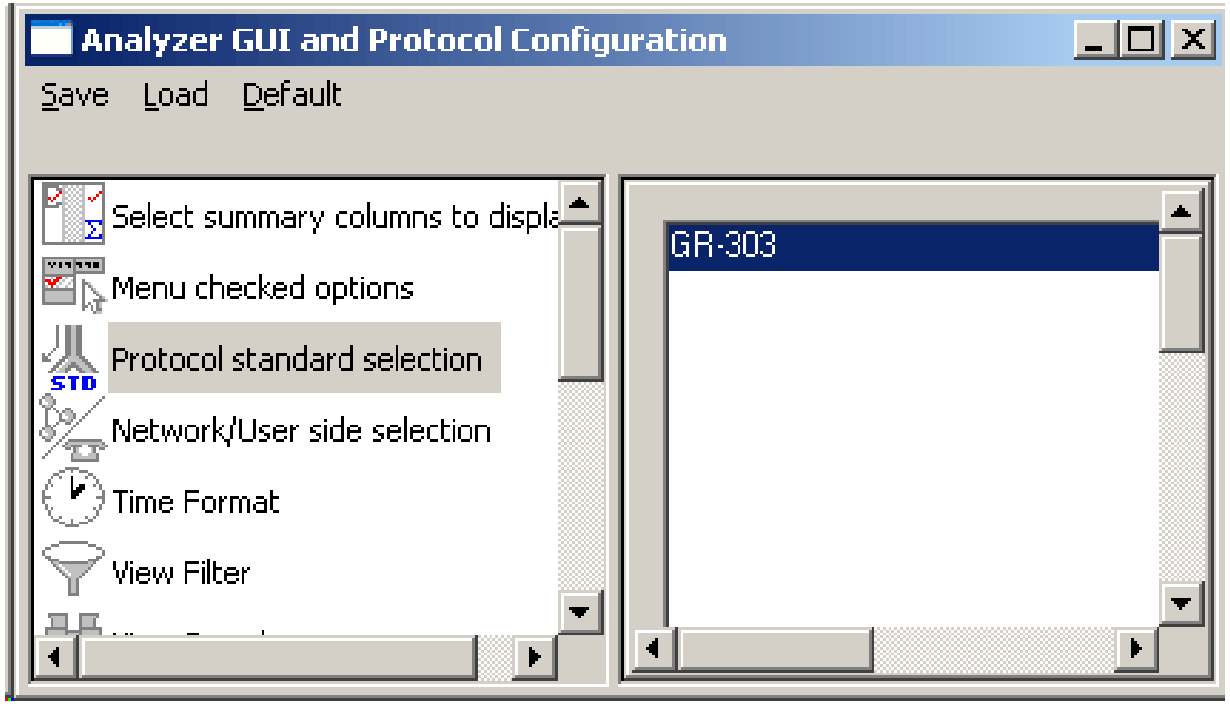
HDLC Analyzer



GR-303 Analyzer



- **HDLC**
  - Please visit http://www.gl.com/hdlc.html for a complete list of supported protocols & specifications for HDLC
- **GR-303**
  - Please visit http://www.gl.com/GR-303analysis.html for a complete list of supported protocols & specifications for GR-303

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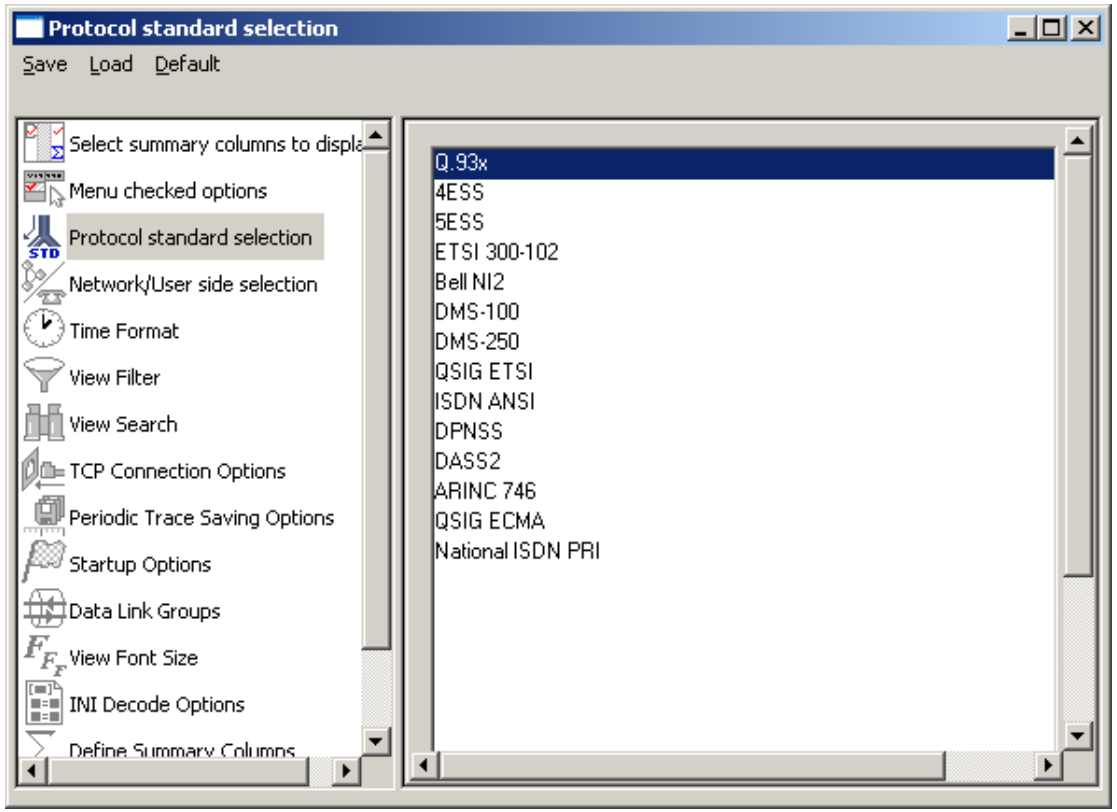
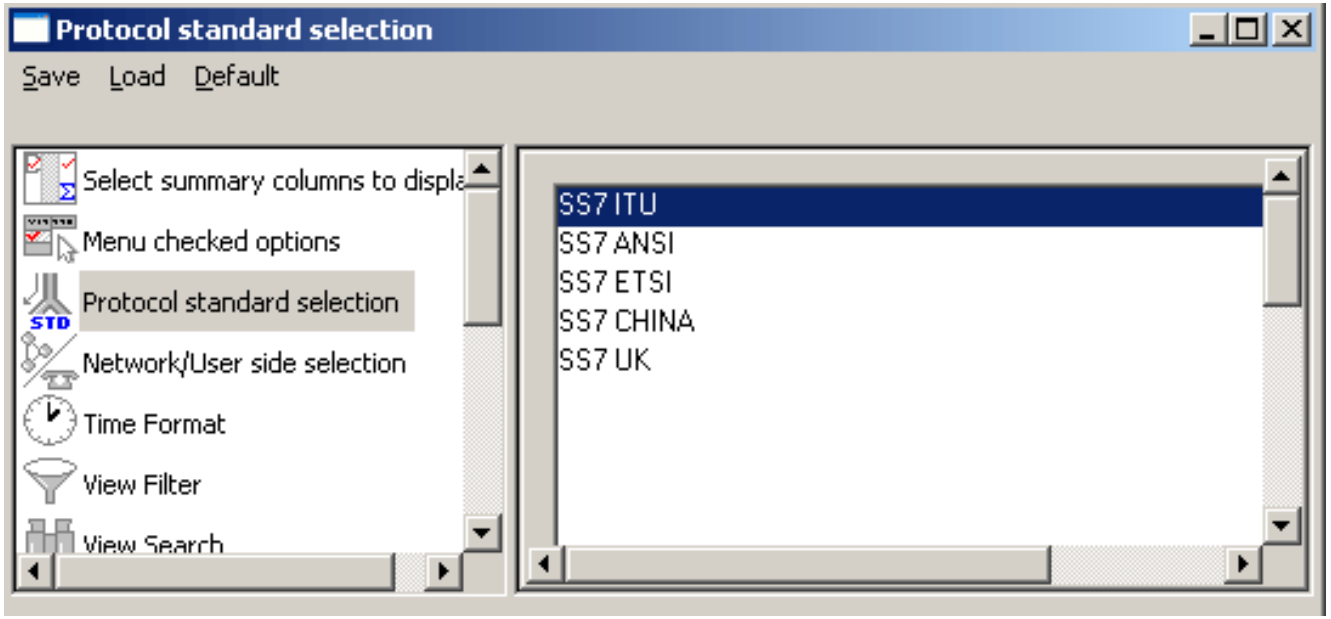
ISDN Analyzer



SS7 Analyzer



- **ISDN**
  - Please visit http://www.gl.com/isdn.html for a complete list of supported protocols & specifications for ISDN
- **SS7**
  - Please visit http://www.gl.com/ss7.html for a complete list of supported protocols & specifications for SS7

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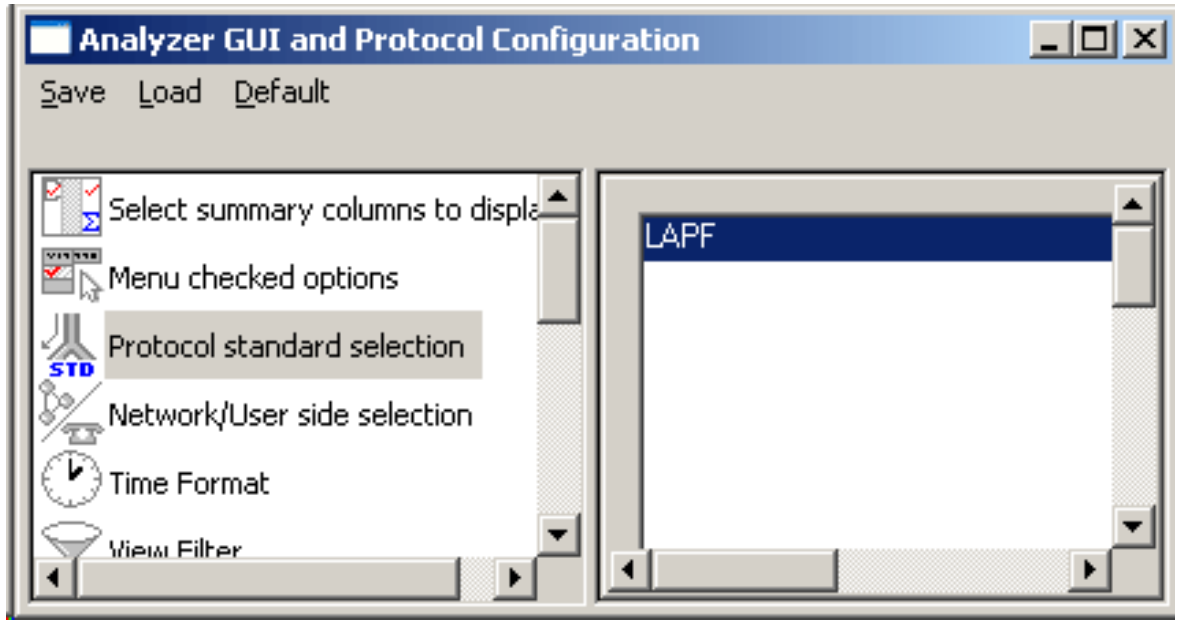
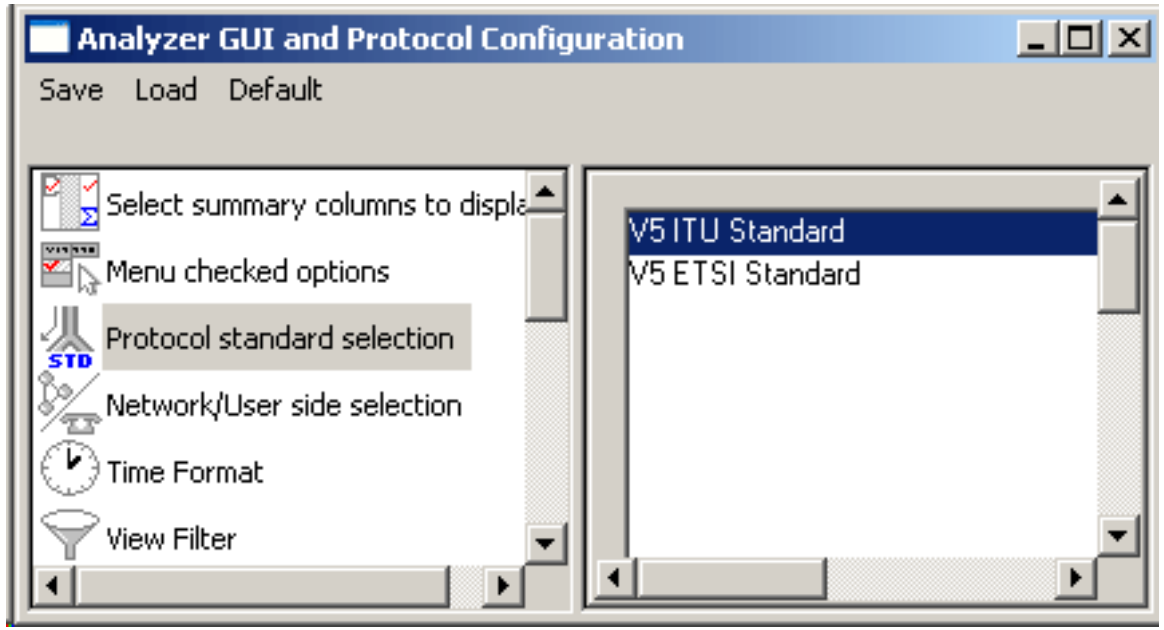
Frame Relay Analyzer

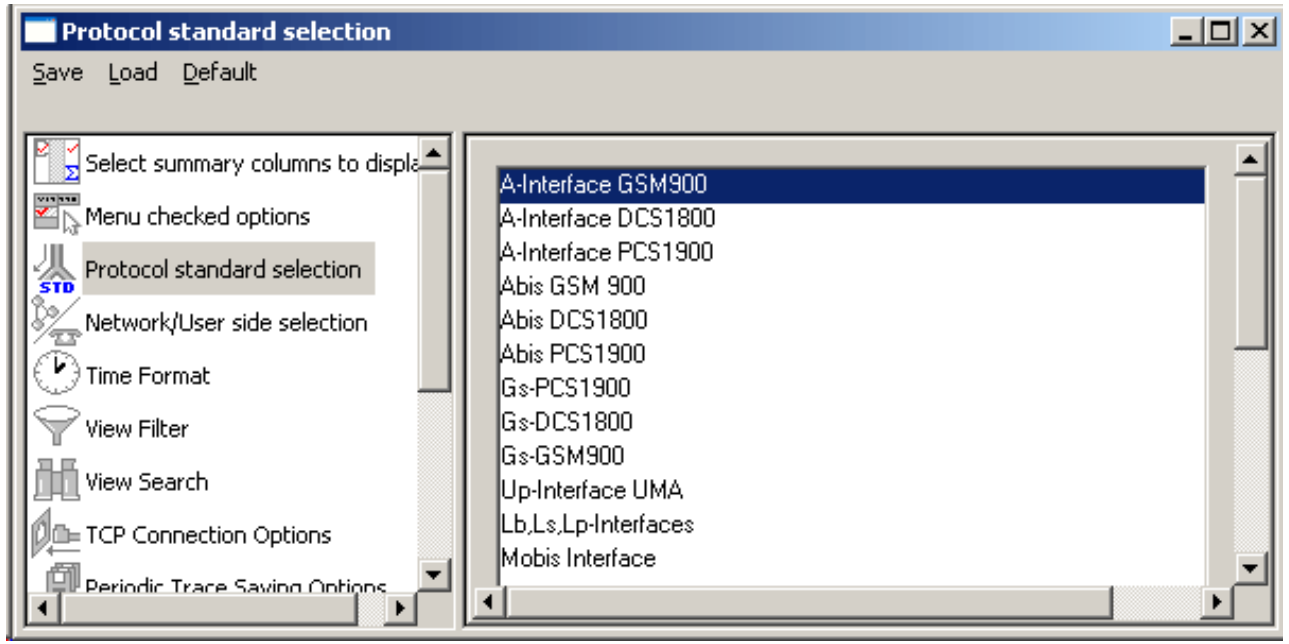


V5.x Analyzer

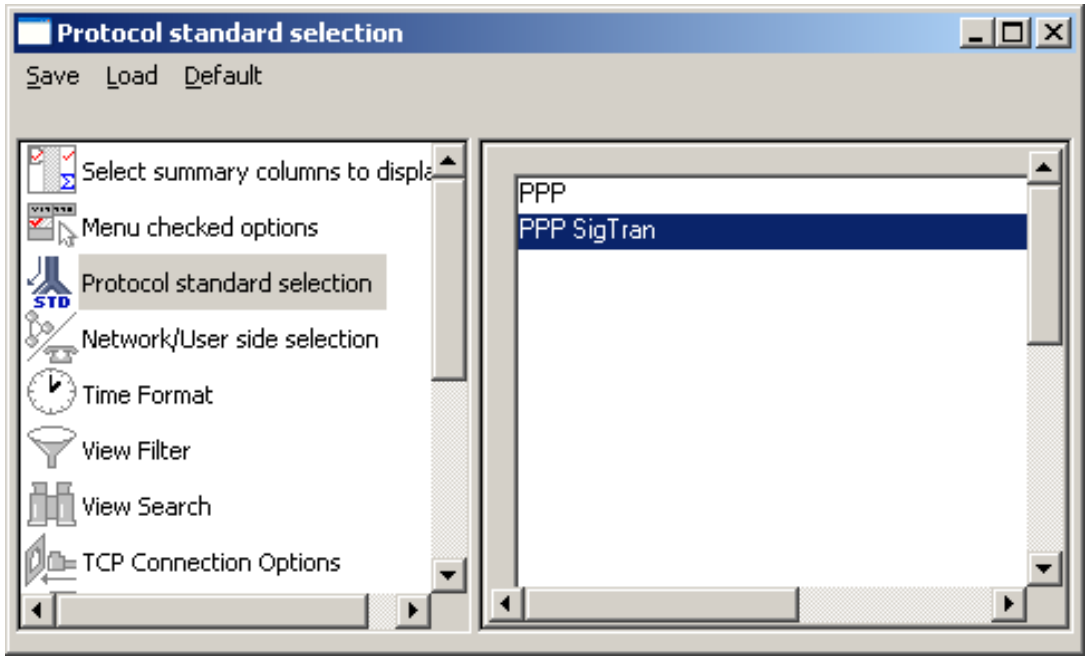


- **Frame Relay**
  - Please visit http://www.gl.com/framerelay.html for a complete list of supported protocols & specifications for Frame Relay
- **V5.x**
  - Please visit http://www.gl.com/v5analyzer.html for a complete list of supported protocols & specifications for V5.x

GSM Analyzer

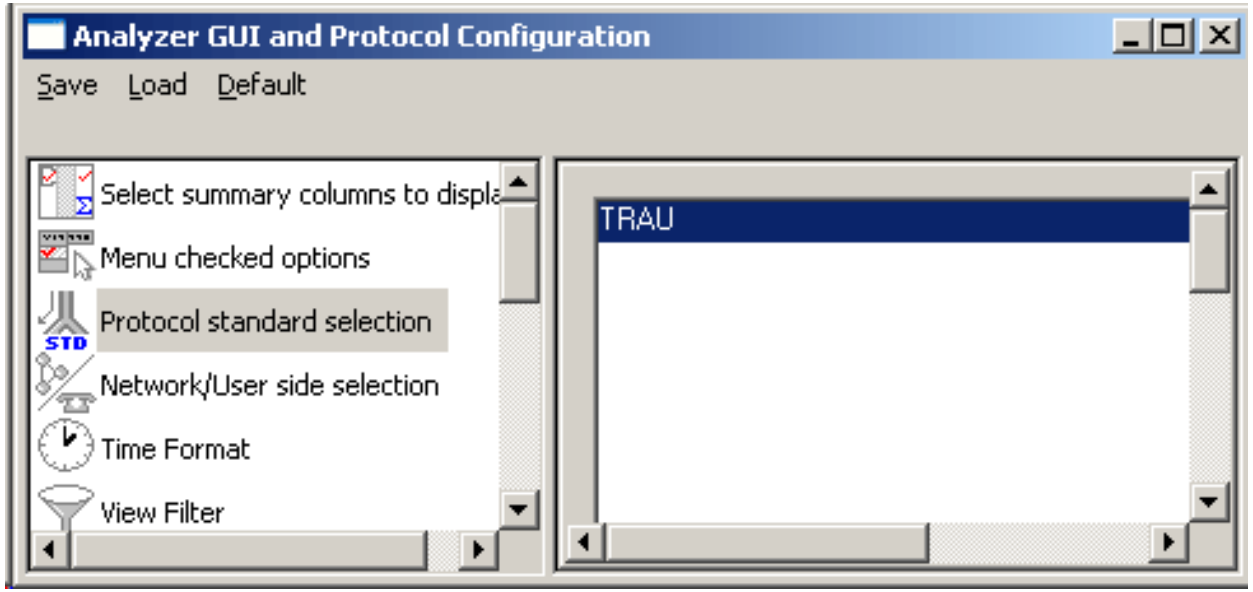


MLPPP Analyzer

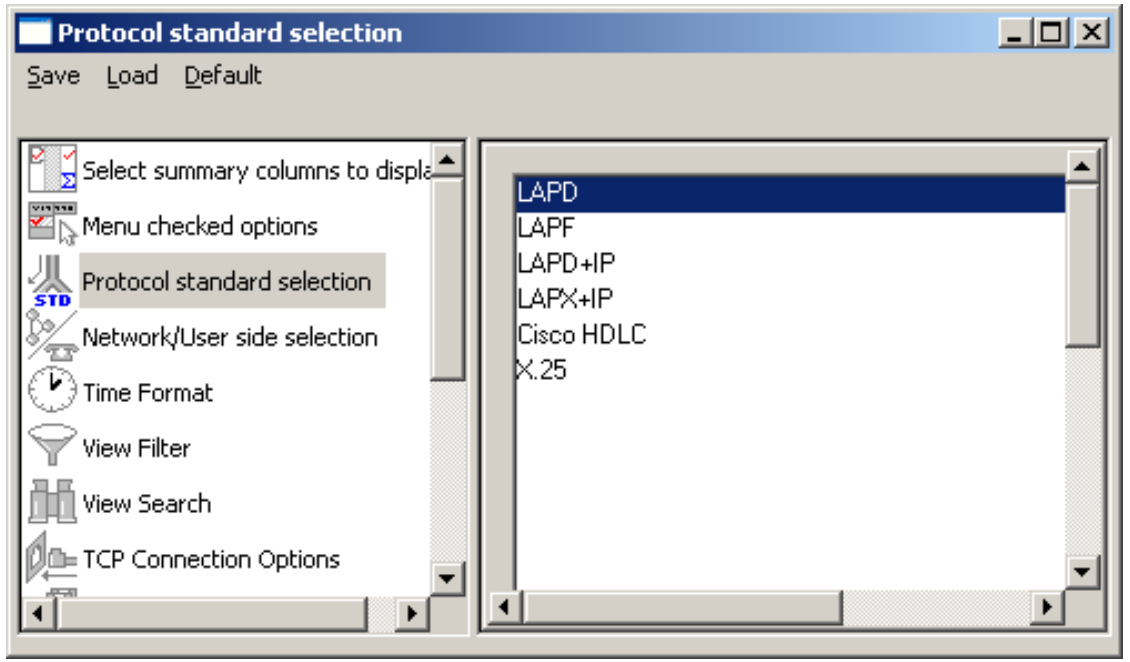


- **GSM**
  - Please visit http://www.gl.com/gsmanalyzer.html for a complete list of supported protocols & specifications for GSM
- **MLPPP**
  - Please visit http://www.gl.com/pppanalyzer.html for a complete list of supported protocols & specifications for MLPPP

TRAU Analyzer

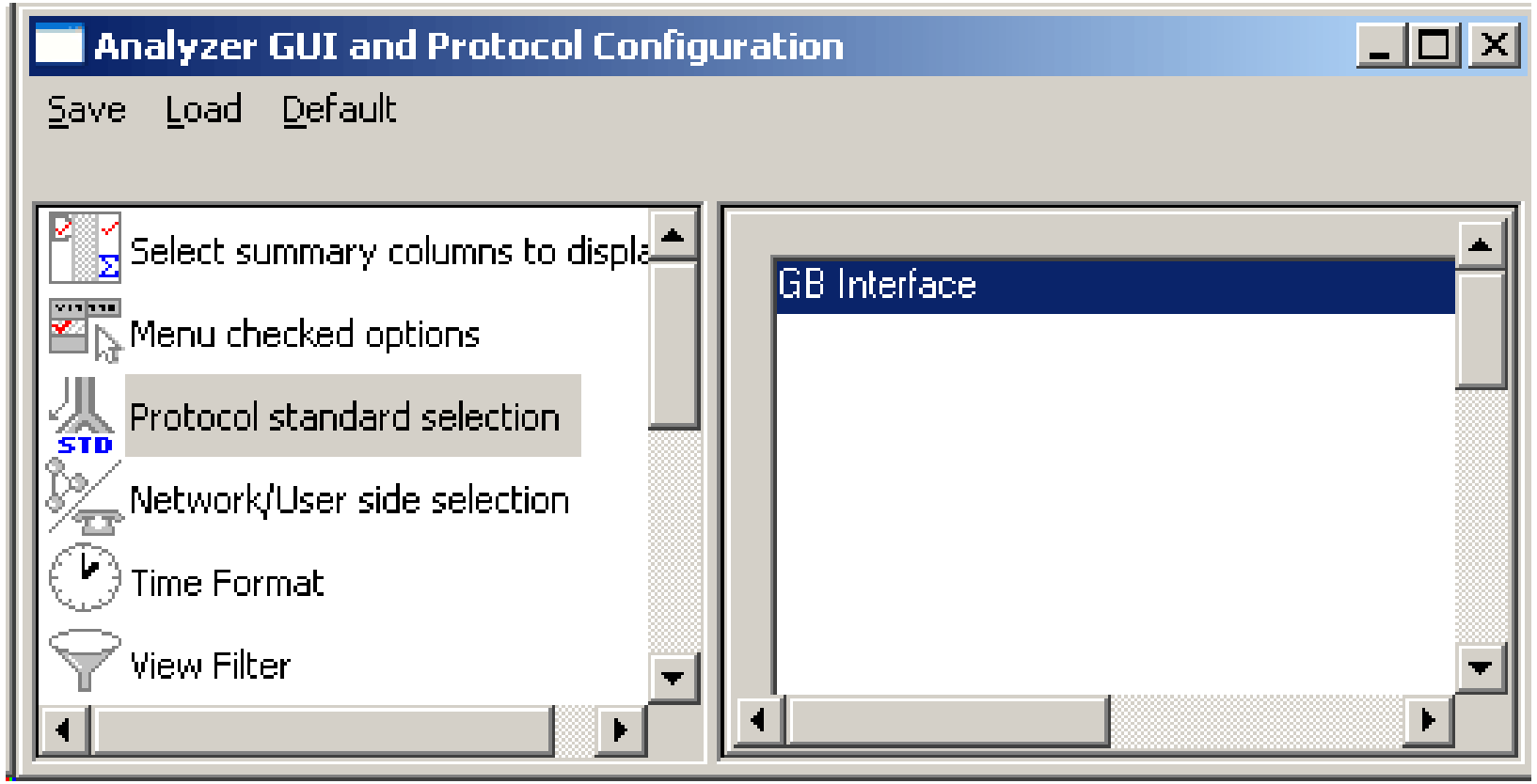


Sa Bits HDLC Analyzer



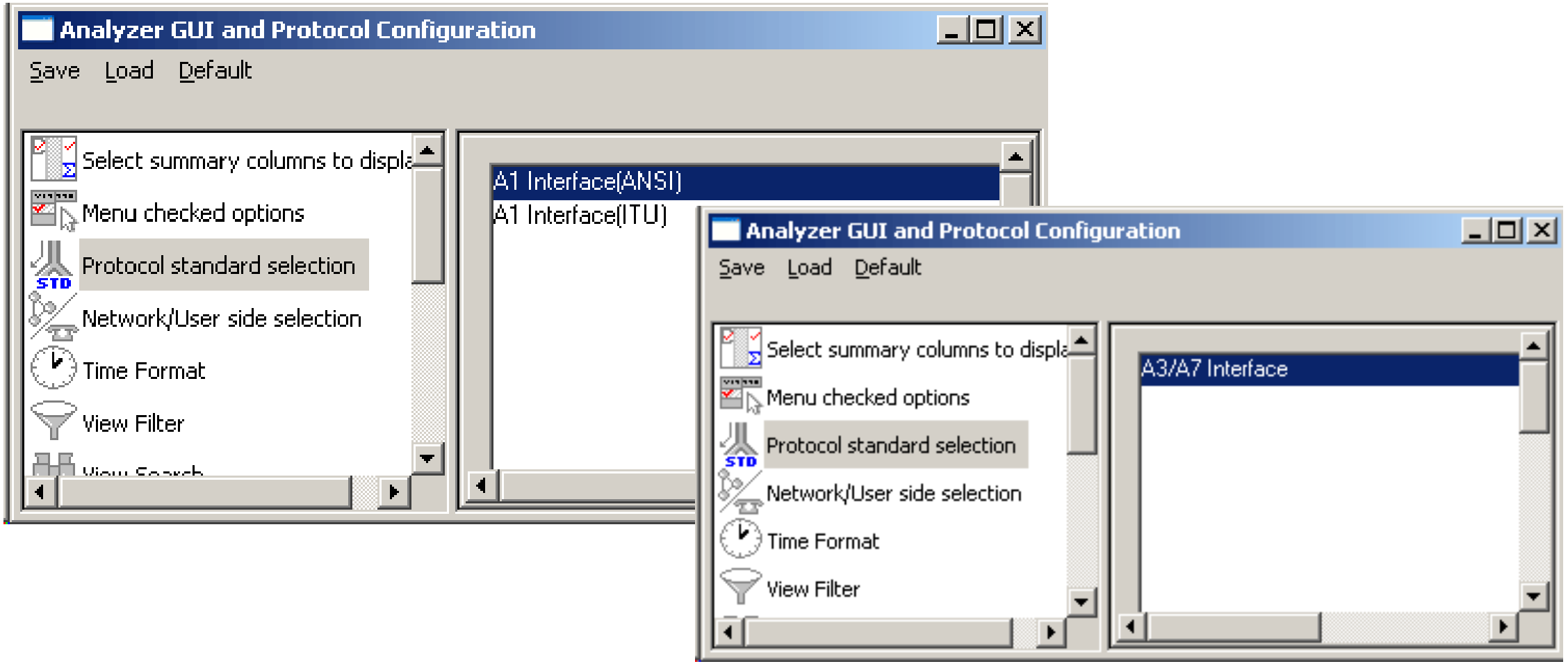
- **TRAU**
  - Please visit http://www.gl.com/trauanalyzer.html for a complete list of supported protocols & specifications for TRAU
- **Sa Bits HDLC**
  - Please visit http://www.gl.com/sahdlc.html for a complete list of supported protocols & specifications for Sa HDLC

GPRS Interface Analyzer



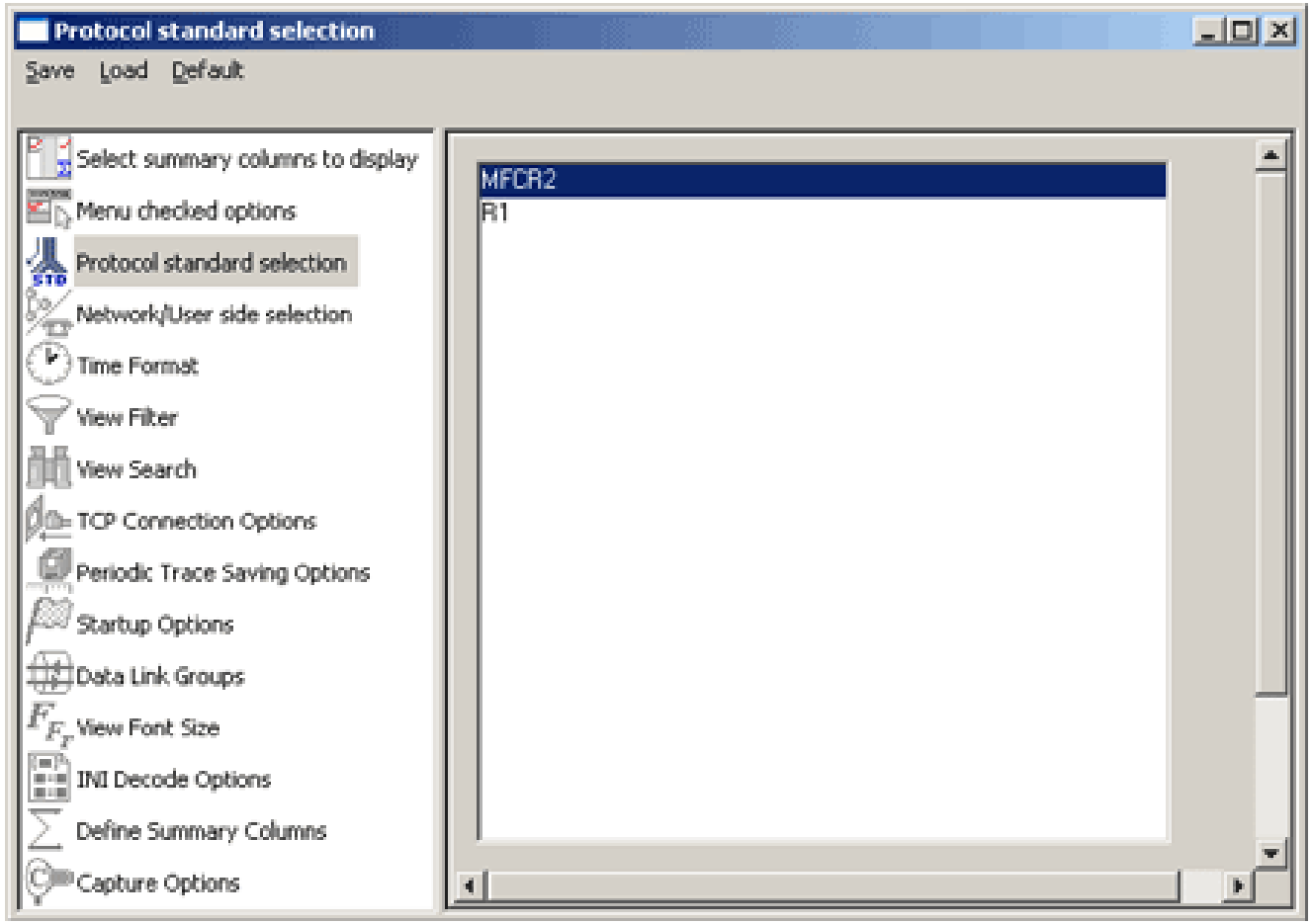
- Please visit http://www.gl.com/gprsanalyzer.html for a complete list of supported protocols & specifications for GPRS Gb Interfaces

CDMA Analyzers



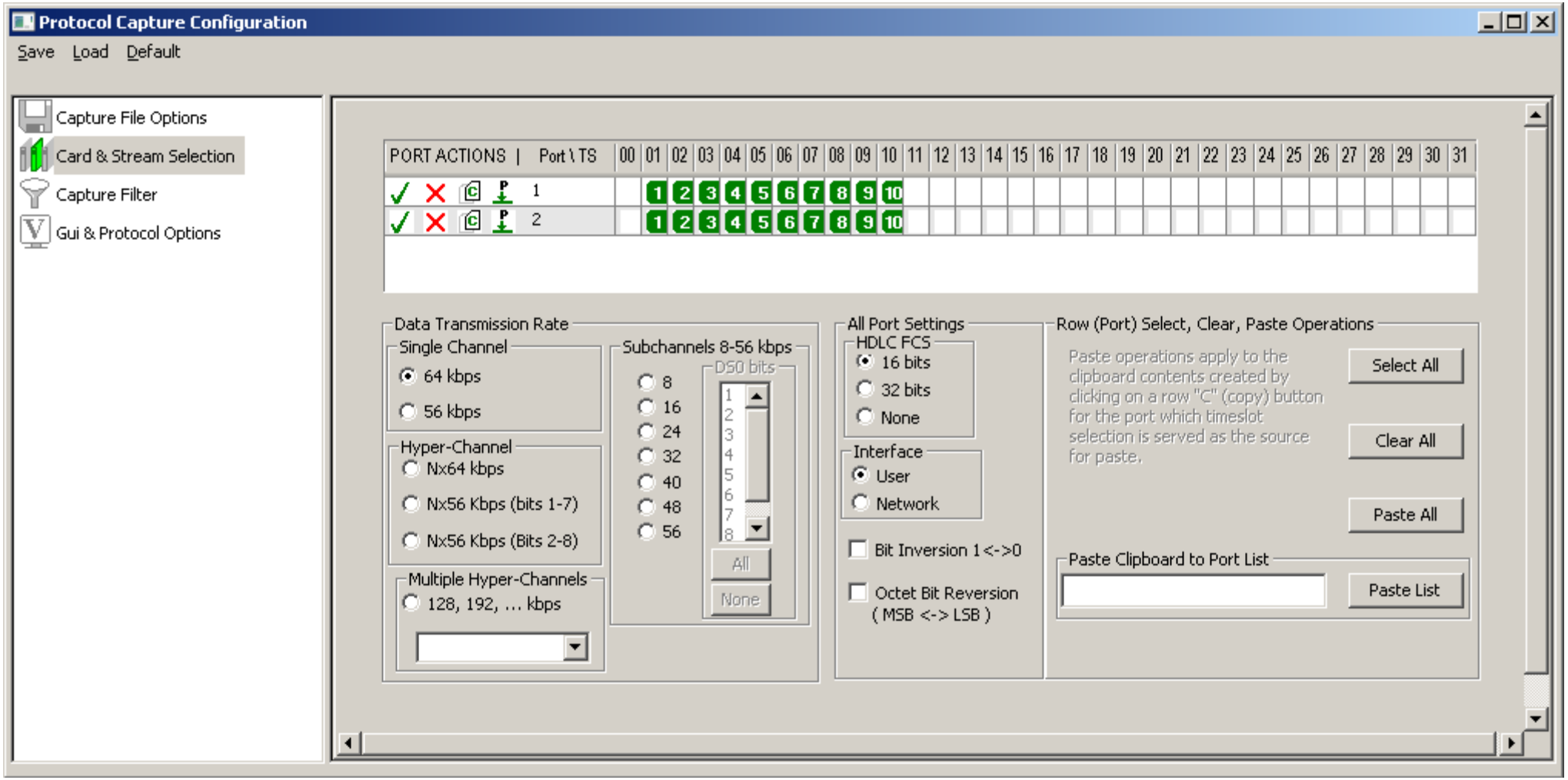
- Please visit http://www.gl.com/cdma2000analyzer.html for a complete list of supported protocols & specifications for CDMA2000 variants

CAS Analyzer



- Please visit http://www.gl.com/cas-analysis.html for a complete list of supported protocols & specifications for CAS Analyzer

Real-time Analysis
HDLC Based Protocol Analyzers



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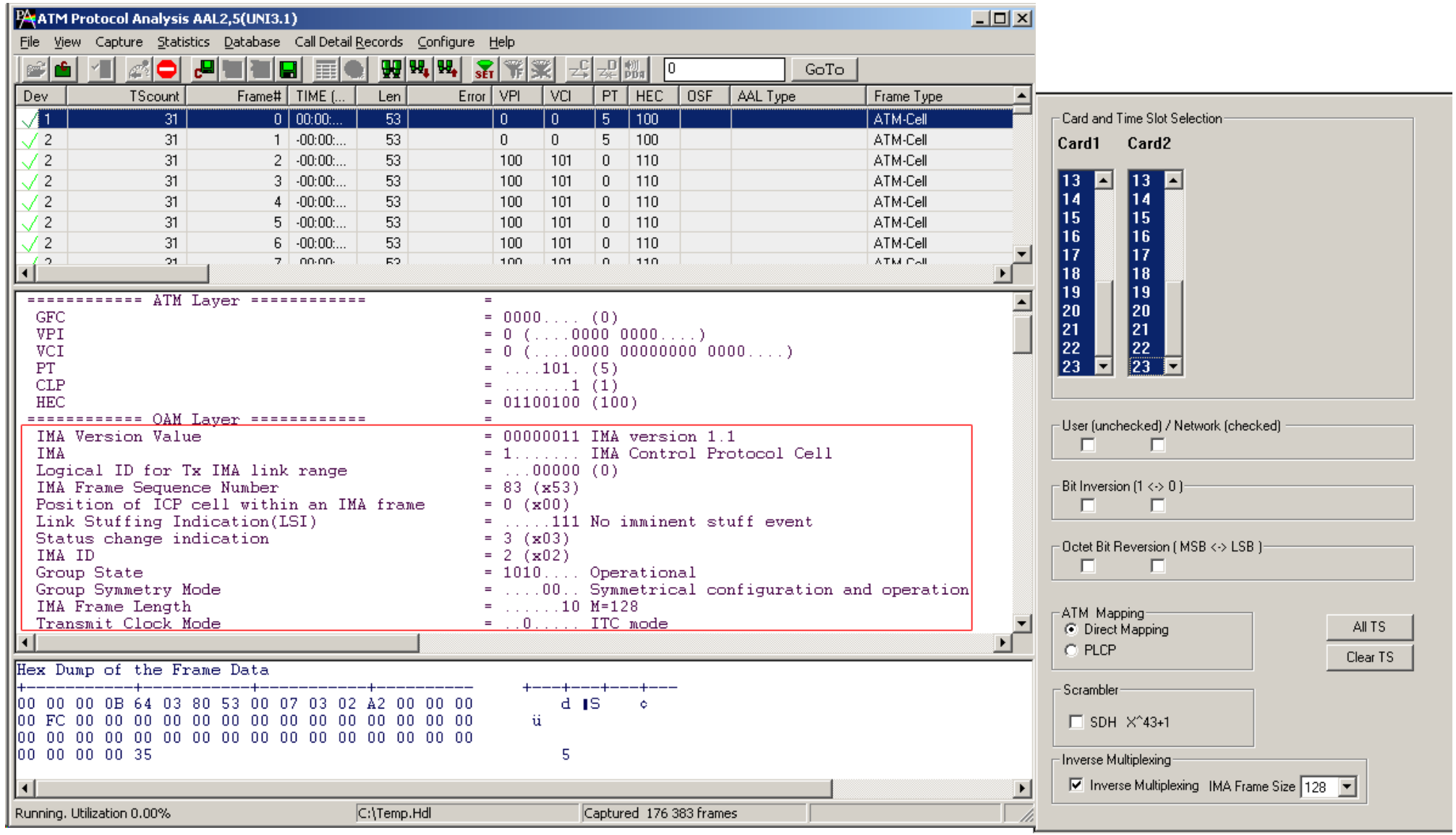
HDLC Based Protocol Analyzers

- Streams can be captured on the selected time slots (contiguous or non-contiguous), sub-channels (fractional DS0 to DS1), hyper channels (n x 64 kbps, or n x 56 kbps), or full bandwidth
- Frames may also be captured based on their FCS (16 bits, 32 bits, none), bit inversion, octet bit reversion, user/network side options
- Recorded trace file can then be played back, analyzed offline, exported to ASCII file, or printed

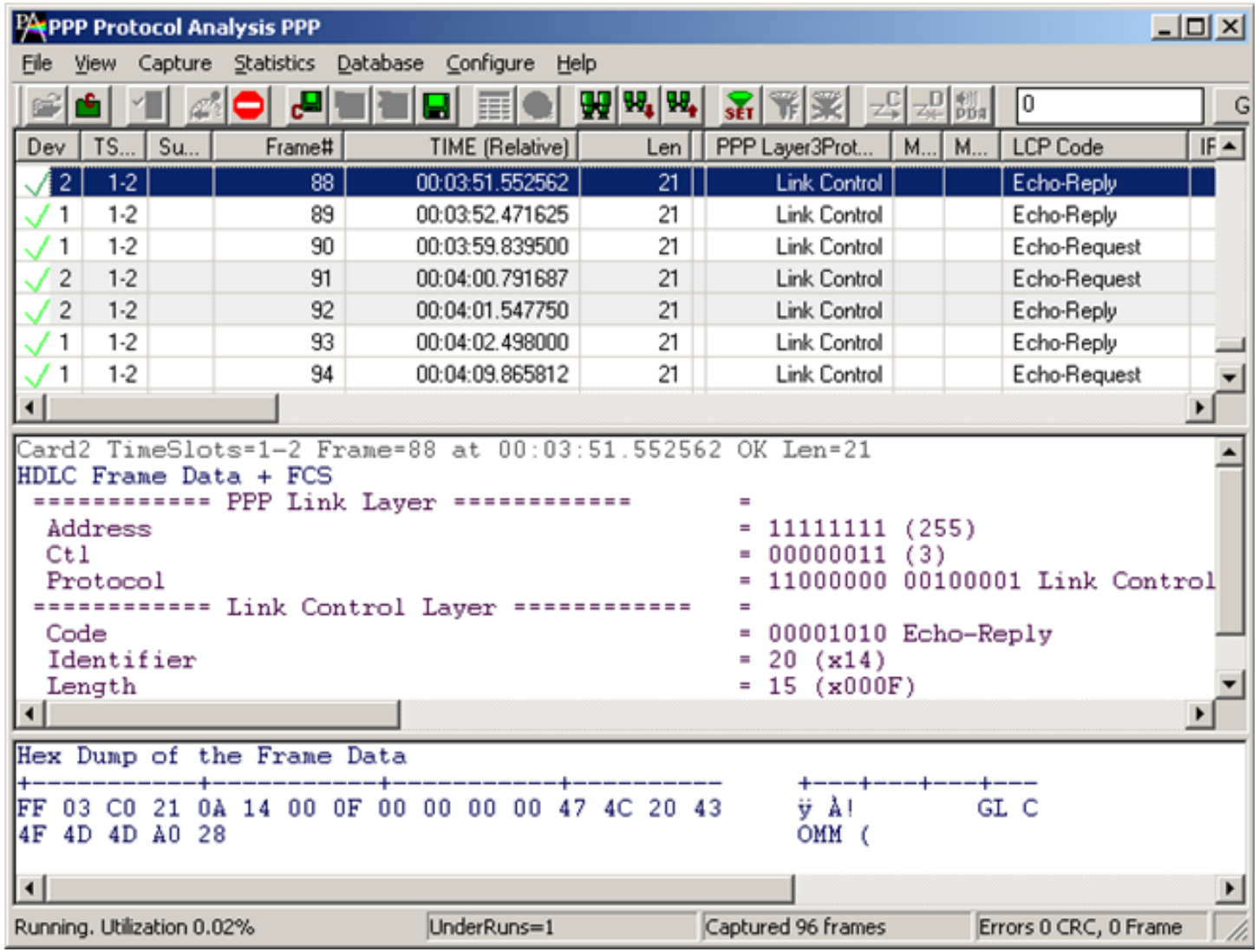
ATM Based Protocol Analyzers

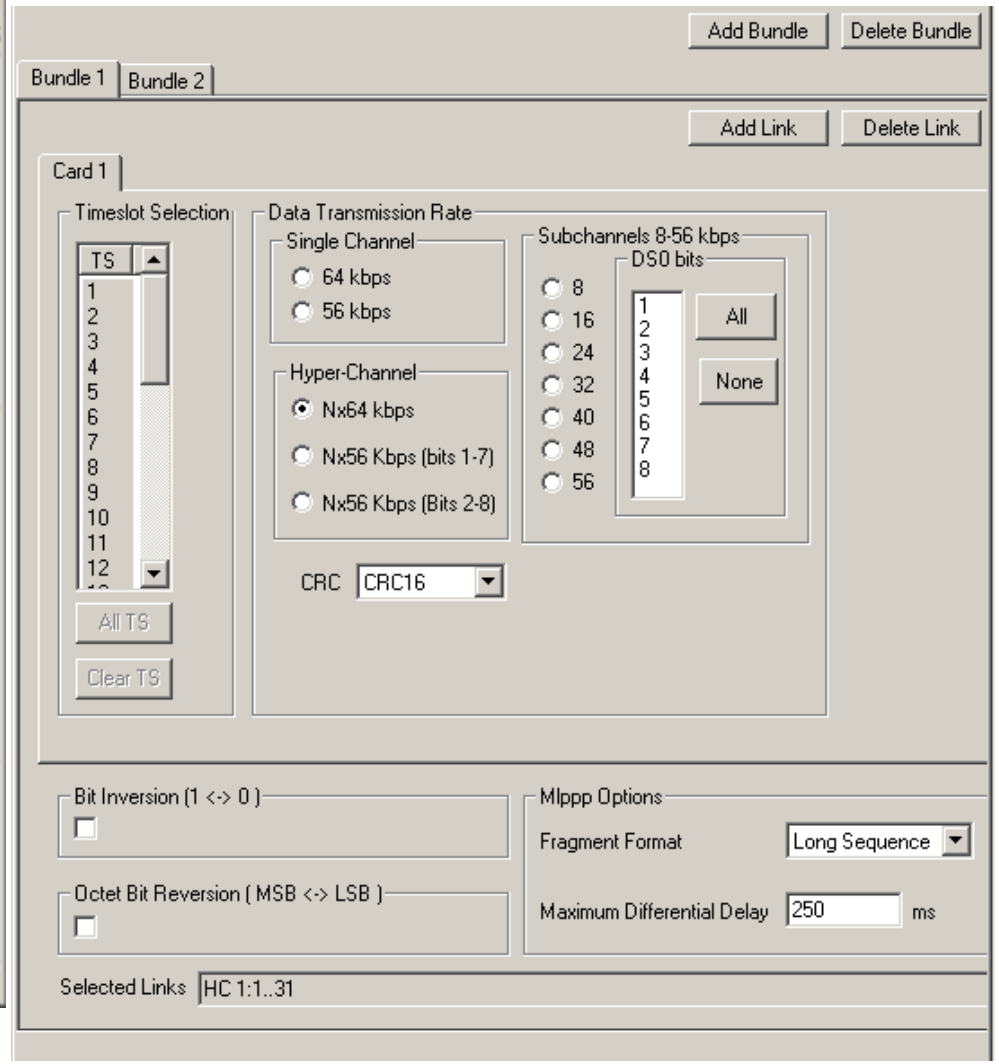


ATM Based Protocol Analyzers

- Captures, decodes, filters, and reassembles AAL2 and AAL5 frames in real-time, from within the ATM cells according to user defined VPI/VCI.
- Streams can be captured on the selected time slots (contiguous or non-contiguous), or full bandwidth
- Supports capturing and decoding of ATM frames with ATM mapping, user/network side, bit reversion, octet bit inversion, and scrambler options
- ATM, CDMA on ATM (A3 A7), and UMTS protocol analyzers now support decoding with the IMA (Inverse Multiplexing over ATM) option
- Supports IMA Frame Length ranging from 32, 64, 128, or 256
- Multiple streams of ATM traffic on various T1/E1 channels can be simultaneously decoded with different GUI instances
- Recorded trace file can then be played back, analyzed offline, exported to ASCII file, or printed

Multilink PPP Analysis

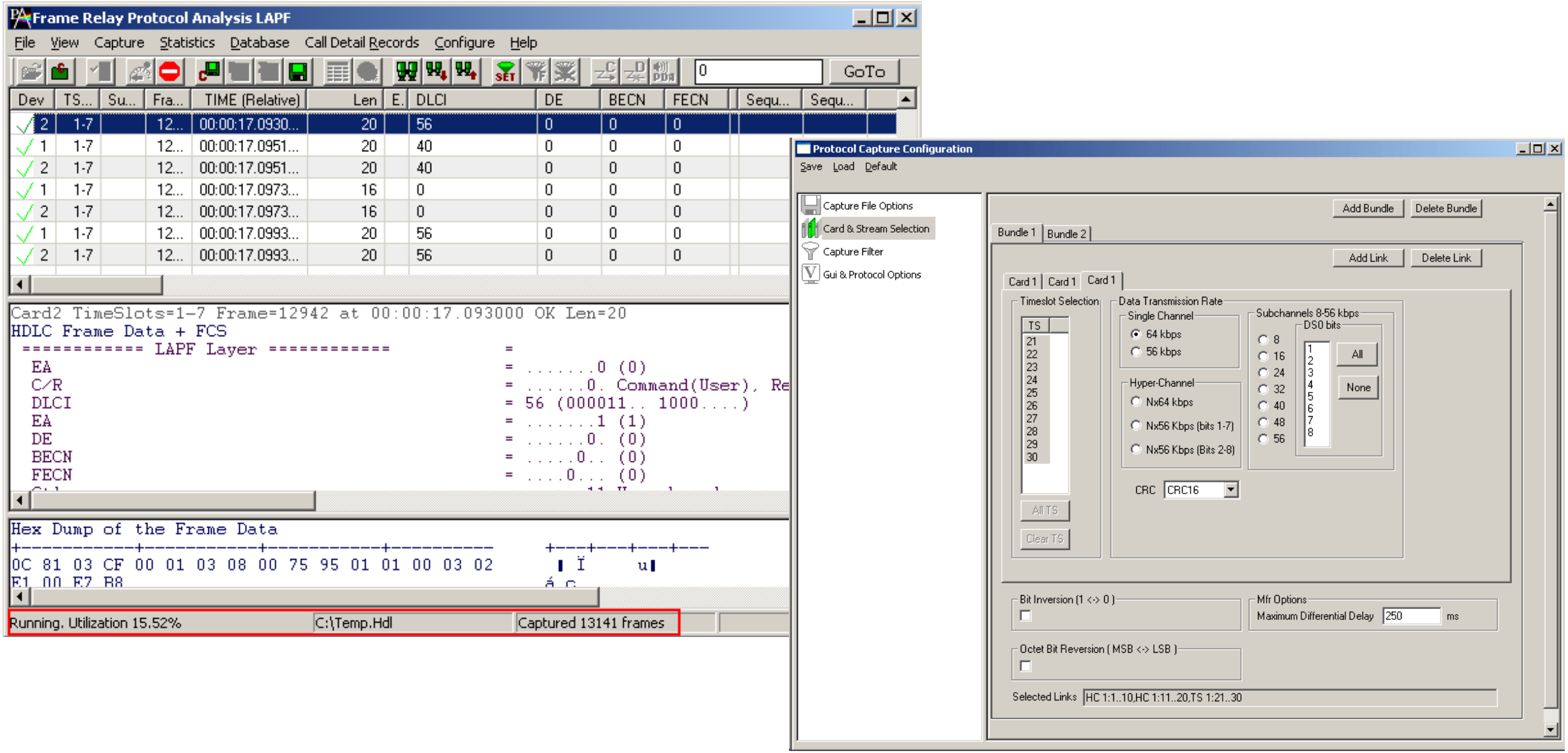




Multilink PPP Analysis

- Supports reassembly and decoding of multiple MLPPP bundles simultaneously. Each MLPPP bundle is created by selecting groups of timeslots on various cards
- Capture frames based on MLPPP options such as fragment format (long or short), & maximum differential delay
- Streams can be captured on the selected time slots (contiguous or non-contiguous), sub-channels (fractional DS0 to DS1), hyper-channels(n x 64 kbps, or n x 56 kbps), or full bandwidth
- Frames may also be captured based on their FCS (16 bits, 32 bits, none), bit inversion, octet bit reversion, user/network side options
- Recorded trace file can then be analyzed offline, exported to ASCII file, or printed

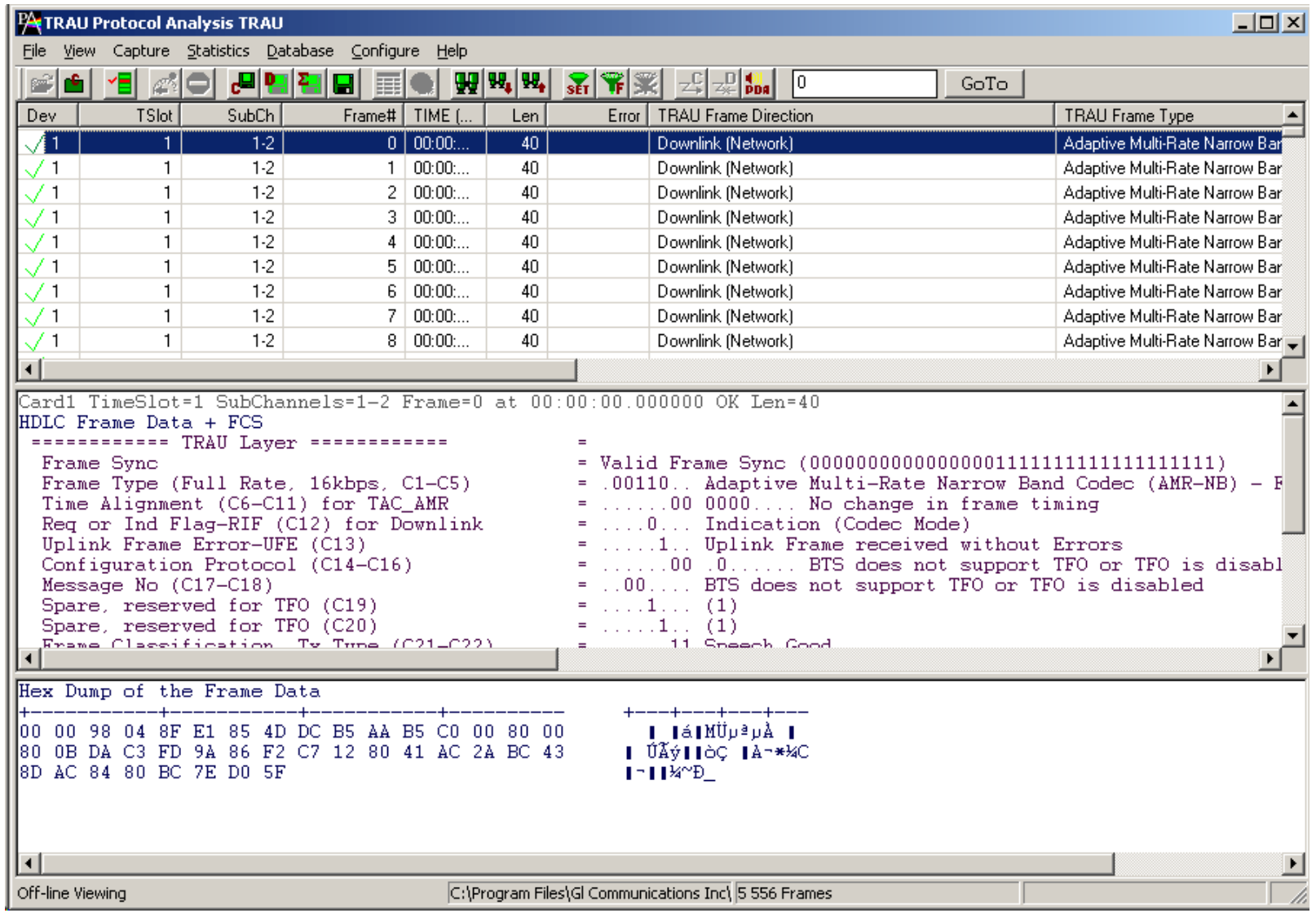
Multilink Frame Relay Analysis

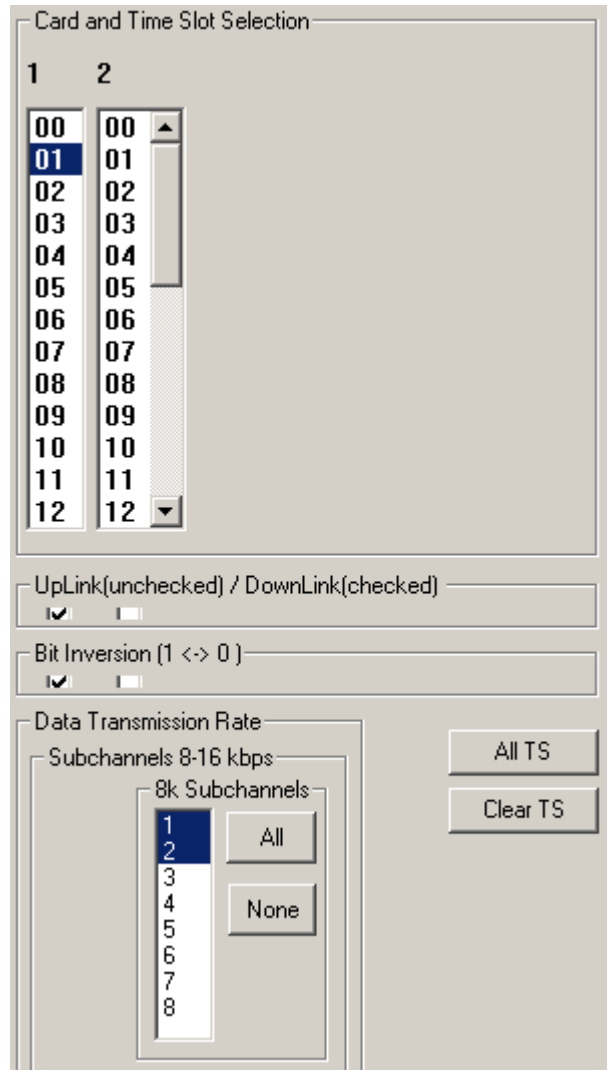


Frame Relay Analysis

- Each MFR bundle is created by selecting groups of timeslots on various cards
- Supports reassembly and decoding of multiple MFR bundles simultaneously. Each MFR bundle will reassemble packets from FR links
- Streams can be captured on the selected time slots (contiguous or non-contiguous), sub-channels (fractional DS0 to DS1), hyper-channels(n x 64 kbps, or n x 56 kbps), or full bandwidth (56kbps, or 64kbps)
- Frames may also be captured based on their FCS (16 bits, 32 bits, none), bit inversion, octet bit reversion, user/network side options
- Capture frames based on maximum differential delay
- Recorded trace file can then be analyzed offline, exported to ASCII file, or printed

TRAU Analysis

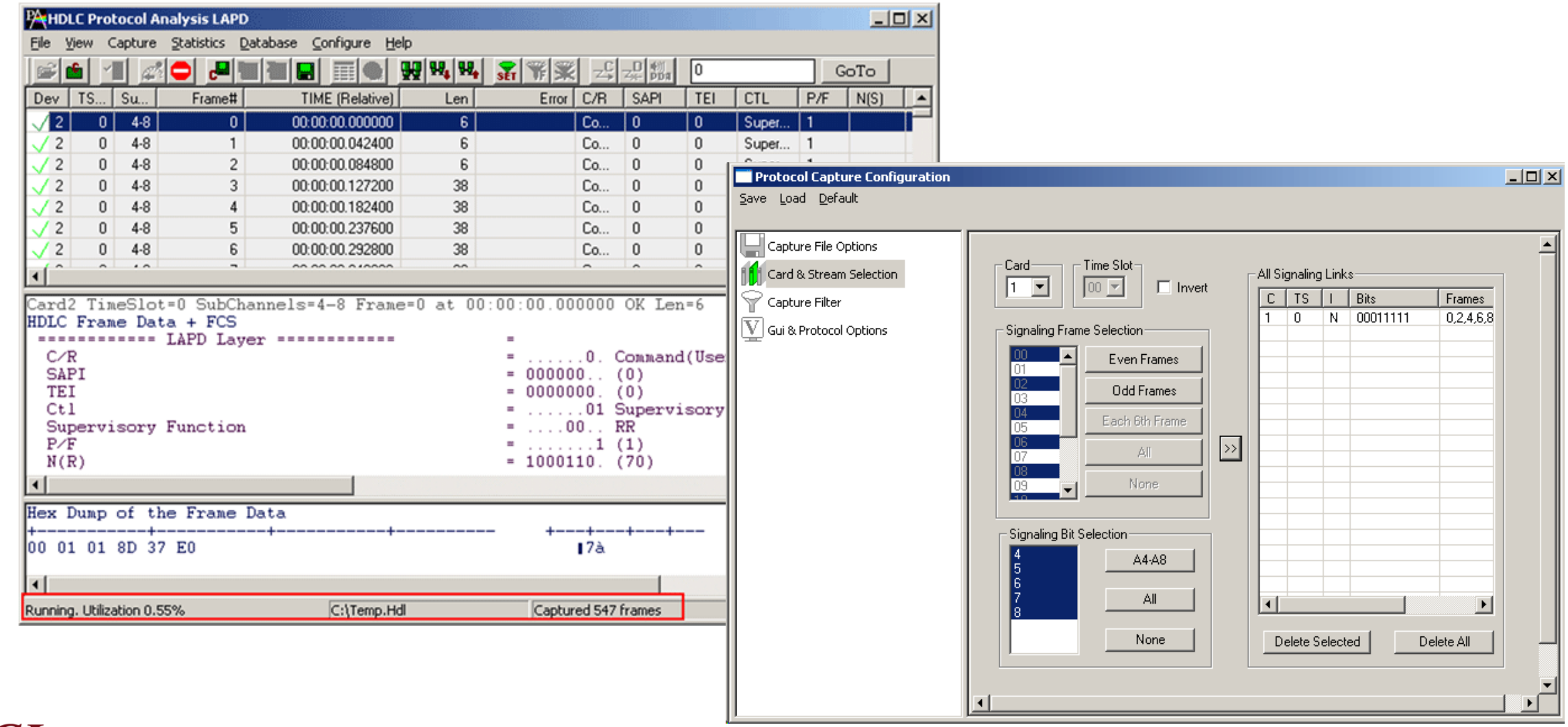




TRAU Analysis

- Frames can be captured on the selected time slots (contiguous or non-contiguous), sub-channels or full bandwidth 32 or 24 channels
- Frames may also be captured based on bit inversion and user/network side options
- Capture and decode TRAU frames such as FR (Full Rate GSM 6.10), HR (Half Rate), EFR (Enhanced Full Rate) , AMR(Adaptive Multi Rate), AMR-WB, RIF, O&M, Data at 16 kbps (GSM 08.60) & 8kbps (GSM 08.61)
- Recorded trace file can then be played back, analyzed offline and exported to ASCII file, or printed

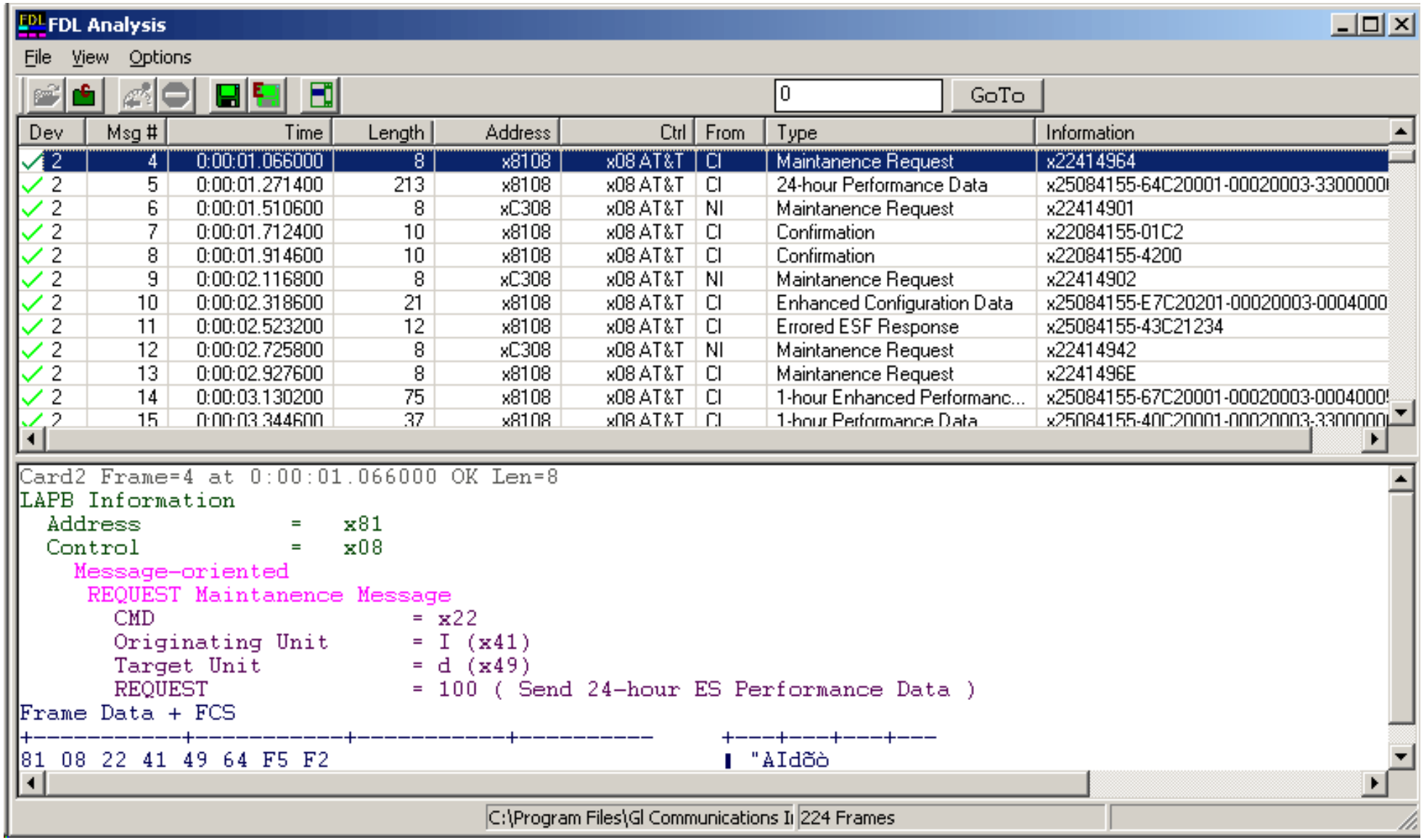
E1 Maintenance Data Link Analysis (Sa Bit HDLC)



E1 Maintenance Data Link Analysis (Sa Bit HDLC)

- Captures stream of Sa Bit HDLC frames on the selected even or odd frames of the E1 multi-frame
- Capture HDLC frames on selected frames Sa bits, i.e. bits 4-8 of the non-frame alignment signal
- Operates at 4,8,12,16 or 20 Kbit/s
- Supports inversion/non- inversion of the data
- Recorded trace file can then be played back, analyzed offline and exported to ASCII file, or printed

T1 Facility Data Link (FDL) Analysis



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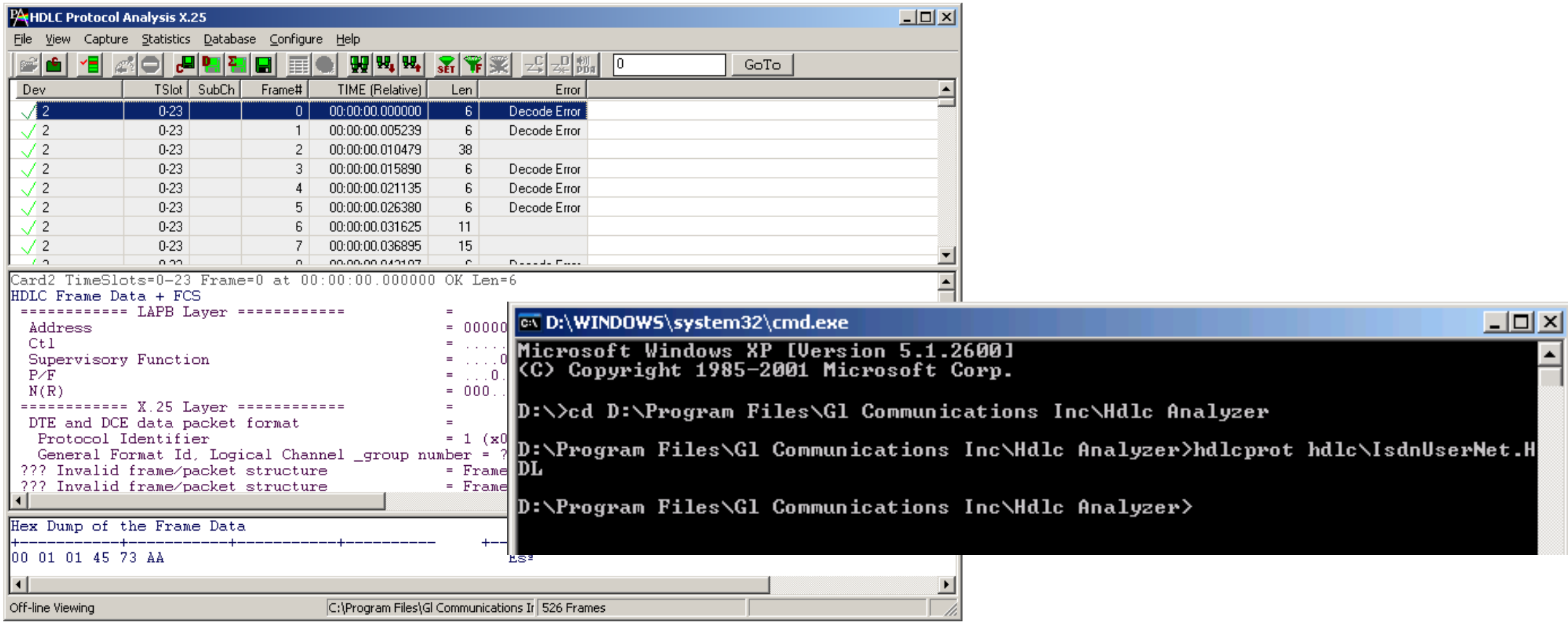
FDL Analysis

- Performs FDL decode and analysis on T1 channels real time and off-line using saved files with High Level Data Link (HDLC) frames and bit-patterned Extended Super Frame (ESF) data link messages
- Captures stream of HDLC frames on the selected cards and embedded bit-patterned ESF data link messages
- Decodes FDL messages based on the AT&T TR54016, ANSI T1.403, T1.408, I.431, G.963 and G.704
- Recorded trace file can then be played back, and analyzed offline

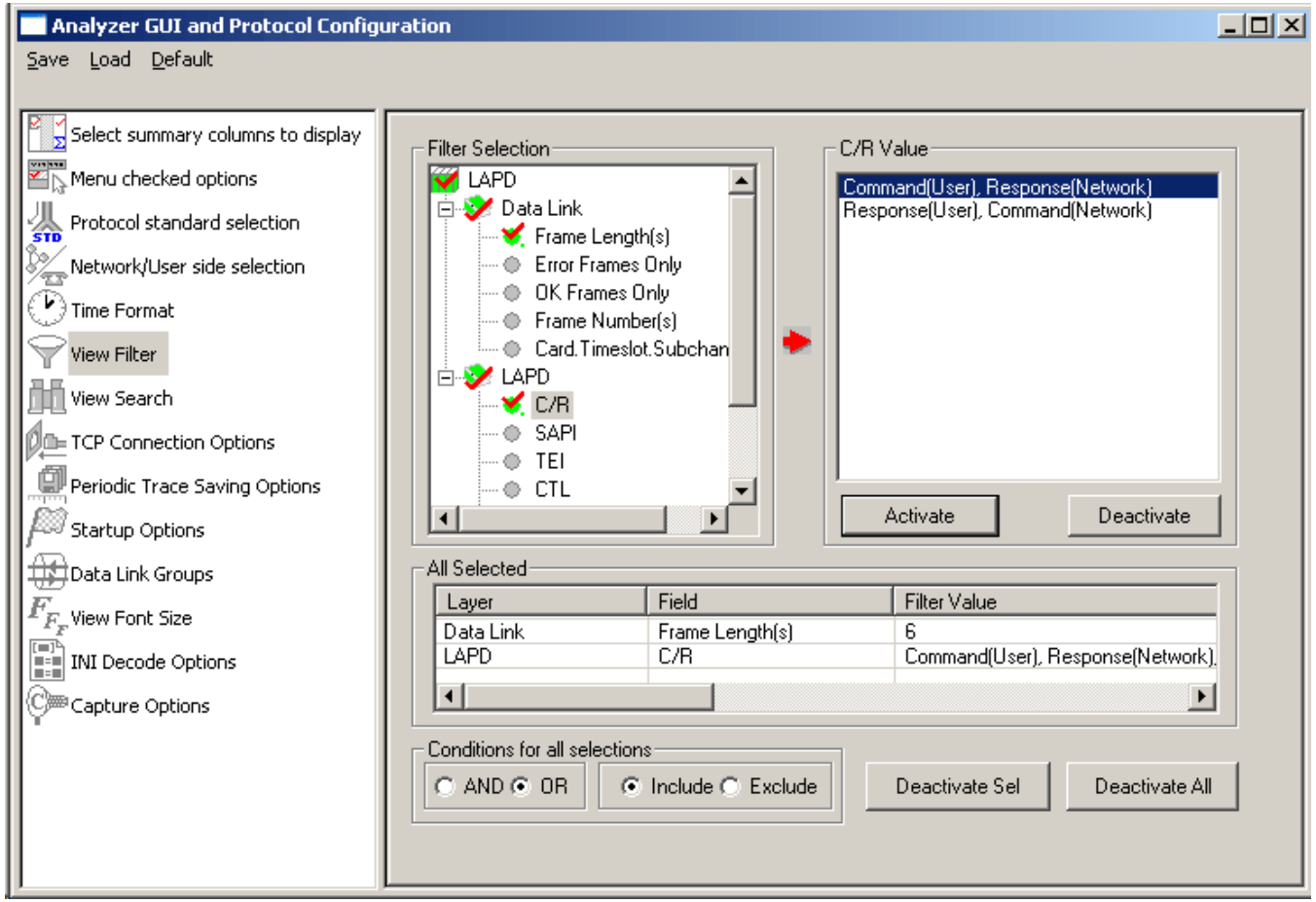
Offline Analysis



- Off-line analysis is equivalent to transmitting/capturing a file in pre-defined timeslots
- Captured frames or only the filtered frames can be exported to *.HDL file for the further off-line analysis
- Trace file for offline analysis can be loaded either through analyzer GUI or through simple command-line arguments

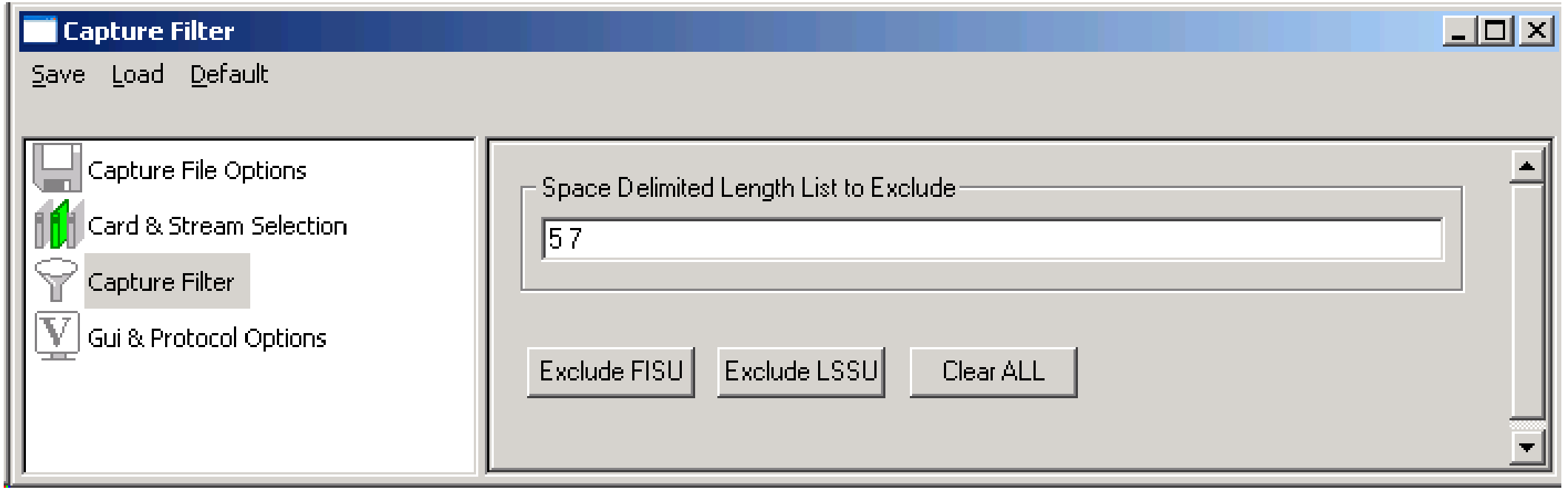
GL Communications

Filters – Display Filter



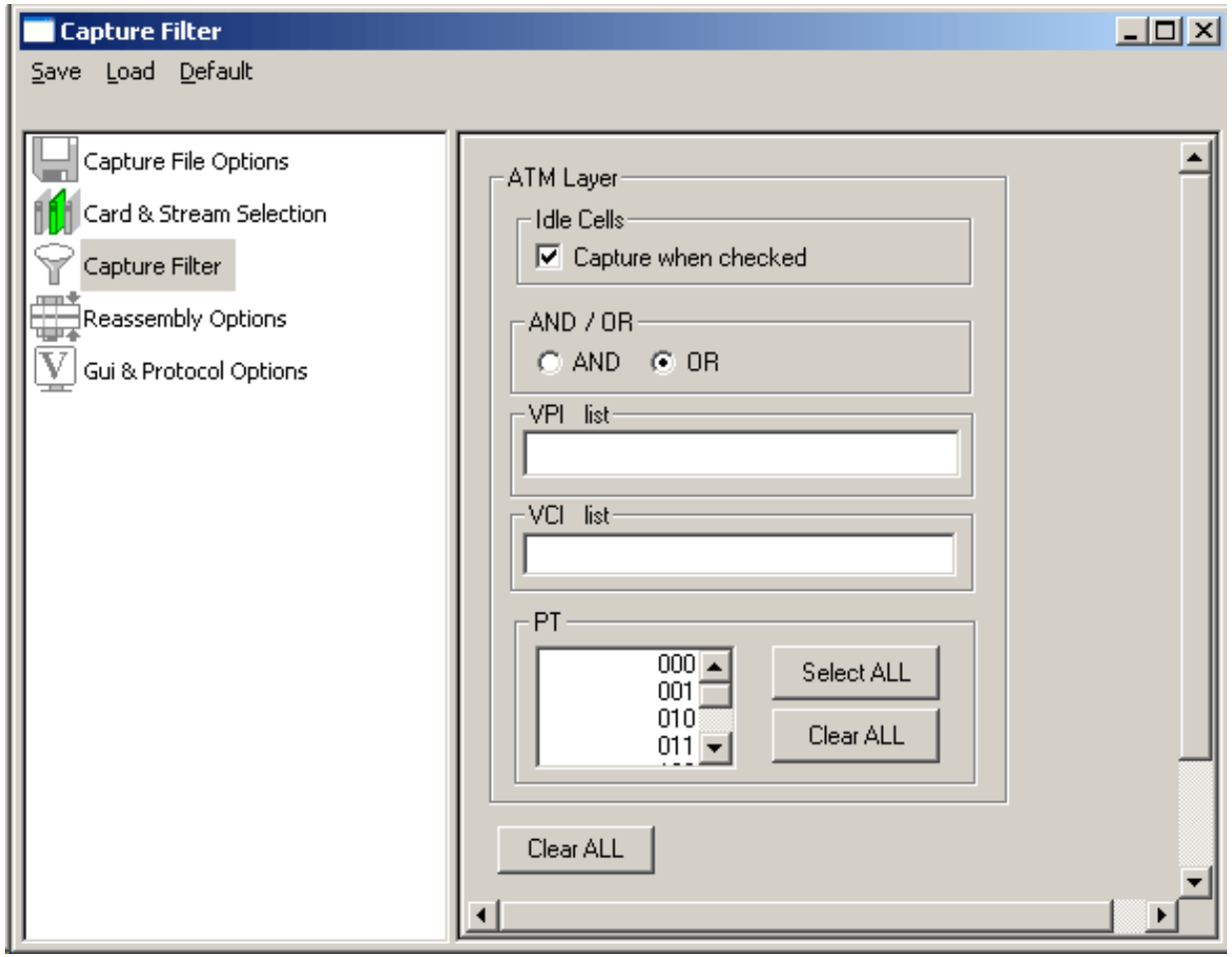
- Isolate certain specific frames from all frames in real-time as well as offline
- Filter applies to the captured frames and is based on the data link and other decoded protocol field values

Filters - Real-time Capture Filter
HDLC Based Protocol Analyzers



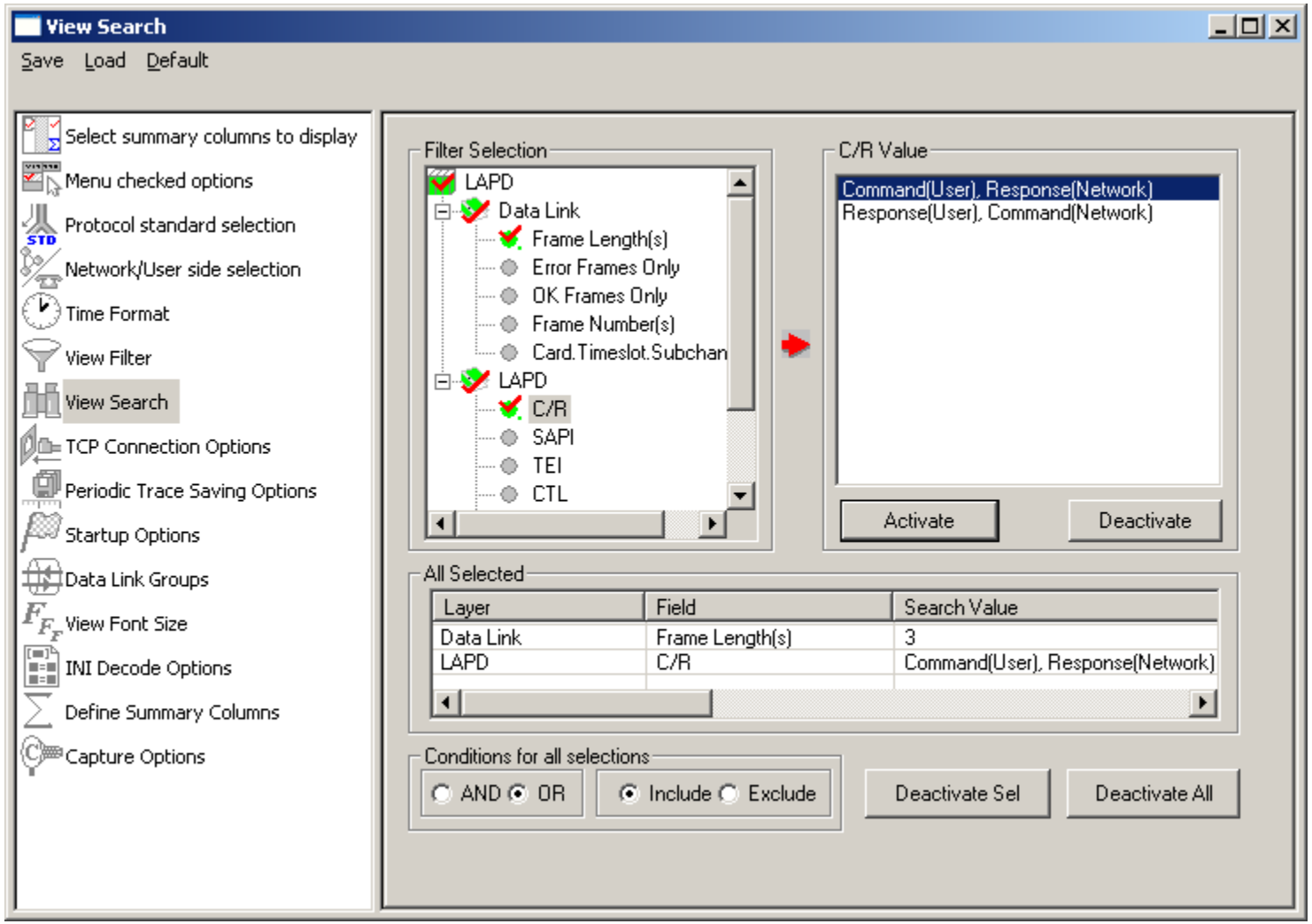
- Real-time capture filter can be set prior to capturing frames
- Real-time filter for HDLC based protocols is done by excluding LSSU (Link Status Signal Unit), FISU (Fill-in Signal Unit), or any other user-defined frame

Filters - Real-time Capture Filter
ATM Based Protocol Analyzers



- Real-time filter for ATM based protocols is done by entering the VPI and VCI values

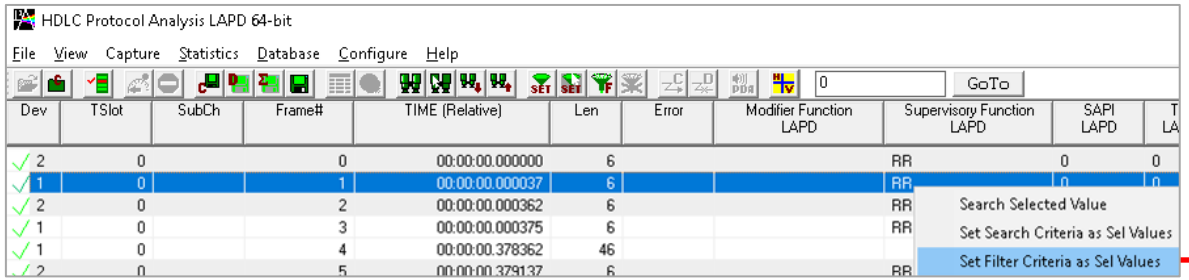
Search Options

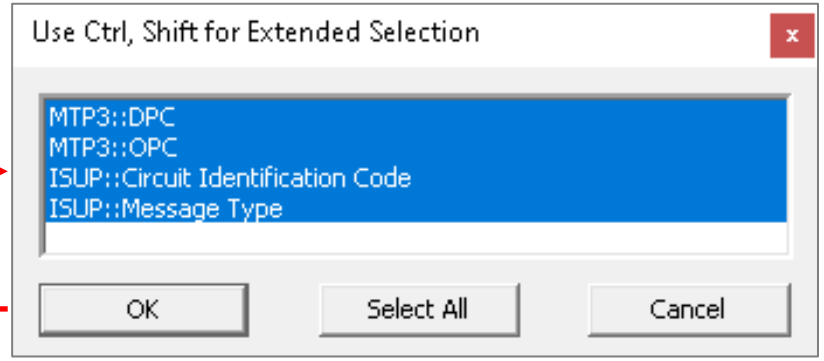


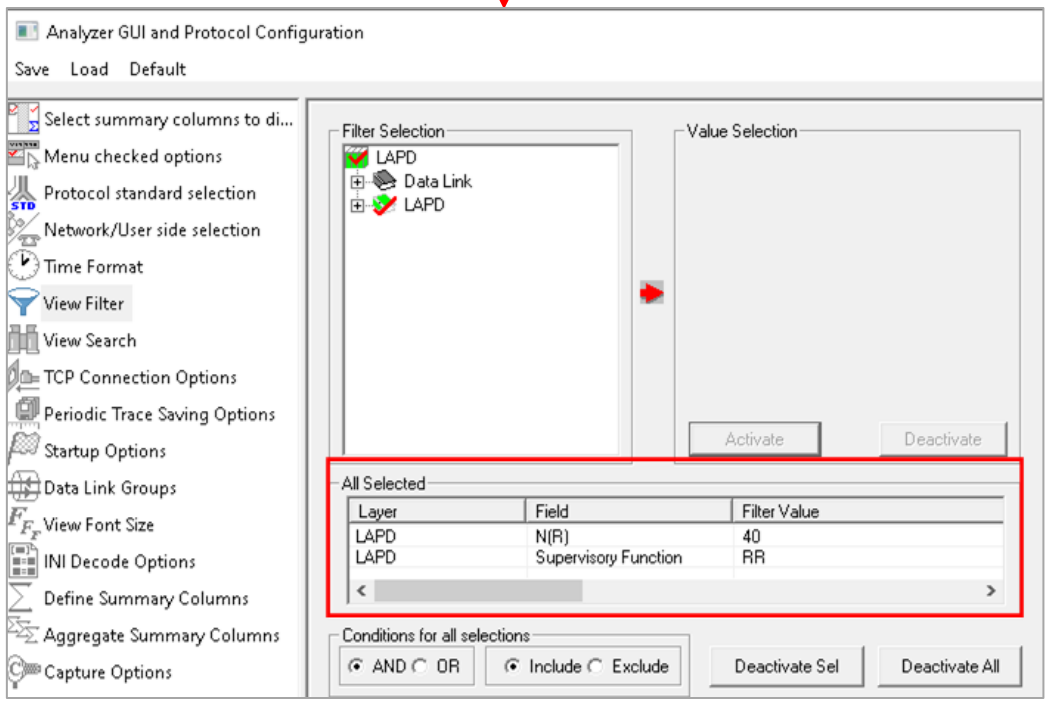
- Search features helps users to search for a particular frame based on specific search criteria

Sample Filtering Criteria From Screen Selection

- Allows the user to create filter criteria automatically from the current screen selection

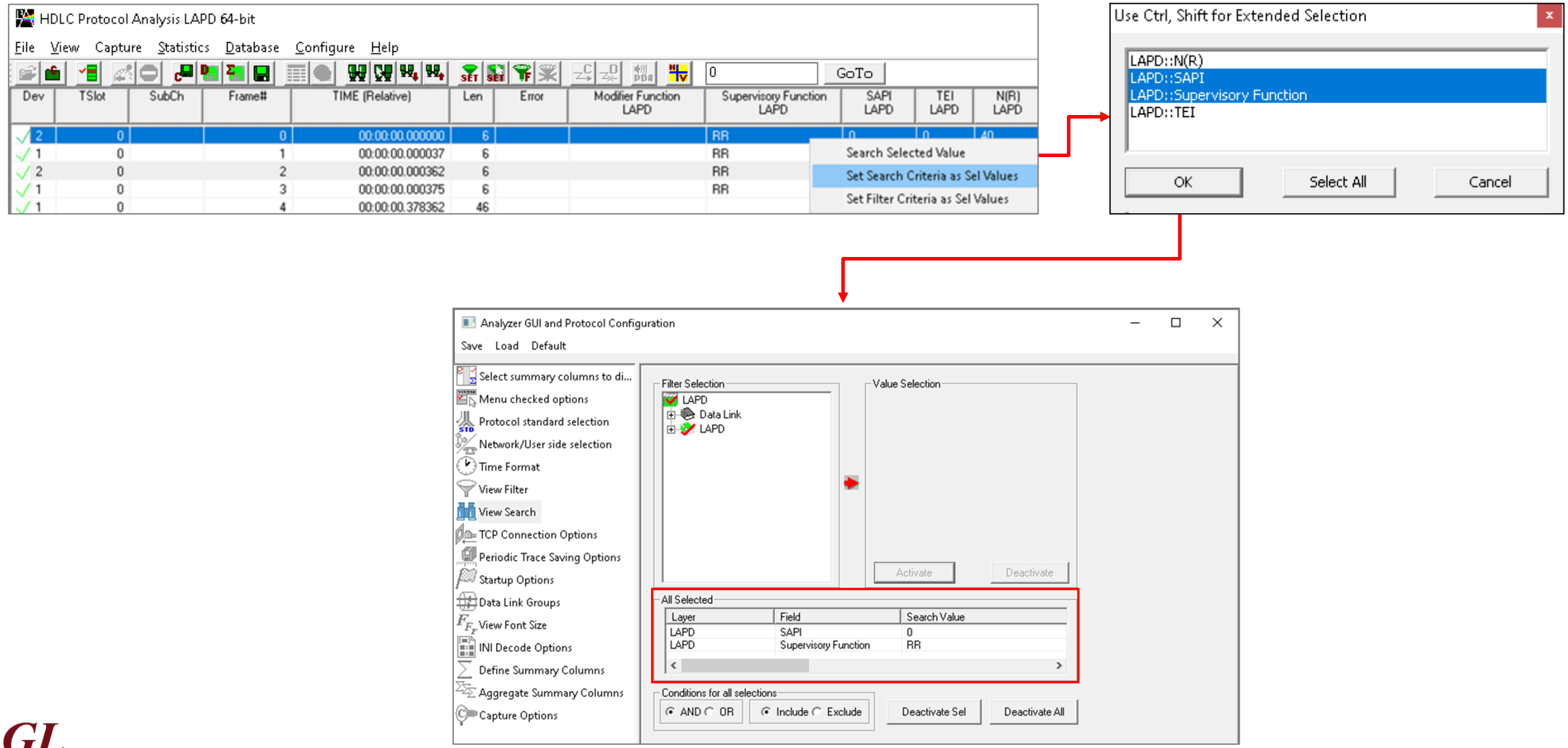






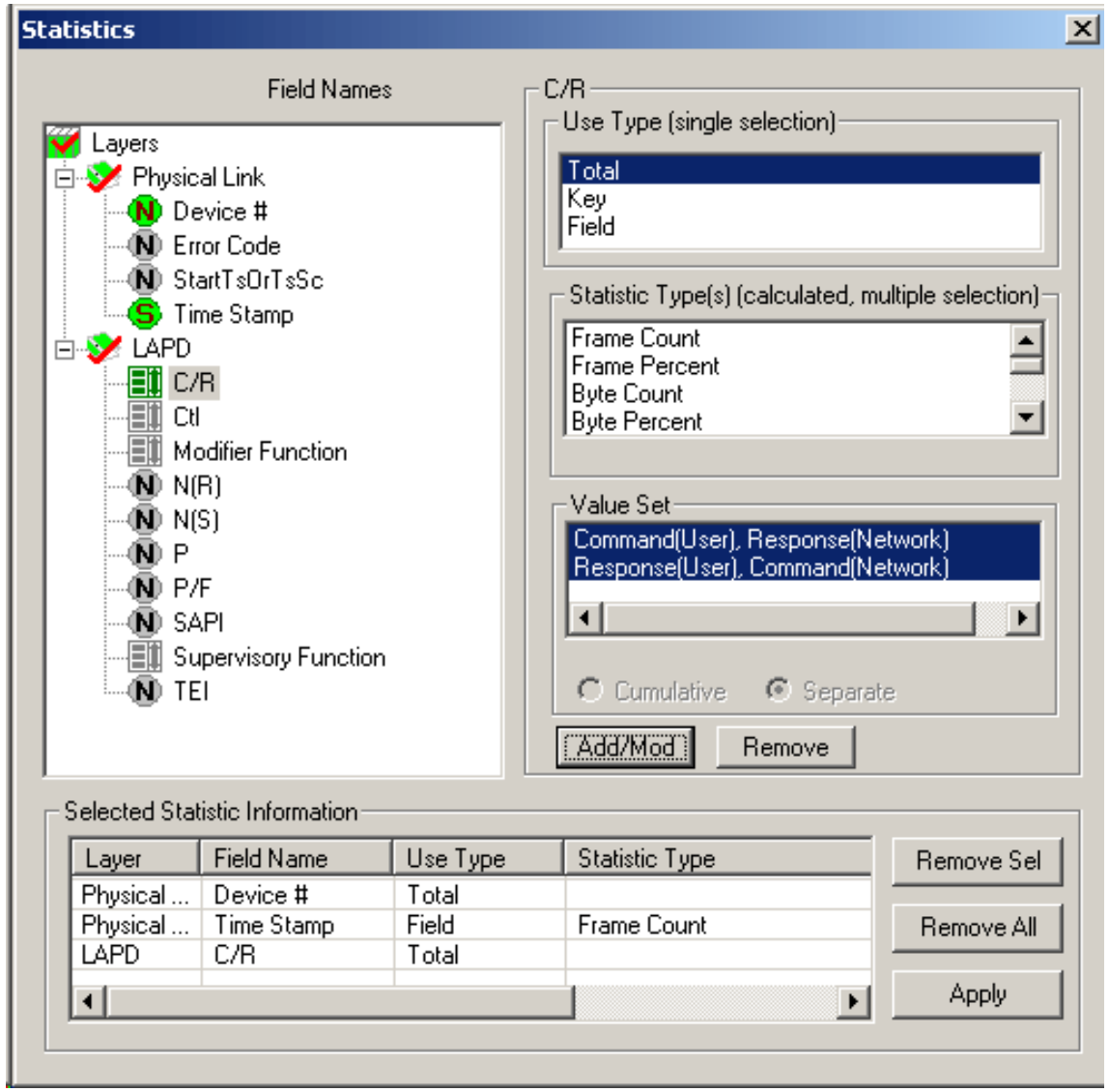
Sample Search Criteria From Screen Selection

- Allows the user to create search criteria automatically from the current screen selection



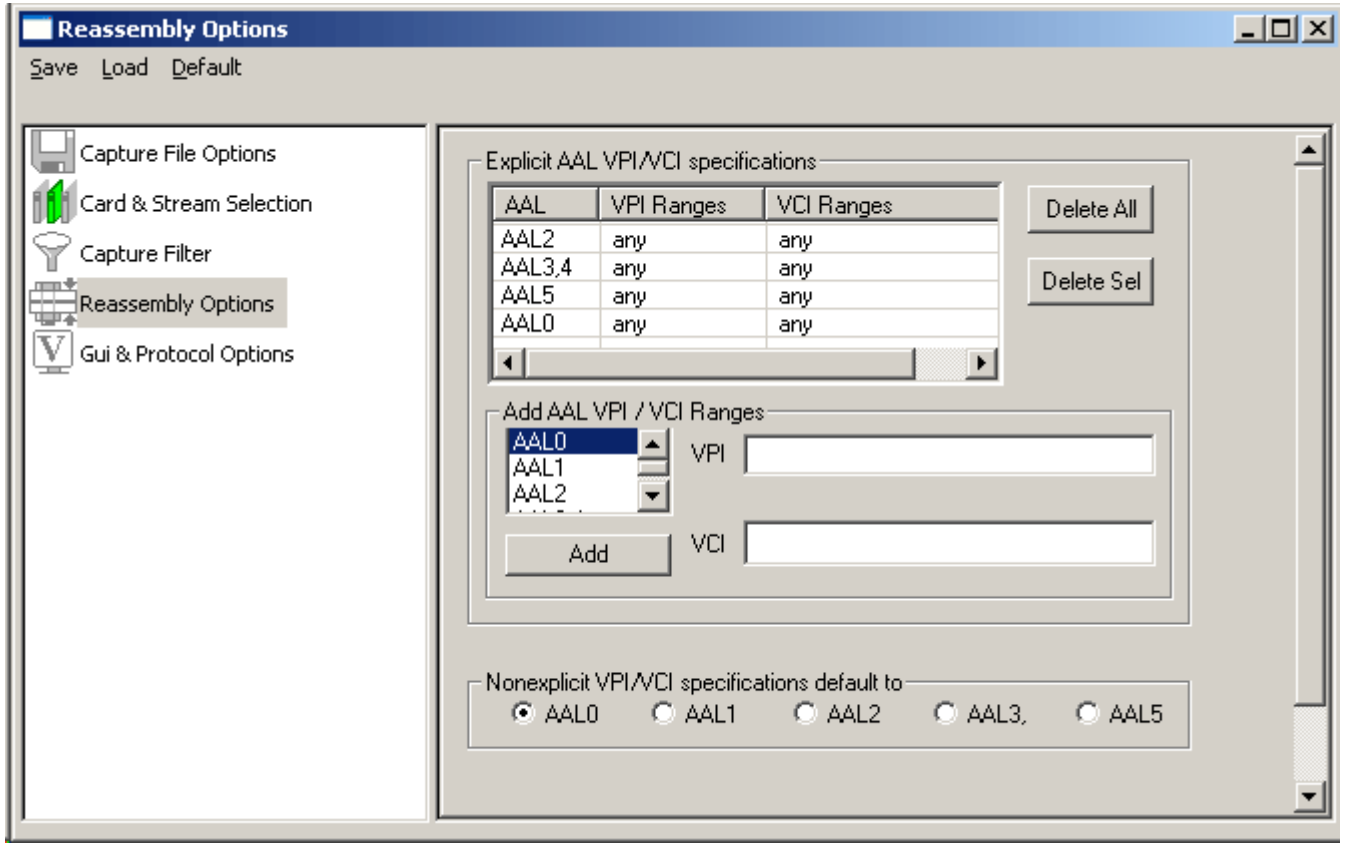
Statistics

- Statistics is an important feature available in protocol analyzer and can be obtained for all frames both in real-time as well as offline mode
- Numerous statistics can be obtained to study the performance of the network based on protocol fields and different parameters

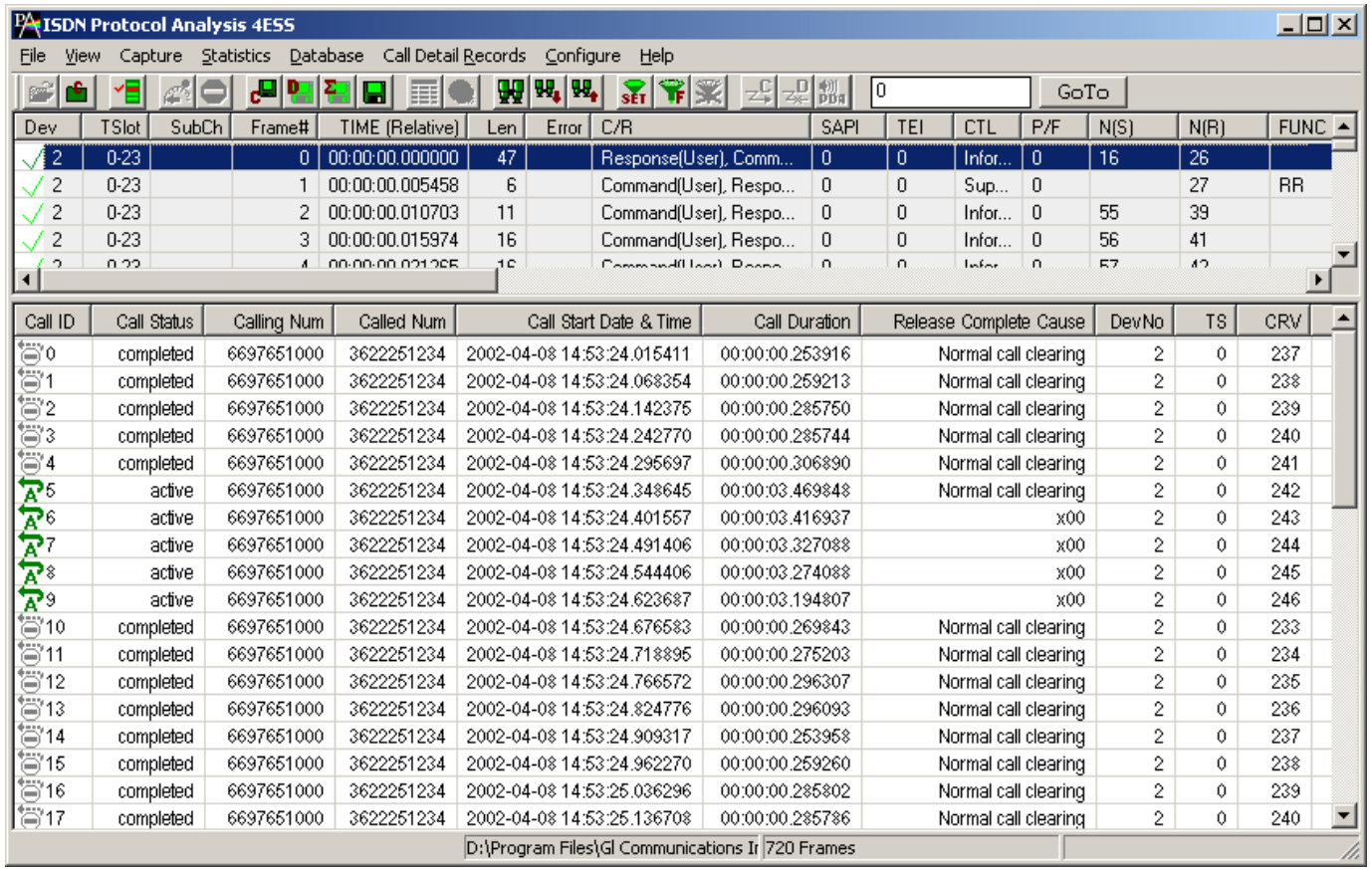


Reassembly Option in ATM Analyzers

- Specify VPI /VCI values to reassemble as per the segmentation and reassembly rules defined by the specified AAL type
- ATM cells not satisfying the user specification will be reassembled as per the default specification

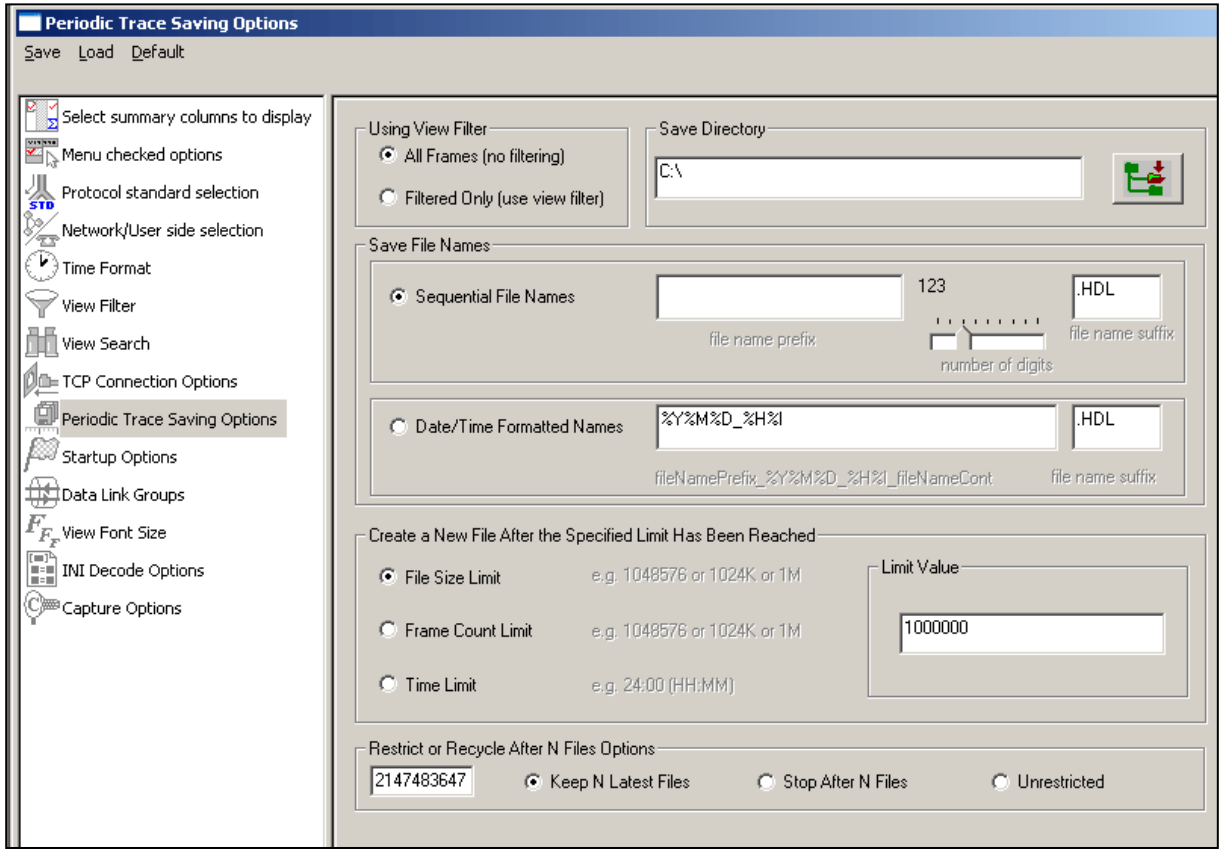


Call Detail Records



- Call trace defining important call specific parameters such as call ID, status (active or completed), duration, CRV, release complete cause etc. are displayed
- CDR Find option allows to search a particular call detail record from the captured traces

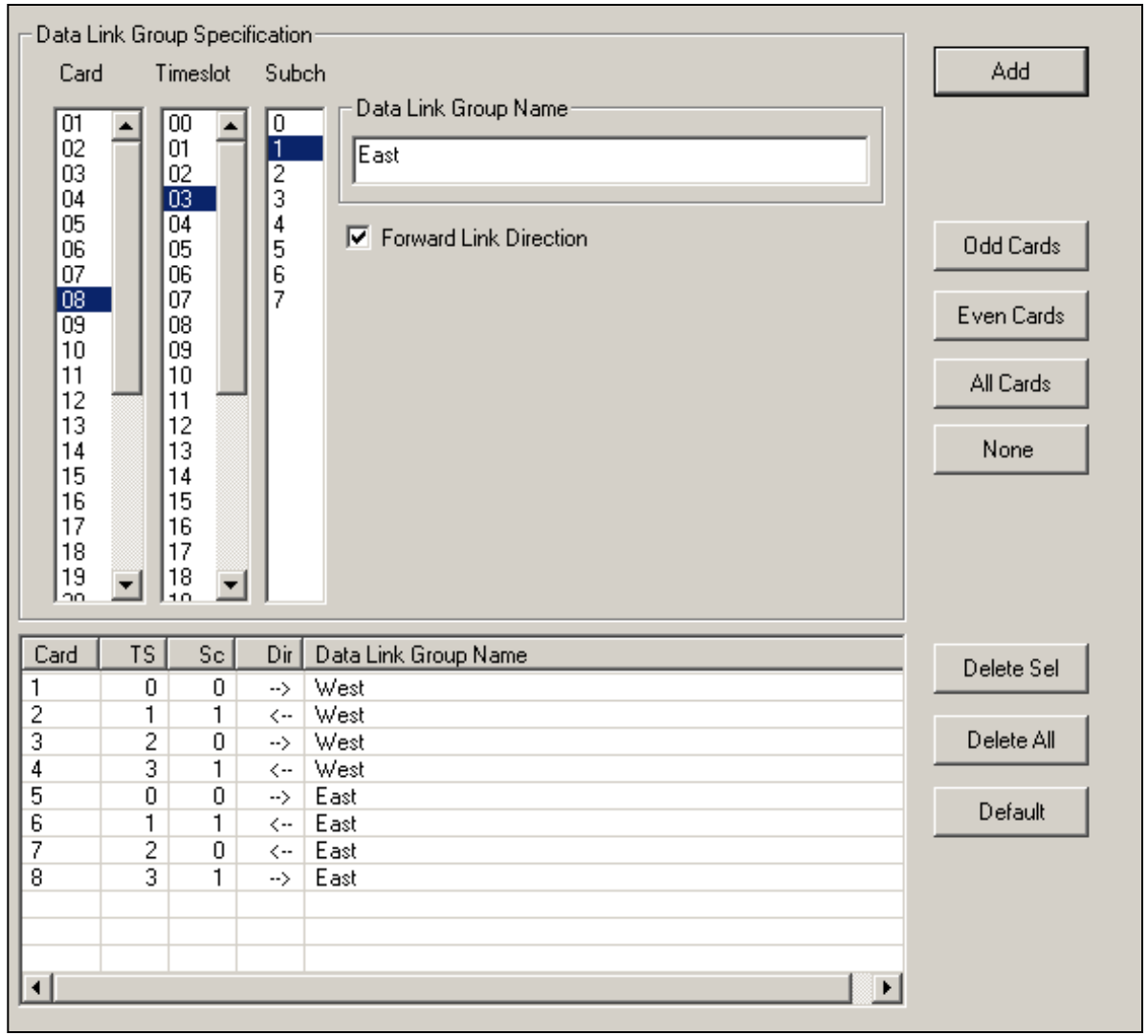
Saving options for the trace files



- Captured trace files can be controlled by saving the trace using different conventions such as –
- Trace files with user-defined prefixes
- Trace file with date-time prefixes
- Slider control to indicate the total number of files, file size, frame count, or time limit

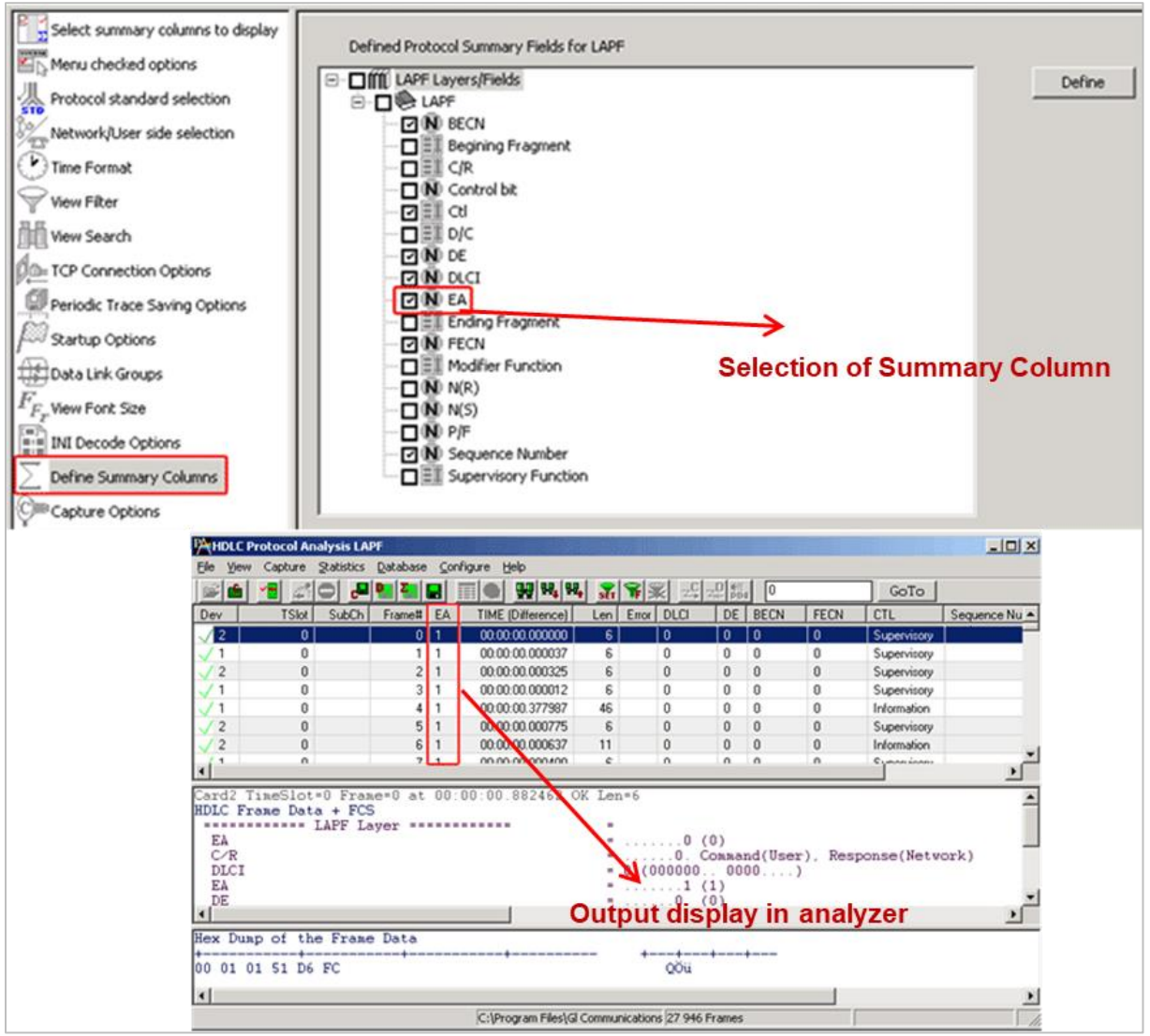
Data Link Group

- Data link groups that help in defining the direction of the calls in each network and form logical groups comprised of unidirectional (either 'Forward' or 'Backward') data links
- Applicable For SS7, ISDN, GSM, GPRS, Frame Relay, GR-303, CDMA A1 Interface, and V5.x Analyzers only



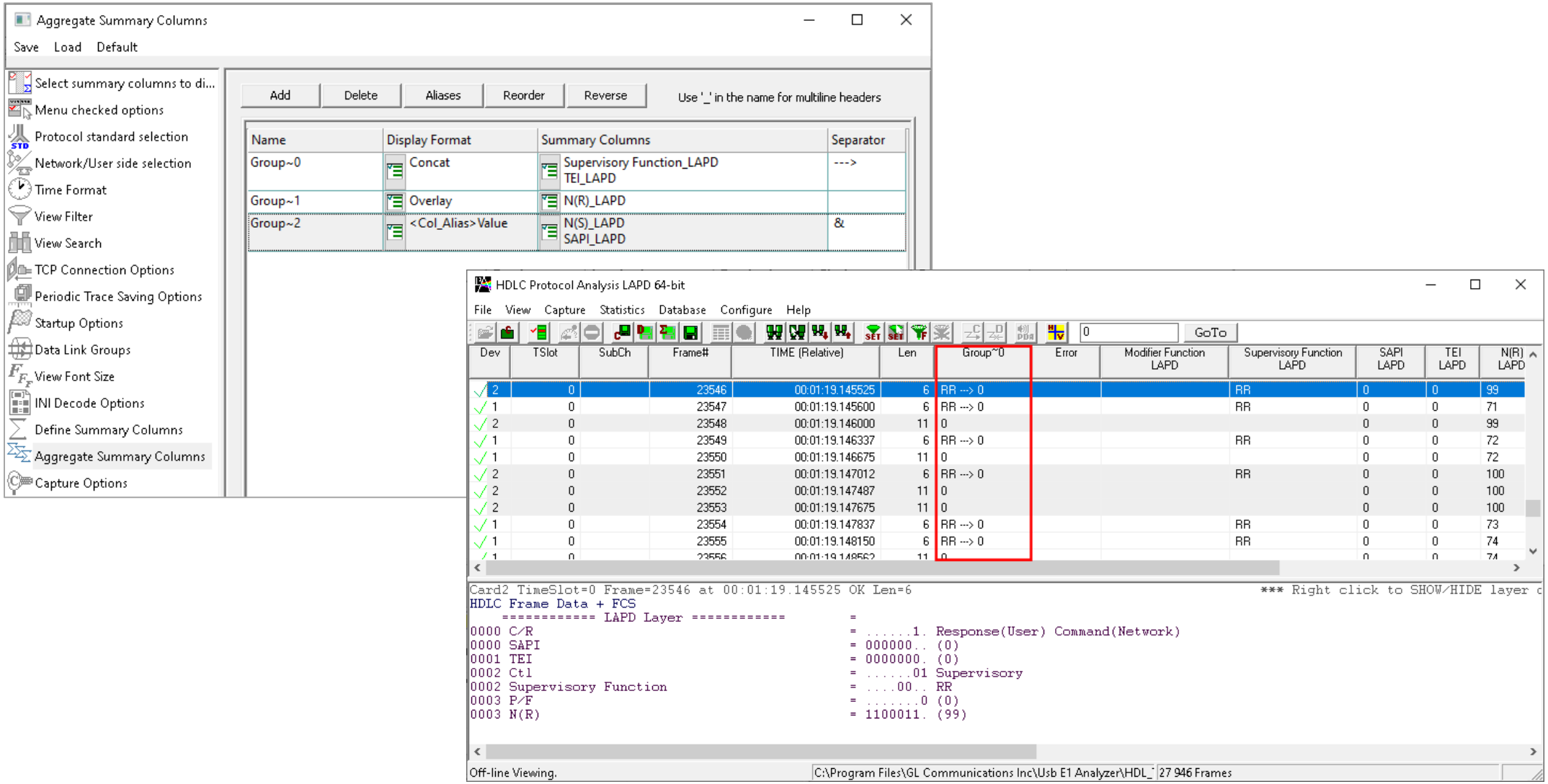
Define Summary Columns

- Required protocol fields can be added through Define summary column option
- User can remove the protocol field which is not required

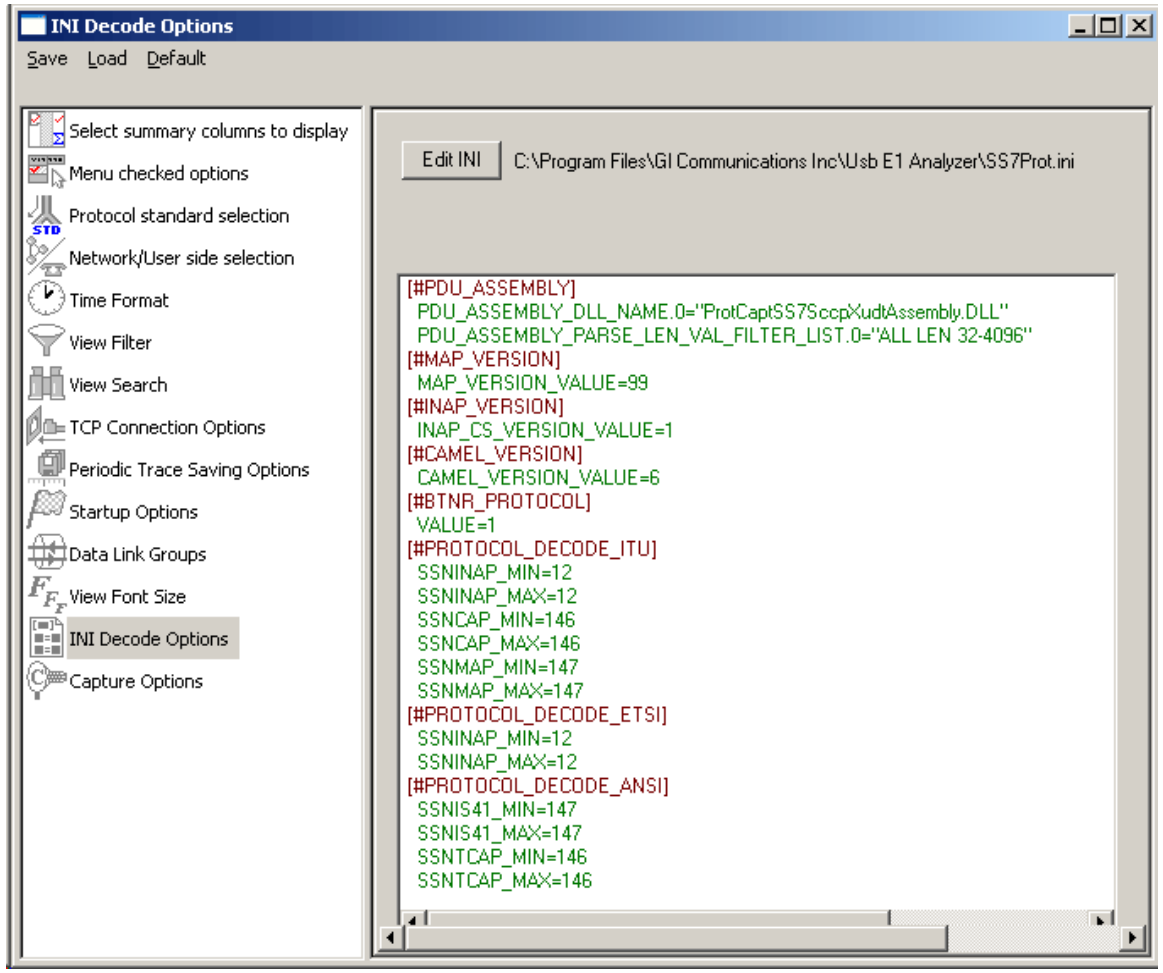


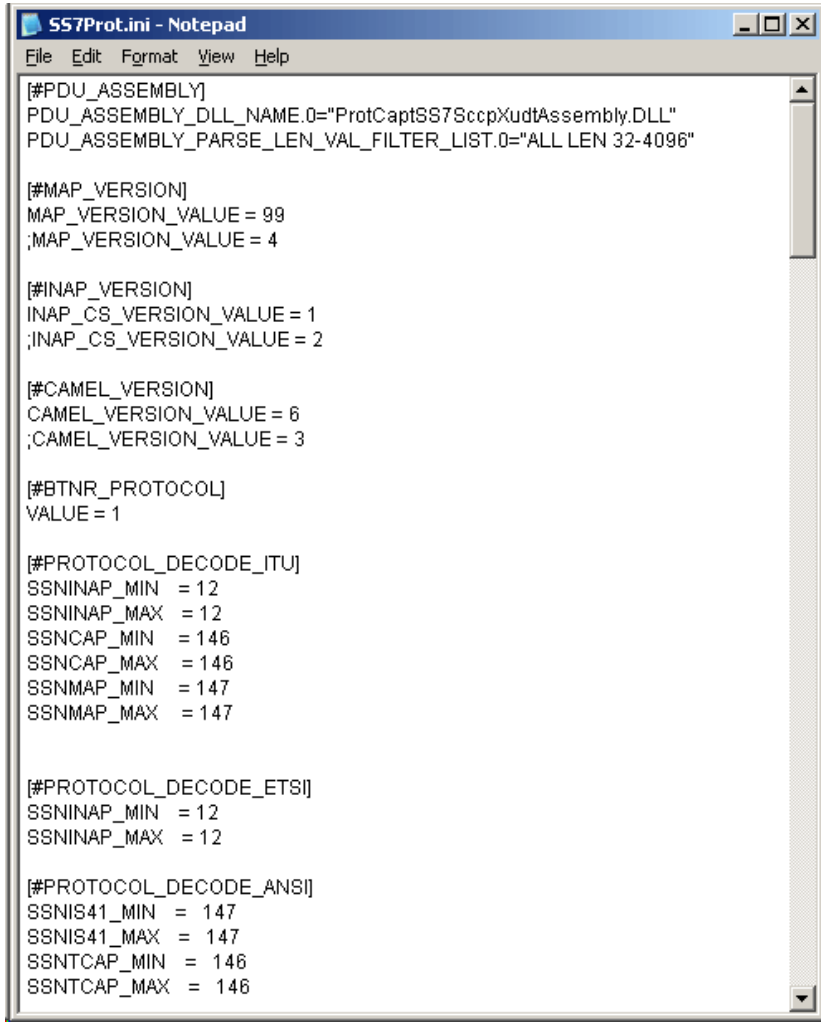
Aggregate Group Column

- The user can create multiple aggregate column groups and prioritize the groups as per the requirement to display the summary results efficiently. The figure shows sample aggregate column group for HDLC Protocol



Configuring INI Decode Options



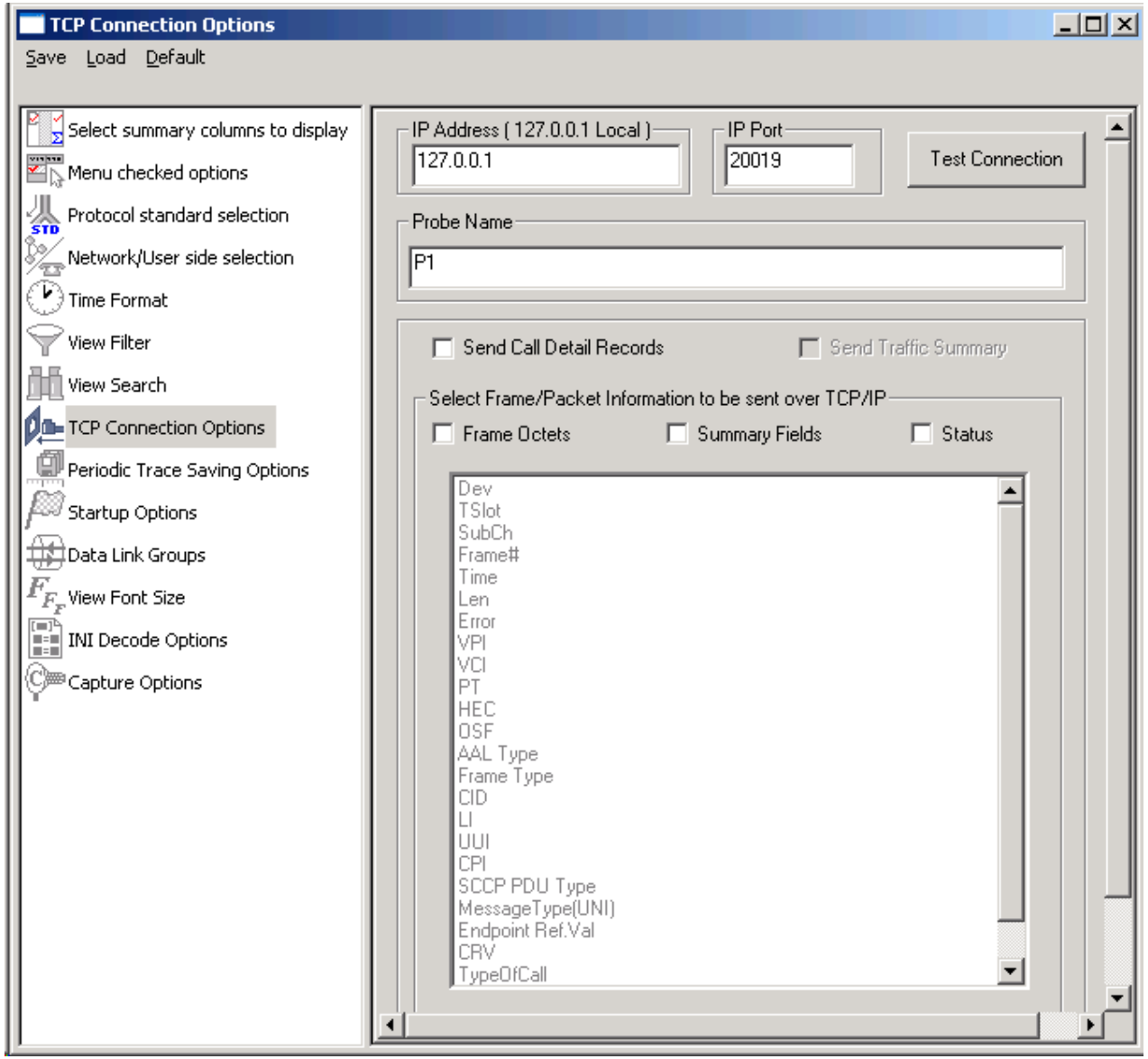


- INI configuration file enables the user to enter the required custom values depending on the protocol, for example, show above is a screenshot SS7 protocol decode customization

GL Communications

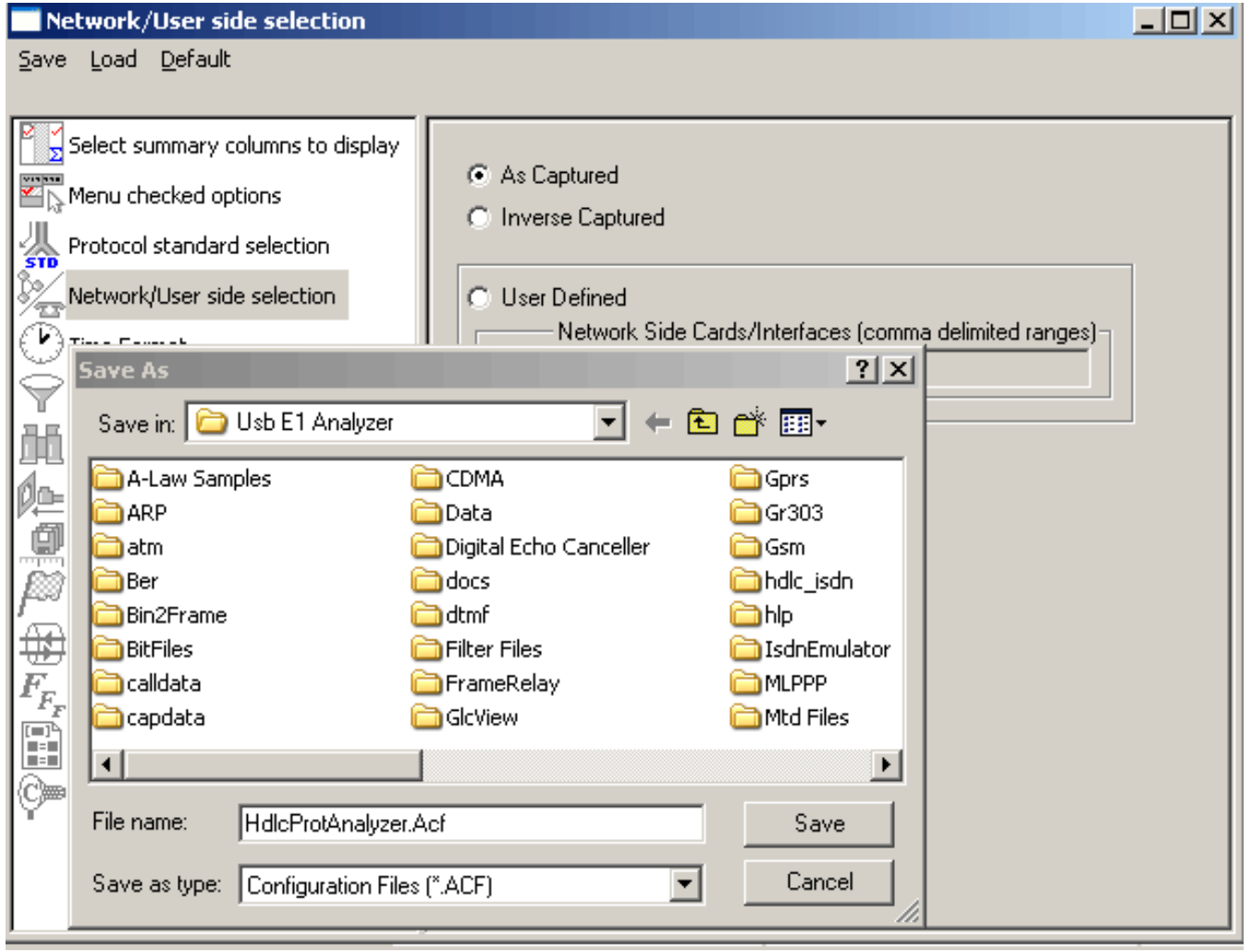
TCP Connection Options

- Used for Network Surveillance and Monitoring
- Designed to send protocol summary information and binary frame data via TCP- IP connection to a Database Loader to load data into a database



Save/Load All Configuration Settings

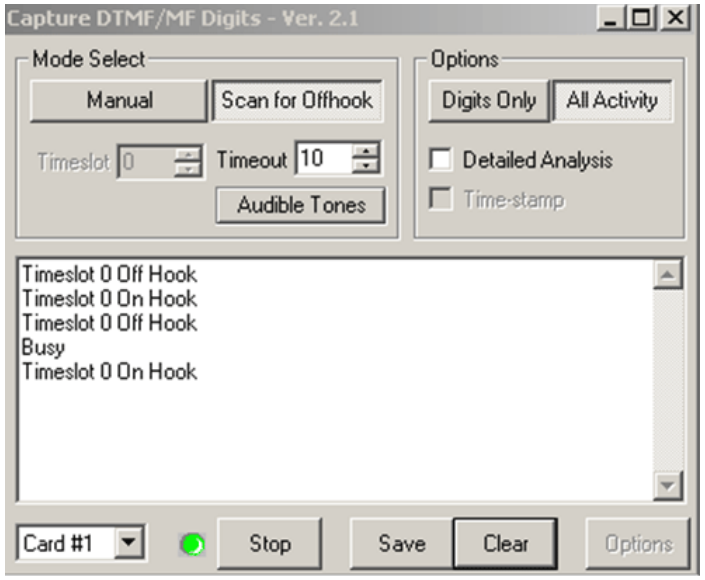
- Provides a consolidated interface for GUI and protocol settings required in the analyzer such as protocol selection, periodic saving options, etc.
- Configuration settings can be saved to a file, loaded from a configuration file, or just revert to the default values using the default option

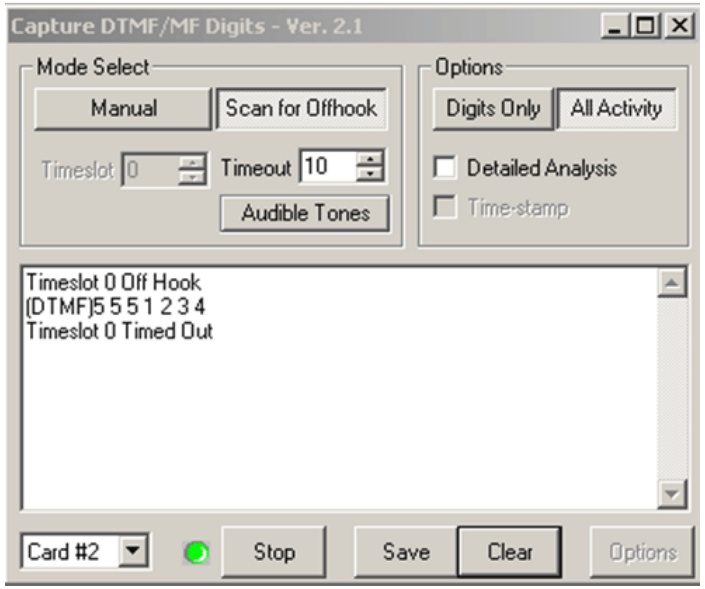


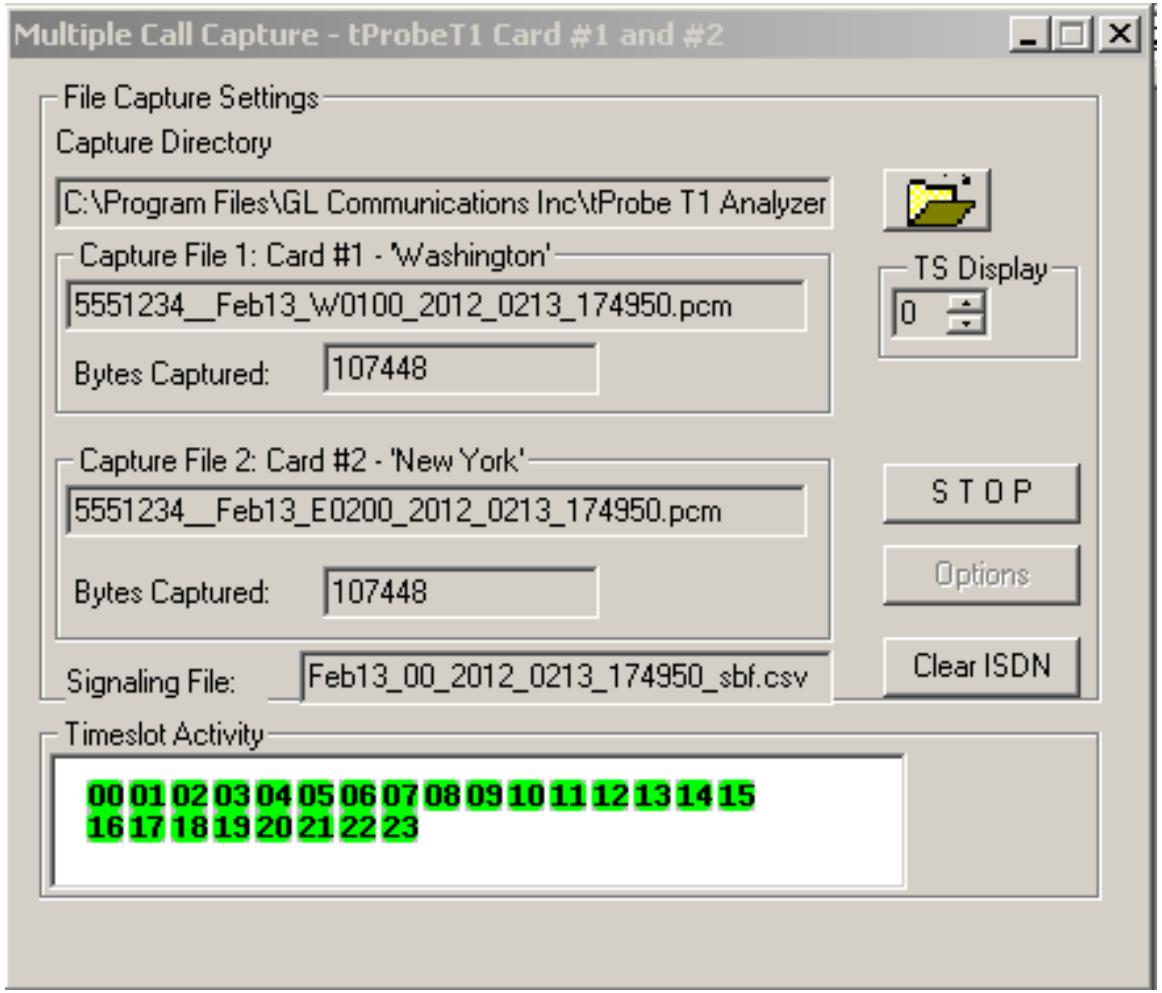
CAS Protocols - Capture and Analysis

- Other Supported Applications for CAS Analysis
- Call Capture & Analysis (CCA) application – Supports signaling, tones, DTMF / MF/ MFC-R2
- DTMF/ MF / MFC-R2 Detector
- Client-Server Based applications - for remote and scripted control of MFC-R2 signaling and digit capture, analysis and other functions such as transmission, and more
- MFC-R2 Digit Analysis (r2ana.exe) - DOS application for analyzing R2 tones and signaling

CAS Protocols - Capture and Analysis

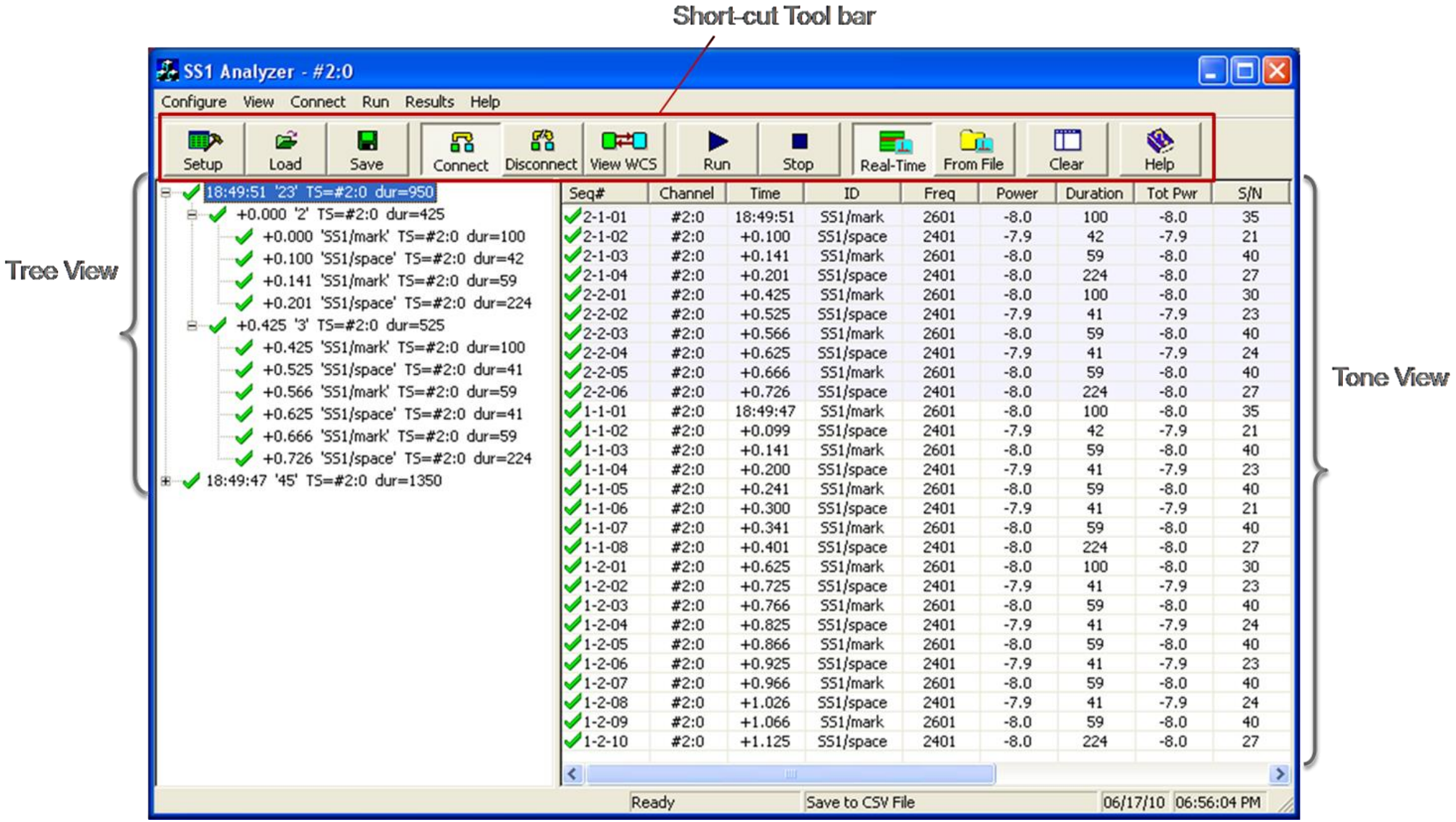






GL Communications

SS1 Analyzer



GL Communications

Key Features

- Analyzer can capture either TDM or audio signals
- Analyzer can analyze either 2-digit or 3-digit dial codes
- Analyzer displays received dial codes, including the characteristics of the underlying tones
- Save analyzer results to Microsoft® Access and Microsoft® Excel file formats
- Operate the SS1 Analyzer either remotely from the data acquisition site, or on the local PC

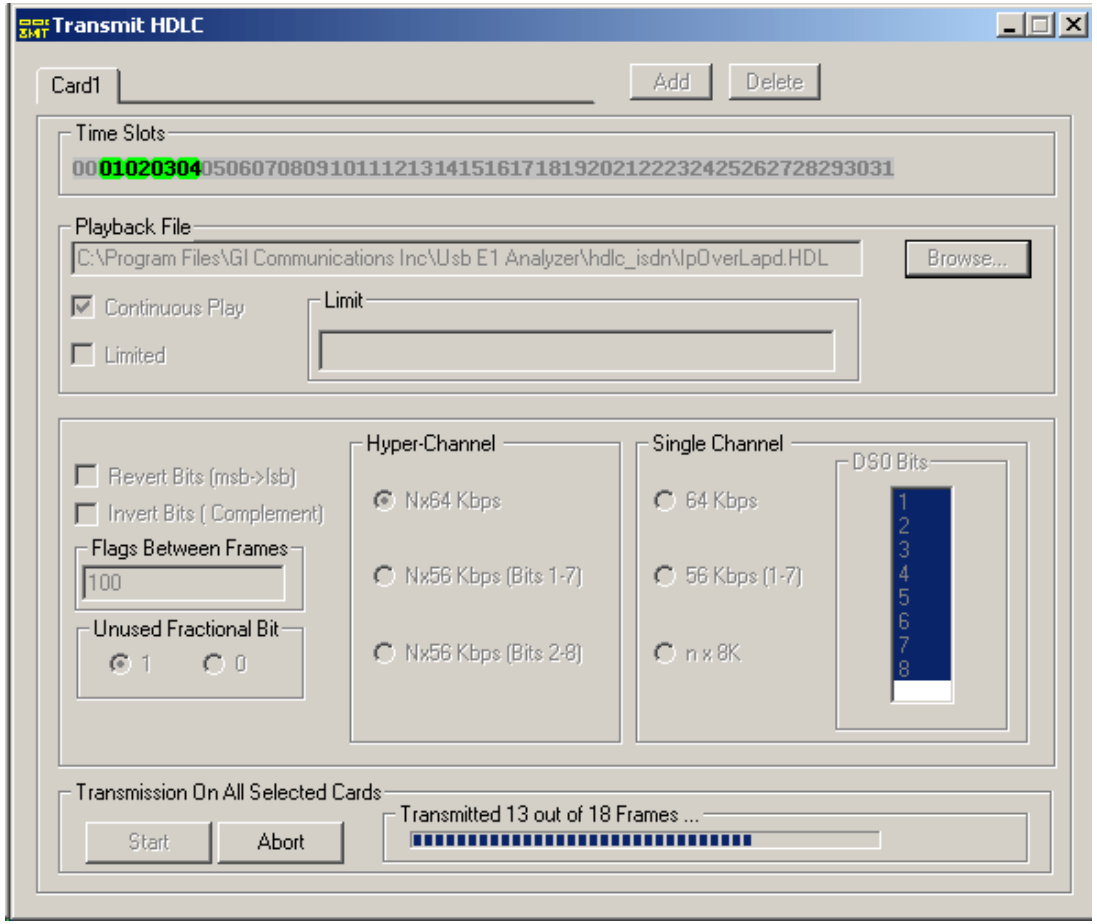
Protocol Simulation

Supported Protocols

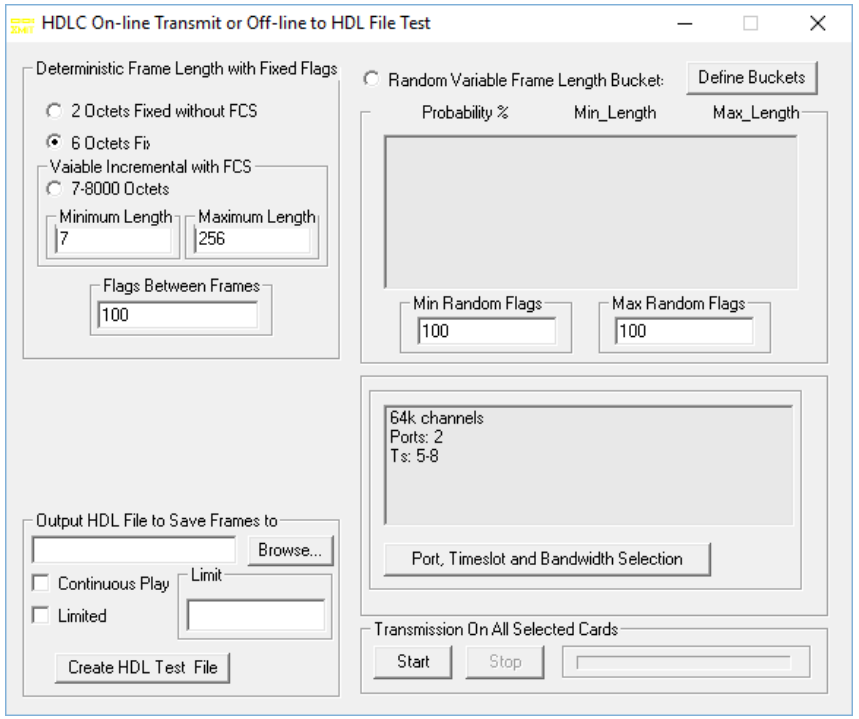
- ATM with Inverse Multiplexing
- Multilink Frame Relay
- Multilink PPP
- HDLC
- SS7 (ISUP, INAP, MAP, CAP, IUP)
- ISDN, LAPD
- GSM
- TRAU
- CAS
- SS1
- E1 Maintenance Data Link Playback
- T1 Facility Data Link Playback

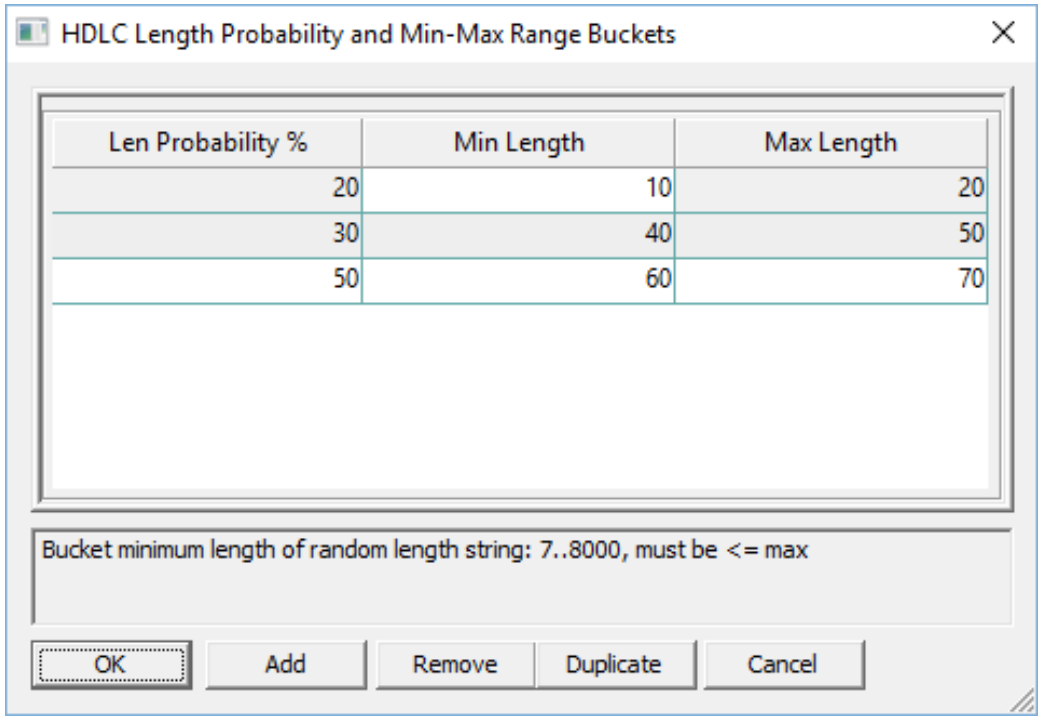
HDLC Playback

- Transmits HDLC frames in the pre-recorded files over T1/E1 channels
- Provides the option to reverse or inverse bits in the selected data during transmission
- Frames can be transmitted on selected time slots (contiguous or non-contiguous), sub-channels or full bandwidth



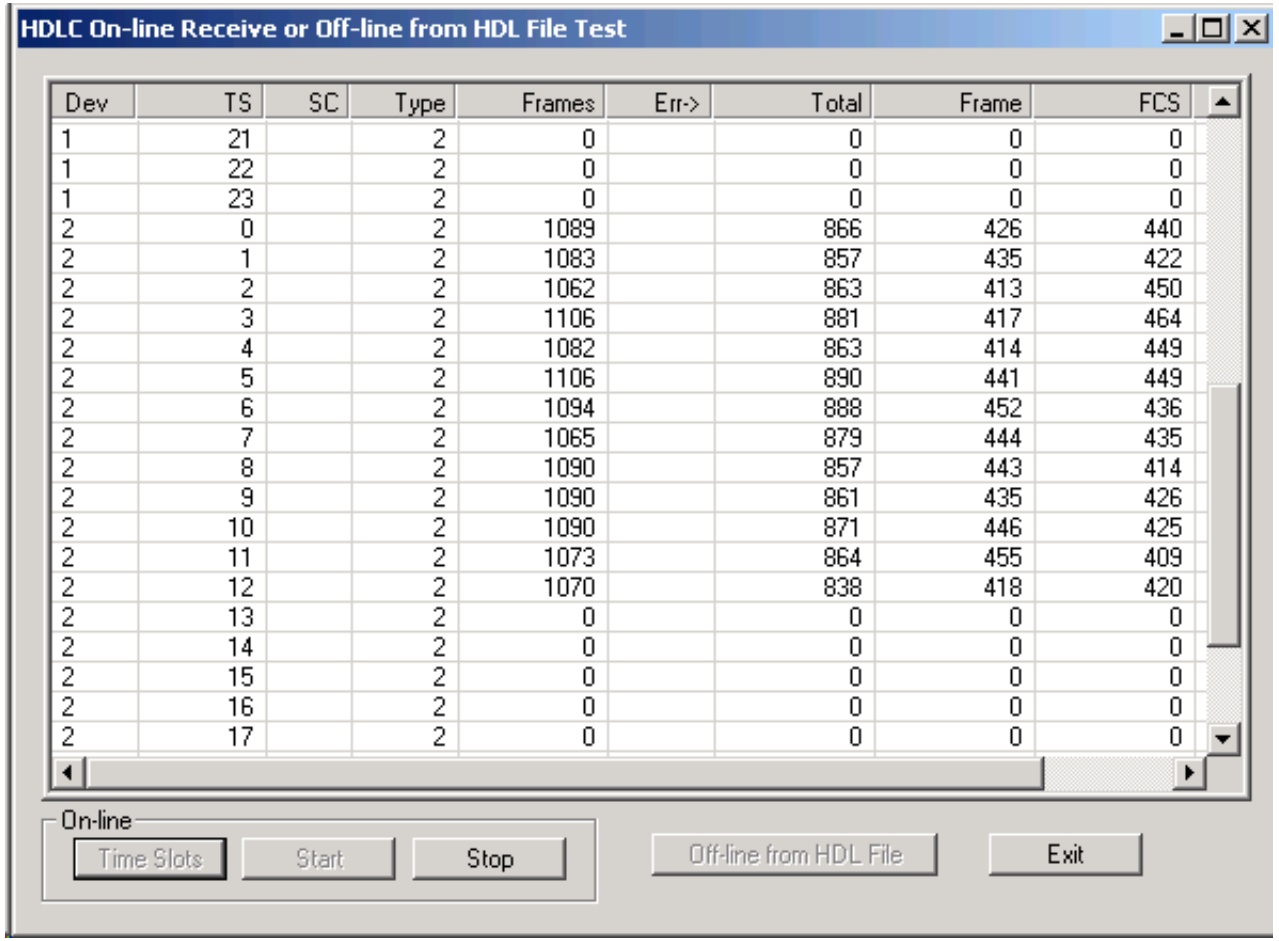
HDLC Tx Test





- Generates HDLC test frames, and transmits them over T1/E1 or records them to an HDLC file for subsequent use with other applications
- Provides options to define random frame length value with a probability of 100
- The probability can be defined in terms of percentage (100%)
- Different types of frame length values can be defined by distributing the Probability (100%)

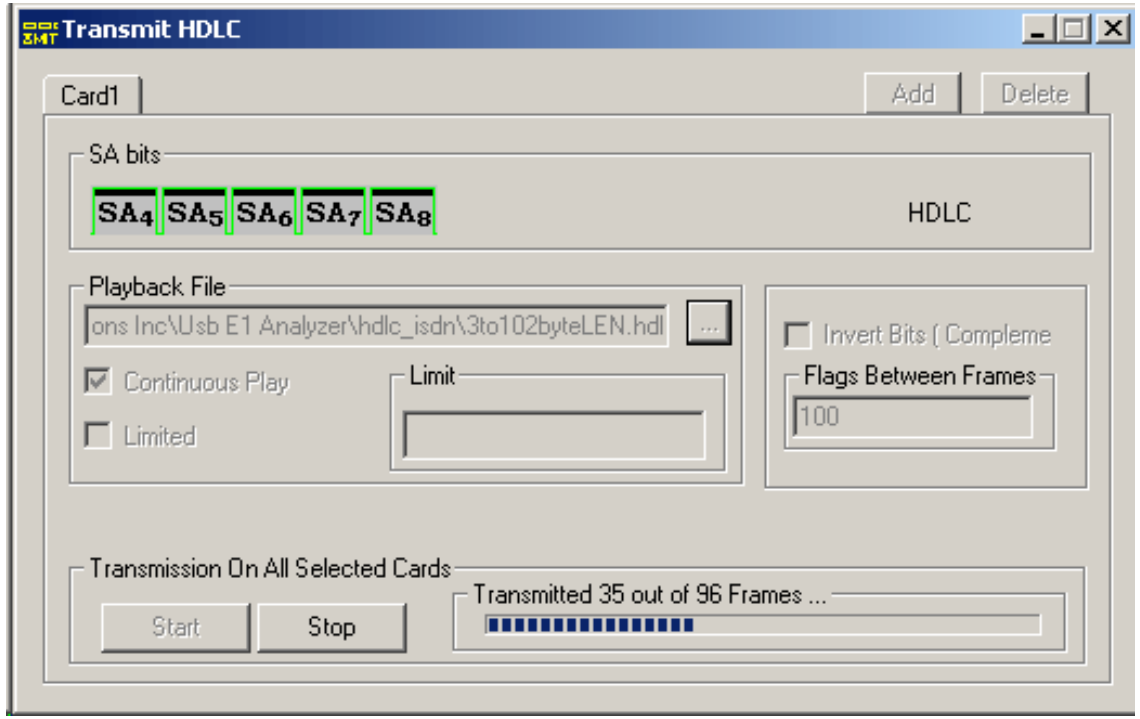
HDLC Rx Test

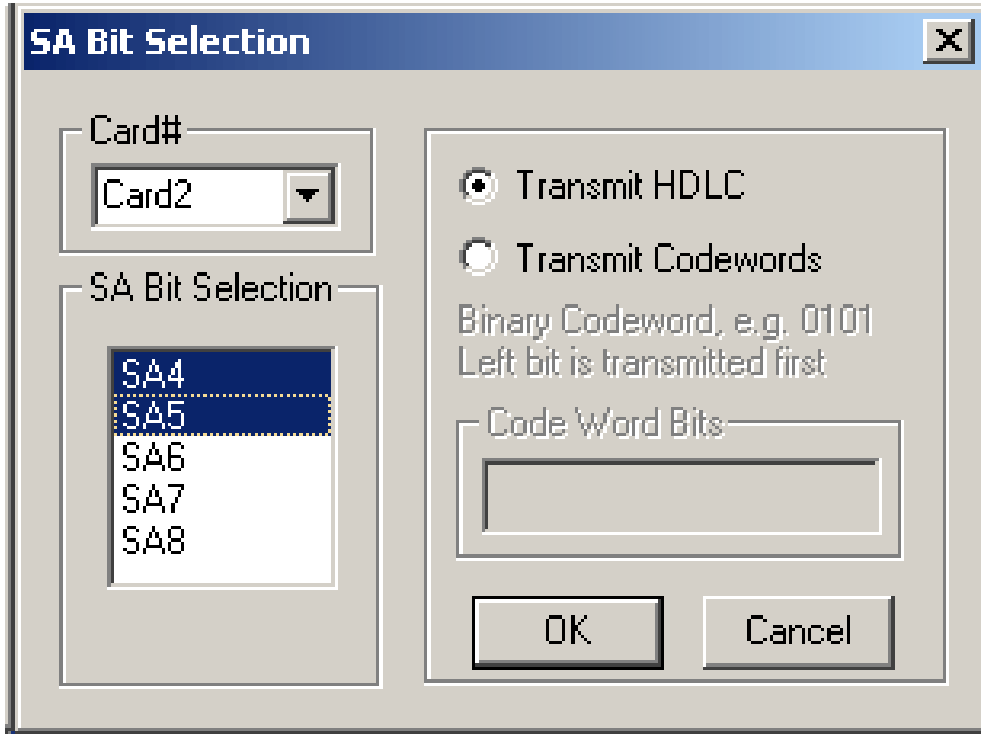


Dev	TS	SC	Type	Frames	Err->	Total	Frame	FCS
1	21		2	0		0	0	0
1	22		2	0		0	0	0
1	23		2	0		0	0	0
2	0		2	1089		866	426	440
2	1		2	1083		857	435	422
2	2		2	1062		863	413	450
2	3		2	1106		881	417	464
2	4		2	1082		863	414	449
2	5		2	1106		890	441	449
2	6		2	1094		888	452	436
2	7		2	1065		879	444	435
2	8		2	1090		857	443	414
2	9		2	1090		861	435	426
2	10		2	1090		871	446	425
2	11		2	1073		864	455	409
2	12		2	1070		838	418	420
2	13		2	0		0	0	0
2	14		2	0		0	0	0
2	15		2	0		0	0	0
2	16		2	0		0	0	0
2	17		2	0		0	0	0

- Receive frames in real-time over T1/E1 or can verify an off-line HDL file for correct frame order and data integrity

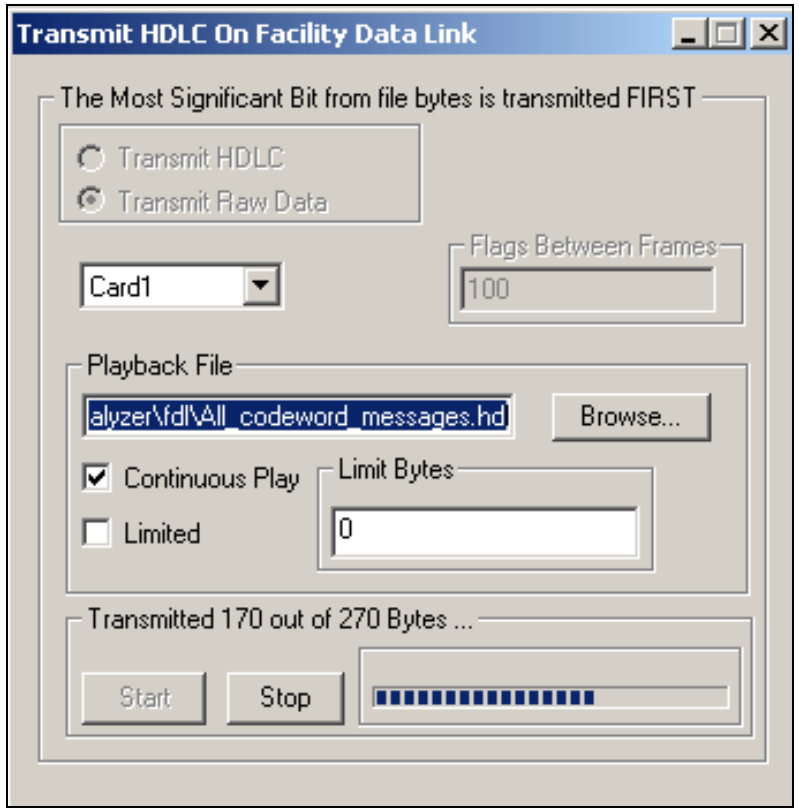
E1 Maintenance Data Link Playback (Sa Bits HDLC)





- Capability to transmit HDLC and/or codewords on E1 line(s)
- Codewords can be specified via user interface
- Continuous transmission or limited transmission for a specified number of bytes
- Provides an option to enable bits inversion and to specify Flags between frames

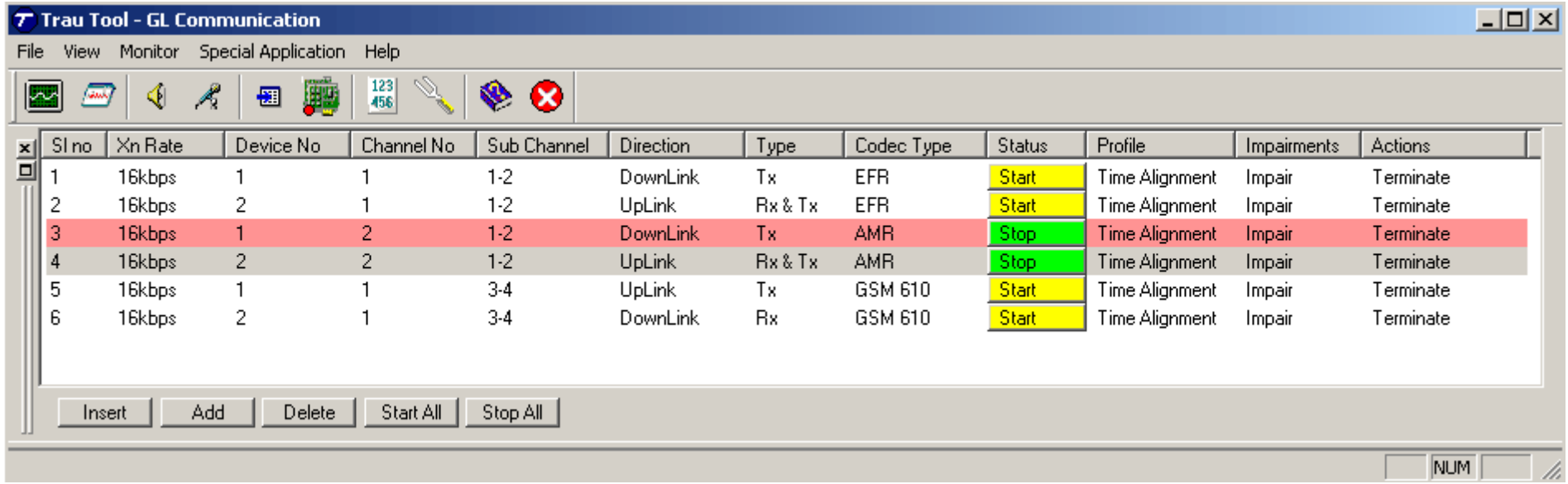
T1 Facility Data Link (FDL) Playback



- Capability to transmit valid HDLC frames or the raw data from a file of raw (hex) bytes (codeword strings, etc.) directly into the FDL bit stream
- Number of flags between frames may be specified for HDLC transmission
- Continuous transmission or limited transmission for a specified number of bytes

GL Communications

TRAU ToolBox™

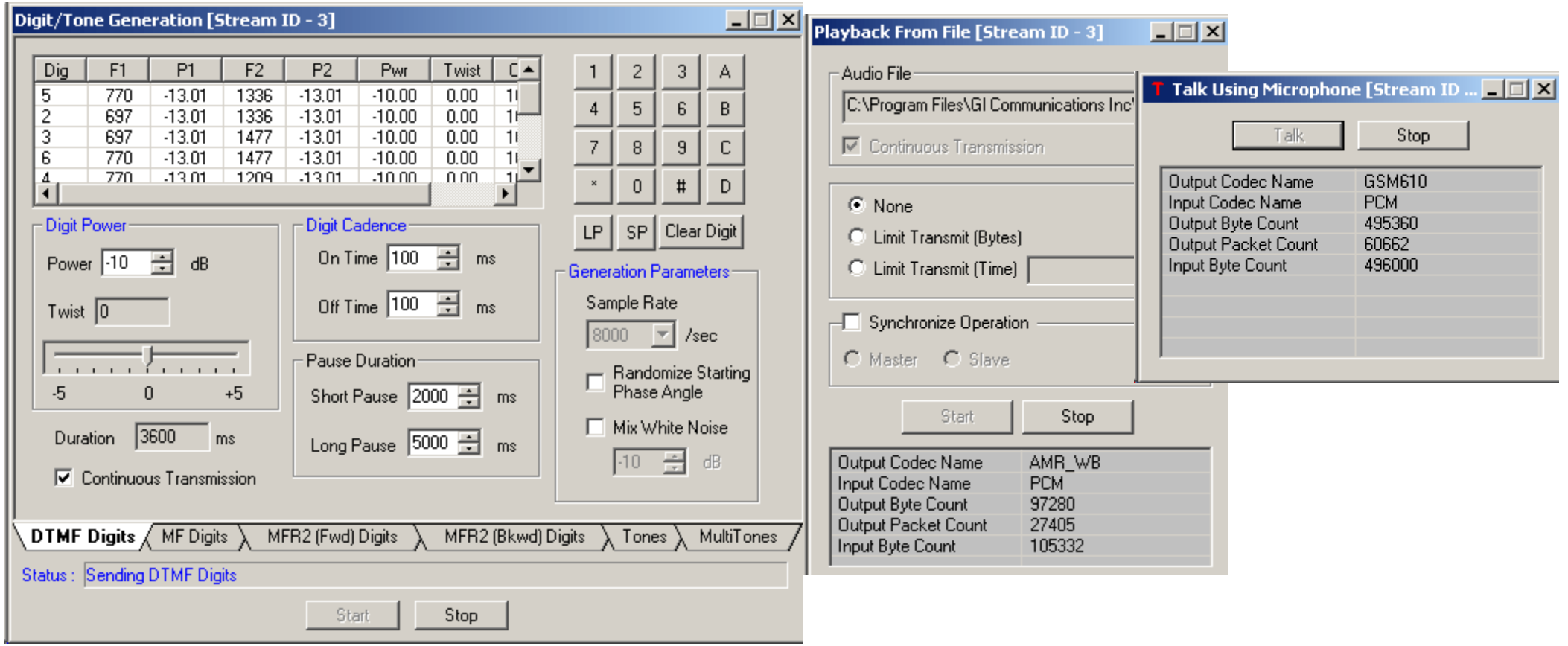


- Supports multiple sessions of Uplink or downlink in 8/16 Kbps
- Supports all speech codec for verification of correct voice transmission which includes

  GSM codecs such as 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 the Data codec which includes Data,

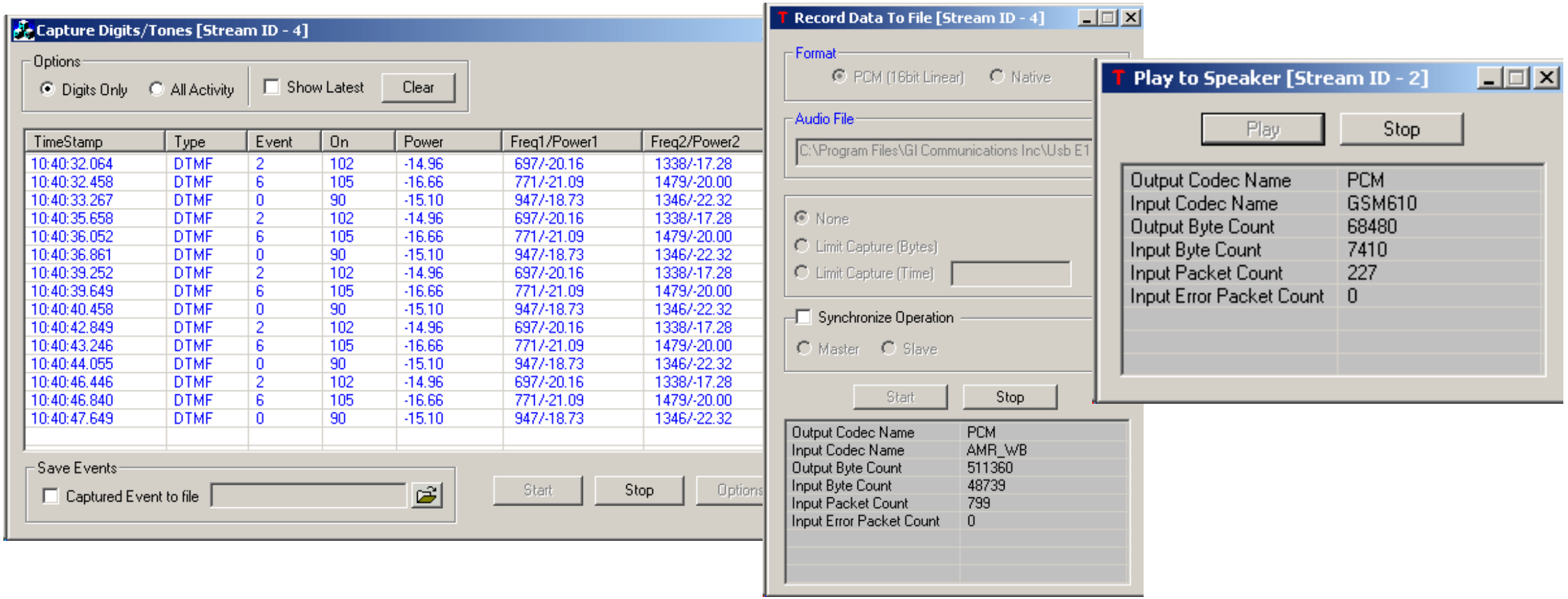
  Data 14.5kbps Sync, and Data 14.5kbps (Extended Data)
- Include the ability to monitor TRAU stream contents using an oscilloscope and spectrum analyzer

TRAU Traffic Generation



- Sends tones or digits (DTMF / MF / MFR2 (Fwd/Bkwd)) on established sessions
- Playback From File application supports voice files such as *.wav and *.pcm files
- Real-time voice is generated with the default audio device (microphone)

TRAU Traffic Detection

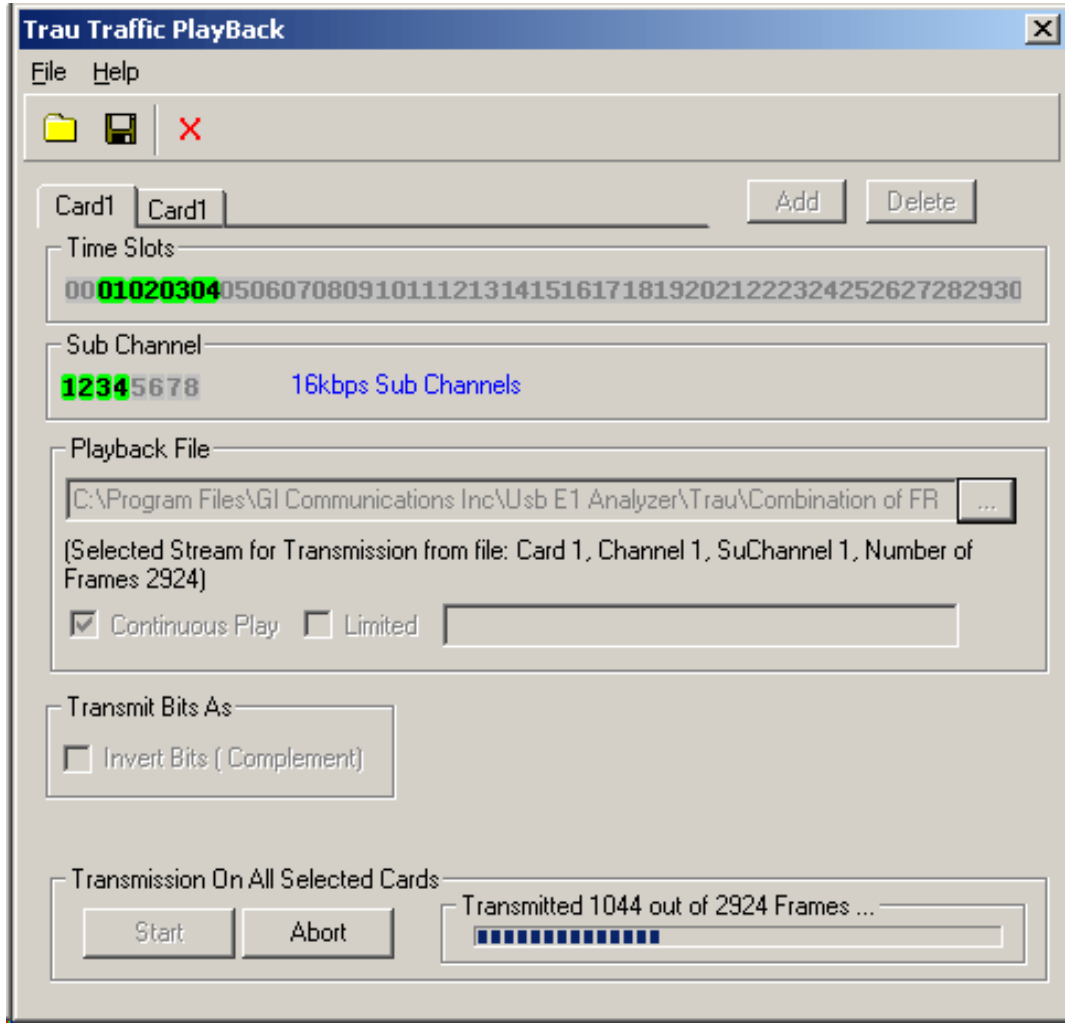


- Capture Digits/Tones application detects digits / tones, and view all activities during capture
- Record data to file application can record the incoming data on a session to a file (*.pcm)
- Play to Speaker application supports playing of incoming voice directly to the system's speaker

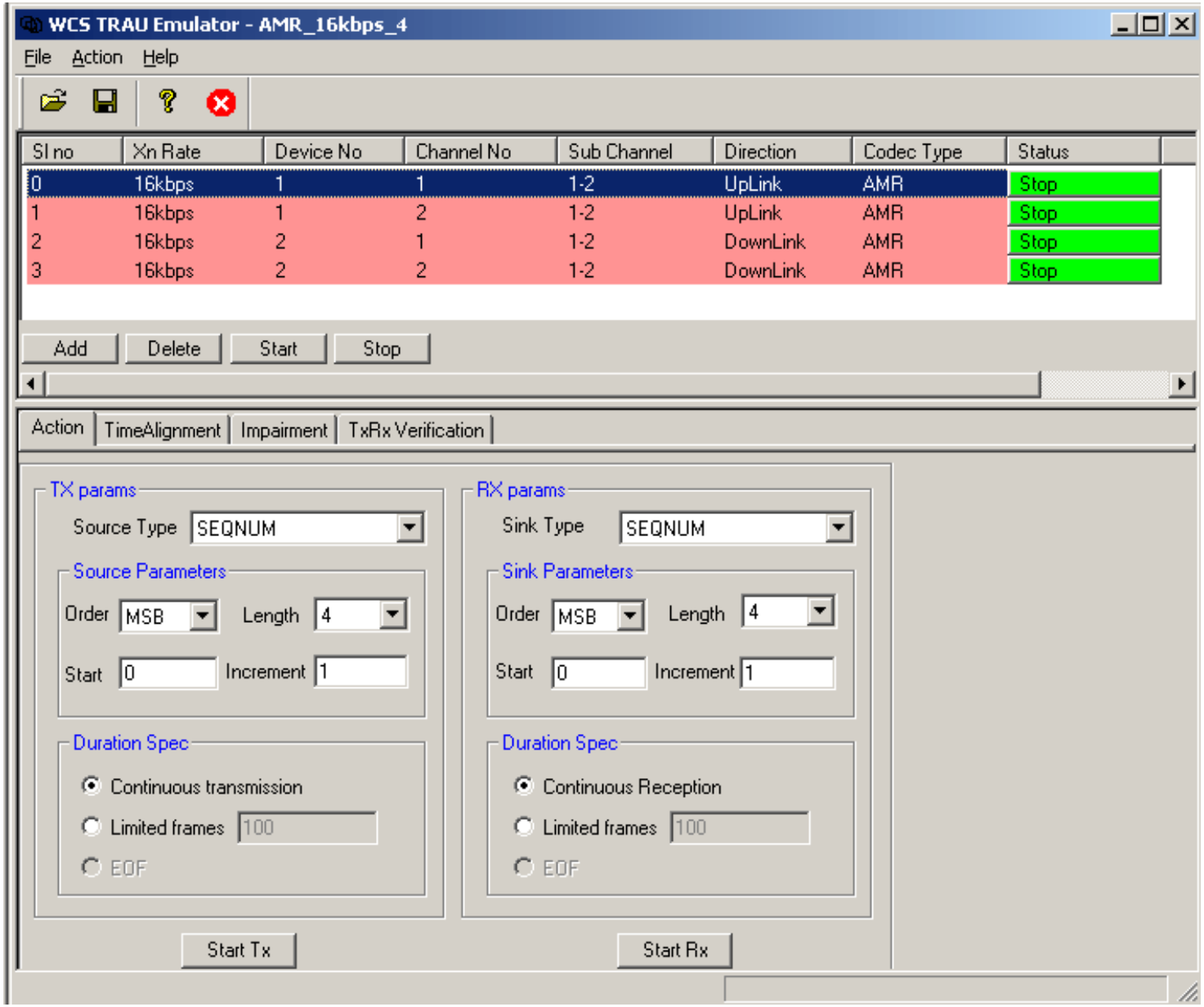
GL Communications

TRAU Traffic Playback

- Recorded trace files can be transmitted on specific channels/sub-channels
- Data transmission rates supported includes 16kbps and 8 kbps
- Other options include - Bit Inversion, Continuous transmission, Limited transmission



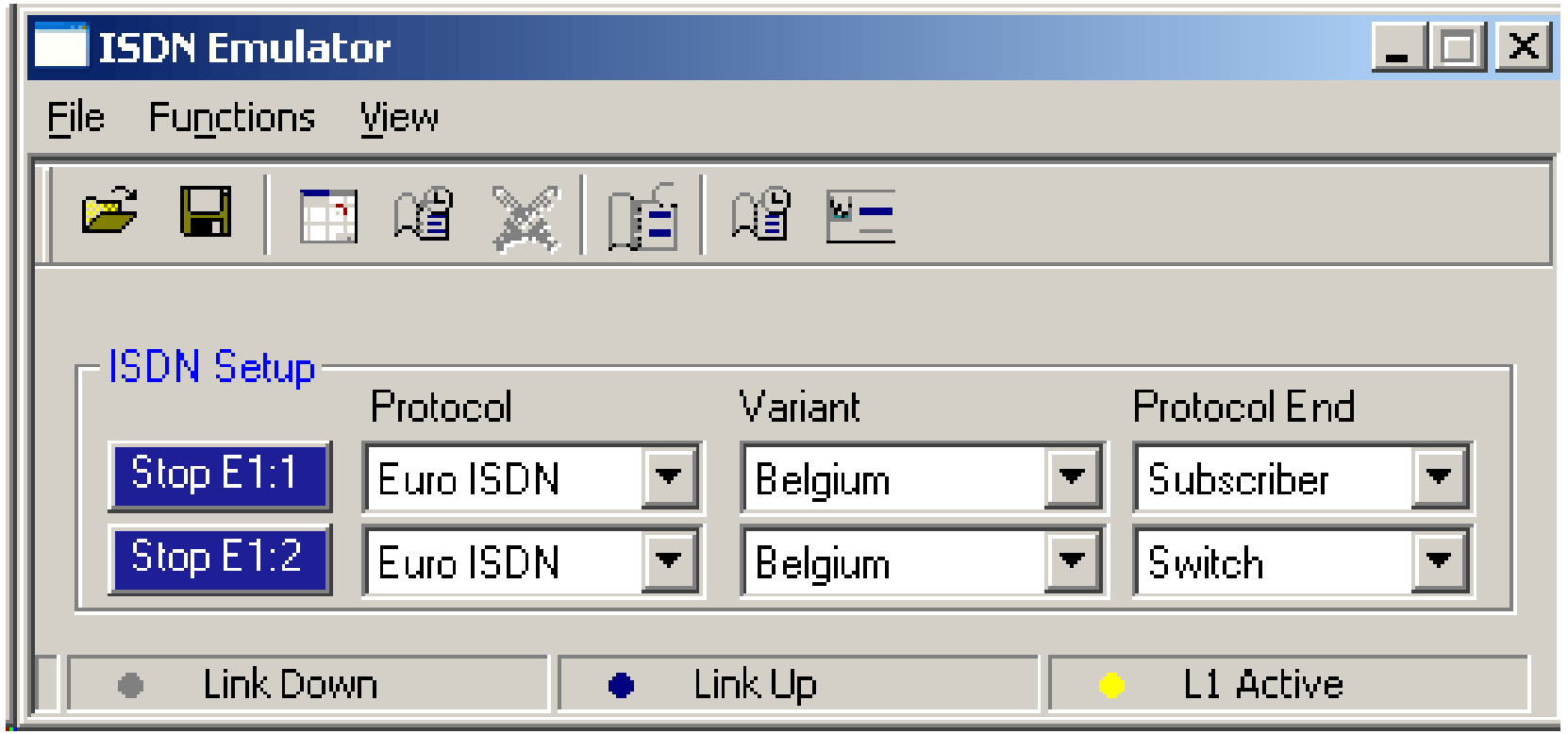
TRAU Tx/Rx Test



Features

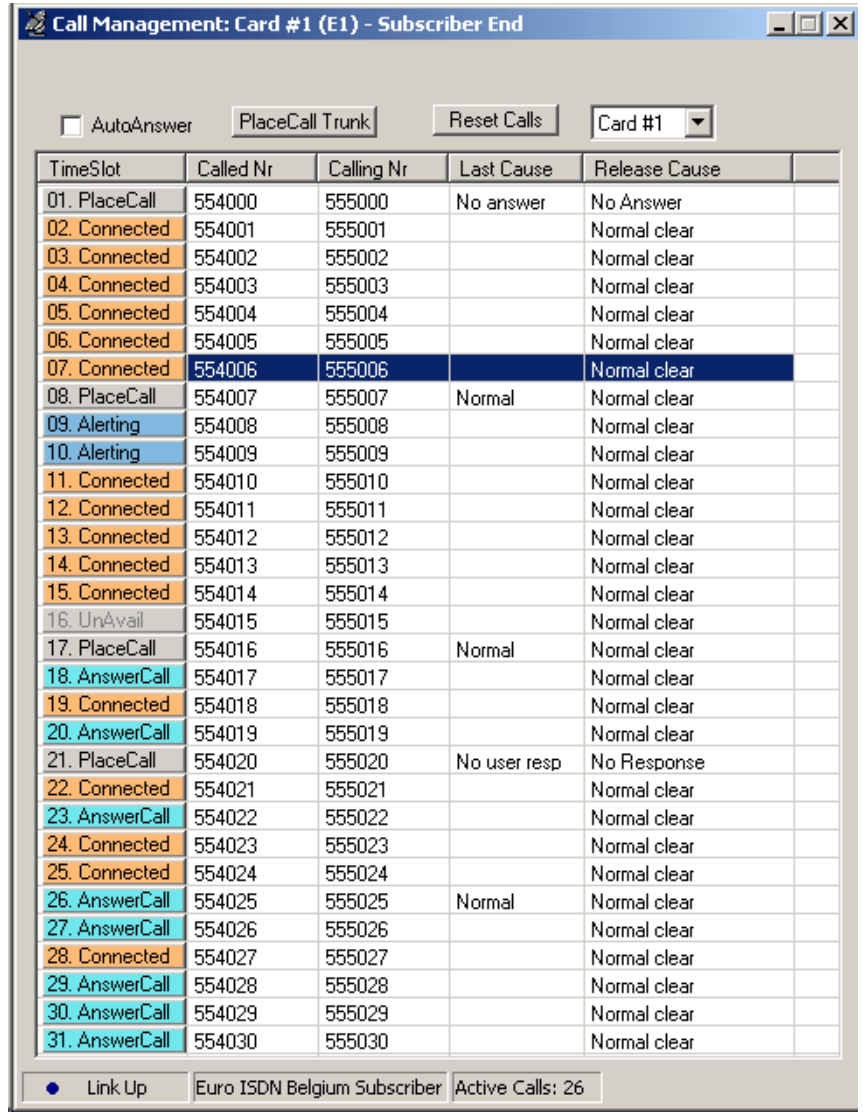
- Simulates TRAU traffic over Abis and A interfaces
- Can be used to test the backhaul network
- Time Alignment can be applied in the TRAU frames
- Payload traffic generation and verification
- Supports various impairments - CRC error, frame duplication, and more
- Provides detailed test (Tx/Rx) results for each TRAU link
- Ideal solution for automated testing using command line scripts

ISDN Emulator



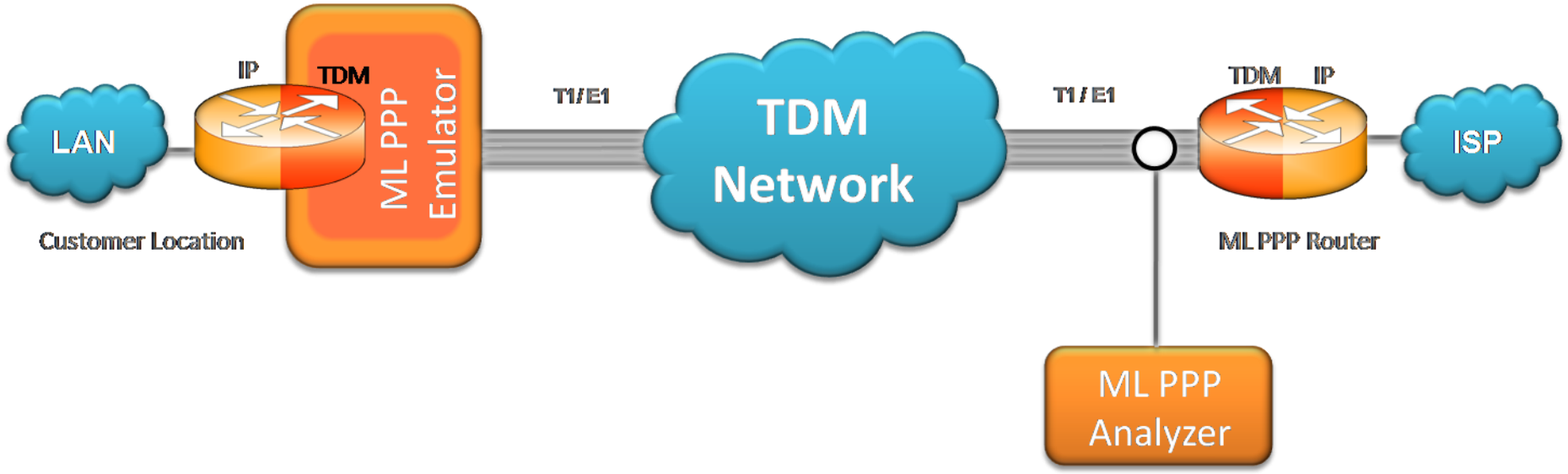
- Complete solution for testing, troubleshooting, installation and maintenance of devices and networks implementing PRI ISDN
- ISDN configuration includes selection of various ISDN standards, variants and NFAS, and more
- Send/capture PCM voice files, send/detect DTMF/MF digits, and send/detect frequency tones over an established calls

GL Communications



- Call Management screen allows the user to place calls on a single or on all timeslots manually

MC-MLPPP Emulator



- GUI based WCS client, which simulates MC-MLPPP and PPP protocols over T1/E1 links
- Capable of generating and receiving MC-MLPPP/PPP traffic (with or without impairments)
- Traffic source can be sequence number, HDL files (containing packets/frames), flat binary file, user-defined frames (ASCII HEX file), and Ethernet data

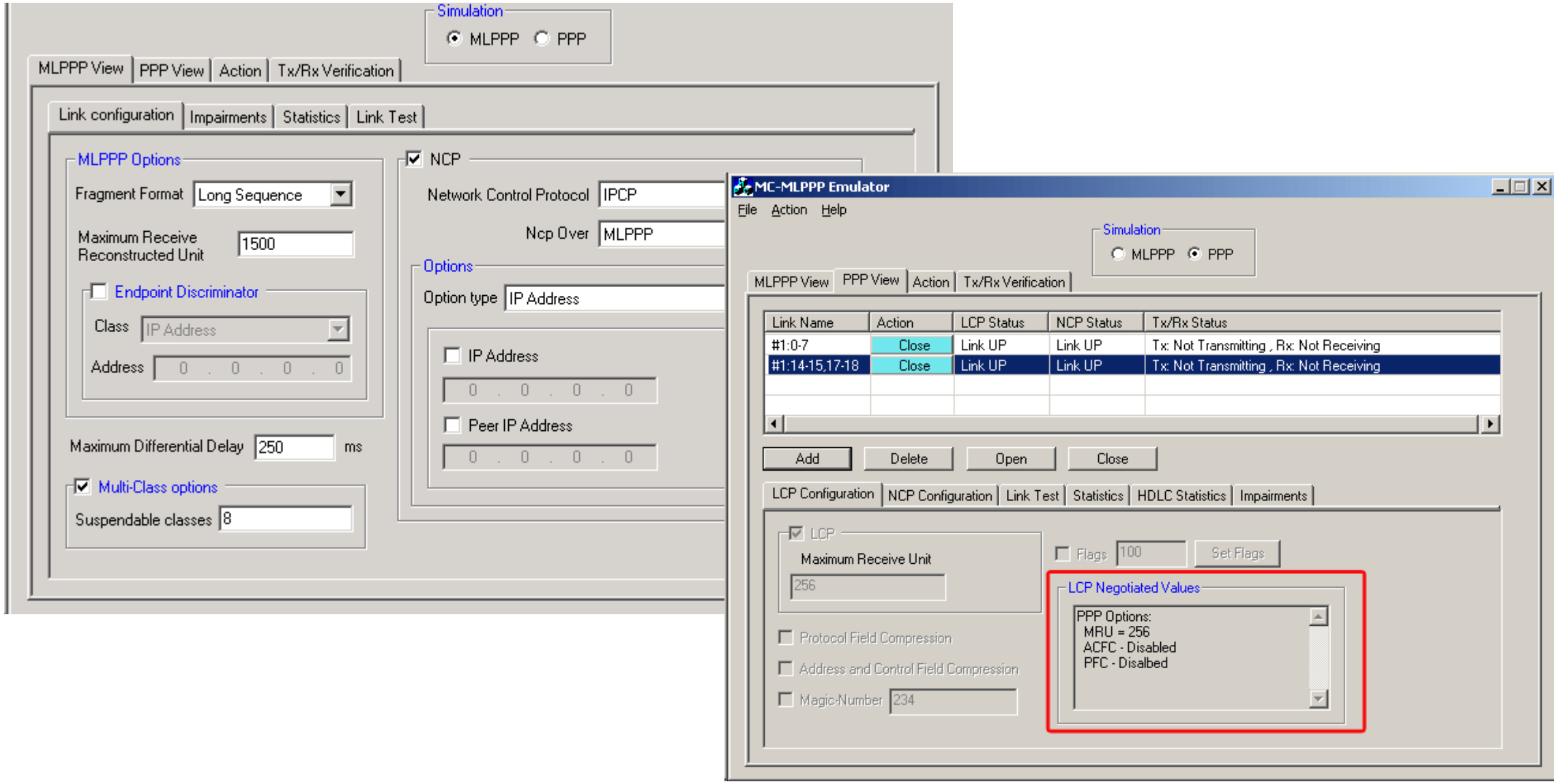
Features

- Performs MC-MLPPP as well as PPP simulation
- Supports LCP with the following negotiation options
  - PPP options: MRU, ACFC, PFC, and Magic Number
  - MLPPP Options: MRRU, Short/ Long Sequence Fragment Format, & Endpoint Discrimination
  - Multi-Class Options: Multilink Header Format
- Supports following NCP's:
  - IPCP - RFC 1332 and RFC 1877 standards
  - BCP - RFC 3518 standard
  - PPPMuxCP - RFC 3153 PPP Multiplexing
- Supports LCP Echo Test at PPP and MLPPP level
- Payload traffic generation and verification (Sequence number, HDL file (containing packets/frames), Flat Binary file, Ethernet traffic, and User defined frames (ASCII HEX file))
- Transmit and receive Ethernet traffic over T1E1 links in bridge or router mode

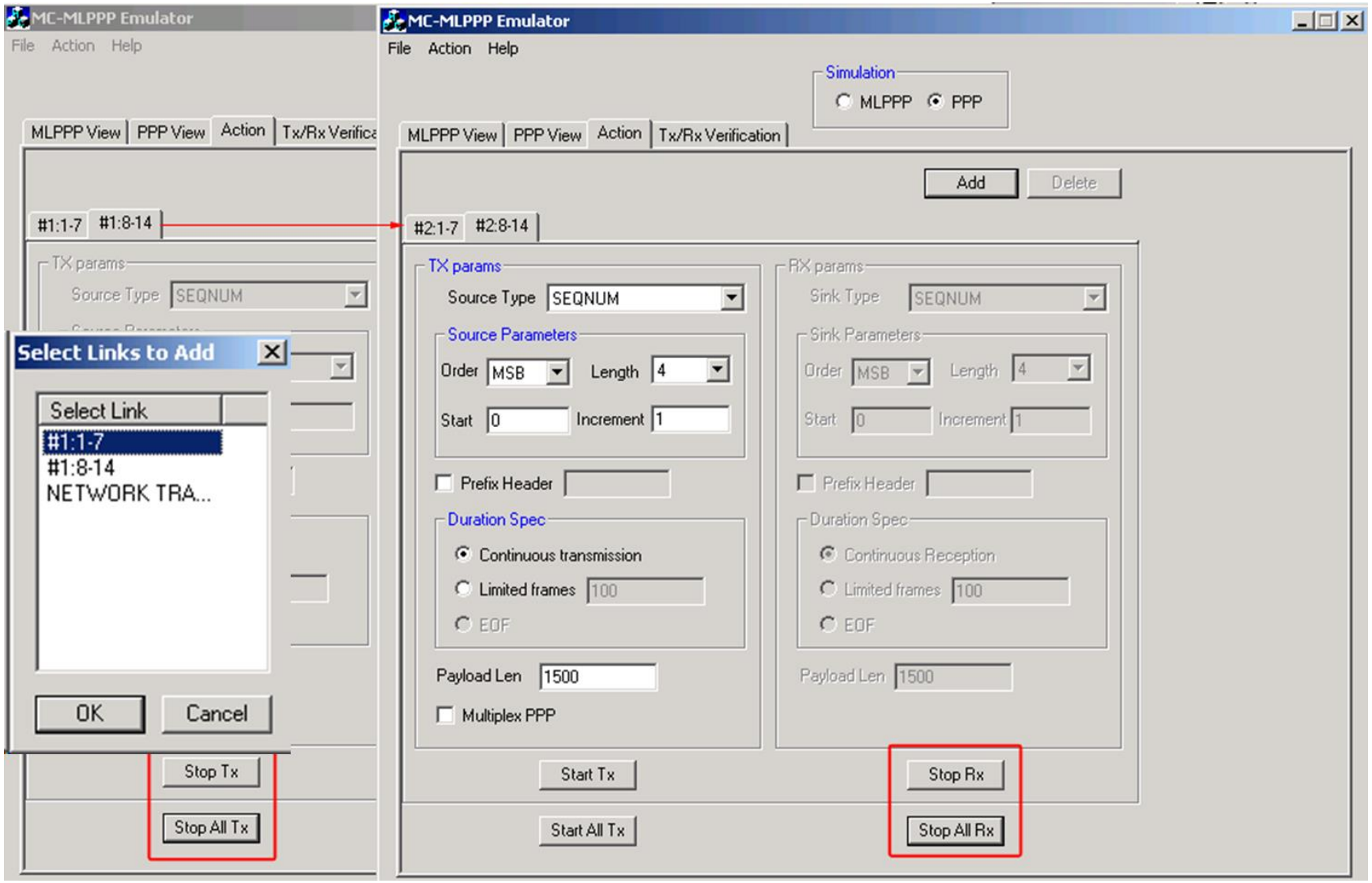
Features

- Differential link delay insertion between PPP links during transmission
  - User configurable bandwidth using flags
- Supports fragmentation and reassembly at MLPPP level
- Supports various impairments at PPP link layer and MLPPP Layer
- Provides detailed PPP and MLPPP statistics
- Provides detailed test (Tx/Rx) results per class / per link in GUI as well as through log file in command line
- Ideal solution for automated testing using command line scripts
- Support for HDLC framing with CRC16, CRC32 or without CRC
- Supports IP compression
  - RFC 3544 - IP Header Compression over PPP
  - RFC 1144 - Van Jacobson TCP/IP Compression
  - RFC 2507 - IP Header Compression
  - RFC 2508 - Compressed RTP

MLPPP Simulation and PPP Simulation

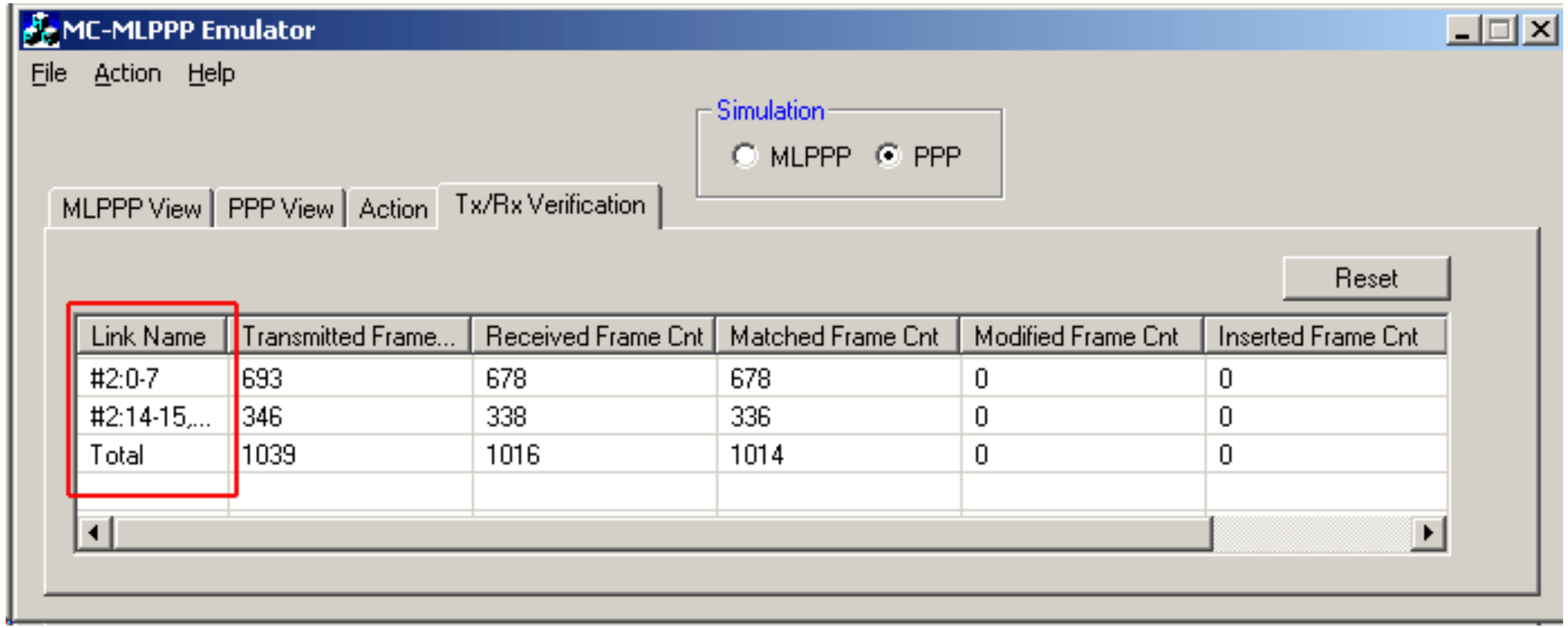


Transmission and Reception Action



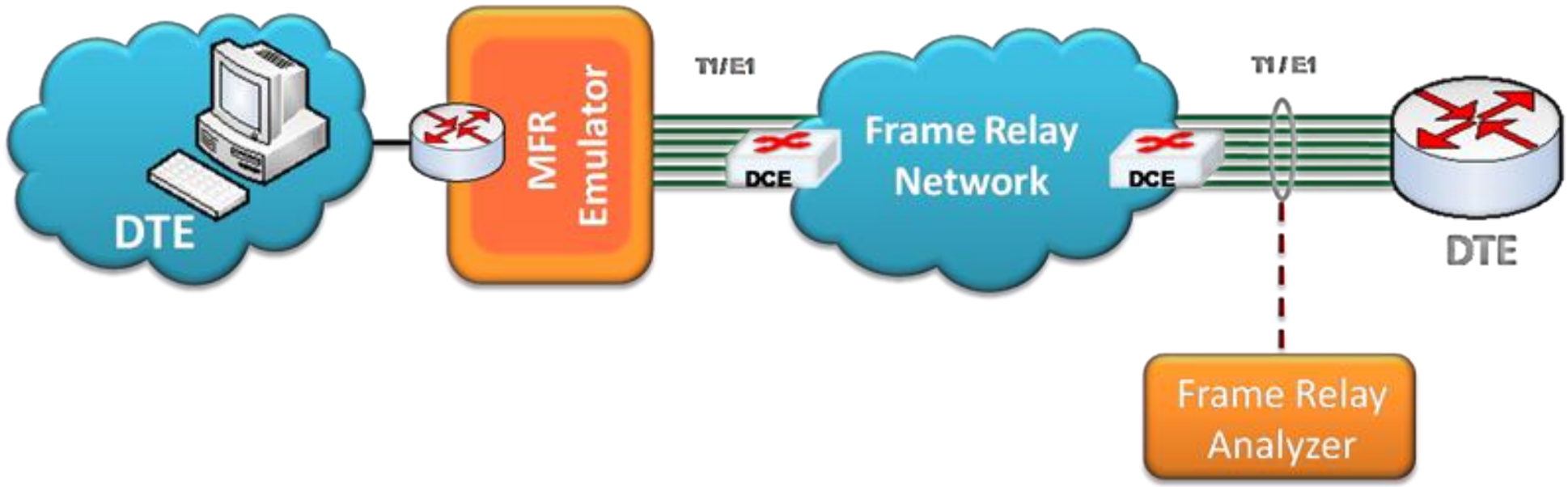
GL Communications

Tx Rx Verification



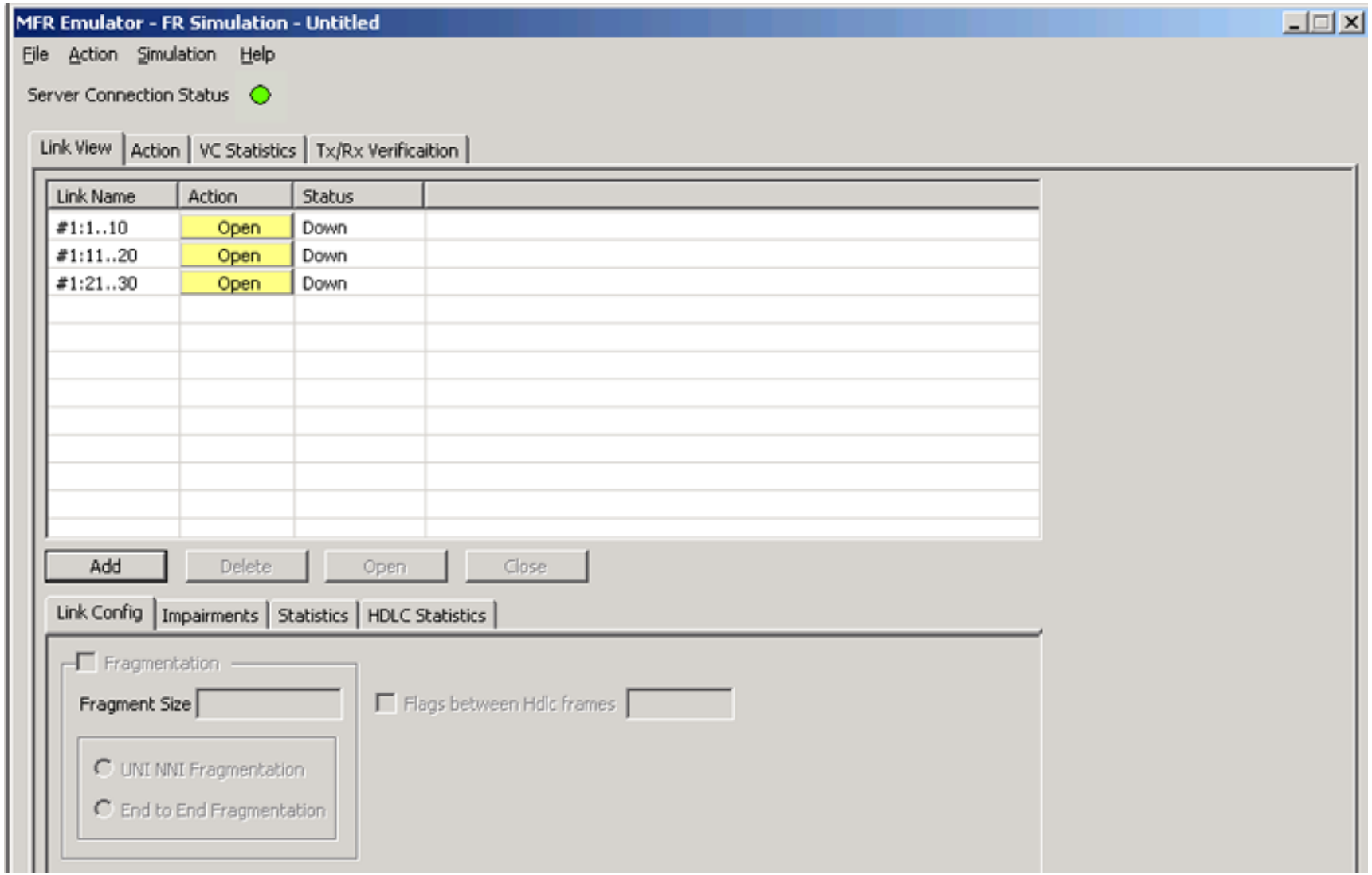
- Tx Rx Verification is common GUI that shows Tx/Rx results for each class (in case of MLPPP) or for each link (in case of PPP)

MFR Emulator

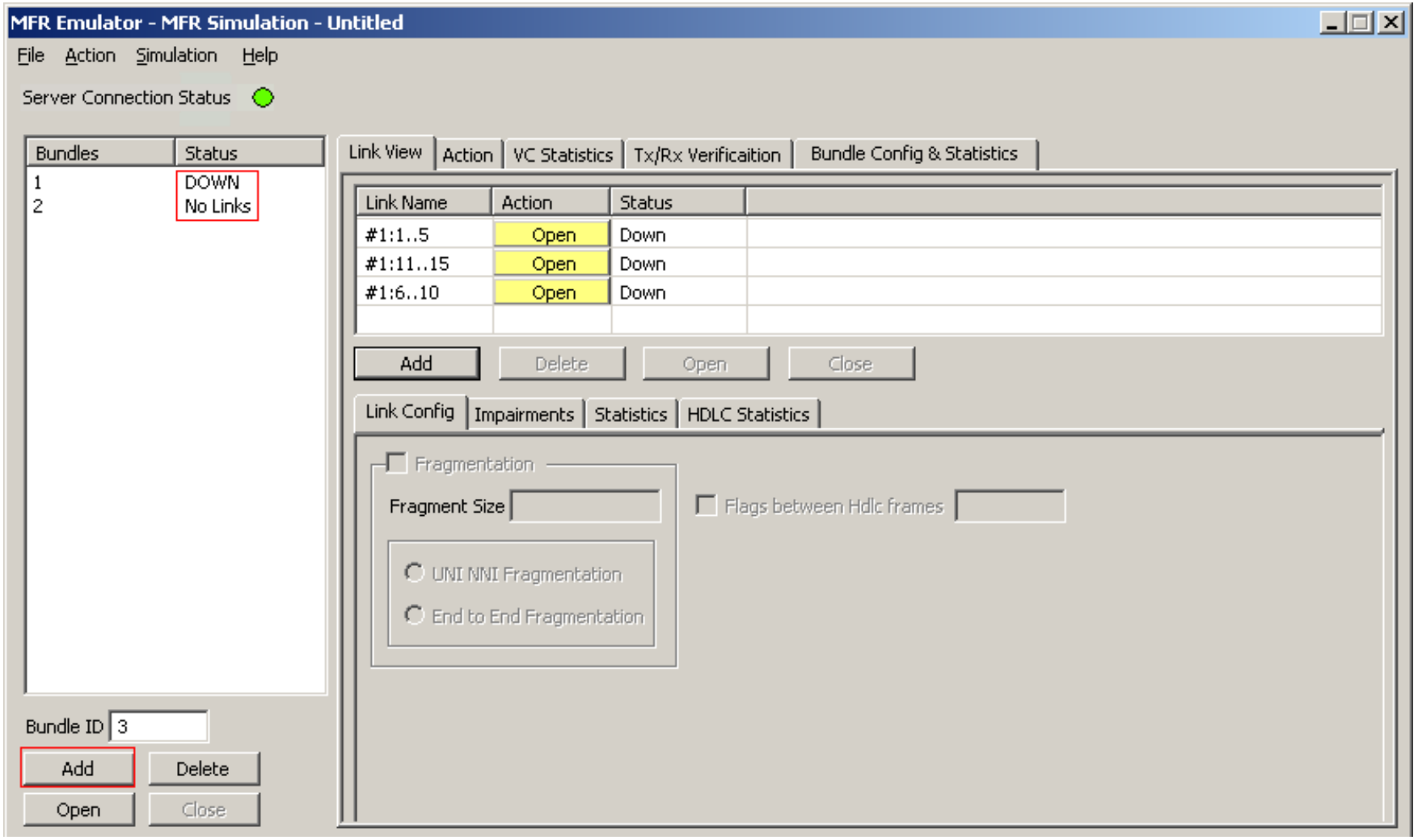


- GUI based WCS client, which simulates Multi-Link Frame Relay Emulation
- Capable of generating and receiving MFR/FR traffic (with or without impairments)
- Traffic source can be sequence number, HDL files (containing packets/frames), flat binary file, user-defined frames (ASCII HEX file), and Ethernet data

FR Simulation



MFR Simulation

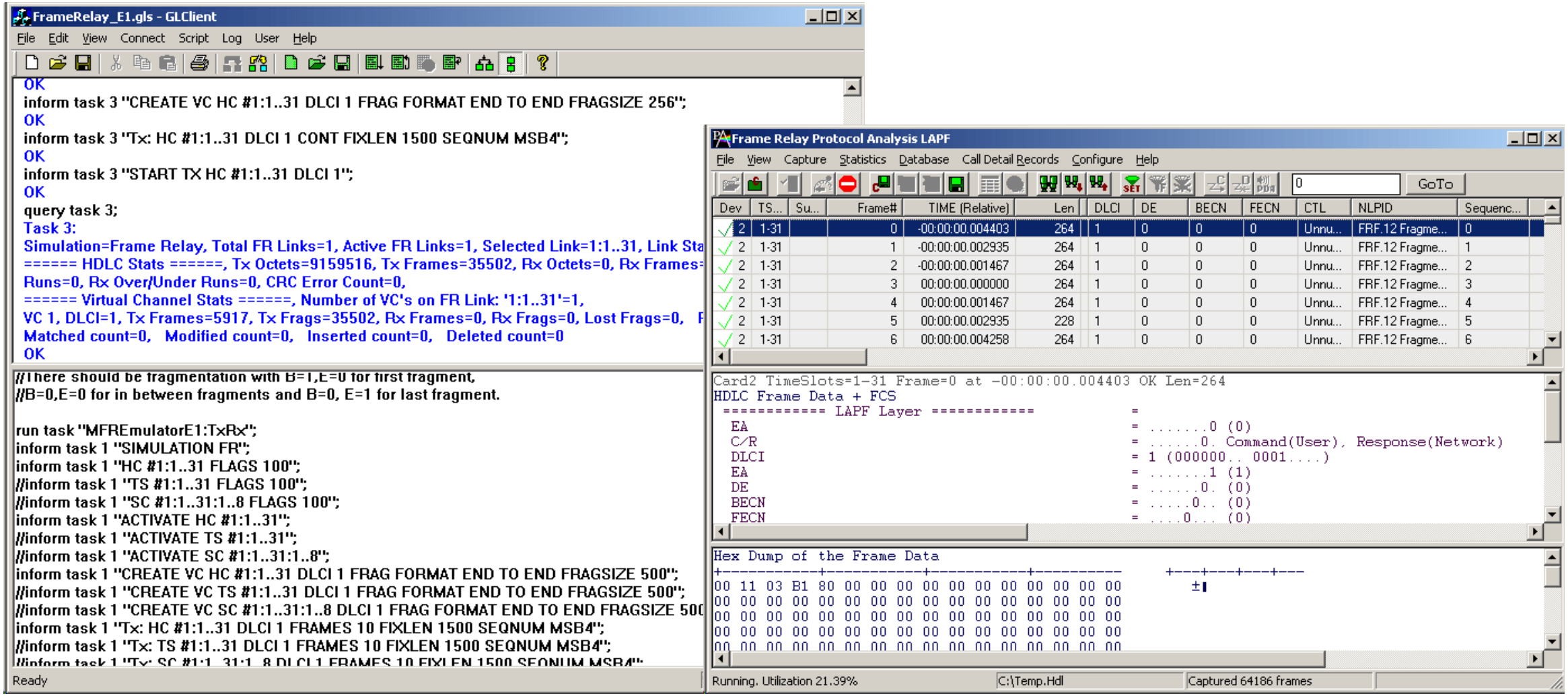


Features

- Performs MFR as well as FR simulation on up to 16 T1/E1 lines; Group FR links to create a MFR bundle with each bundle/link configured with multiple virtual channels for traffic Tx/Rx
- Supports hyper channels with discontinuous (sparse) timeslots
- Dynamically add/remove (open/close) of Frame Relay links without loss in data
- Multiple MFR Bundles/FR links can be created
- Generate and verify end to end traffic on each Virtual Channel
- User configurable FR/MFR packet and fragment size, bandwidth using flags, and maximum link differential delay
- Supports both Interface (UNI and NNI) and End-to-End fragmentation
- Transmit and receive Ethernet traffic over T1E1 links by operating either in bridge or router mode
- Supports various Byte level, Frame level , CRC error, and Frame error impairments at link level
- Ideal solution for automated testing using command line scripts

Client-Server MFR Emulation

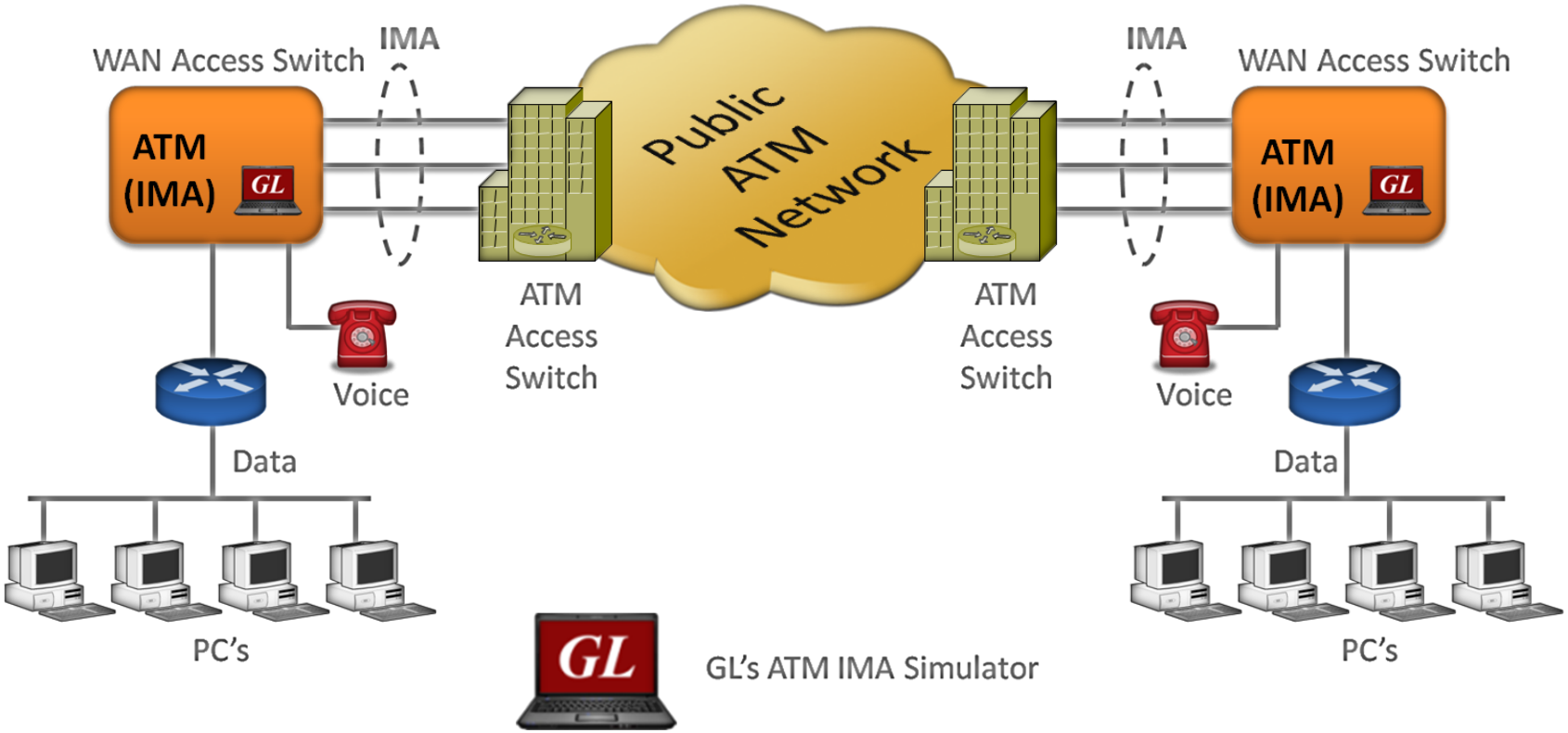
Sample script for Transmission and Reception of MFR Frames



Features

- Activate/deactivate the individual bundle links in the MFR bundle
- Create/delete the virtual channels on the links
- Sends MFR frames with or without impairments
- Receives MFR frames
- Generates & receives traffic using source and sink types
  - Sequence numbers
  - Hex string frame
  - Binary flat files
  - HDL trace files (GL's proprietary file format)
- Various impairments can be applied on each individual FR links and virtual channels

IMA Network



- GUI based WCS client, which simulates IMA Emulation
- Capable of generating and receiving ATM traffic
- Traffic source can be sequence number, HDL files (containing packets/frames), flat binary file, user-defined frames (ASCII HEX file), and Ethernet data

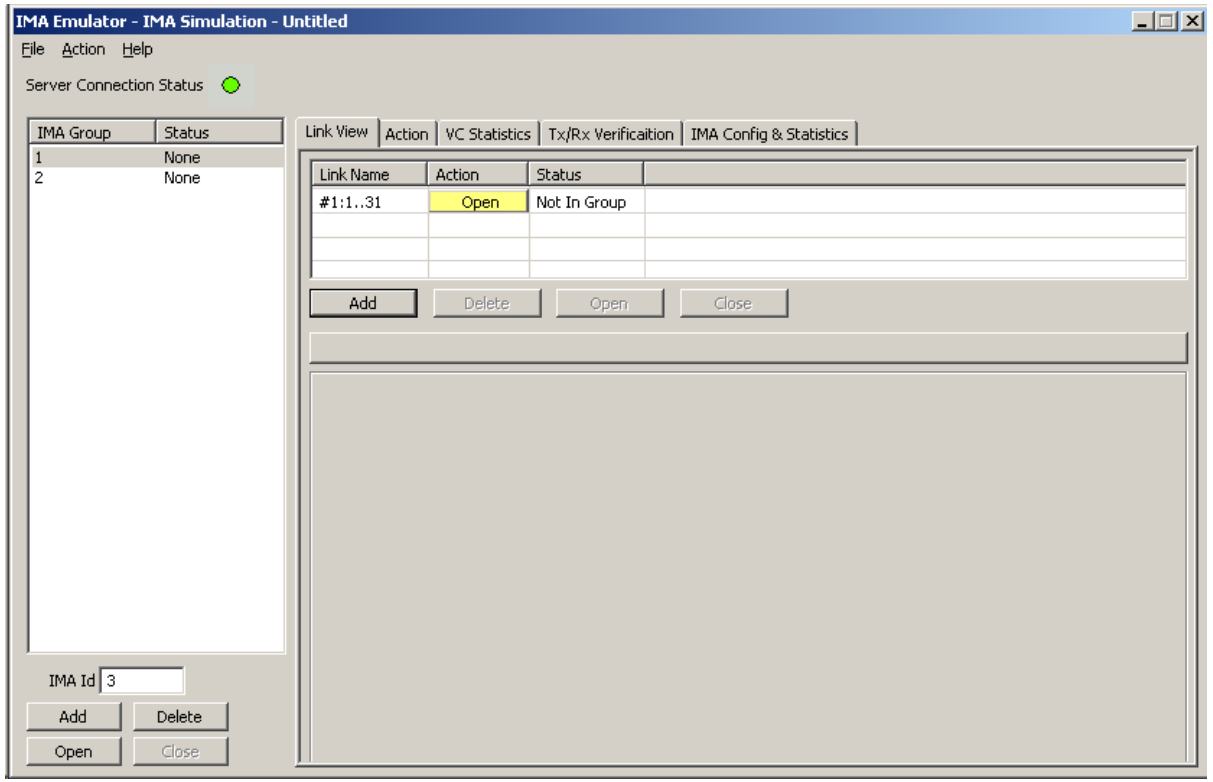
GL Communications

Features

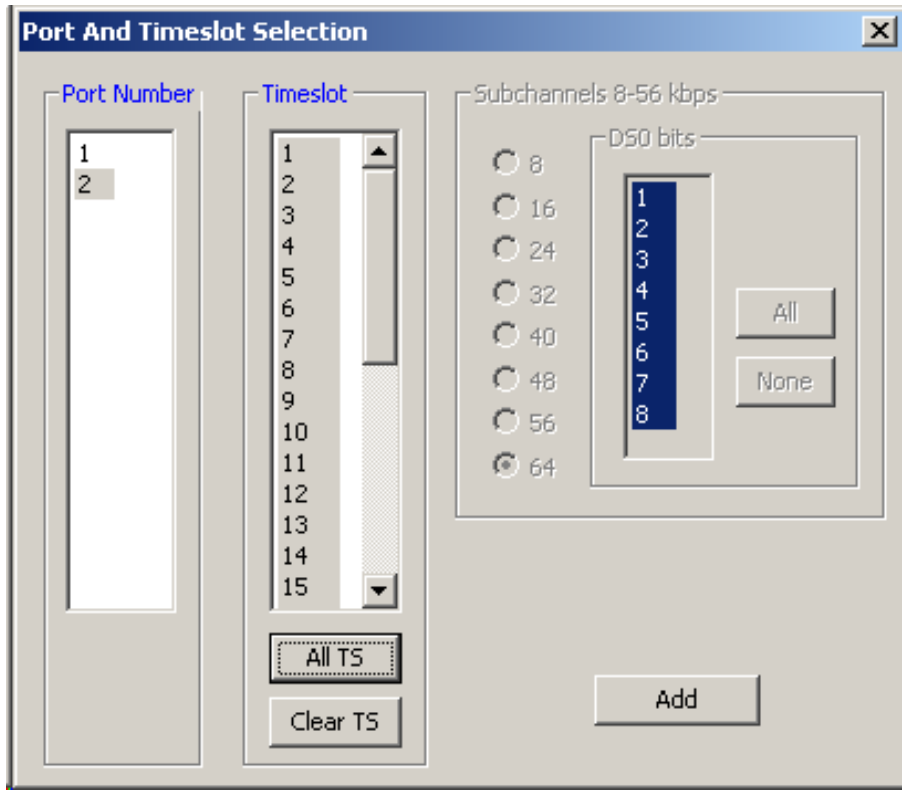
- Performs IMA simulation
- Supports 16 T1/E1 ports
- Support for Full or Fractional Timeslots for ATM Link
- Supports hyper channels with discontinuous (sparse) timeslots
- Supports IMA Frame Length ranging from 32, 64, 128, or 256
- Dynamically add/remove (Open/Close) of ATM links without loss in data
- Multiple IMA groups can be created in IMA Simulation
- Create and delete Virtual Channels on IMA group
- Generate and verify end to end traffic on each Virtual Channel
- User configurable AAL5 packet size
- Payload traffic generation and verification using Sequence number, HDL file (containing packets/frames), Flat Binary file, and User defined frame (ASCII HEX file) for each Virtual Channel independently

Adding links to form an IMA Group

Added Links



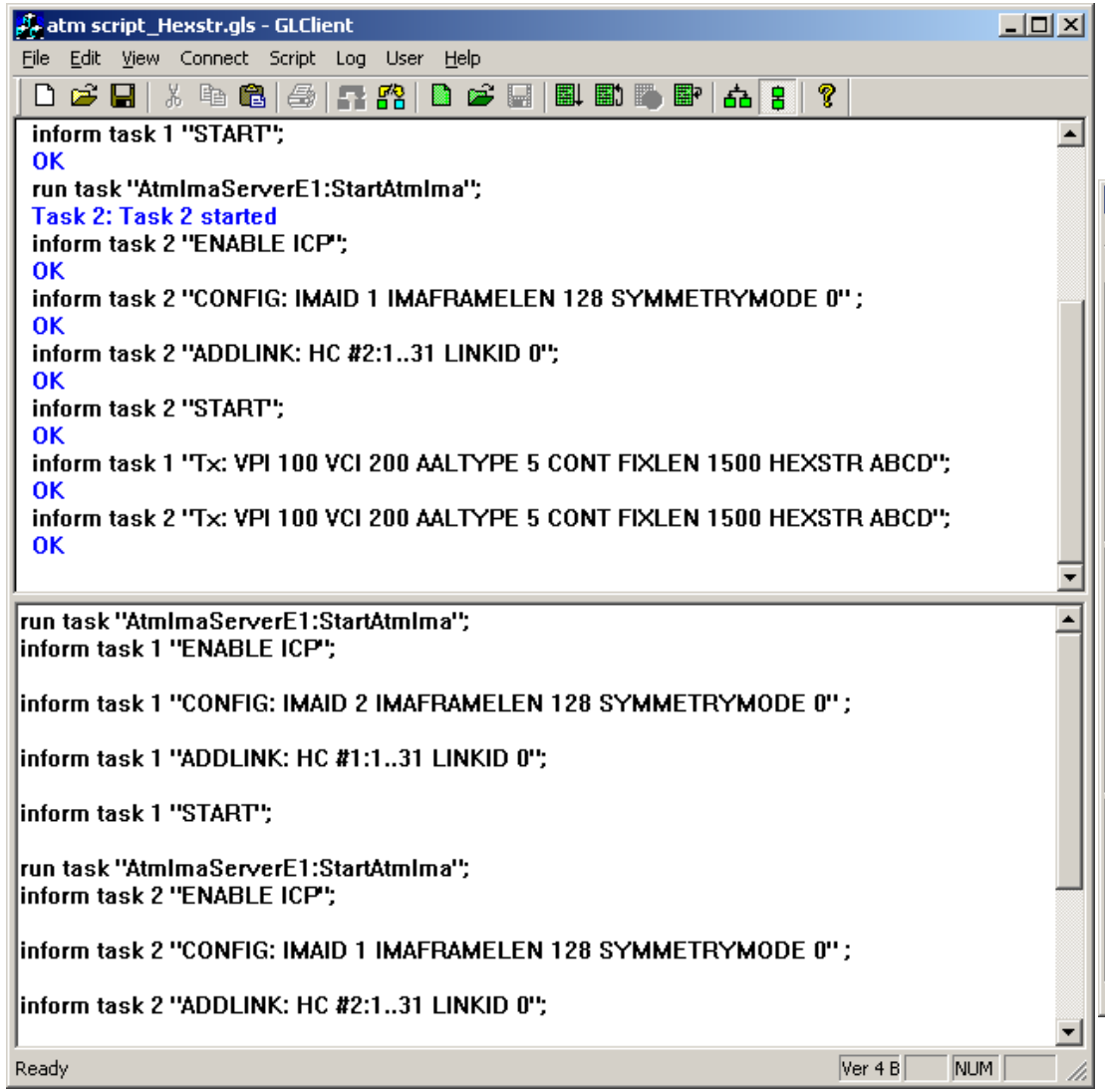
Link Selection

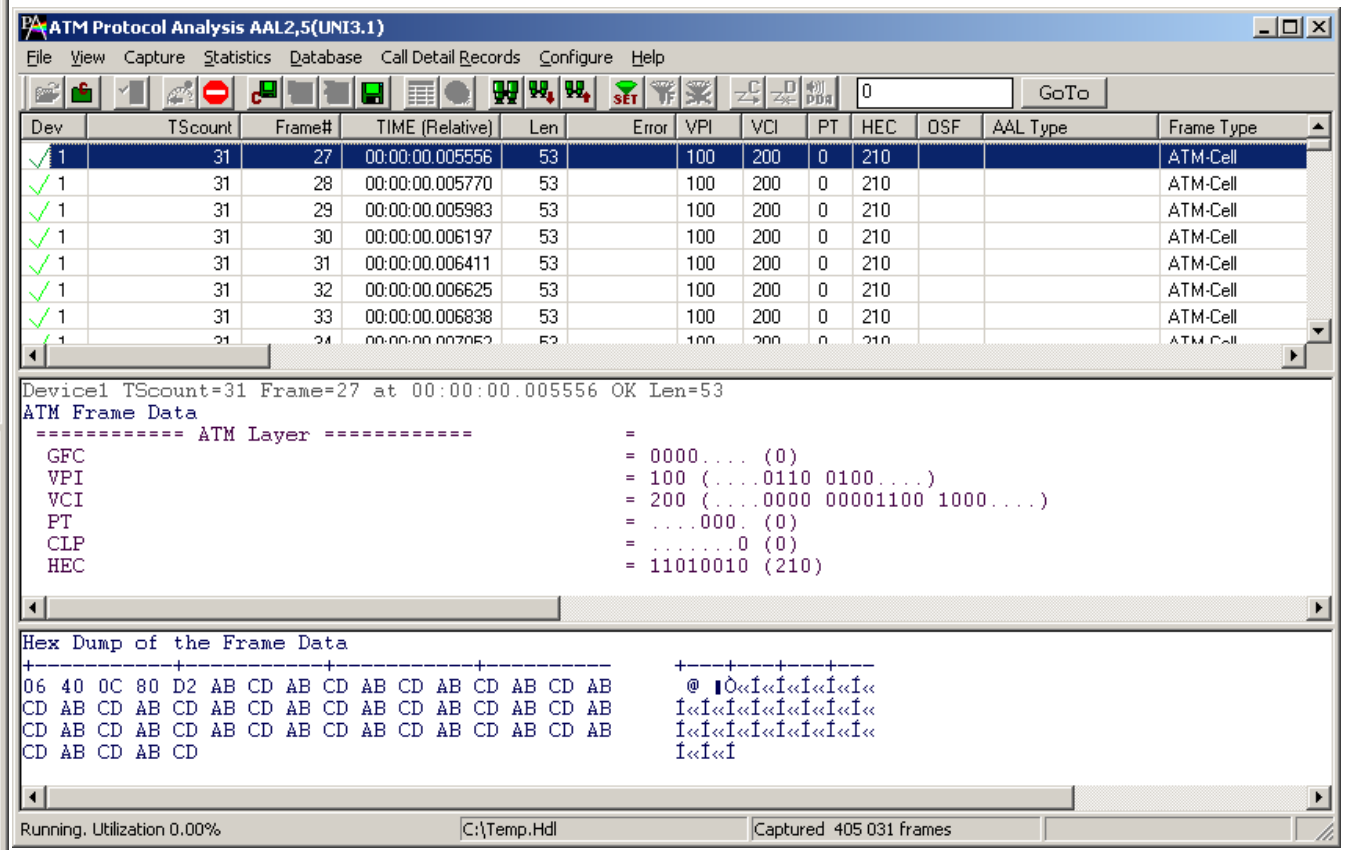


- Various links (of any bandwidth varying from 64Kbps to n*64Kpbs or sub channels) can be added to form an IMA Group. Within a group all links should be of equal bandwidth
- IMA group, channels into a single network-layer channel

GL Communications

Client Server Inverse Multiplex for ATM





GL Communications

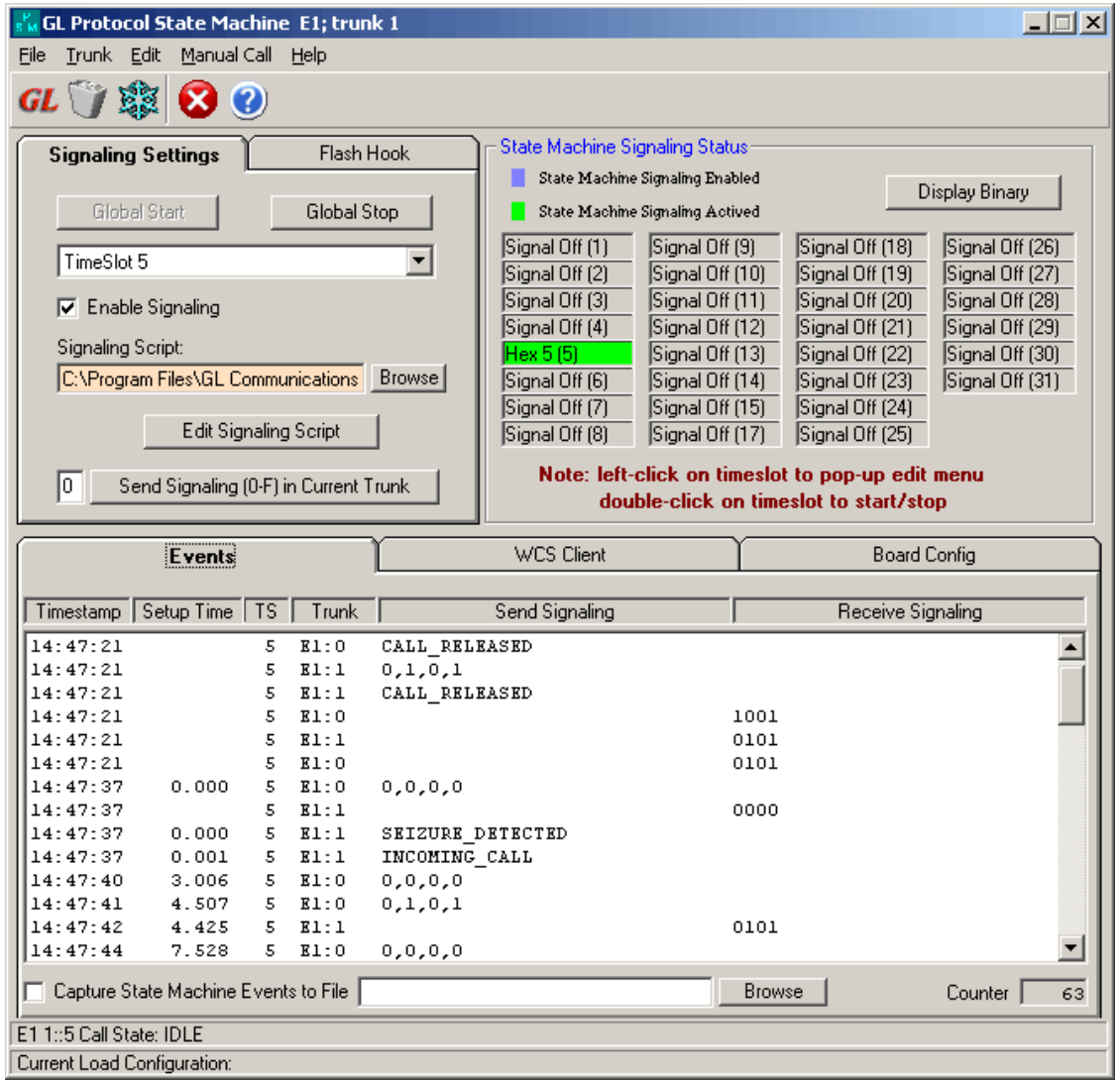
Features

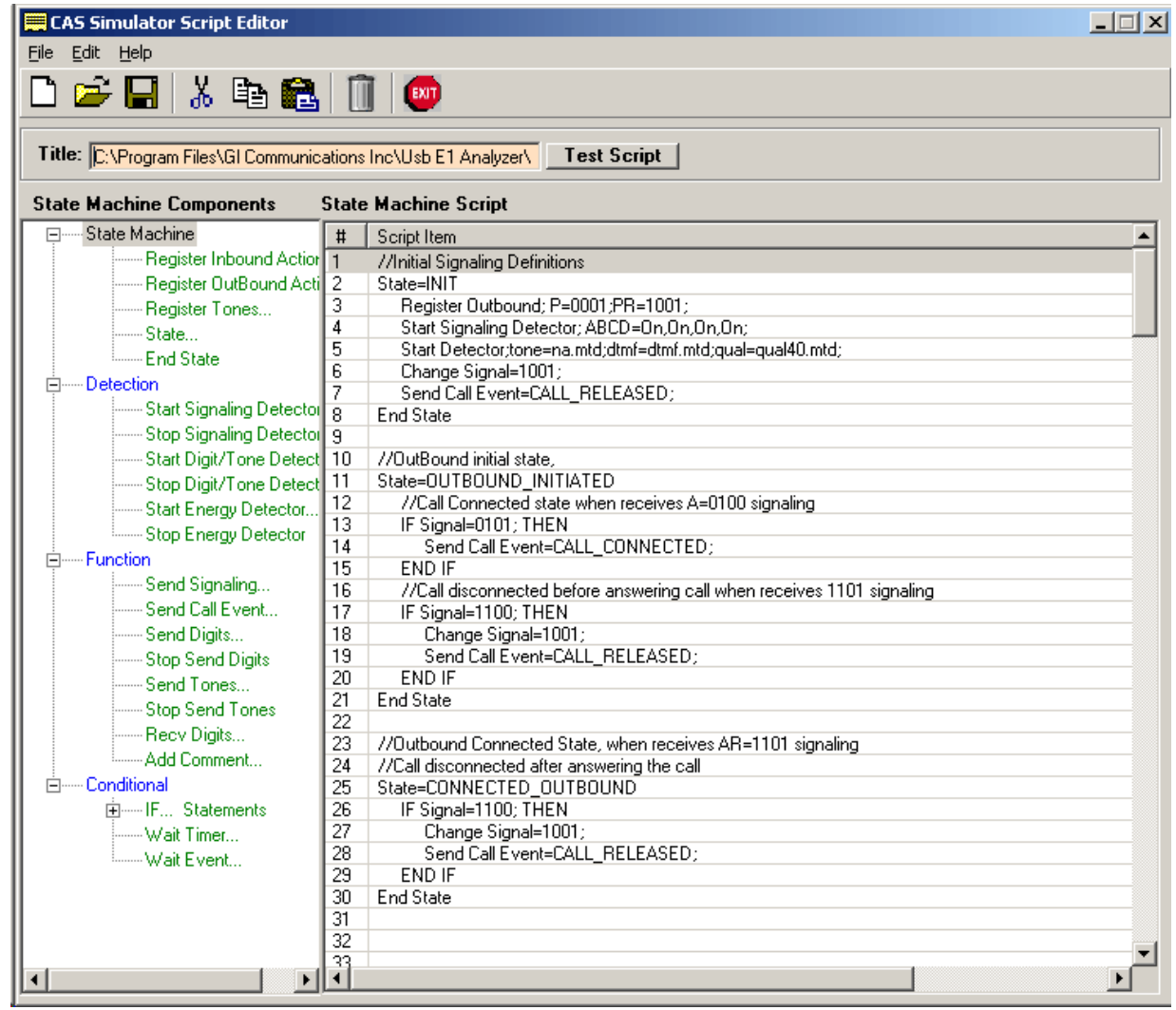
- Create and delete Virtual Channels on IMA group
- Generate and verify end to end traffic on each Virtual Channel
- Payload traffic generation and verification using Sequence number, HDL file (containing packets/frames), Flat Binary file, and User defined frame (ASCII HEX file) for each Virtual Channel independently
- Provides detailed statistics for IMA group and each Virtual Channel
- Dynamically add/remove (Open/Close) of ATM links without loss in data

CAS Simulation

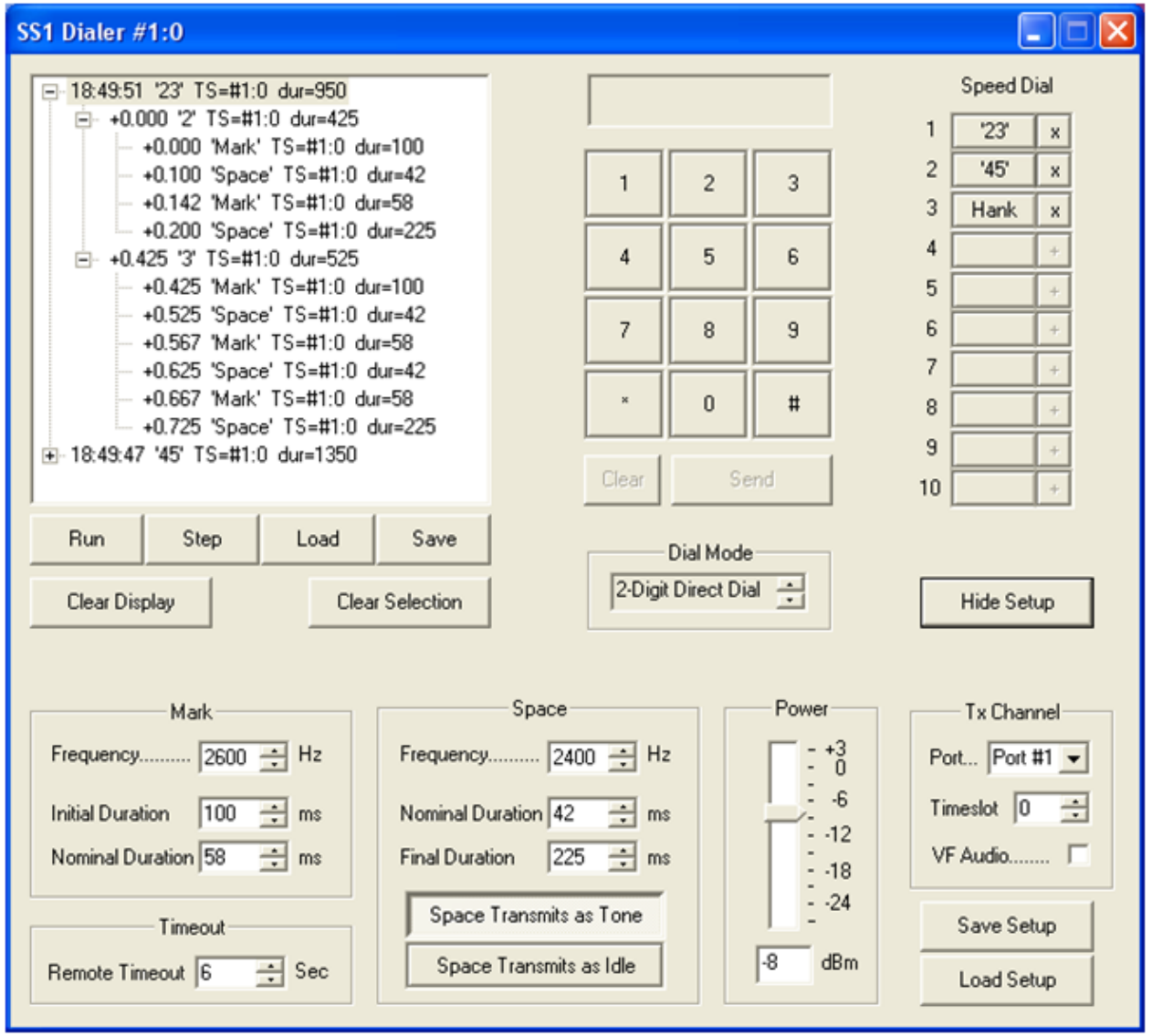
- Features
  - Uses client-server technique and provides GUI as well as scripted CAS protocol simulation platform
  - Network (NT) and Terminal (TE) - Side Support
  - Implements ITU-T Signaling
  - Called number and calling number identification
  - Customized signaling for each channel through scripts

- Supports the following protocols -
  - E1 MFC-R2 (All variants, full / semi compelled)
  - T1 Winkstart (R1 wink)
  - Multi-frequency compelled protocols based on the R2 standard (MFCR2)
  - T1 Loopstart and T1 Groundstart
  - E1 European Digital CAS (EUC)
  - Any user-defined CAS Protocol


GL Protocol State Machine E1; trunk 1
File Trunk Edit Manual Call Help
Signaling Settings
Flash Hook
Global Start
Global Stop
TimeSlot 5
Enable Signaling
Signaling Script:
C:\Program Files\GL Communications
Browse
Edit Signaling Script
0
Send Signaling (0-F) in Current Trunk
State Machine Signaling Status
State Machine Signaling Enabled
State Machine Signaling Actived
Display Binary
Signal Off (1)
Signal Off (2)
Signal Off (3)
Signal Off (4)
Hex 5 (5)
Signal Off (6)
Signal Off (7)
Signal Off (8)
Signal Off (9)
Signal Off (10)
Signal Off (11)
Signal Off (12)
Signal Off (13)
Signal Off (14)
Signal Off (15)
Signal Off (17)
Signal Off (18)
Signal Off (19)
Signal Off (20)
Signal Off (21)
Signal Off (22)
Signal Off (23)
Signal Off (24)
Signal Off (25)
Signal Off (26)
Signal Off (27)
Signal Off (28)
Signal Off (29)
Signal Off (30)
Signal Off (31)
Note: left-click on timeslot to pop-up edit menu
double-click on timeslot to start/stop
Events
WCS Client
Board Config
Timestamp Setup Time TS Trunk Send Signaling Receive Signaling
14:47:21 5 E1:0 CALL_RELEASED
14:47:21 5 E1:1 0,1,0,1
14:47:21 5 E1:1 CALL_RELEASED
14:47:21 5 E1:0 1001
14:47:21 5 E1:1 0101
14:47:21 5 E1:0 0101
14:47:37 0.000 5 E1:0 0,0,0,0
14:47:37 5 E1:1 0000
14:47:37 0.000 5 E1:1 SEIZURE_DETECTED
14:47:37 0.001 5 E1:1 INCOMING_CALL
14:47:40 3.006 5 E1:0 0,0,0,0
14:47:41 4.507 5 E1:0 0,1,0,1
14:47:42 4.425 5 E1:1 0101
14:47:44 7.528 5 E1:0 0,0,0,0
Capture State Machine Events to File
Browse
Counter 63
E1 1::5 Call State: IDLE
Current Load Configuration:


CAS Simulator Script Editor
File Edit Help
Title: C:\Program Files\GI Communications Inc\Usb E1 Analyzer\
Test Script
State Machine Components
State Machine
Register Inbound Actior
Register OutBound Acti
Register Tones...
State...
End State
Detection
Start Signaling Detecto
Stop Signaling Detecto
Start Digit/Tone Detect
Stop Digit/Tone Detect
Start Energy Detector...
Stop Energy Detector
Function
Send Signaling...
Send Call Event...
Send Digits...
Stop Send Digits
Send Tones...
Stop Send Tones
Recv Digits...
Add Comment...
Conditional
IF... Statements
Wait Timer...
Wait Event...
State Machine Script
Script Item
1 //Initial Signaling Definitions
2 State=INIT
3 Register Outbound; P=0001;PR=1001;
4 Start Signaling Detector; ABCD=On,On,On,On;
5 Start Detector;tone=na.mtd;dtmf=dtmf.mtd;qual=qual40.mtd;
6 Change Signal=1001;
7 Send Call Event=CALL_RELEASED;
8 End State
9
10 //OutBound initial state,
11 State=OUTBOUND_INITIATED
12 //Call Connected state when receives A=0100 signaling
13 IF Signal=0101; THEN
14 Send Call Event=CALL_CONNECTED;
15 END IF
16 //Call disconnected before answering call when receives 1101 signaling
17 IF Signal=1100; THEN
18 Change Signal=1001;
19 Send Call Event=CALL_RELEASED;
20 END IF
21 End State
22
23 //Outbound Connected State, when receives AR=1101 signaling
24 //Call disconnected after answering the call
25 State=CONNECTED_OUTBOUND
26 IF Signal=1100; THEN
27 Change Signal=1001;
28 Send Call Event=CALL_RELEASED;
29 END IF
30 End State
31
32

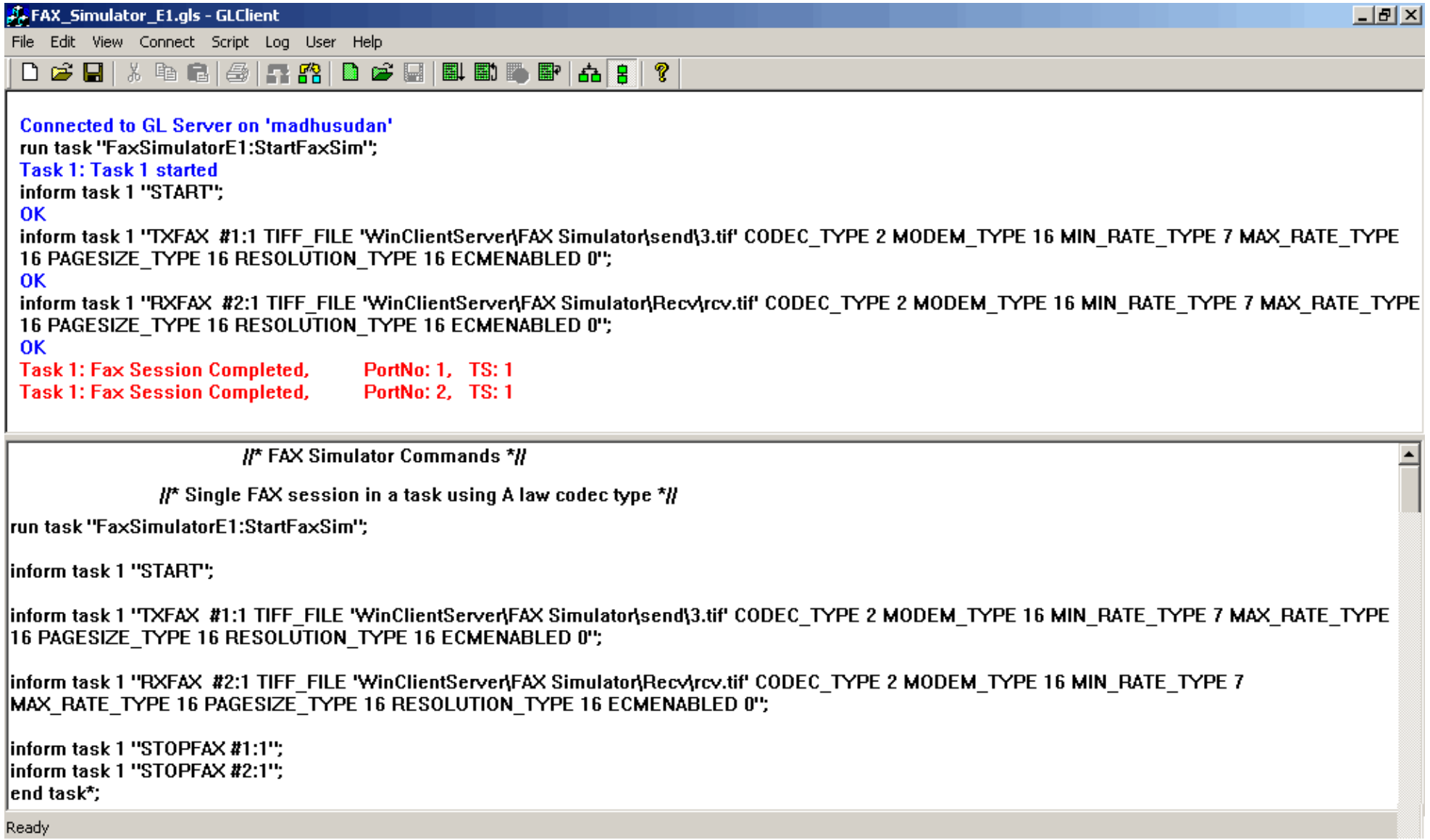
SS1 Emulator ("SS1 Dialer")



Key Features

- Generate and introduce SS1 Dial Codes on Transmit Channels using SS1 Dialer
- Control ‘mark’ & ‘space’ frequency, duration, and power during transmission of SS1 Tones
- Dual monitoring capability allowing multiple instances of SS1 analyzer to simultaneously tap E and W direction traffic
- Spectral Graph feature presents a captured dial code as a graphical waveform

FAX Simulator

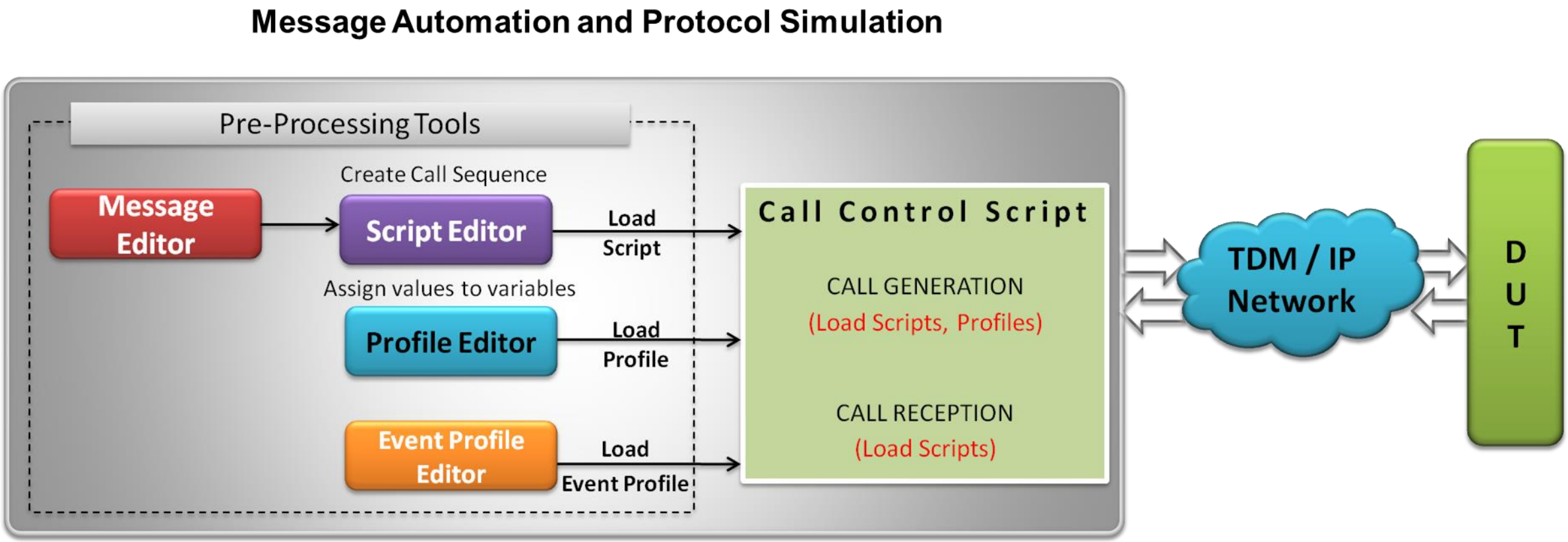


GL Communications

MAPS™ – Script Based Emulation

- Script based protocol simulation and conformance test tool - covers solutions for both protocol simulation and protocol analysis
- Supports a variety of protocols such as ISUP, MAP, CAS, ISDN, MLPPP, GSM A, GSM Abis and others
- Includes various ready-to-use test plans and test cases to support the testing of a required real-time scenario
- Provides the unlimited ability to edit messages and control scenarios (message sequences)
- "Message sequences" are generated through scripts; Generate and respond to calls / messages
- Impairments can be applied to messages to simulate error conditions
- Supports transmission/detection of various TDM traffic such as, digits, voice file, single & dual tones

MAPS™ Working Principle



Working Principle

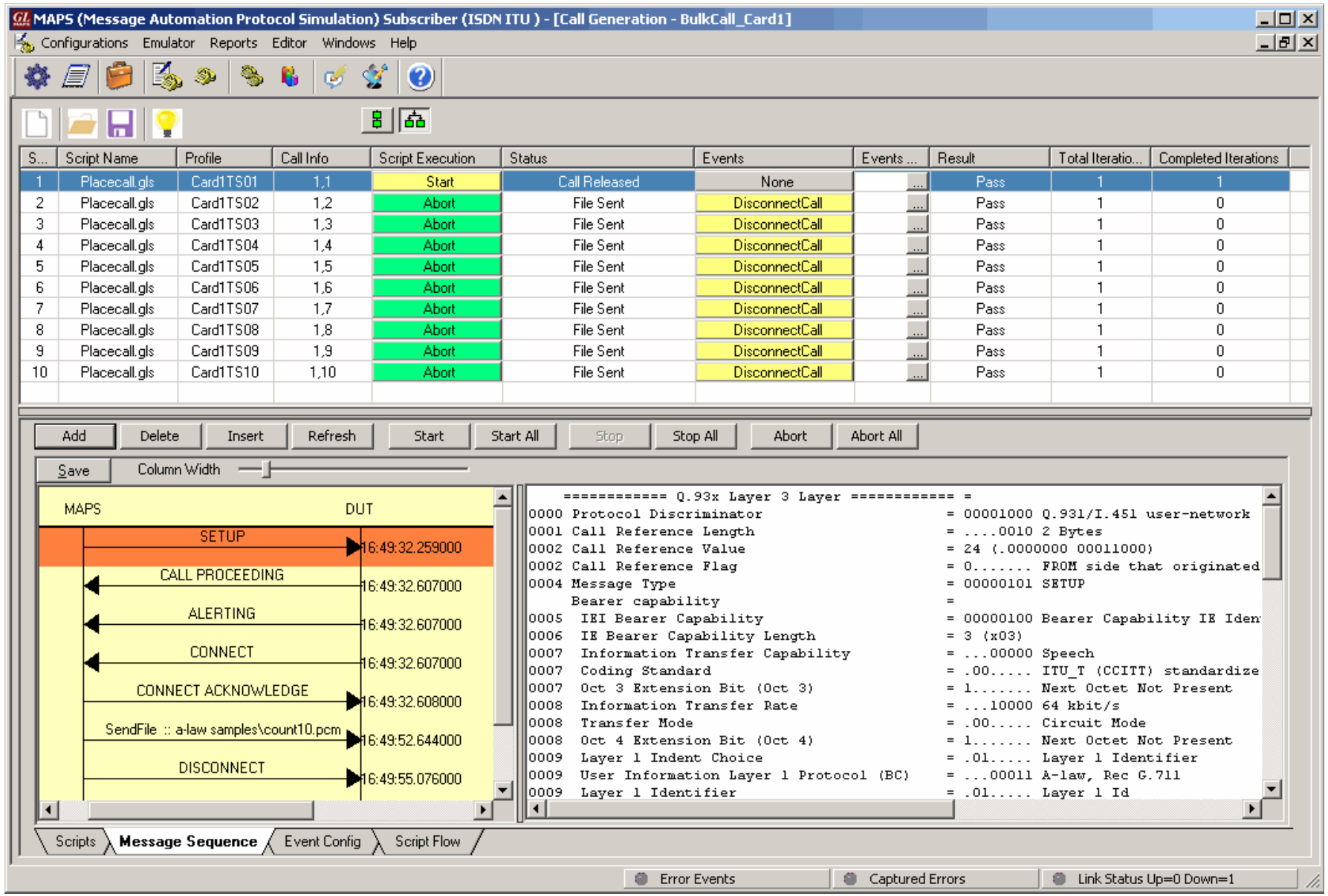
- The message templates form the backbone of MAPS™ application
- Message templates are created using an utility Message Editor with user-selected protocol fields and default values for each protocol field
- The protocol fields can be accessed by scripts as variables using import / export files
- Scripts comprises of sequence of commands that performs the required operation using pre-defined message templates
- Script Editor is another powerful utility of MAPS, in which sequences of message templates can be grouped together in an order to create call flow (scripts)
- Profile consists of values assigned to the variables
- Profiles can be created using a utility called Profile Editor where the values can be assigned to the variables
- Event Profiles consists of values assigned to the variables during run-time. Event Profile Editor allows you to create Event Profiles for user-defined events in a script. The value in the profiles can be changed during script execution.
- MAPS™ provides the ability to create any number of scripts to simulate a real-time scenario with MAPS™ and DUT

Supported Protocols

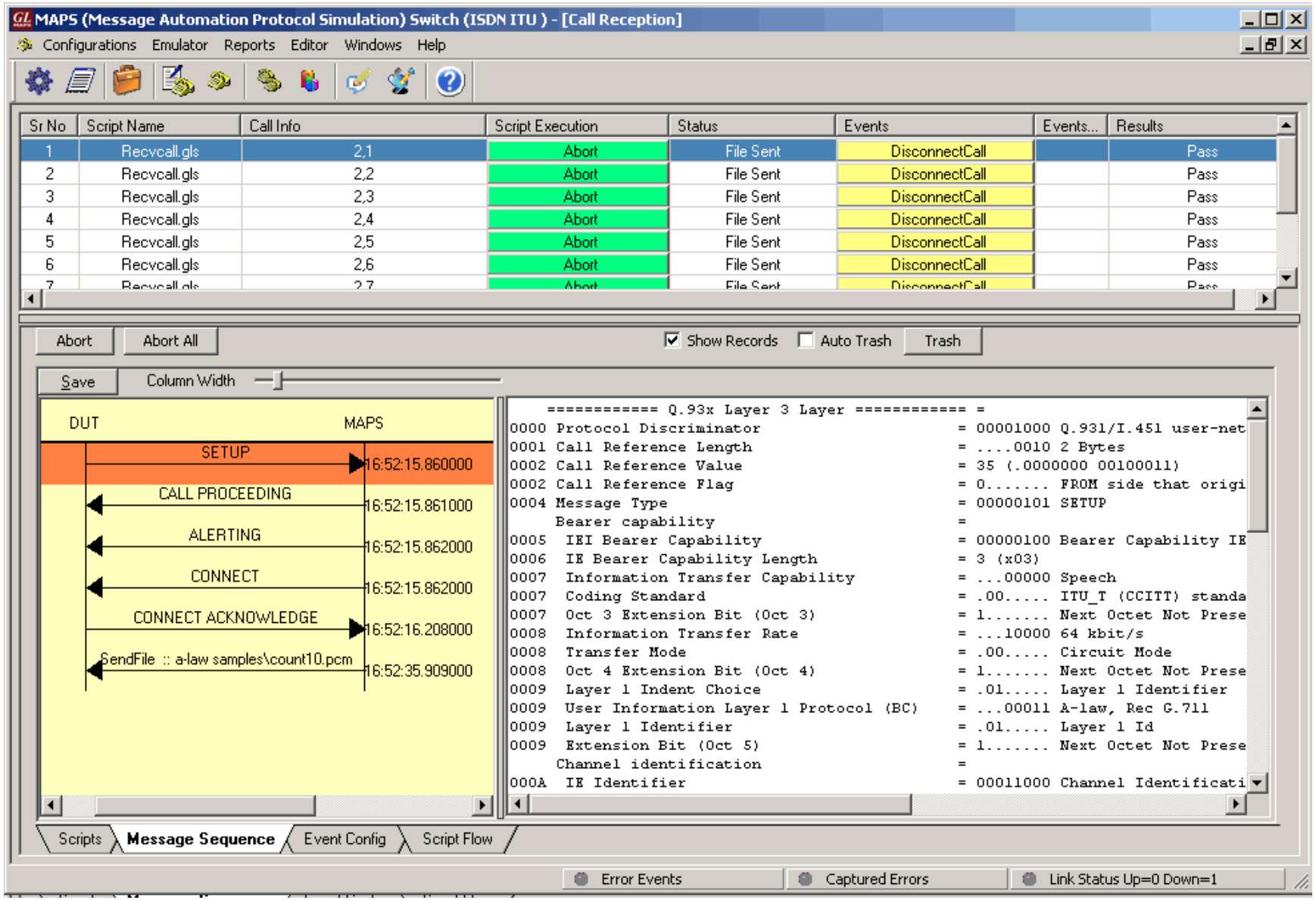
- Testing binary based protocols over T1 E1
  - ISDN, LAPD
  - SS7 (ISUP, INAP, MAP, CAP, IUP)
  - GSM A, Abis
  - MLPPP Conformance
  - CAS

- Testing protocols over IP
  - SIP, SIP-I
  - MEGACO, MGCP
  - ISDN SIGTRAN (ISDN over IP)
  - SS7 SIGTRAN (SS7 over IP)
  - GSMAoIP (GSM A over IP)
  - LTE (S1, eGTP)
  - UMTS (IuCS, IuH, IuPS)
  - UMTS GnGp

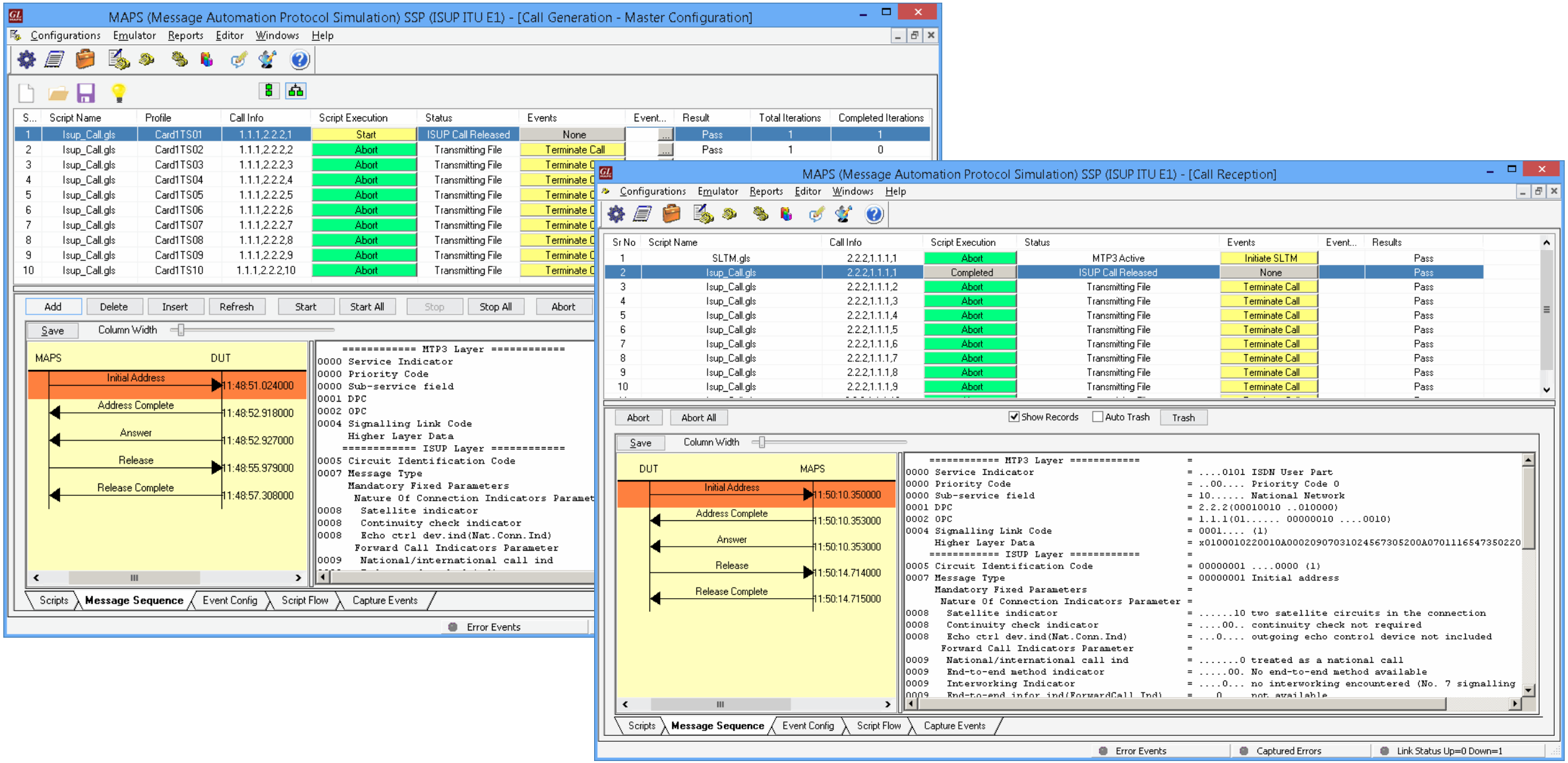
Call Generation



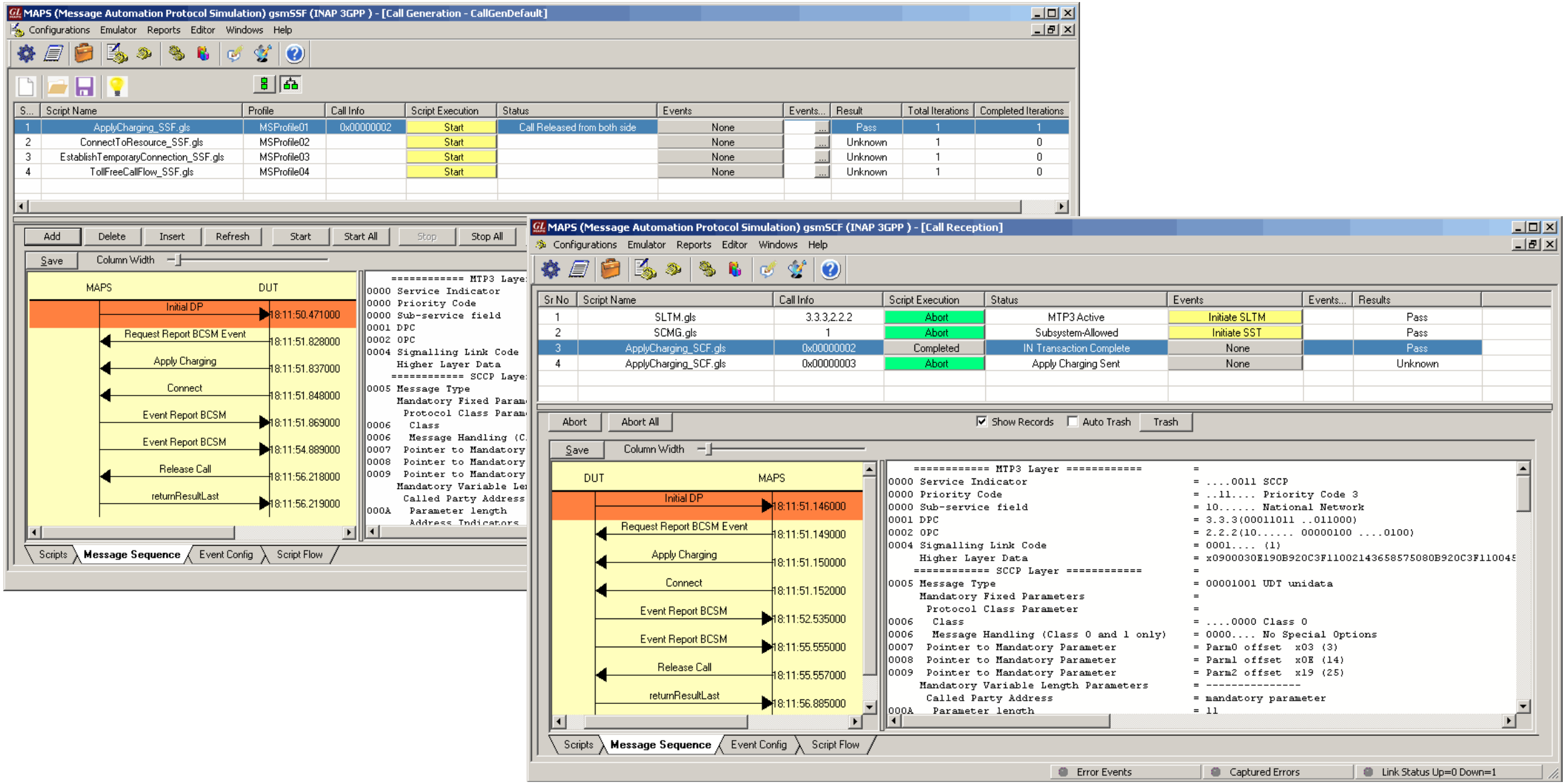
Call Reception



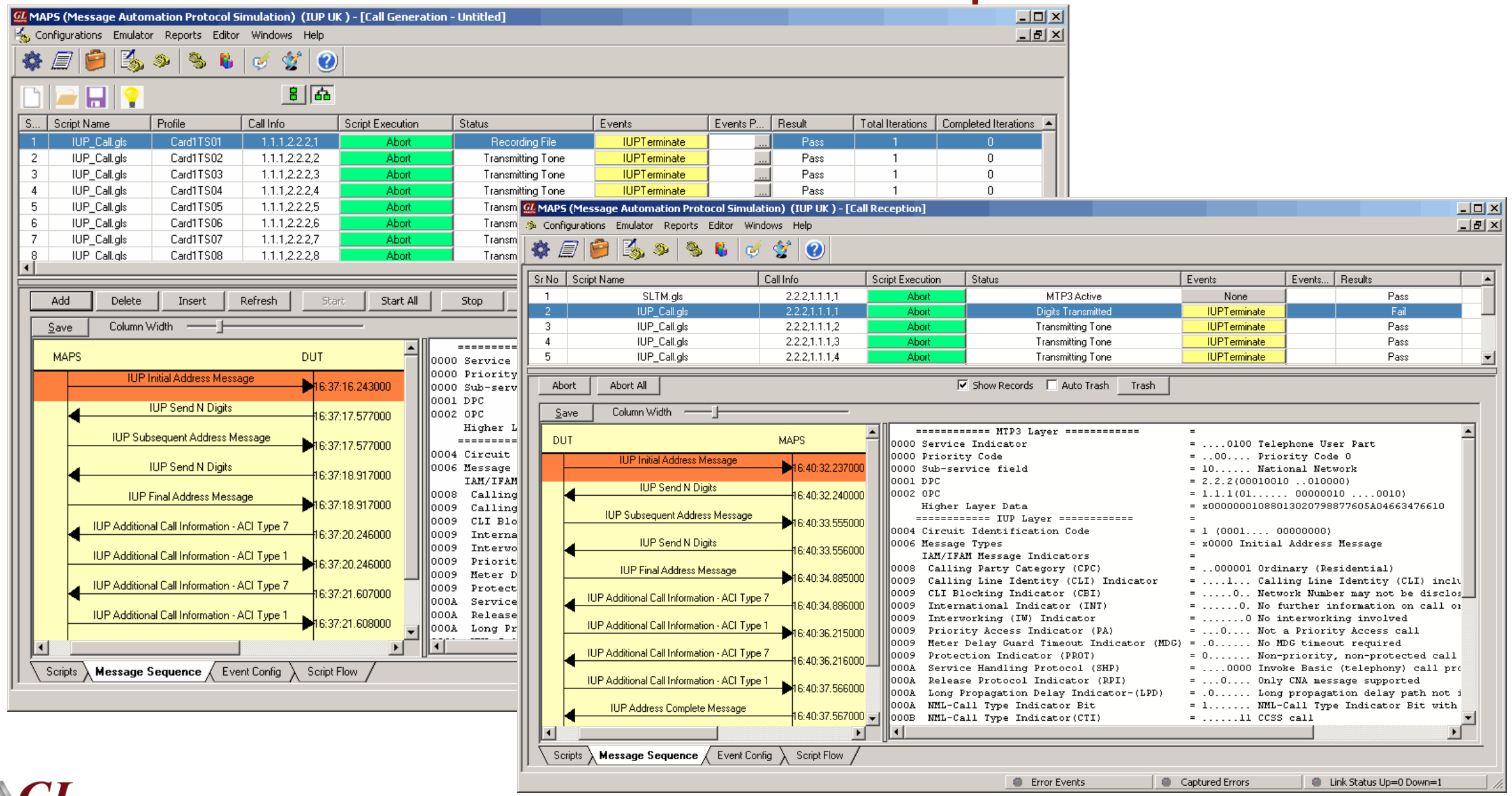
Call Generation and Reception



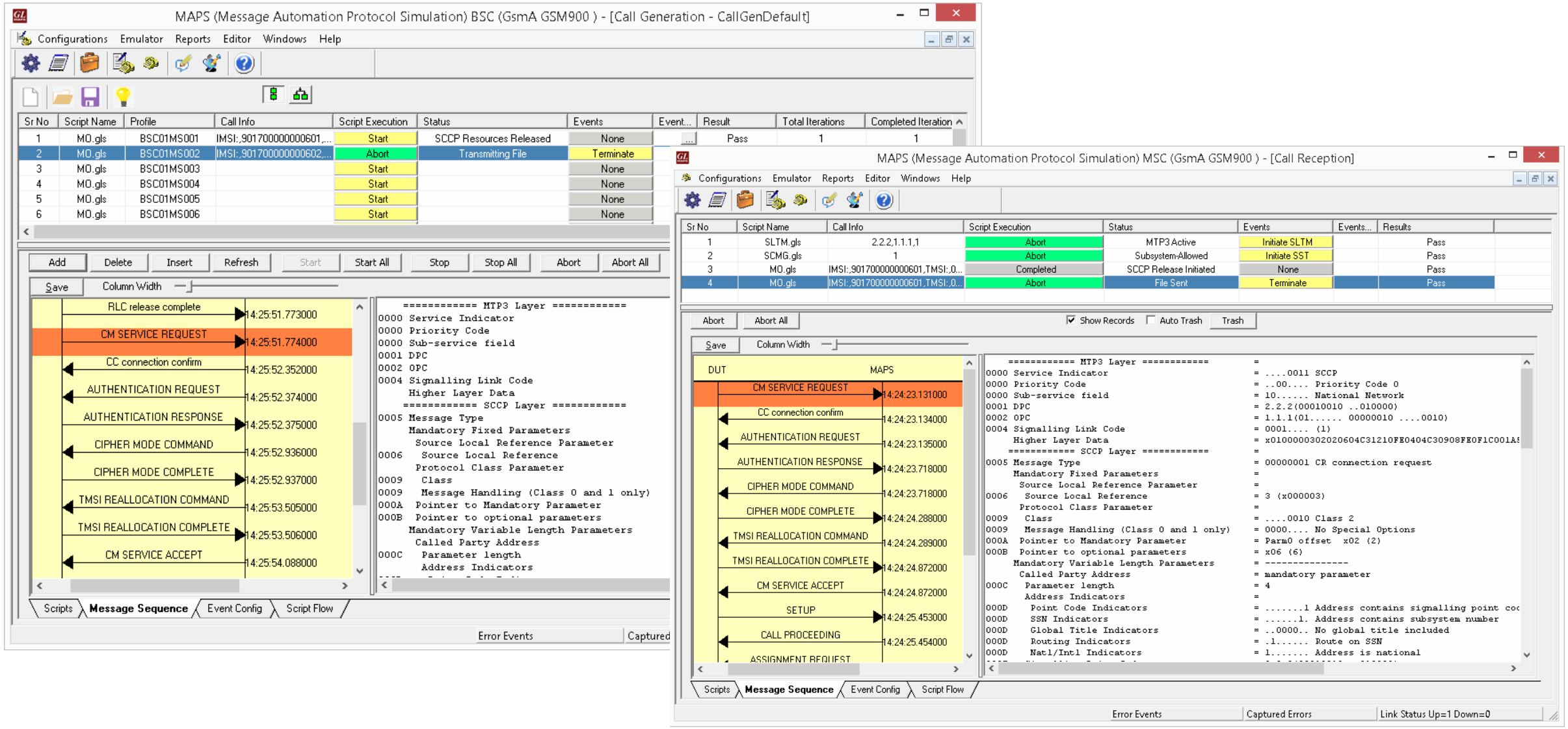
Call Generation and Reception



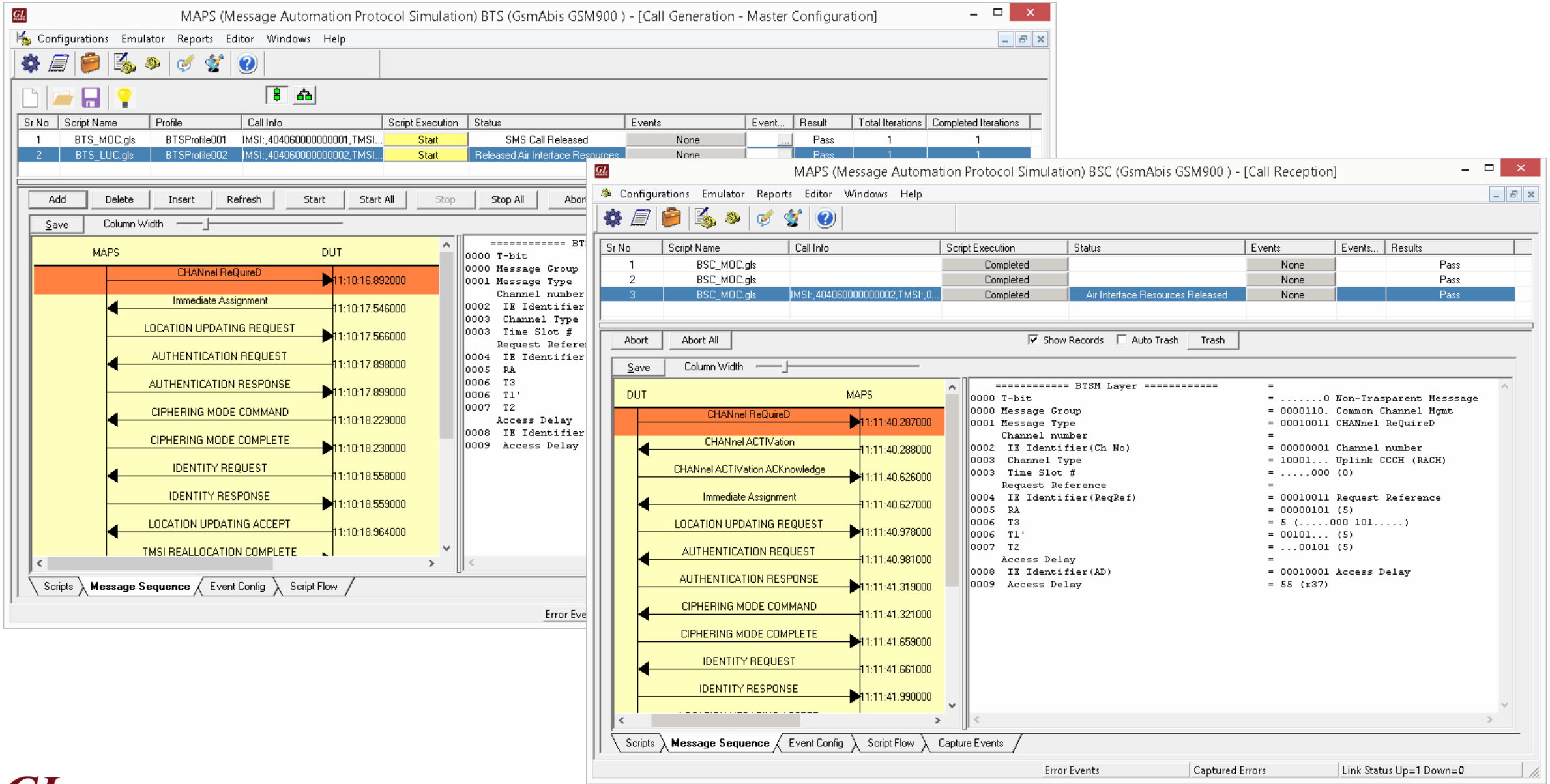
Call Generation and Reception



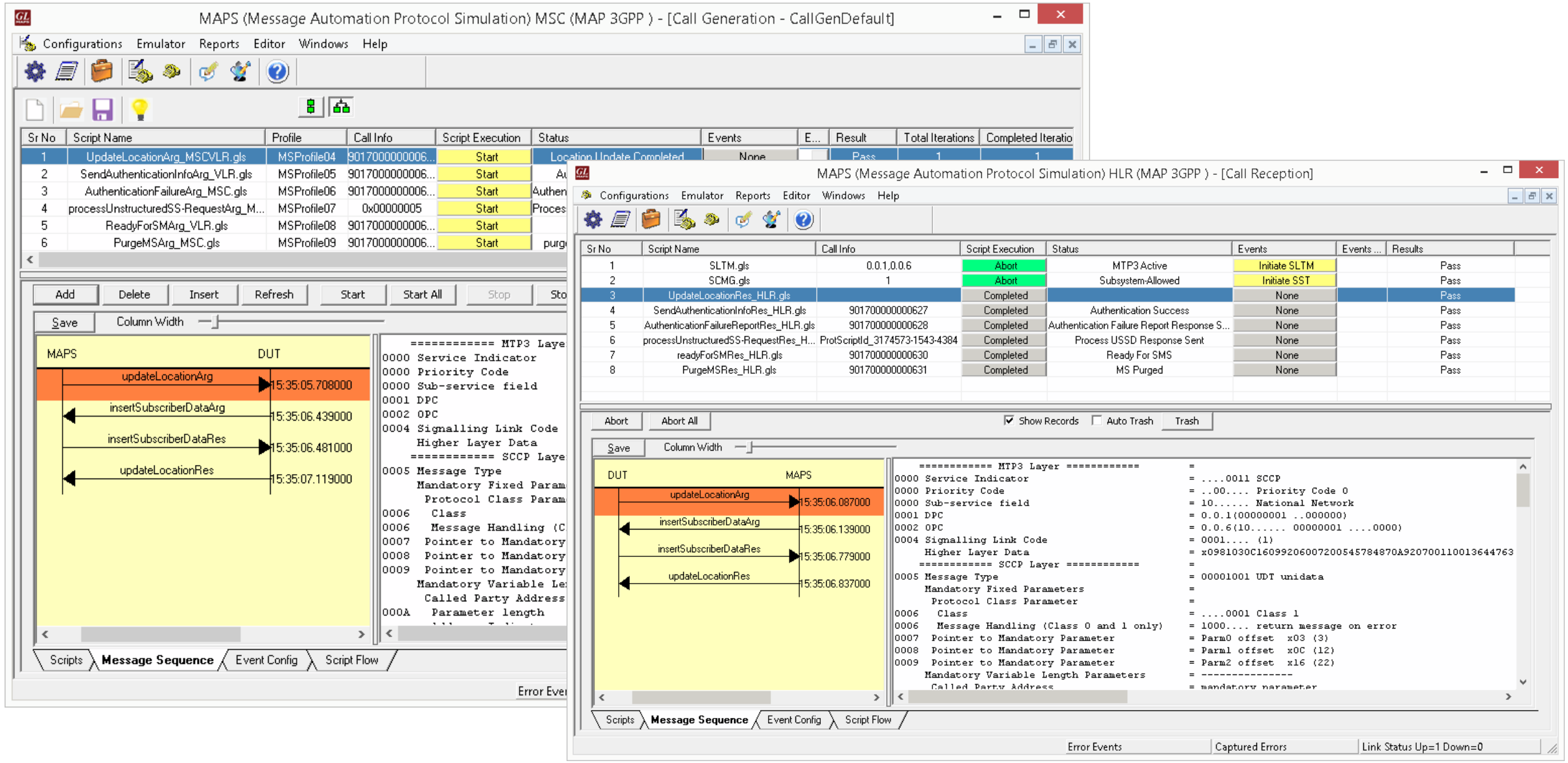
Call Generation and Reception



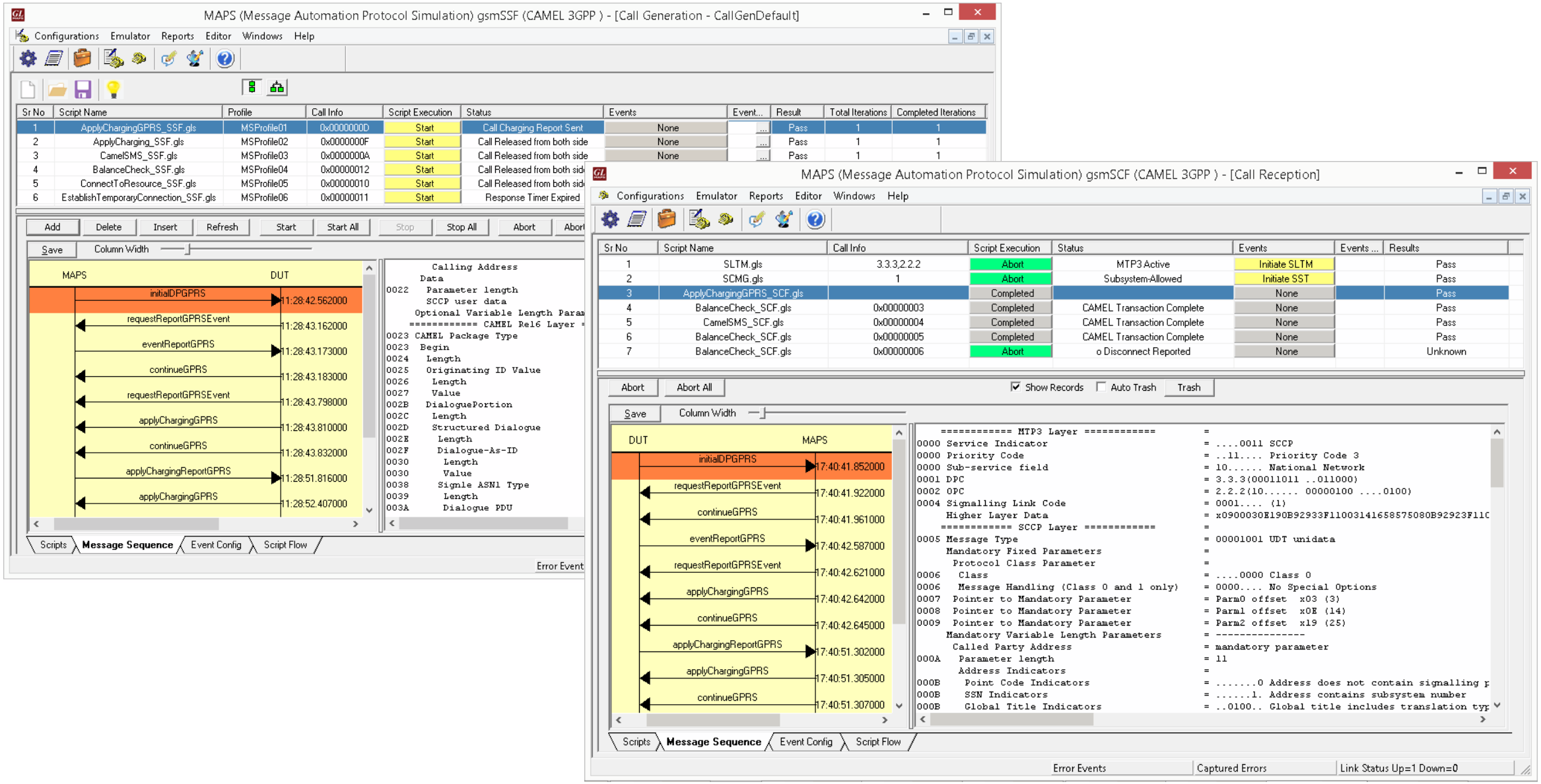
Call Generation and Reception



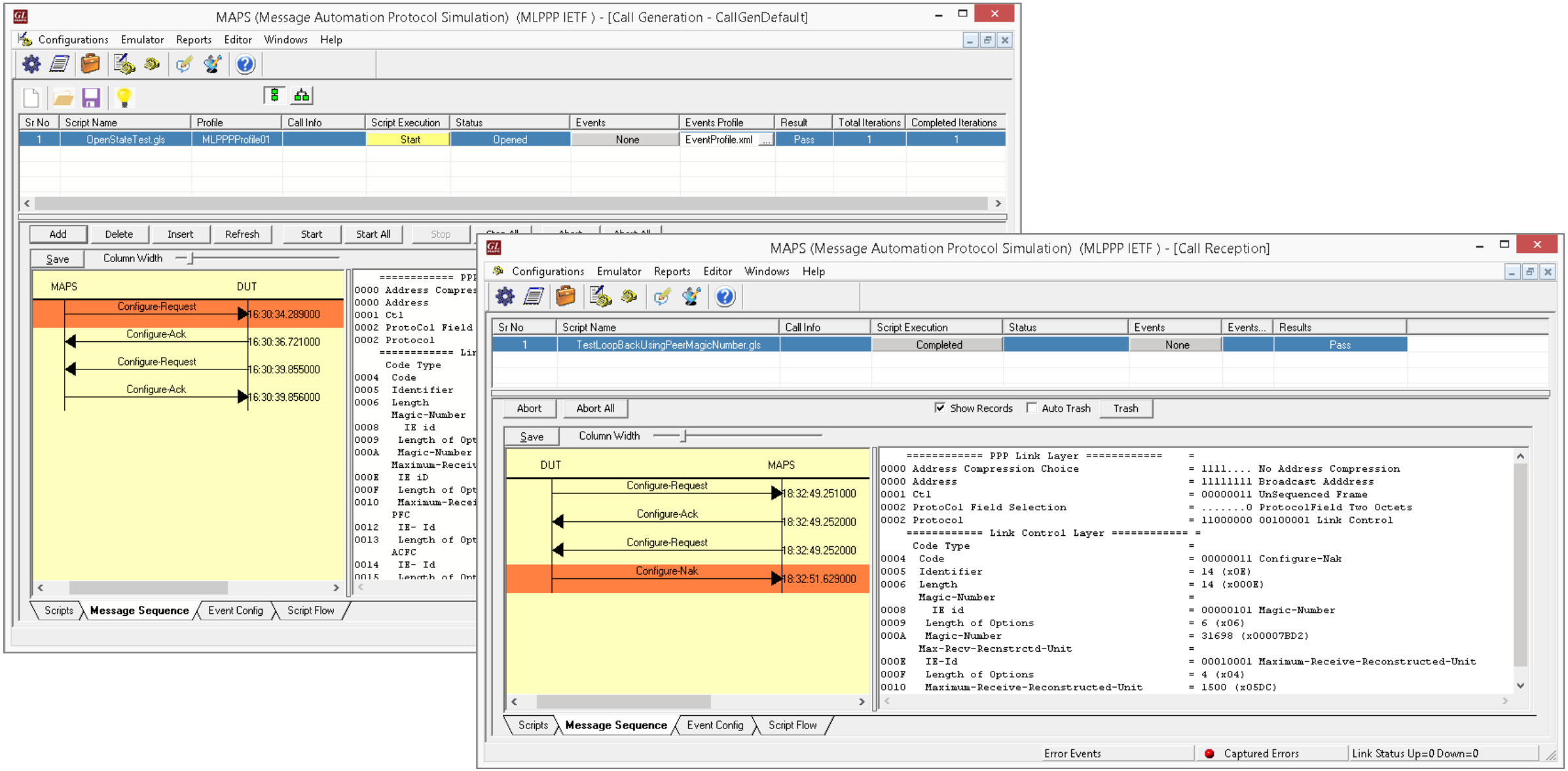
Call Generation and Reception



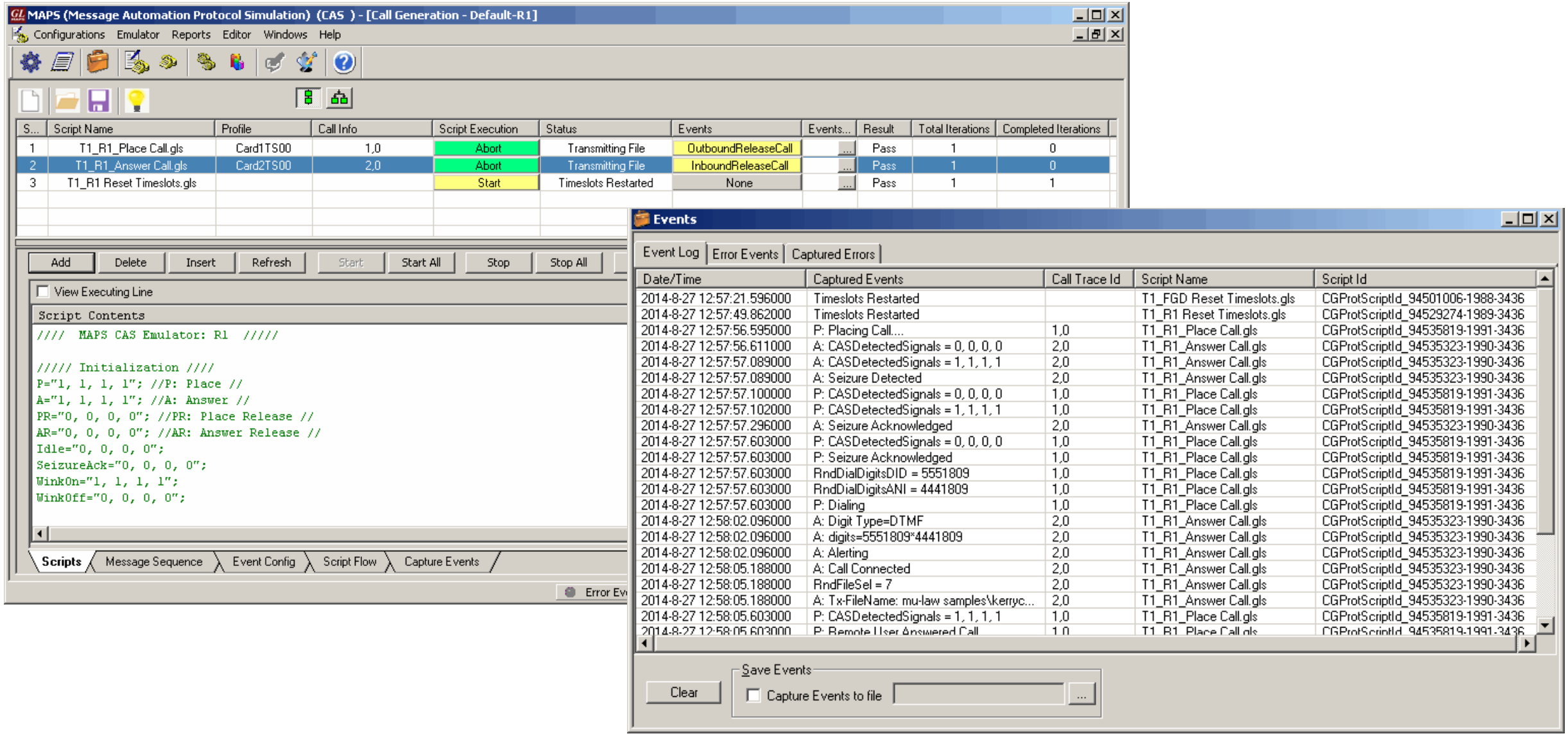
Call Generation and Reception



Call Generation and Reception



Call Generation and Reception



Call Generation

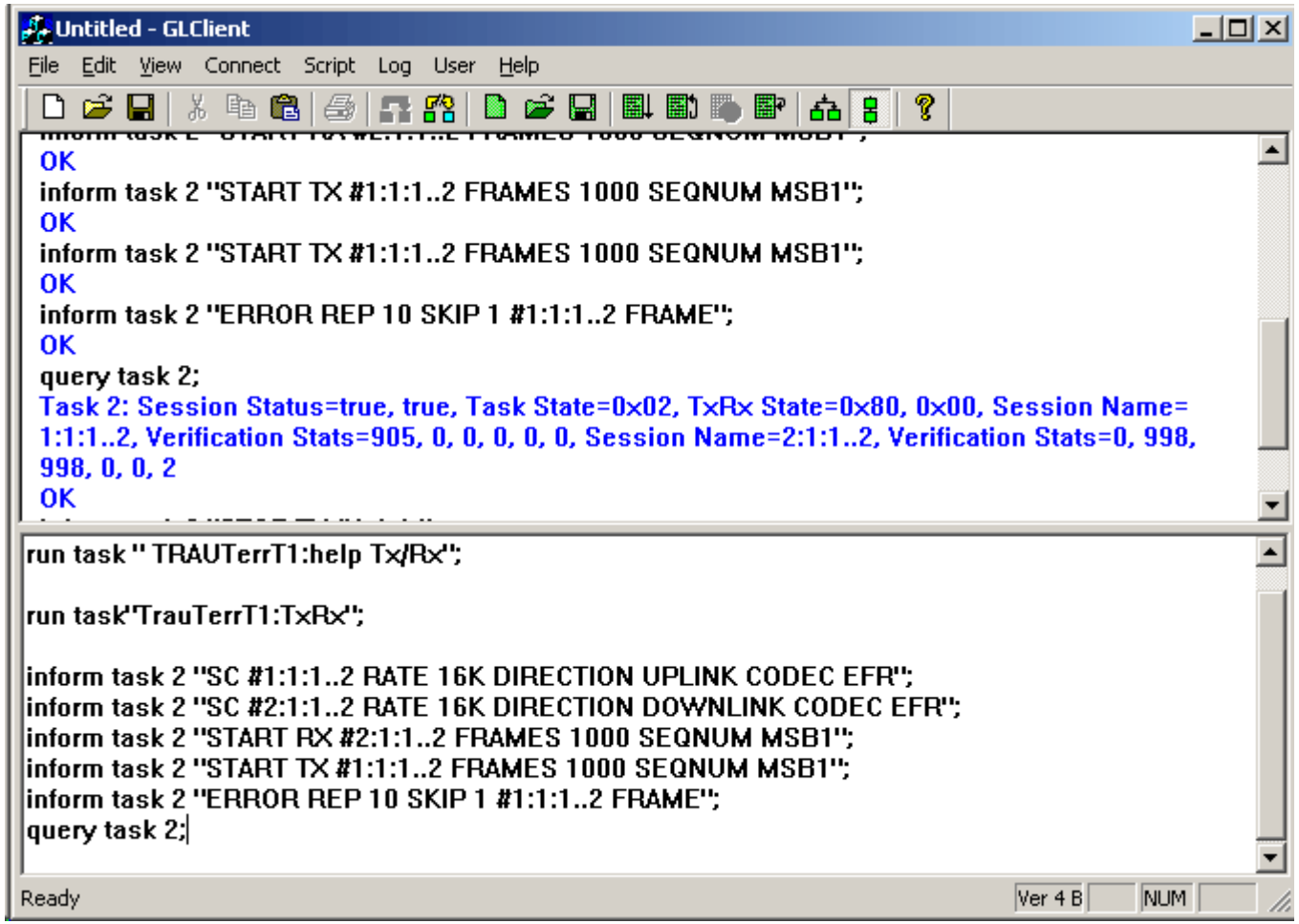
- Interactive GUI to view status, results, call information, total iterations to be done, and number of completed iterations
- Uses profiles to change the field values in the messages during a call
- Events allow redirection of script execution on-the-go. The custom parameters in the events can also be changed during script execution using event profiles
- Impairments can be applied to messages to simulate error conditions
- Provides protocol trace with full message decoding, custom trace, and graphical ladder diagrams of call flow with time stamp while simulation is running
- Call flow graph allows to easily verify the messages exchanged between MAPS™ and DUT
- Support for Bulk Call Simulation with option to configure stress/load testing parameters such as Call per second (CPS), Busy hour call attempts (BHCA), Max Simultaneous Calls and Burst parameters
- Provides the associated captured events and error events during call simulation

Call Reception

- Once the calls are successfully established, the received call instances are displayed in the Call Reception window automatically
- Triggers the execution on reception of pre-defined messages. To receive calls, the scripts are configured against the messages to be received
- Provide the result of the test with detail protocol decode and ladder diagram

Protocol Emulation using Client-Server Scripts

- Provides various modules for analysis and emulation of protocols such as CAS, SS7, ISDN, HDLC, Multilink PPP, TRAU, ATM IMA, and Multi-Link Frame Relay
- Best suited for remote script based operations
- Easy control of T1/E1 servers through software clients via TCP/ IP / UDP



GL Communications

Remote Protocol Analyzers

What are Remote Protocol Analyzers?

- “Remote Protocol Analyzer” or RPA functionality is an extension of the feature rich capability available with GL’s GUI based Protocol Analyzers
- Supported protocols for remote analysis includes -
  - HDLC
  - ISDN
  - SS7
  - GR303
  - Frame Relay
  - V5.x
- HDLC based protocols can be monitored remotely via a set of hardware and software features available with our T1 or E1 based protocol analyzers
- The RPA functionality permits:
  - unattended and 24/7 operation
  - remote accessibility for difficult connection situations
  - remote non-intrusive operation
  - remote detailed diagnostic capability

Key Features

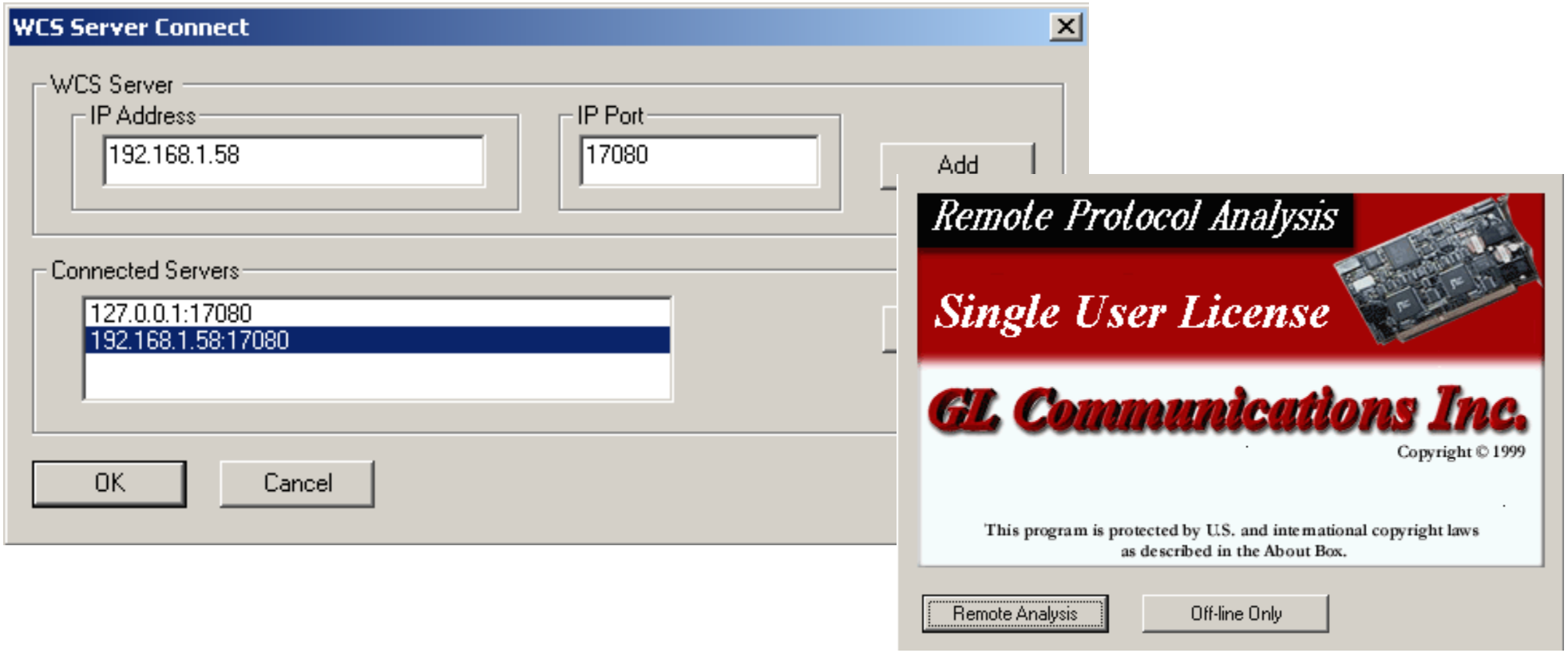
- Client side consists of a PC with Ethernet connectivity and GUI Remote Protocol Analysis software – no special T1 or E1 hardware is required
- Multiple T1/E1 servers may be simultaneously connected to a single remote client using a single GUI
- Multiple remote clients may access a single T1/E1 server. Also, the T1/E1 server is fully functional while being accessed as a server. Thus, a user may perform T1/E1 operations locally on the server while a remote client is accessing the same server, in real time
- Supports real-time and offline analysis at the remote client location
- Remote analyzers support capturing of encapsulated protocols and long frames
- Common filtering criteria can be set for T1/E1 cards located on multiple servers

Pre-requisites

- At the site of monitoring
  - Dual T1/E1 PCI based cards or USB based T1/E1 units
  - T1/E1 Server software with HDLC capture software

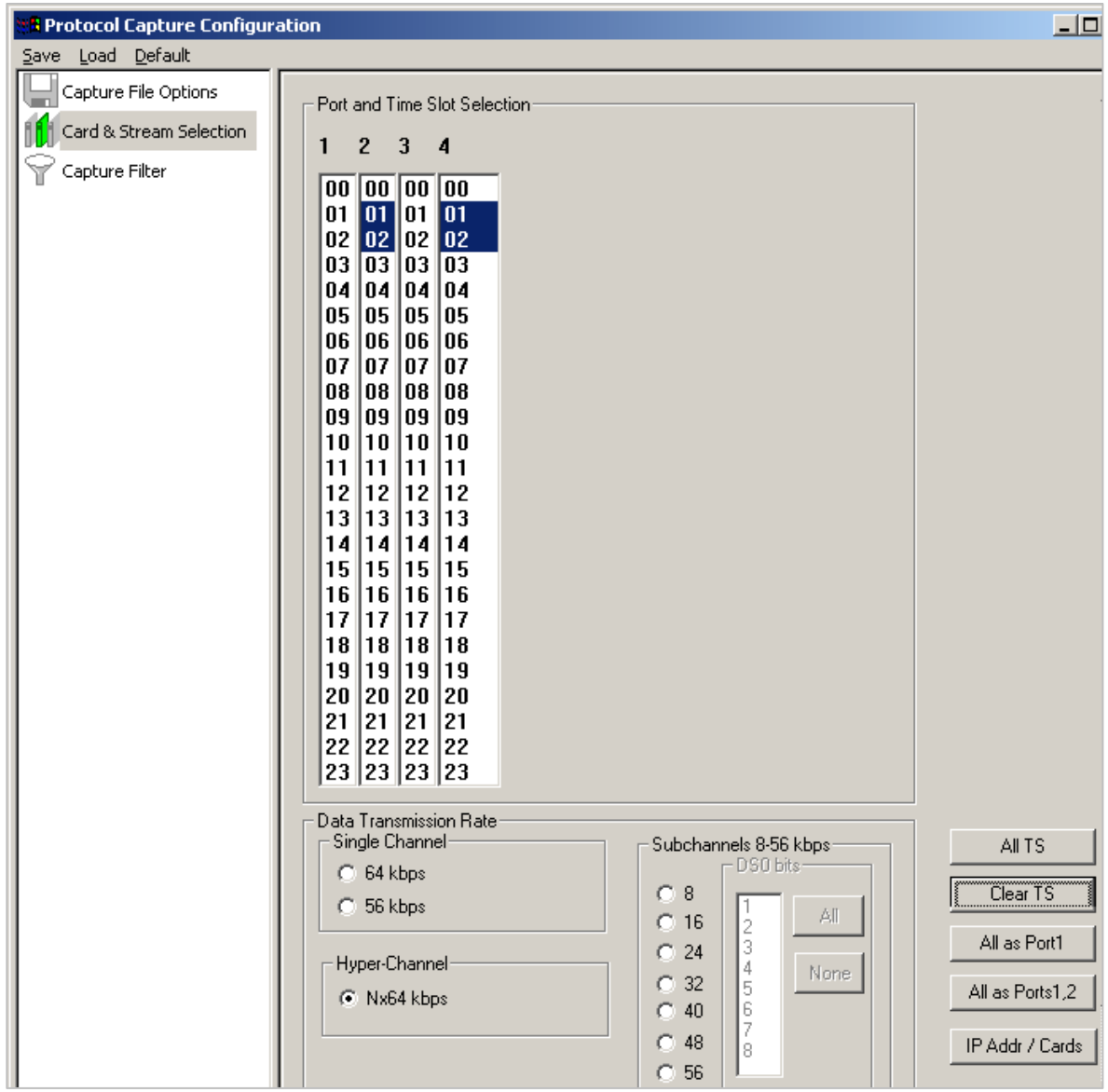
- At the client location
  - Appropriate GUI based “Remote Protocol Analyzer” such as ISDN, SS7, and others – licensed via “Dongle”
  - LAN/WAN TCP/IP Network with sufficient bandwidth to transport HDLC frames

Remote Analysis



- Users are required to enter IP address of the WCS server and an IP Port
- Multiple Server IP Addresses can be added to connect simultaneously to all T1E1 cards
- Lists an IP addresses and the IP port numbers
- Option is provided for an user to select the desired IP address of the server

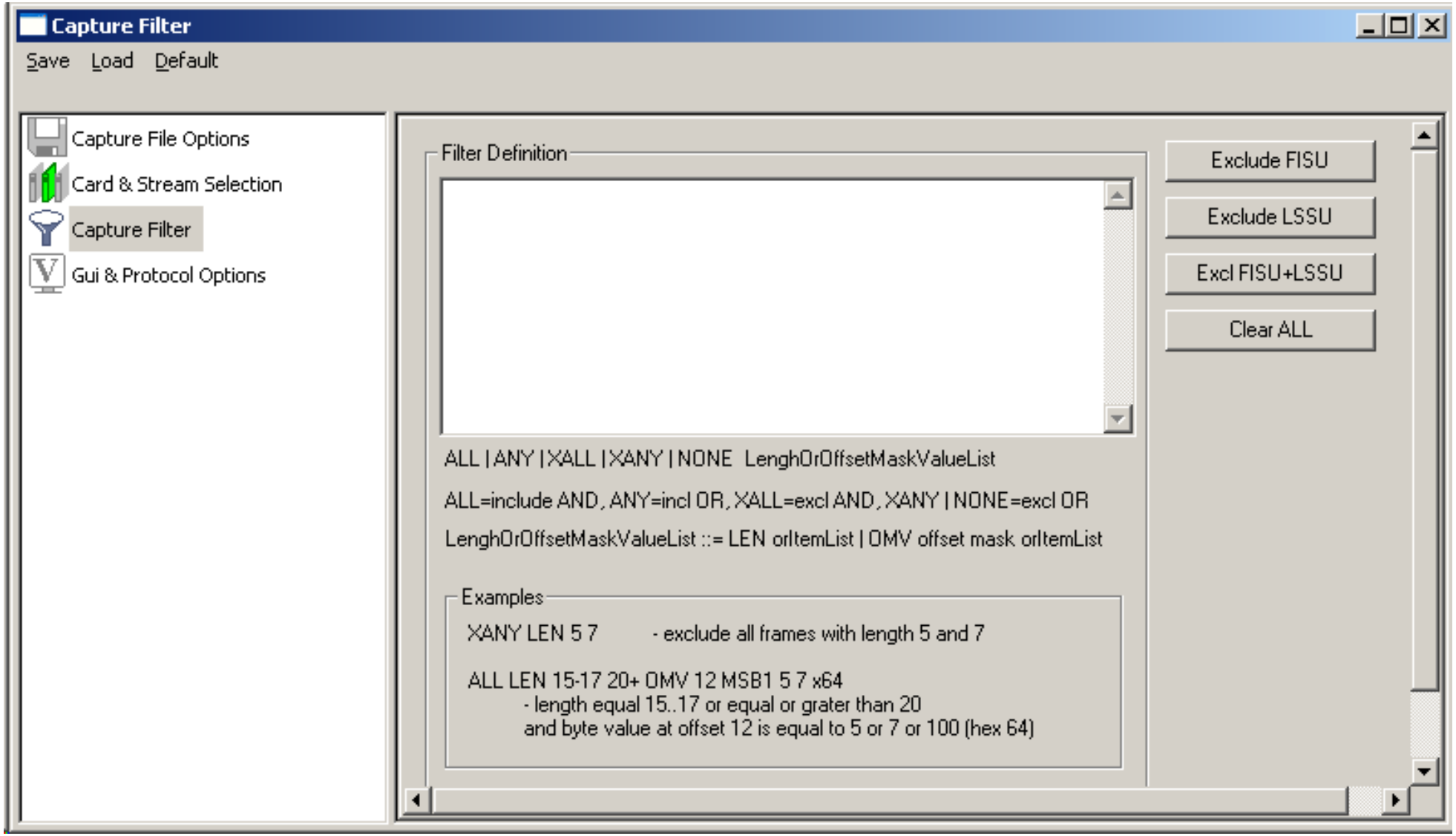
Stream Selection



Stream Selection

- Streams can be captured on the selected time slots (contiguous or non-contiguous), sub-channels (fractional DS0 to DS1) or full bandwidth
- Frames may also be contained in n x 64 kbps
- Recorded trace file can then be analyzed offline, exported to ASCII file, or printed

Capture Filter



Capture Filter

- Real-time capture filter can be set prior to capturing frames
- Real-time filter for HDLC based protocols is done by excluding LSSU (Link Status Signal Unit), FISU (Fill-in Signal Unit), or any other user-defined frame

Thank you