
Protocol Analysis and Emulation

T1 E1 T3 E3 Optical

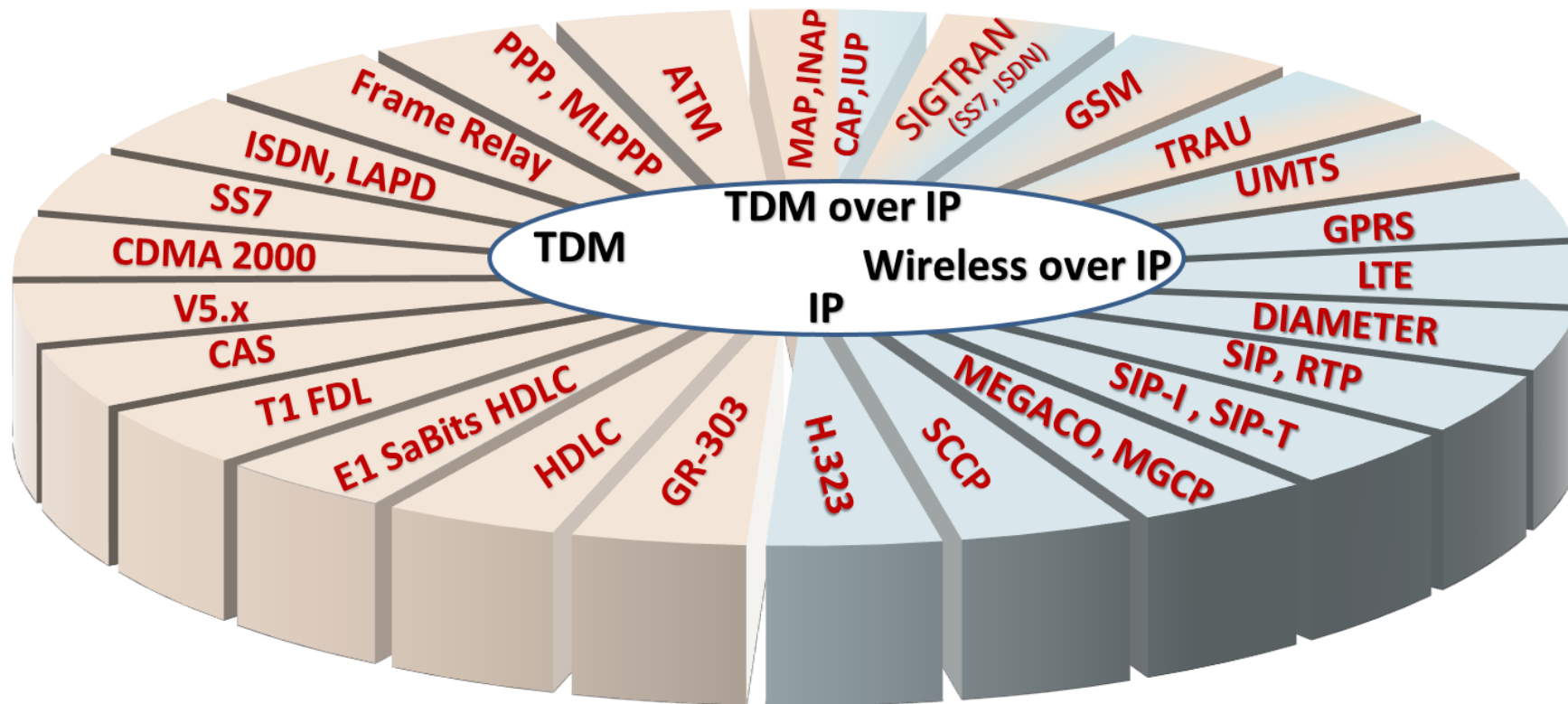


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Index

- Protocol Analyzers
 - General Features
 - HDLC Based Analysis
 - ATM IMA Analysis
 - MLPPP Analysis
 - Frame Relay Analysis
 - E1 Maintenance Data Link Analysis
 - T1 Facility Data Link Analysis
 - Channel Associated Signaling (CAS)
 - SS1 Analyzer
 - Remote Protocol Analyzers
 - Remote Analysis Features
 - Stream/Interface Selection
 - Capture Filter
- Protocol Emulators
 - HDLC Playback and HDLC Tx/Rx Test
 - E1 Maintenance Data Link Playback
 - T1 Facility Data Link Playback
 - TRAU ToolBox, Traffic Playback
 - TRAU WCS Tx/Rx Test
 - ISDN Emulator
 - MLPPP Emulator
 - Multilink Frame Relay Emulator
 - Inverse Multiplexing over ATM
 - MAPS™ TDM Simulators
 - CAS Simulator
 - FAX Simulator
 - SS1 Dialer

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

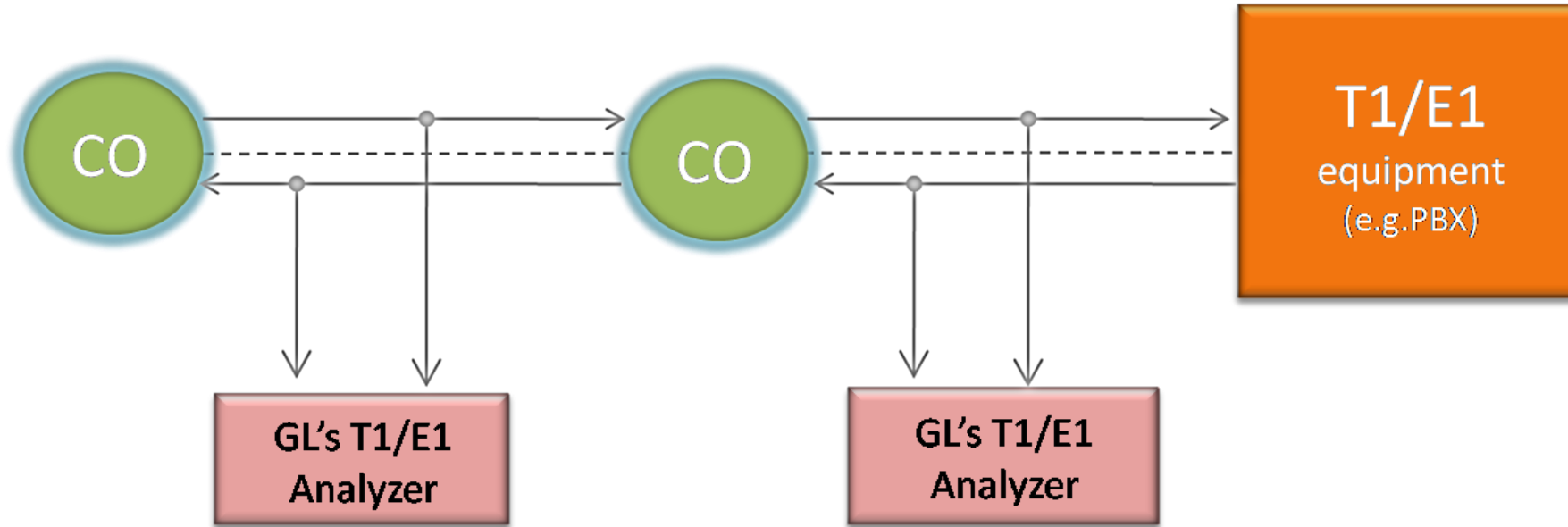
Protocol Analysis over T3 E3

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

Protocol Analysis over Optical

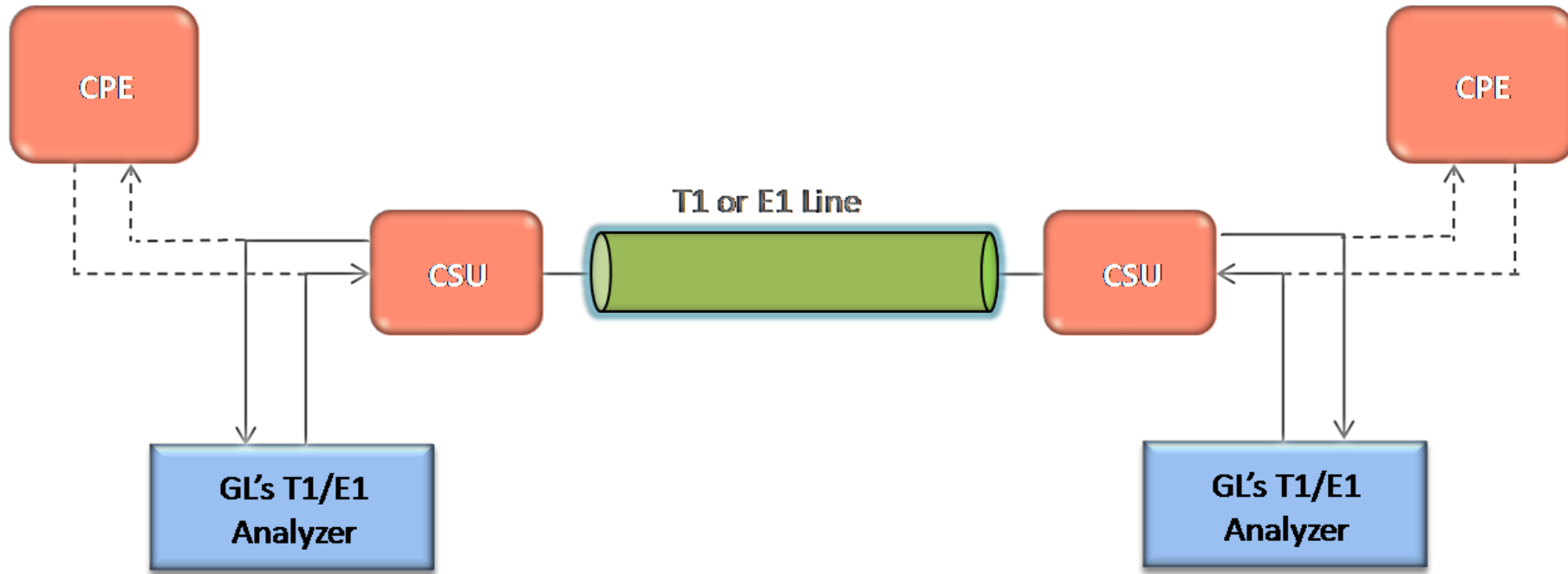
- ATM
- PPP over SONET (PoS)
- OC-3/OC-12/STM-1/STM-4 Transparent Payload
- Channelized access for T1 E1 T3 E3
- (For processing ISDN, SS7, CAS and other channelized protocols)

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



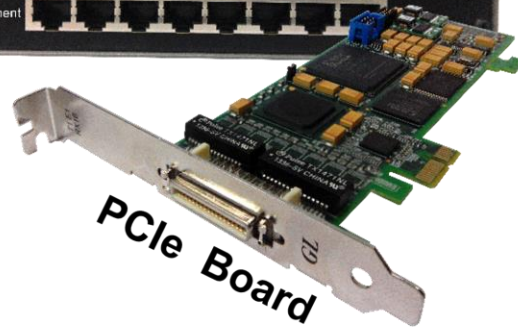
CPE = Customer Premise Equipment
CSU = Channel Service Unit

Example Applications:

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

T1 E1 Platforms

16-Port T1 E1 Breakout-Box



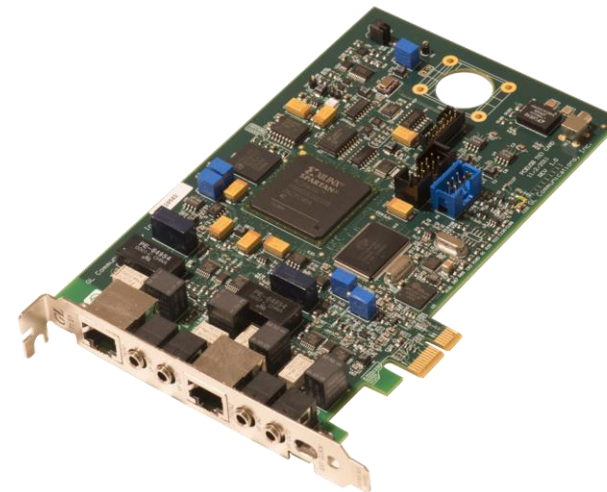
Quad / Octal T1 E1 PCIe Card



Back Panel

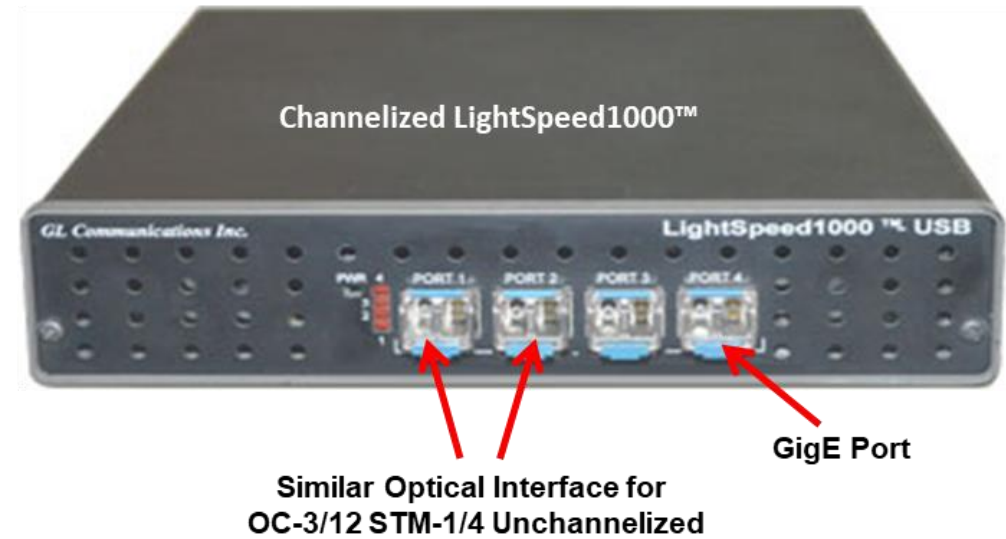
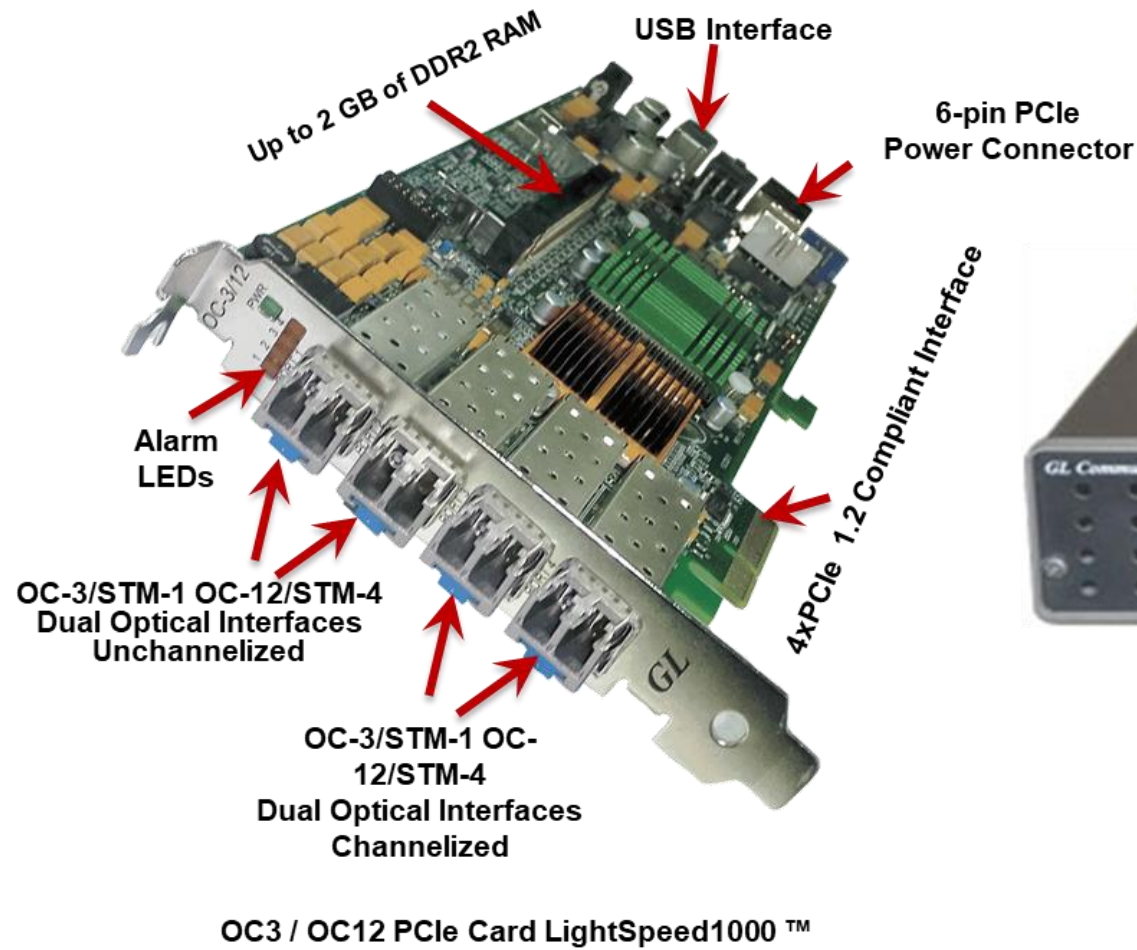
Front Panel

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



Dual T1 E1 Express (PCIe) Board

LightSpeed1000™ Platform



USB T3E3 Platform



Portable USB based
Dual T3 E3 Analyzer Unit



2U Rack T3 E3 Analyzer



T3 T1 E3 E1 Multi-Tester Rackmount

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

T1 E1 Physical Layer Analysis

Dev	Frame#	TIME (Date)	Error	AIS Alarm Status T1/E1 Physical	Carrier Loss Alarm Status T1/E1 Physical	Sync Loss Alarm Status T1/E1 Physical	T1 Blue/E1 Remote Alarm Status T1/E1 Physical	T1 Yellow/E1 Distant Alarm Status T1/E1 Physical
✓ 1	0	2016-12-21 11:56:57.187000		ON	off	ON	ON	off
✓ 2	1	2016-12-21 11:56:57.187000		ON	off	ON	ON	off
✓ 3	2	2016-12-21 11:56:57.187000		ON	off	ON	ON	off
✓ 4	3	2016-12-21 11:56:57.187000		ON	off	ON	ON	off
✓ 5	4	2016-12-21 11:56:57.187000		ON	off	ON	ON	off
✓ 6	5	2016-12-21 11:56:57.187000		ON	off	ON	ON	off
✓ 7	6	2016-12-21 11:56:57.187000		ON	off	ON	ON	off
✓ 8	7	2016-12-21 11:56:57.187000		ON	off	ON	ON	off
✓ 9	8	2016-12-21 11:56:57.187000		ON	off	ON	ON	off
✓ 10	9	2016-12-21 11:56:57.187000		ON	off	ON	ON	off
✓ 11	10	2016-12-21 11:56:57.187000		ON	off	ON	ON	off

```
Devicel TScout=0 Frame=0 at 2016-12-21 11:56:57.187000 OK Len=12 *** Right click to SHOW/HII
ATM Frame Data
===== T1/E1 Physical Layer =====
0000 Type = 00000001 Alarms
0001 Counter = 00000101 (5)
   Sync Loss Alarm = 00000000 (0)
   Sync Loss Alarm Status = 00000001 ON
   Carrier Loss Alarm = 00000001 (1)
   Carrier Loss Alarm Status = 00000000 off
   T1 Blue/E1 Remote Alarm = 00000010 (2)
   T1 Blue/E1 Remote Alarm Status = 00000001 ON
   T1 Yellow/E1 Distant Alarm = 00000011 (3)
   T1 Yellow/E1 Distant Alarm Status = 00000000 off
   AIS Alarm = 00000100 (4)
   AIS Alarm Status = 00000001 ON
```

- 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

The screenshot displays the configuration and monitoring interface of an SNMP Agent. On the left, a tree view shows the hierarchy of MIBs under the 'SNMP Agent' for IP address 127.0.0.1:161-V2 [Loopback V1]. The tree includes standard MIBs like iso, org, dod, internet, and experimental, as well as private MIBs like enterprises, lanmanager, microsoft, and witcs. The 'snmpV2' MIB is expanded, showing sub-entries like snmpDomains.

On the right, a list of traps is shown, all originating from the '192.168.12.186' host and identified as 'dsx1LineStatusChange'. The traps include details such as Community String, Request ID, sysUpTime, snmpTrapOID, and dsx1LineStatus. Red annotations highlight specific fields: 'T1 Alarm Indication' points to the trap type, 'T1 Port Number' points to the 'dsx1LineStatus' value (e.g., 64, 60, 59, 64), and 'T1 Alarm' points to the 'dsx1LineStatus' value (e.g., 1, 4096, 4096, 4096). The 'Port Number' field in the top right is also highlighted with a red box and the value '162'.

Notification Received on port 162

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

ISDN Protocol Analysis Q.93x 64-bit

File View Capture Statistics Database Call Detail Records Configure Help

0 GoTo

Dev	TSlot	SubCh	Frame#	TIME (Relative)	Len	Error	Message Type Q.93x	Call Reference Value Q.93x	Channel Number Q.93x	Called Number Q.93x
✓ 1	0		4	00:00:00.378362	46		SETUP	1538	6	6704784
✓ 2	0		5	00:00:00.379137	6					
✓ 2	0		6	00:00:00.379775	11		CALL PROCEEDING	1538		
✓ 1	0		7	00:00:00.380175	6					

Card1 TimeSlot=0 Frame=4 at 00:00:00.378362 OK Len=46 *** Right click to SHOW/HIDE layers

HDLC Frame Data + FCS
 ===== LAPD Layer =====
 0000 C/R =1. Response(User) Command(Network)
 0000 SAPI = 000000.. (0)
 0001 TEI = 0000000. (0)
 0002 Ctl =0 Information
 0003 N(D) =(0)

Hex Dump of the Frame Data

```

+-----+-----+-----+-----+-----+-----+-----+-----+
02 01 50 62 08 02 06 02 05 04 03 80 90 A3 18 03      Pb      εε
A9 83 86 6C 08 80 35 35 35 36 30 30 30 70 08 80      @|||1 ε5556000p ε
36 37 30 34 37 38 34 7D 02 91 81 A1 14 4F          6704784} 'i O
  
```

Device #	Frame Count(Device #)
1	13973
total 1	13973
2	13973
total 2	13973

Call ID	Call Status	Calling Num	Called Num	Call Start Date & Time	Call Duration	Release Complete Cause	DevNo	TS	CRV	Interf
1	completed	5551000	5179641	2019-03-11 15:06:49.165250	00:00:00.541387	Normal call clearing	1	0	1794	
2	completed	5552000	1626921	2019-03-11 15:06:49.173825	00:00:00.574650	Normal call clearing	1	0	2050	
3	completed	5553000	8604110	2019-03-11 15:06:49.182400	00:00:00.566350	Normal call clearing	1	0	2306	
4	completed	5554000	9402951	2019-03-11 15:06:49.190887	00:00:00.559737	Normal call clearing	1	0	2562	
5	completed	5555000	8752706	2019-03-11 15:06:49.199575	00:00:00.552900	Normal call clearing	1	0	2818	

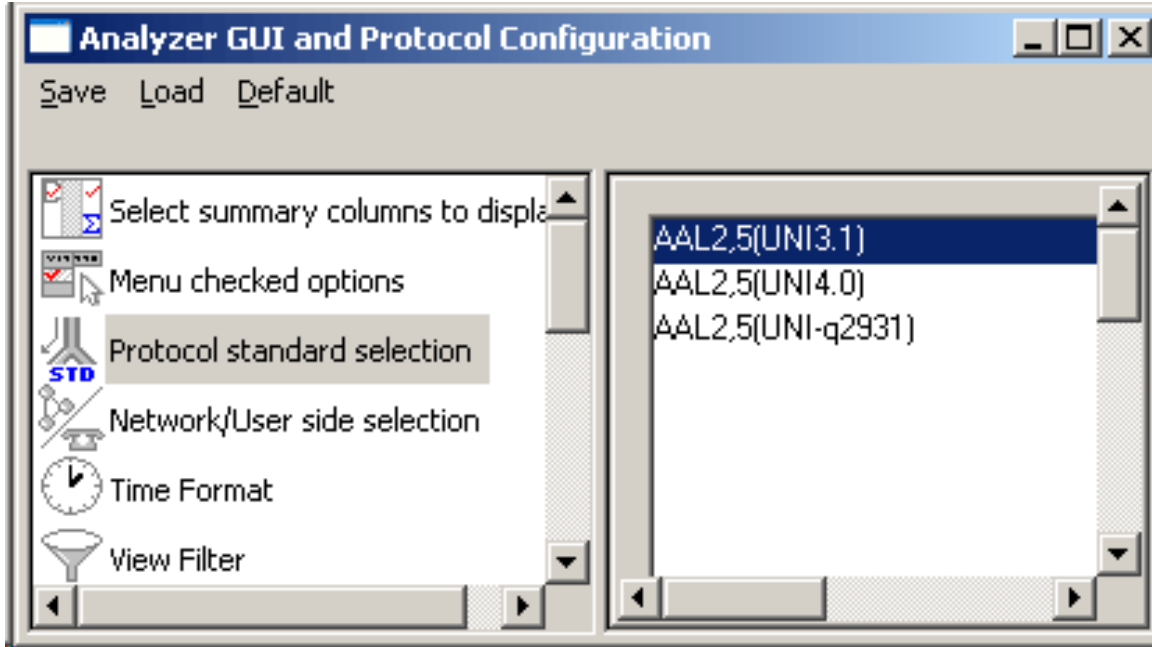
C:\Program Files\GL Communications Inc\U | 27 946 Frames

Different Views

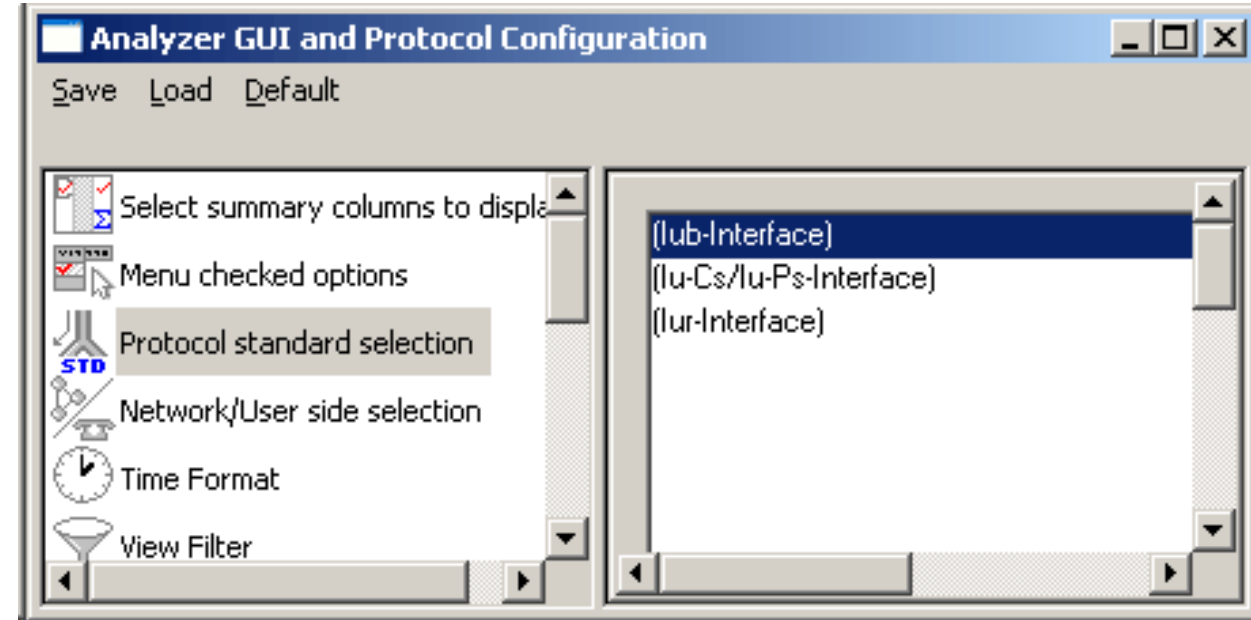
- **Summary View:** This pane displays the columns that contain Card Number, Timeslots, Frame Number, Time, Frame Error Status, Command/Response, Length, Error, C/R, SAPI, CTL, P/F, FUNC, and more in a tabular format
- **Detail View:** This pane displays in detail about a frame in order to analyze and 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

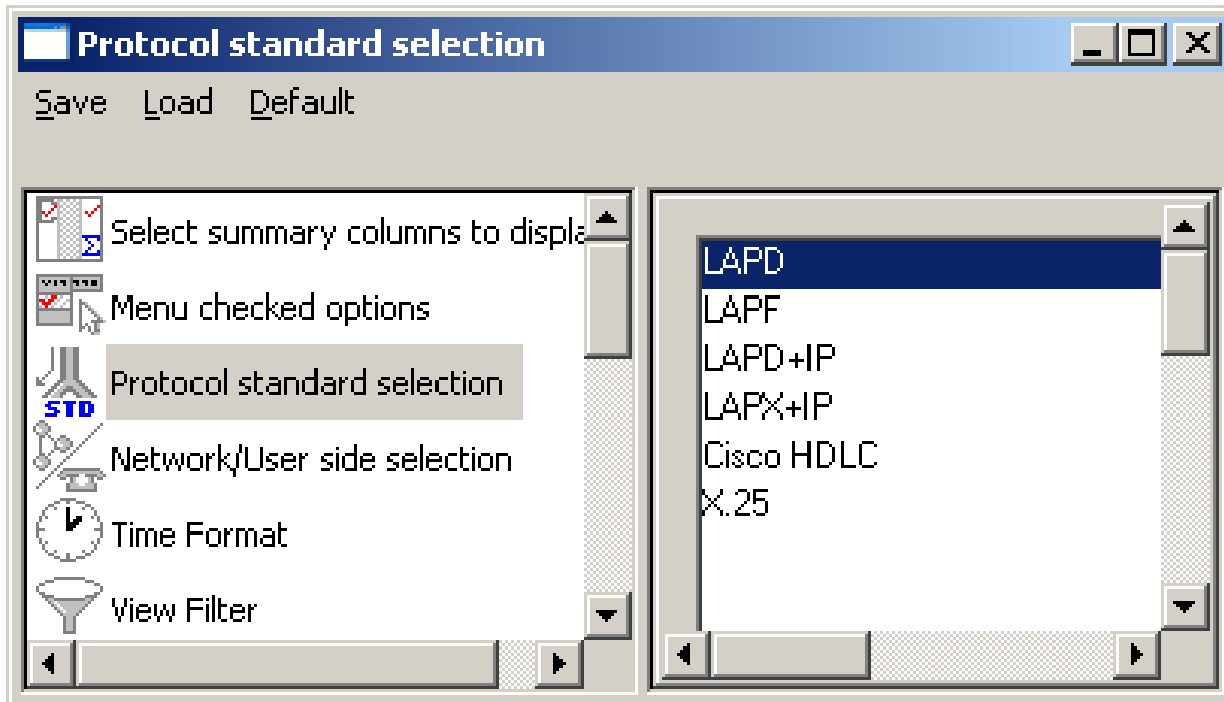


UMTS Analyzer

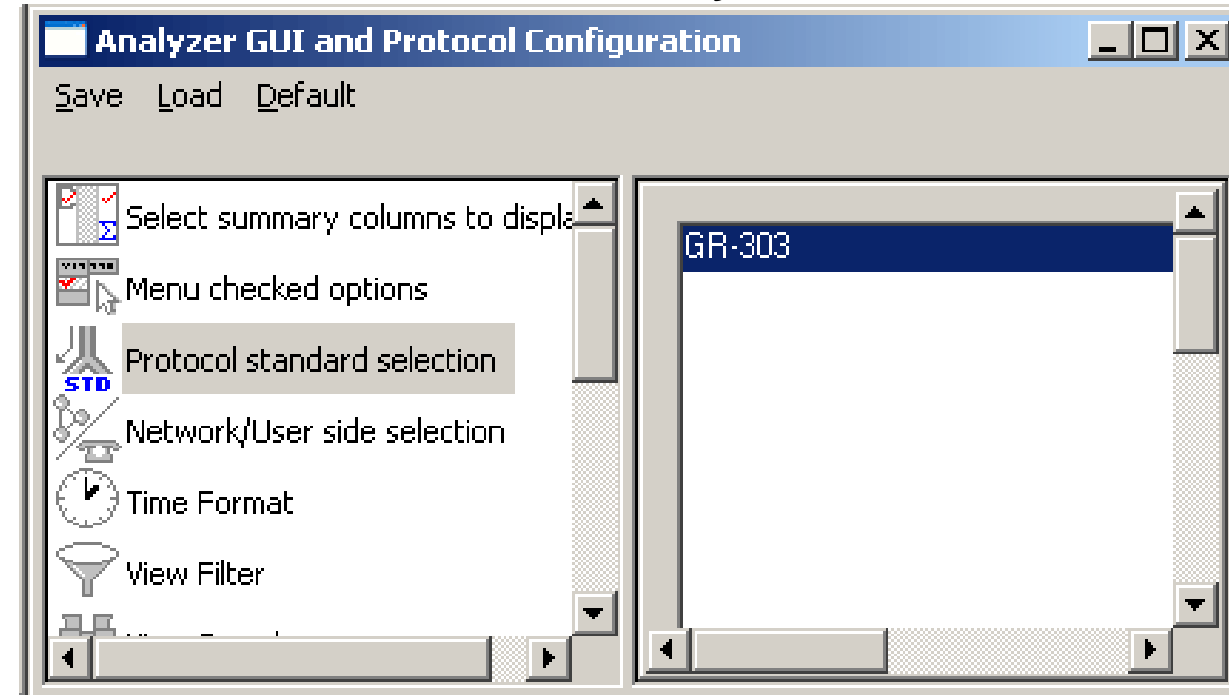


- ATM
 - Please visit <http://www.gl.com/atmanalyzer.html> for a list of supported protocols & specifications for ATM
- UMTS
 - Please visit <http://www.gl.com/umtsanalyzer.html> for a list of supported protocols & specifications for UMTS

HDLC Analyzer



GR-303 Analyzer



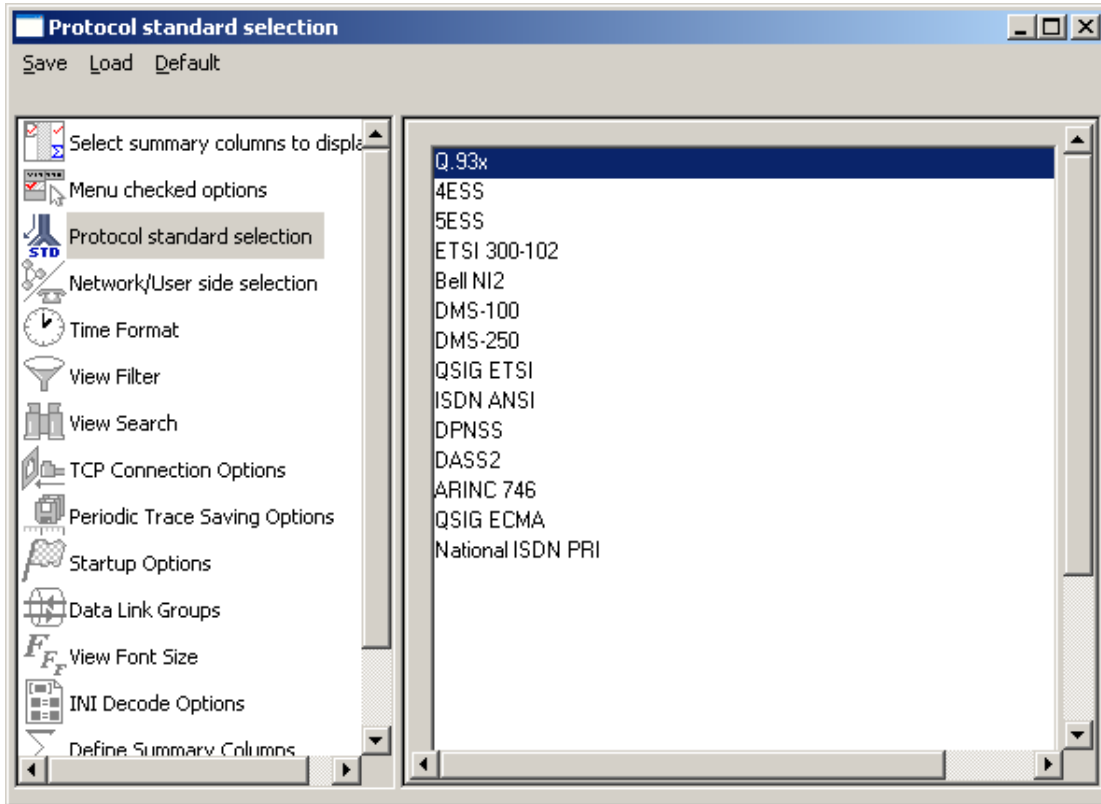
- **HDLC**

- Please visit <http://www.gl.com/hdlc.html> for a complete list of supported protocols & specifications for HDLC

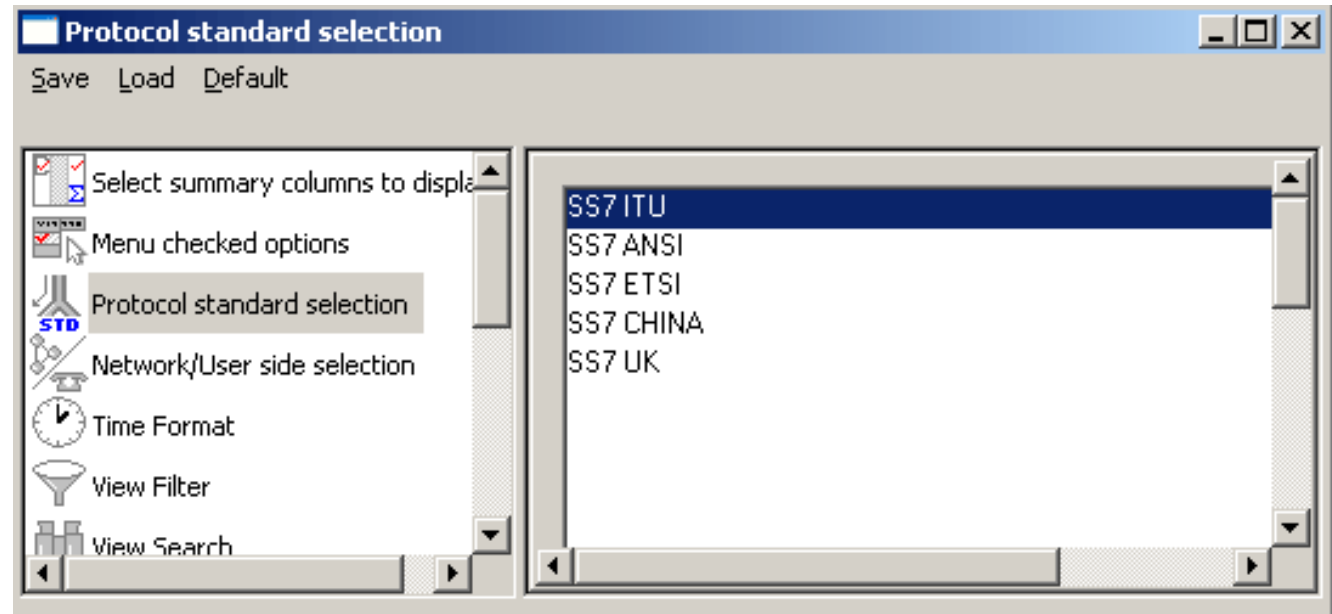
- **GR-303**

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

ISDN Analyzer



SS7 Analyzer



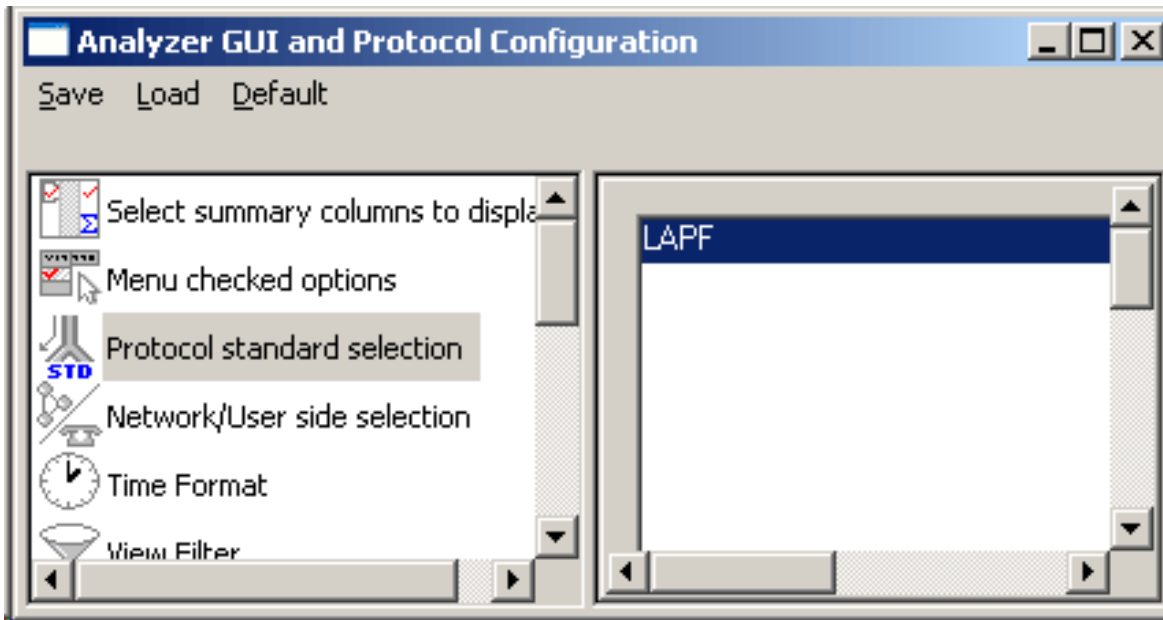
- **ISDN**

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

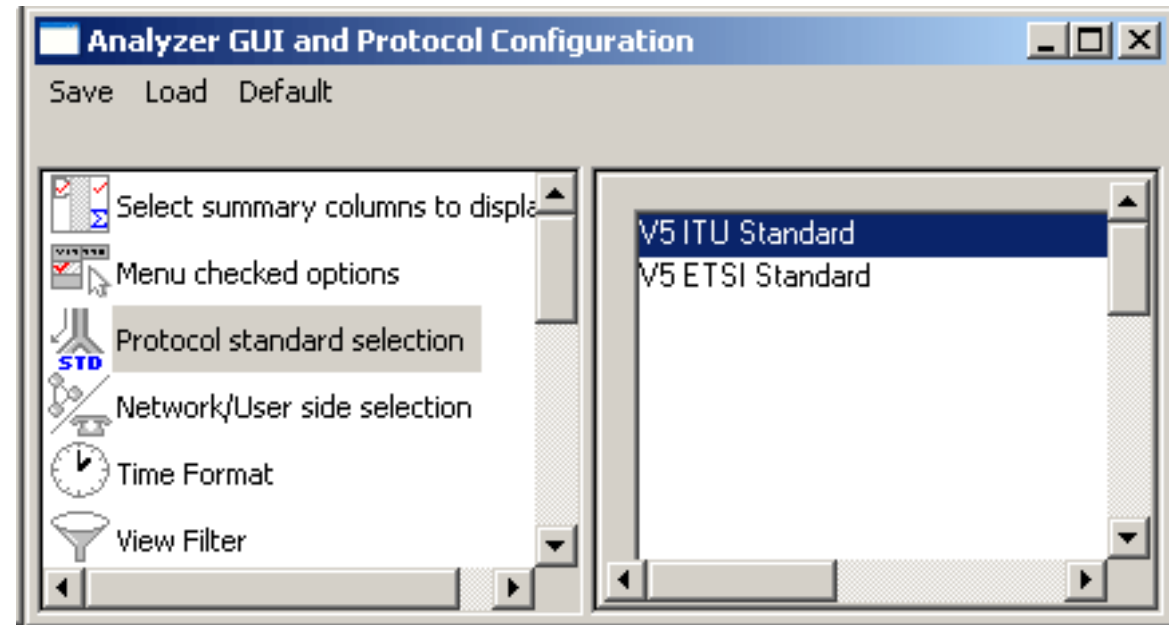
- **SS7**

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

Frame Relay Analyzer



V5.x Analyzer



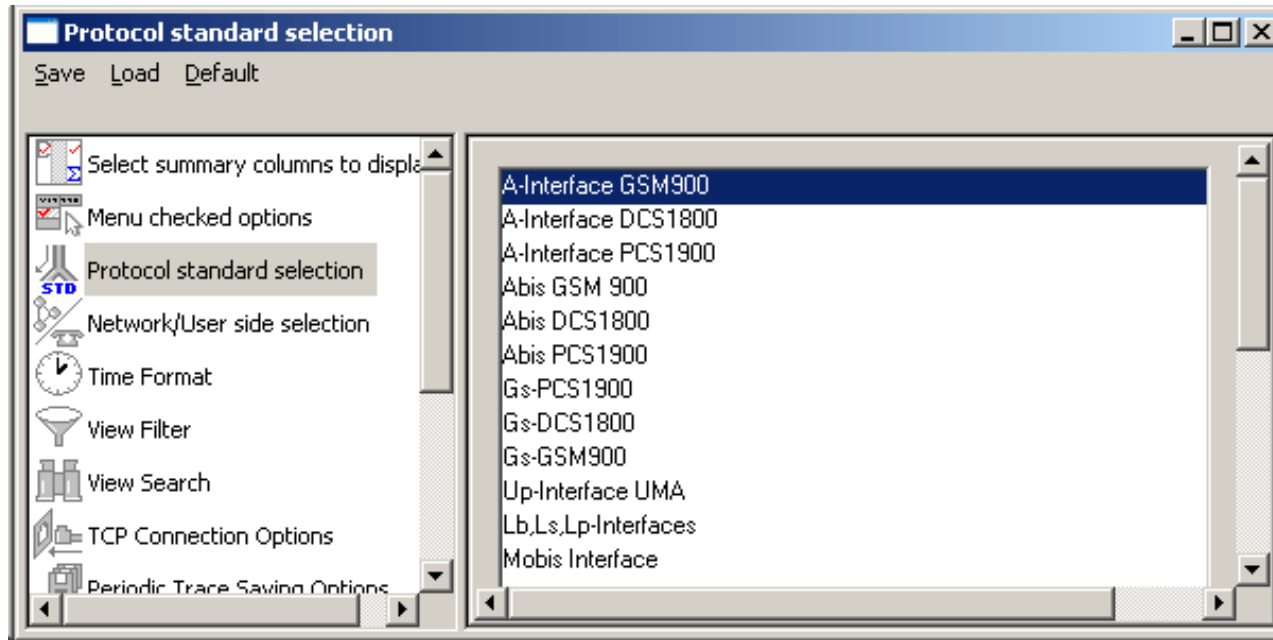
- **Frame Relay**

- Please visit <http://www.gl.com/framerelay.html> for a complete list of supported protocols & specifications for Frame Relay

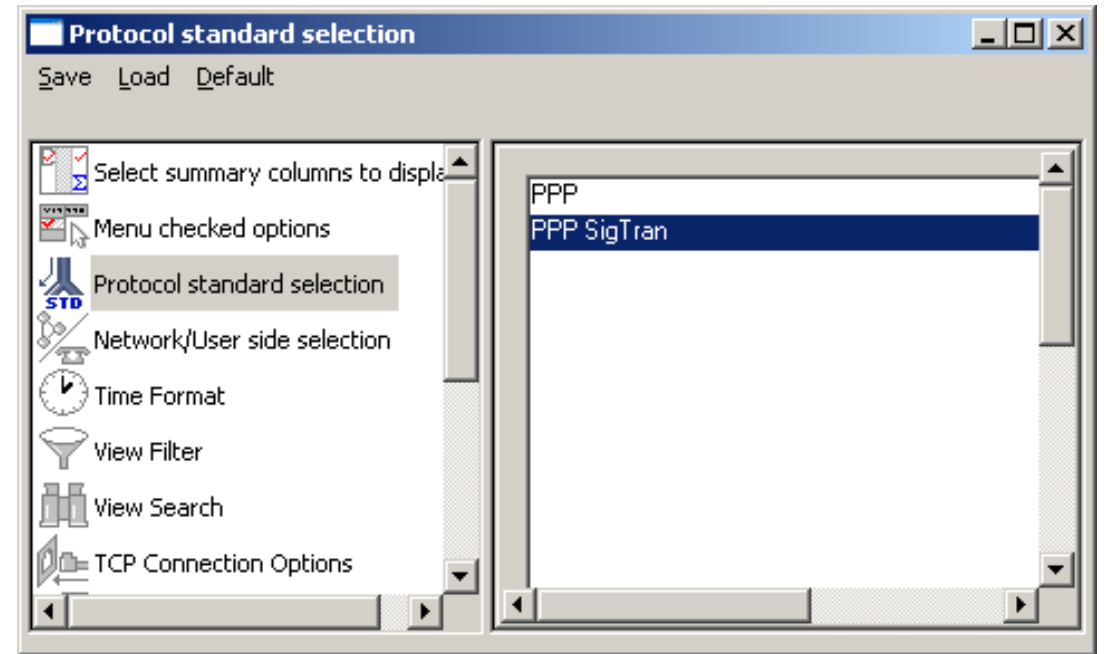
- **V5.x**

- Please visit <http://www.gl.com/v5analyzer.html> for a complete list of supported protocols & specifications for V5.x

GSM Analyzer



MLPPP Analyzer



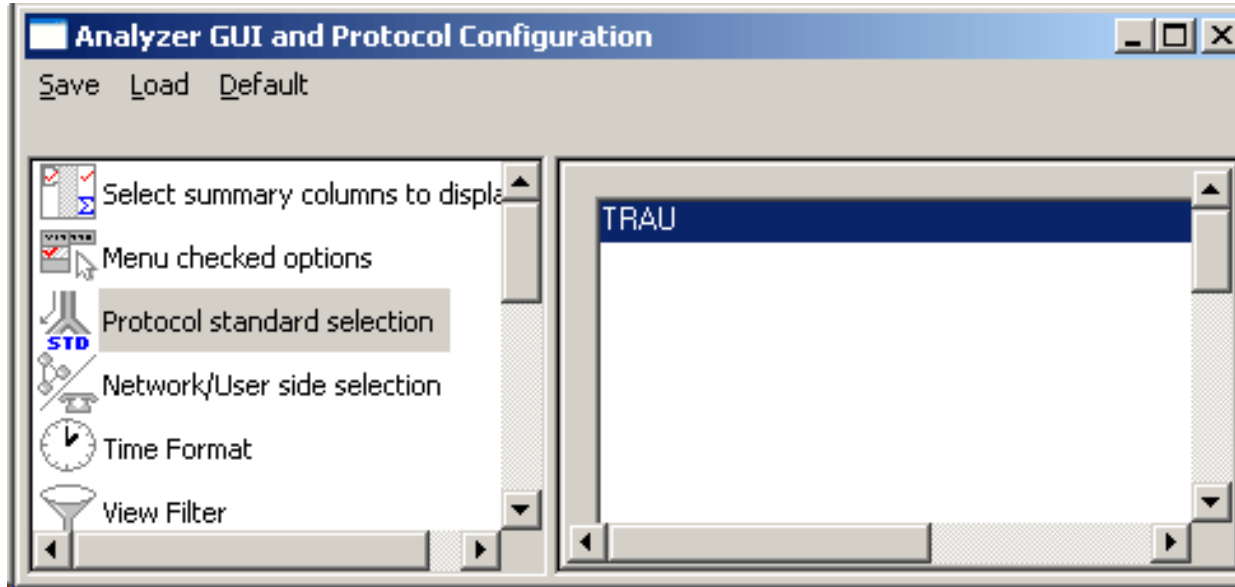
- **GSM**

- Please visit <http://www.gl.com/gsmalyzer.html> for a complete list of supported protocols & specifications for GSM

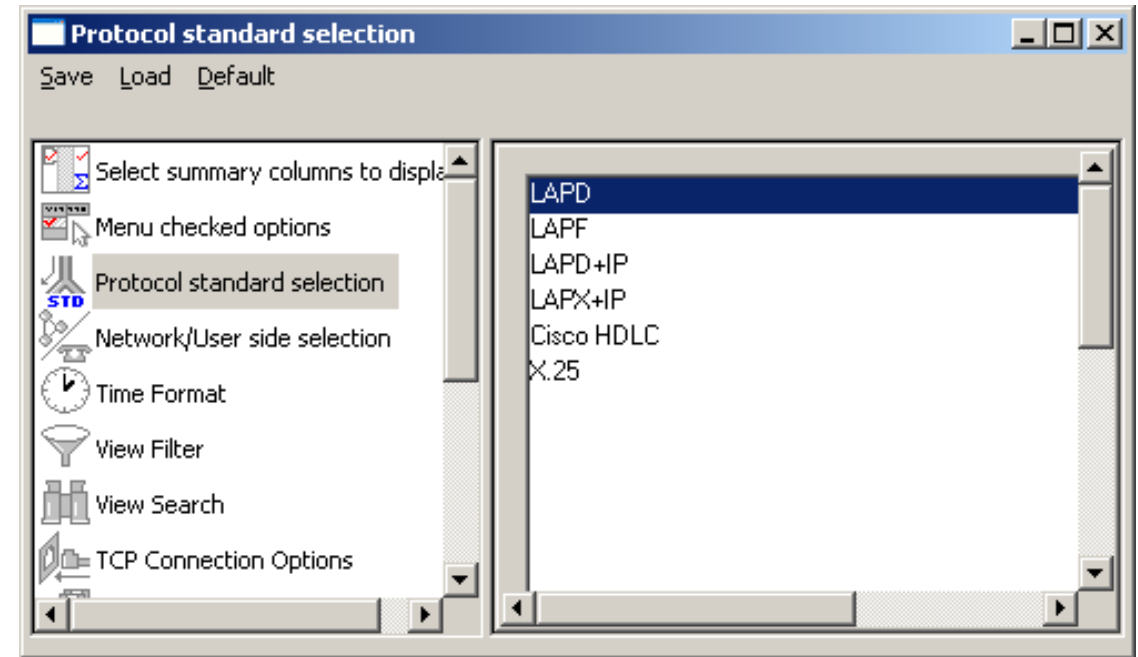
- **MLPPP**

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

TRAU Analyzer



Sa Bits HDLC Analyzer



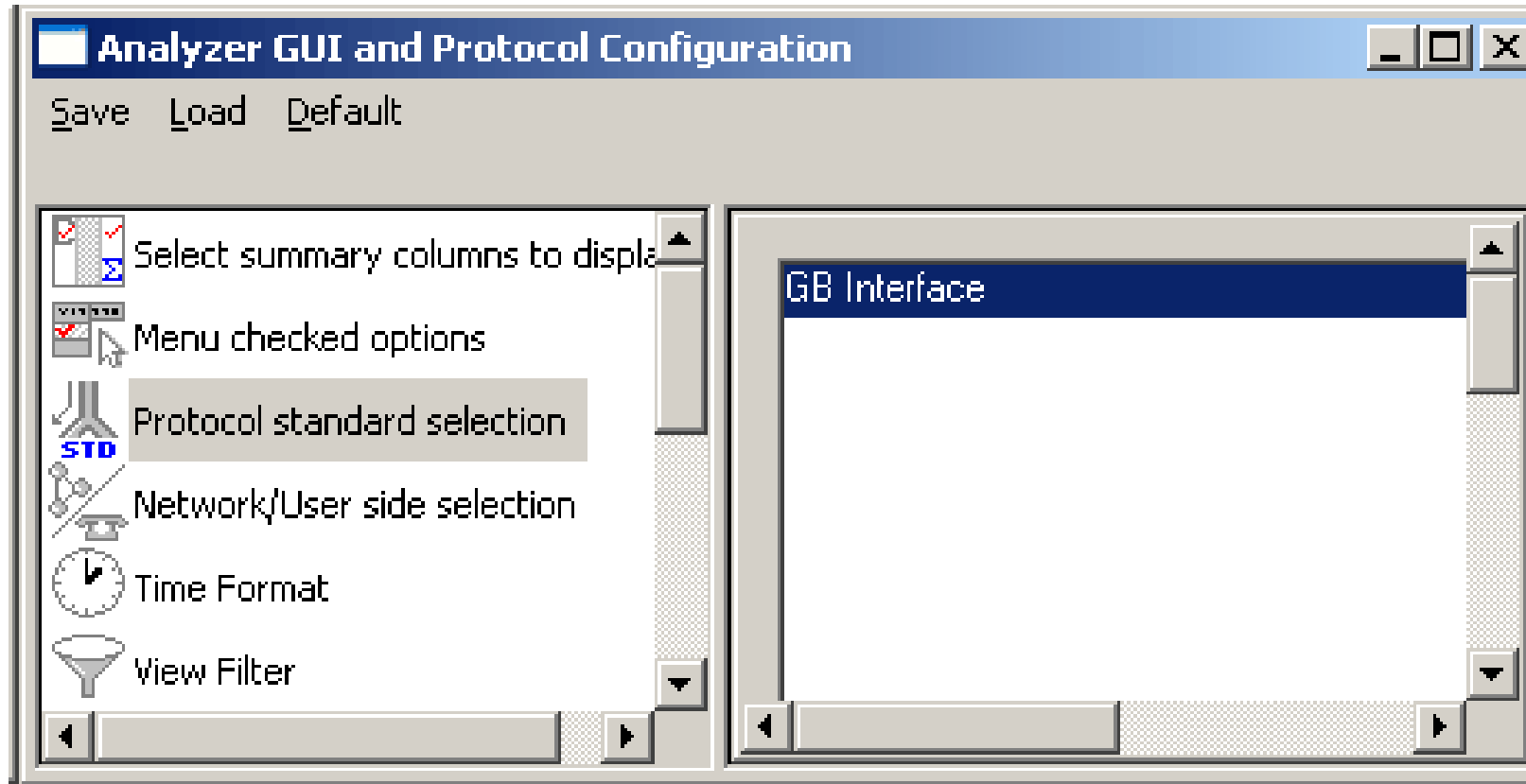
- **TRAU**

- Please visit <http://www.gl.com/trauanalyzer.html> for a complete list of supported protocols & specifications for TRAU

- **Sa Bits HDLC**

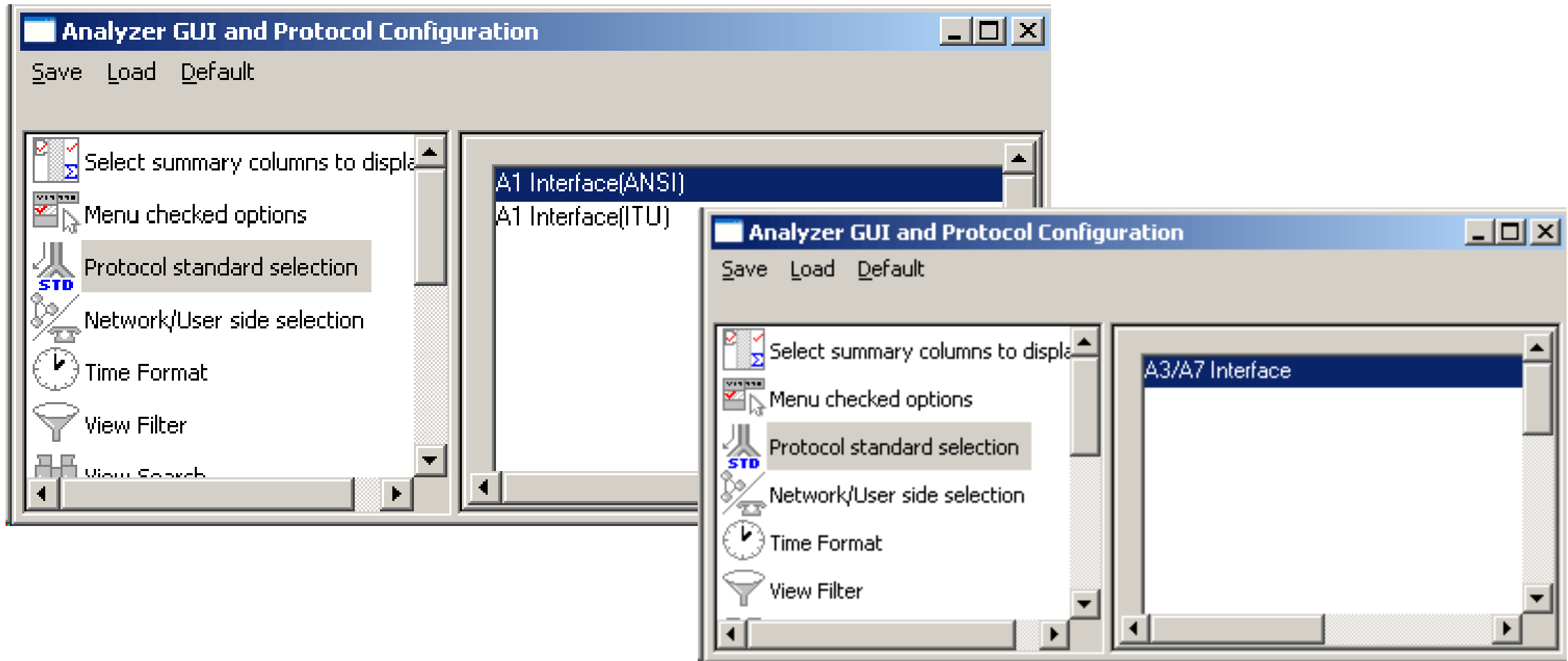
- Please visit <http://www.gl.com/sahdlc.html> for a complete list of supported protocols & specifications for Sa HDLC

GPRS Interface Analyzer



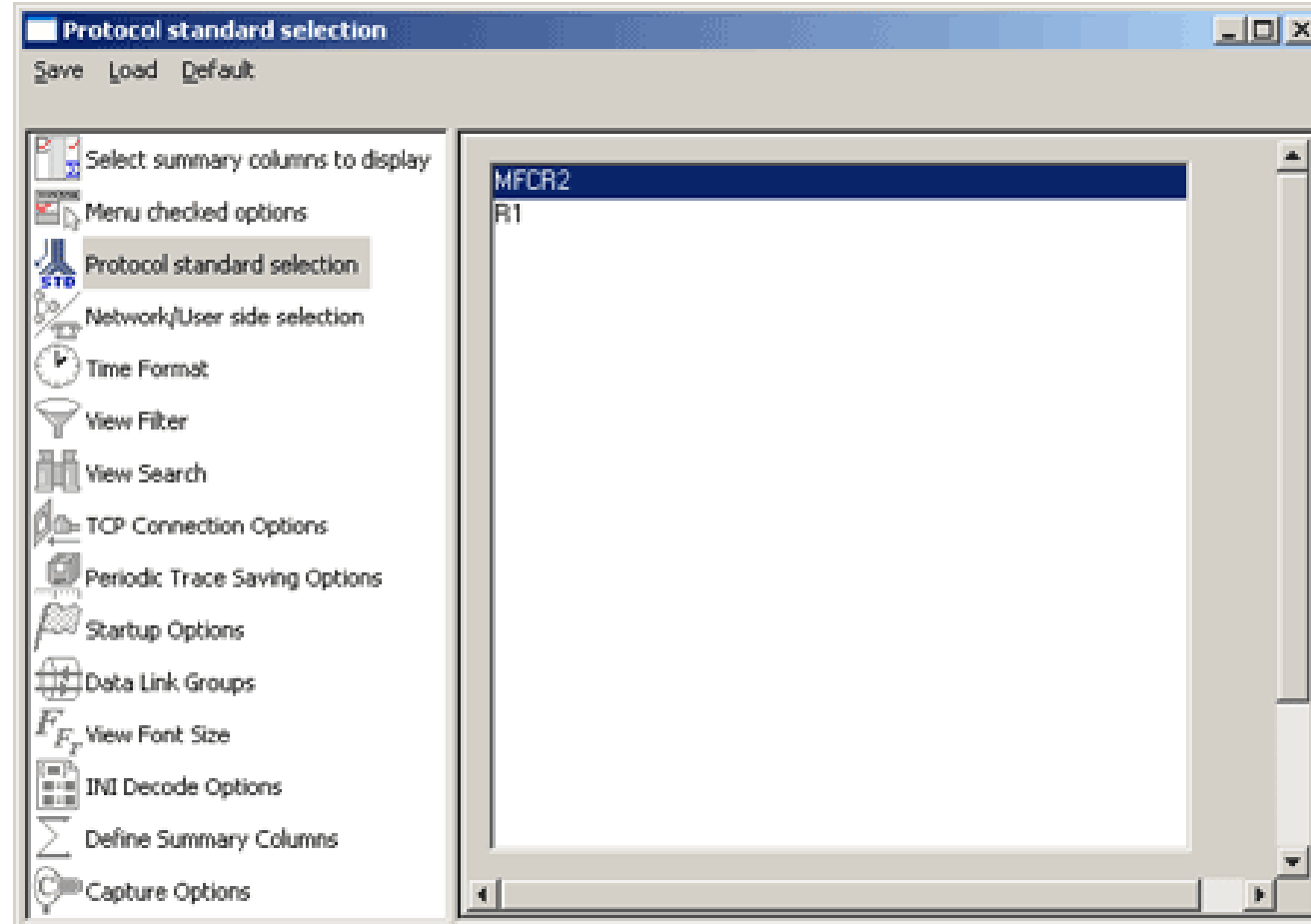
- Please visit <http://www.gl.com/gprsanalyzer.html> for a complete list of supported protocols & specifications for GPRS Gb Interfaces

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

The screenshot displays the 'Protocol Capture Configuration' window. On the left, there is a sidebar with icons for 'Capture File Options', 'Card & Stream Selection', 'Capture Filter', and 'Gui & Protocol Options'. The main area features a table for 'PORT ACTIONS' with columns for 'Port \ TS' and timeslots 00-31. Two rows are shown, both with timeslots 01-10 highlighted in green. Below the table are several configuration panels: 'Data Transmission Rate' (Single Channel: 64 kbps, 56 kbps; Hyper-Channel: Nx64 kbps, Nx56 Kbps (bits 1-7), Nx56 Kbps (Bits 2-8); Multiple Hyper-Channels: 128, 192, ... kbps), 'Subchannels 8-56 kbps' (radio buttons for 8, 16, 24, 32, 40, 48, 56 and a 'D50 bits' spinner), 'All Port Settings' (HDLC FCS: 16 bits, 32 bits, None; Interface: User, Network; Bit Inversion 1 <-> 0; Octet Bit Reversion (MSB <-> LSB)), and 'Row (Port) Select, Clear, Paste Operations' (buttons for Select All, Clear All, Paste All, and Paste List).

PORT ACTIONS	Port \ TS	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
✓ ✗ C P	1		1	2	3	4	5	6	7	8	9	10																					
✓ ✗ C P	2		1	2	3	4	5	6	7	8	9	10																					

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

The screenshot displays the ATM Protocol Analysis AAL2,5(UNI3.1) software interface. The main window is divided into several sections:

- Table of Captured Frames:** A table with columns: Dev, TScout, Frame#, TIME [...], Len, Error, VPI, VCI, PT, HEC, DSF, AAL Type, and Frame Type. The first seven rows show ATM-Cell captures with varying VPI and VCI values.
- Protocol Details:**
 - ATM Layer:** GFC = 0000.... (0), VPI = 0 (...0000 0000....), VCI = 0 (...0000 00000000 0000....), PT =101. (5), CLP =1 (1), HEC = 01100100 (100).
 - OAM Layer:** IMA Version Value = 00000011 IMA version 1.1, IMA = 1..... IMA Control Protocol Cell, Logical ID for Tx IMA link range = ...00000 (0), IMA Frame Sequence Number = 83 (x53), Position of ICP cell within an IMA frame = 0 (x00), Link Stuffing Indication(LSI) =111 No imminent stuff event, Status change indication = 3 (x03), IMA ID = 2 (x02), Group State = 1010.... Operational, Group Symmetry Mode =00.. Symmetrical configuration and operation, IMA Frame Length =10 M=128, Transmit Clock Mode = ..0..... ITC mode.
- Hex Dump of the Frame Data:** Shows the raw hexadecimal data of the frame, with a vertical line indicating the start of the IMA section.
- Configuration Panel (Right):**
 - Card and Time Slot Selection:** Card1 and Card2 dropdown menus, both set to 13.
 - User (unchecked) / Network (checked):** Radio buttons.
 - Bit Inversion (1 <-> 0):** Radio buttons.
 - Octet Bit Reversion (MSB <-> LSB):** Radio buttons.
 - ATM Mapping:** Radio buttons for Direct Mapping (selected) and PLCP.
 - Scrambler:** Check box for SDH X^43+1 (unchecked).
 - Inverse Multiplexing:** Check box for Inverse Multiplexing (checked), IMA Frame Size dropdown set to 128.

At the bottom of the window, it shows: Running, Utilization 0.00%, C:\Temp.Hdl, and Captured 176 383 frames.

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

PPP Protocol Analysis PPP

File View Capture Statistics Database Configure Help

Dev	TS...	Su...	Frame#	TIME (Relative)	Len	PPP Layer3Prot...	M...	M...	LCP Code	IF
✓ 2	1-2		88	00:03:51.552562	21	Link Control			Echo-Reply	
✓ 1	1-2		89	00:03:52.471625	21	Link Control			Echo-Reply	
✓ 1	1-2		90	00:03:59.839500	21	Link Control			Echo-Request	
✓ 2	1-2		91	00:04:00.791687	21	Link Control			Echo-Request	
✓ 2	1-2		92	00:04:01.547750	21	Link Control			Echo-Reply	
✓ 1	1-2		93	00:04:02.498000	21	Link Control			Echo-Reply	
✓ 1	1-2		94	00:04:09.865812	21	Link Control			Echo-Request	

Card2 TimeSlots=1-2 Frame=88 at 00:03:51.552562 OK Len=21

HDLC Frame Data + FCS

```

===== PPP Link Layer =====
Address                = 11111111 (255)
Ctl                    = 00000011 (3)
Protocol               = 11000000 00100001 Link Control
===== Link Control Layer =====
Code                   = 00001010 Echo-Reply
Identifier             = 20 (x14)
Length                 = 15 (x000F)
    
```

Hex Dump of the Frame Data

```

+-----+-----+-----+-----+-----+-----+-----+-----+
FF 03 C0 21 0A 14 00 0F 00 00 00 00 47 4C 20 43   y A!      GL C
4F 4D 4D A0 28                                     OMM (
    
```

Running. Utilization 0.02% UnderRuns=1 Captured 96 frames Errors 0 CRC, 0 Frame

Bundle 1 Bundle 2

Add Bundle Delete Bundle

Add Link Delete Link

Card 1

Timeslot Selection

TS	▲
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
...	

All TS Clear TS

Data Transmission Rate

Single Channel

64 kbps

56 kbps

Hyper-Channel

Nx64 kbps

Nx56 Kbps (bits 1-7)

Nx56 Kbps (Bits 2-8)

CRC

Subchannels 8-56 kbps

DS0 bits

1	
2	
3	
4	
5	
6	
7	
8	

All None

Bit Inversion (1 <-> 0)

Mppp Options

Fragment Format

Octet Bit Reversion (MSB <-> LSB)

Maximum Differential Delay ms

Selected Links

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($n \times 64$ kbps, or $n \times 56$ 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 Protocol Analysis LAPF

File View Capture Statistics Database Call Detail Records Configure Help

0 GoTo

Dev	TS...	Su...	Fra...	TIME (Relative)	Len	E	DLCI	DE	BECN	FECN	Sequ...	Sequ...
✓ 2	1-7		12...	00:00:17.0930...	20		56	0	0	0		
✓ 1	1-7		12...	00:00:17.0951...	20		40	0	0	0		
✓ 2	1-7		12...	00:00:17.0951...	20		40	0	0	0		
✓ 1	1-7		12...	00:00:17.0973...	16		0	0	0	0		
✓ 2	1-7		12...	00:00:17.0973...	16		0	0	0	0		
✓ 1	1-7		12...	00:00:17.0993...	20		56	0	0	0		
✓ 2	1-7		12...	00:00:17.0993...	20		56	0	0	0		

Card2 TimeSlots=1-7 Frame=12942 at 00:00:17.093000 OK Len=20
HDLC Frame Data + FCS
----- LAPF Layer -----
EA =0 (0)
C/R =0. Command(User), Re
DLCI = 56 (000011... 1000....)
EA =1 (1)
DE =0. (0)
BECN =0.. (0)
FECN =0... (0)

Hex Dump of the Frame Data

0C 81 03 CF 00 01 03 08 00 75 95 01 01 00 03 02 | I u |
E1 00 E7 B8 | a c |

Running, Utilization 15.52% C:\Temp.Hdl Captured 13141 frames

Protocol Capture Configuration

Save Load Default

Capture File Options
Card & Stream Selection
Capture Filter
Gui & Protocol Options

Bundle 1 Bundle 2
Add Bundle Delete Bundle
Add Link Delete Link

Card 1 Card 1 Card 1

Timeslot Selection
TS
21
22
23
24
25
26
27
28
29
30
All TS
Clear TS

Data Transmission Rate
Single Channel
 64 kbps
 56 kbps
Hyper-Channel
 Nx64 kbps
 Nx56 Kbps (bits 1-7)
 Nx56 Kbps (Bits 2-8)
CRC CRC16

Subchannels 8-56 kbps
DS0 bits
1
2
3
4
5
6
7
8
All
None

Bit Inversion (1 <-> 0)

Mfr Options
Maximum Differential Delay 250 ms

Octet Bit Reversion (MSB <-> LSB)

Selected Links HC 1:1..10.HC 1:11..20.TS 1:21..30

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($n \times 64$ kbps, or $n \times 56$ 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 Protocol Analysis TRAU

File View Capture Statistics Database Configure Help

0 GoTo

Dev	TSlot	SubCh	Frame#	TIME (...)	Len	Error	TRAU Frame Direction	TRAU Frame Type
✓ 1	1	1-2	0	00:00:...	40		Downlink (Network)	Adaptive Multi-Rate Narrow Bar
✓ 1	1	1-2	1	00:00:...	40		Downlink (Network)	Adaptive Multi-Rate Narrow Bar
✓ 1	1	1-2	2	00:00:...	40		Downlink (Network)	Adaptive Multi-Rate Narrow Bar
✓ 1	1	1-2	3	00:00:...	40		Downlink (Network)	Adaptive Multi-Rate Narrow Bar
✓ 1	1	1-2	4	00:00:...	40		Downlink (Network)	Adaptive Multi-Rate Narrow Bar
✓ 1	1	1-2	5	00:00:...	40		Downlink (Network)	Adaptive Multi-Rate Narrow Bar
✓ 1	1	1-2	6	00:00:...	40		Downlink (Network)	Adaptive Multi-Rate Narrow Bar
✓ 1	1	1-2	7	00:00:...	40		Downlink (Network)	Adaptive Multi-Rate Narrow Bar
✓ 1	1	1-2	8	00:00:...	40		Downlink (Network)	Adaptive Multi-Rate Narrow Bar

Card1 TimeSlot=1 SubChannels=1-2 Frame=0 at 00:00:00.000000 OK Len=40

HDLCL Frame Data + FCS

```

===== TRAU Layer =====
Frame Sync = Valid Frame Sync (00000000000000001111111111111111)
Frame Type (Full Rate, 16kbps, C1-C5) = .00110.. Adaptive Multi-Rate Narrow Band Codec (AMR-NB) - F
Time Alignment (C6-C11) for TAC_AMR = .....00 0000.... No change in frame timing
Req or Ind Flag-RIF (C12) for Downlink = ....0... Indication (Codec Mode)
Uplink Frame Error-UFE (C13) = ....1... Uplink Frame received without Errors
Configuration Protocol (C14-C16) = .....00 .0..... BTS does not support TFO or TFO is disabl
Message No (C17-C18) = .00..... BTS does not support TFO or TFO is disabled
Spare, reserved for TFO (C19) = ....1... (1)
Spare, reserved for TFO (C20) = ....1... (1)
Frame Classification_Tx Type (C21-C22) = .....11 Speech Good
    
```

Hex Dump of the Frame Data

```

+-----+-----+-----+-----+-----+-----+
00 00 98 04 8F E1 85 4D DC B5 AA B5 C0 00 80 00      | | | | | | | | | | | | | | | |
80 0B DA C3 FD 9A 86 F2 C7 12 80 41 AC 2A BC 43      | | | | | | | | | | | | | | | |
8D AC 84 80 BC 7E D0 5F                              | | | | | | | | | | | | | | | |
    
```

Off-line Viewing C:\Program Files\GL Communications Inc\ 5 556 Frames

Card and Time Slot Selection

1 2

00	00
01	01
02	02
03	03
04	04
05	05
06	06
07	07
08	08
09	09
10	10
11	11
12	12

UpLink(unchecked) / DownLink(checked)

Bit Inversion (1 <-> 0)

Data Transmission Rate

Subchannels 8-16 kbps

8k Subchannels

1
2
3
4
5
6
7
8

All TS

Clear TS

All

None

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)

HDLC Protocol Analysis LAPD

File View Capture Statistics Database Configure Help

0 GoTo

Dev	TS...	Su...	Frame#	TIME (Relative)	Len	Error	C/R	SAPI	TEI	CTL	P/F	N(S)
✓ 2	0	4-8	0	00:00:00.000000	6		Co...	0	0	Super...	1	
✓ 2	0	4-8	1	00:00:00.042400	6		Co...	0	0	Super...	1	
✓ 2	0	4-8	2	00:00:00.084800	6		Co...	0	0			
✓ 2	0	4-8	3	00:00:00.127200	38		Co...	0	0			
✓ 2	0	4-8	4	00:00:00.182400	38		Co...	0	0			
✓ 2	0	4-8	5	00:00:00.237600	38		Co...	0	0			
✓ 2	0	4-8	6	00:00:00.292800	38		Co...	0	0			

Card2 TimeSlot=0 SubChannels=4-8 Frame=0 at 00:00:00.000000 OK Len=6
HDLC Frame Data + FCS

```

***** LAPD Layer *****
C/R          = .....0. Command(Use
SAPI         = 000000.. (0)
TEI          = 0000000. (0)
Ctl          = .....01 Supervisory
Supervisory Function = ....00.. RR
P/F          = .....1 (1)
N(R)        = 1000110. (70)
    
```

Hex Dump of the Frame Data

```

+-----+-----+-----+-----+-----+
00 01 01 8D 37 E0                               |7a
    
```

Running. Utilization 0.55% C:\Temp.Hdl Captured 547 frames

Protocol Capture Configuration

Save Load Default

Capture File Options
 Card & Stream Selection
 Capture Filter
 Gui & Protocol Options

Card: 1 Time Slot: 00 Invert

Signaling Frame Selection
 00
 01
 02
 03
 04
 05
 06
 07
 08
 09
 10

Signaling Bit Selection
 4
 5
 6
 7
 8

All Signaling Links

C	TS	I	Bits	Frames
1	0	N	00011111	0,2,4,6,8

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

FDL Analysis

File View Options

0 GoTo

Dev	Msg #	Time	Length	Address	Ctrl	From	Type	Information
✓ 2	4	0:00:01.066000	8	x8108	x08 AT&T	CI	Maintenance Request	x22414964
✓ 2	5	0:00:01.271400	213	x8108	x08 AT&T	CI	24-hour Performance Data	x25084155-64C20001-00020003-33000001
✓ 2	6	0:00:01.510600	8	xC308	x08 AT&T	NI	Maintenance Request	x22414901
✓ 2	7	0:00:01.712400	10	x8108	x08 AT&T	CI	Confirmation	x22084155-01C2
✓ 2	8	0:00:01.914600	10	x8108	x08 AT&T	CI	Confirmation	x22084155-4200
✓ 2	9	0:00:02.116800	8	xC308	x08 AT&T	NI	Maintenance Request	x22414902
✓ 2	10	0:00:02.318600	21	x8108	x08 AT&T	CI	Enhanced Configuration Data	x25084155-E7C20201-00020003-00040001
✓ 2	11	0:00:02.523200	12	x8108	x08 AT&T	CI	Errored ESF Response	x25084155-43C21234
✓ 2	12	0:00:02.725800	8	xC308	x08 AT&T	NI	Maintenance Request	x22414942
✓ 2	13	0:00:02.927600	8	x8108	x08 AT&T	CI	Maintenance Request	x2241496E
✓ 2	14	0:00:03.130200	75	x8108	x08 AT&T	CI	1-hour Enhanced Performanc...	x25084155-67C20001-00020003-00040001
✓ 2	15	0:00:03.344600	37	x8108	x08 AT&T	CI	1-hour Performance Data	x25084155-40C20001-00020003-33000001

Card2 Frame=4 at 0:00:01.066000 OK Len=8

LAPB Information

```

Address      = x81
Control      = x08
Message-oriented
REQUEST Maintenance Message
  CMD          = x22
  Originating Unit = I (x41)
  Target Unit   = d (x49)
  REQUEST      = 100 ( Send 24-hour ES Performance Data )

```

Frame Data + FCS

```

+-----+-----+-----+-----+-----+-----+-----+-----+
81 08 22 41 49 64 F5 F2                               | "AId80

```

C:\Program Files\GL Communications I 224 Frames

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

The screenshot displays the HDLC Protocol Analysis X.25 application. The main window shows a table of captured frames with the following data:

Dev	TSlot	SubCh	Frame#	TIME (Relative)	Len	Error
✓ 2	0-23		0	00:00:00.000000	6	Decode Error
✓ 2	0-23		1	00:00:00.005239	6	Decode Error
✓ 2	0-23		2	00:00:00.010479	38	
✓ 2	0-23		3	00:00:00.015890	6	Decode Error
✓ 2	0-23		4	00:00:00.021135	6	Decode Error
✓ 2	0-23		5	00:00:00.026380	6	Decode Error
✓ 2	0-23		6	00:00:00.031625	11	
✓ 2	0-23		7	00:00:00.036895	15	

Below the table, the application shows the details for Card2 TimeSlots=0-23 Frame=0 at 00:00:00.000000 OK Len=6. The HDLC Frame Data + FCS section includes:

- LAPB Layer: Address = 000000, Ctl = 000000, Supervisory Function = 000000, P/F = 000000, N(R) = 000000.
- X.25 Layer: DTE and DCE data packet format = 1 (x0), Protocol Identifier = 1 (x0), General Format Id, Logical Channel_group number = ?.

The Hex Dump of the Frame Data shows: 00 01 01 45 73 AA.

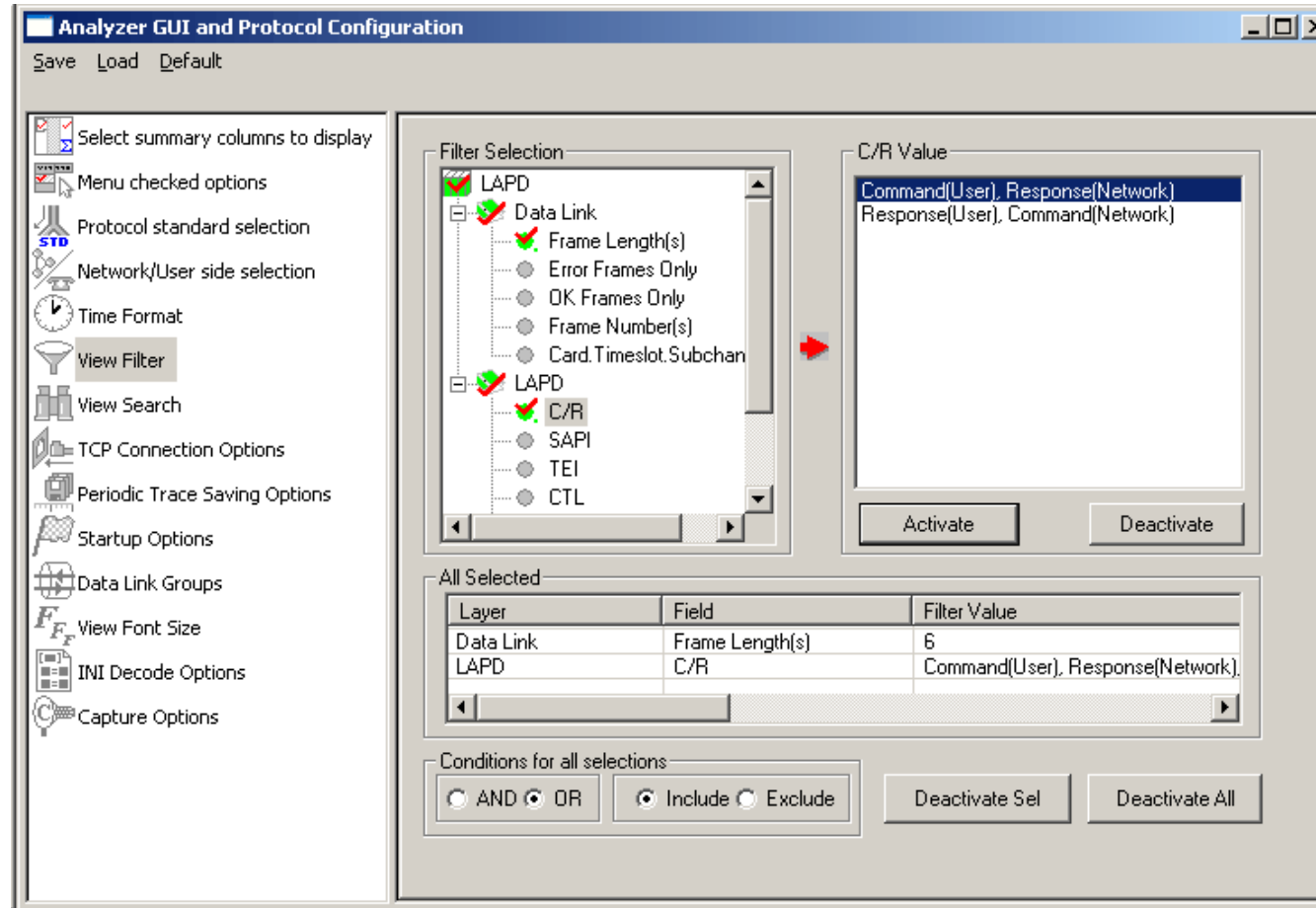
Overlaid on the application is a Windows command prompt window with the following text:

```
C:\D:\WINDOWS\system32\cmd.exe
Microsoft Windows XP [Version 5.1.2600]
(C) Copyright 1985-2001 Microsoft Corp.

D:\>cd D:\Program Files\GL Communications Inc\Hdlc Analyzer
D:\Program Files\GL Communications Inc\Hdlc Analyzer>hdlcprot hdlc\IsdnUserNet.H
DL
D:\Program Files\GL Communications Inc\Hdlc Analyzer>
```

- 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

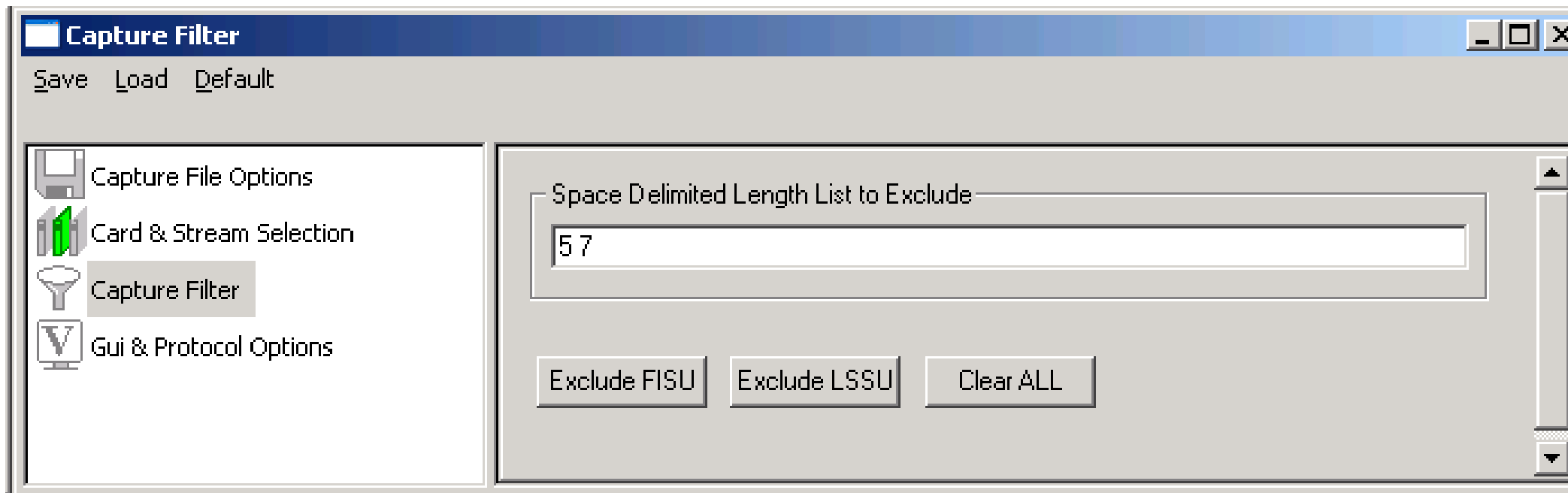
Filters – Display Filter



- 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

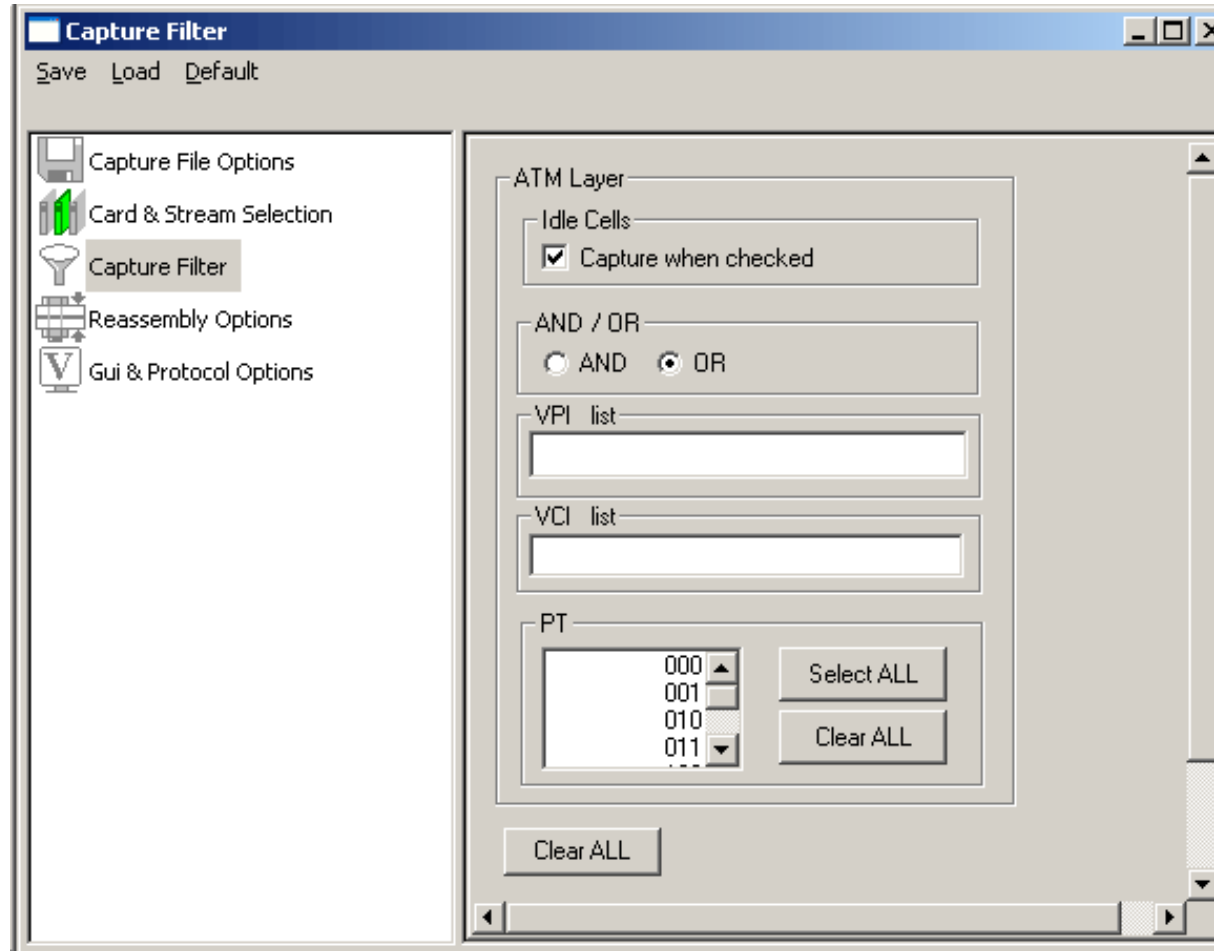
Filters - Real-time Capture Filter

HDLC Based Protocol Analyzers



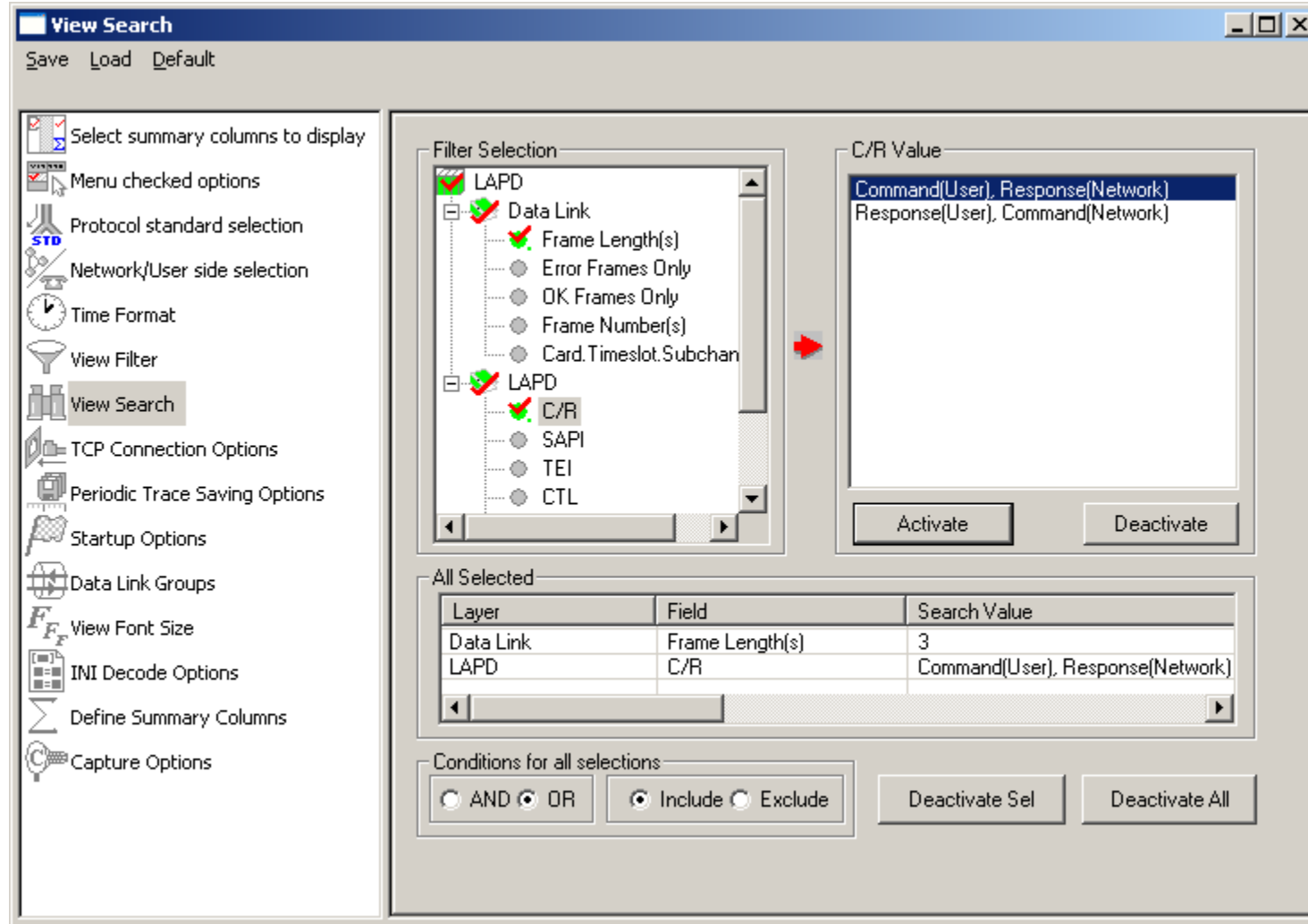
- Real-time capture filter can be set prior to capturing frames
- Real-time filter for HDLC based protocols is done by excluding LSSU (Link Status Signal Unit), FISU (Fill-in Signal Unit), or any other user-defined frame

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

Dev	TSlot	SubCh	Frame#	TIME (Relative)	Len	Error	Modifier Function LAPD	Supervisory Function LAPD	SAPI LAPD	T LA
✓ 2	0		0	00:00:00.000000	6			RR	0	0
✓ 1	0		1	00:00:00.000037	6			RR	0	0
✓ 2	0		2	00:00:00.000362	6			RR		
✓ 1	0		3	00:00:00.000375	6			RR		
✓ 1	0		4	00:00:00.378362	46					
✓ 2	0		5	00:00:00.379137	6			RR		

Use Ctrl, Shift for Extended Selection

- MTP3::DPC
- MTP3::OPC
- ISUP::Circuit Identification Code
- ISUP::Message Type

OK Select All Cancel

Analyzer GUI and Protocol Configuration

Save Load Default

Filter Selection: LAPD, Data Link, LAPD

Value Selection

Activate Deactivate

All Selected		
Layer	Field	Filter Value
LAPD	N(R)	40
LAPD	Supervisory Function	RR

Conditions for all selections: AND OR Include Exclude

Deactivate Sel Deactivate All

Sample Search Criteria From Screen Selection

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

The screenshot shows the HDLC Protocol Analysis tool interface. The main window displays a table of data with columns: Dev, TSlot, SubCh, Frame#, TIME (Relative), Len, Error, Modifier Function LAPD, Supervisory Function LAPD, SAPI LAPD, TEI LAPD, and N(R) LAPD. The first row is selected, and a context menu is open over it with options: Search Selected Value, Set Search Criteria as Sel Values, and Set Filter Criteria as Sel Values. A dialog box titled "Use Ctrl, Shift for Extended Selection" is open, showing a list of search criteria: LAPD::N(R), LAPD::SAPI, LAPD::Supervisory Function, and LAPD::TEI. The "Set Search Criteria as Sel Values" option is highlighted in the context menu, and a red arrow points from this option to the dialog box. Another red arrow points from the dialog box to the "Filter Selection" section of the "Analyzer GUI and Protocol Configuration" window. This window shows a list of filter selections (LAPD, Data Link, LAPD) and a table of "All Selected" criteria.

Dev	TSlot	SubCh	Frame#	TIME (Relative)	Len	Error	Modifier Function LAPD	Supervisory Function LAPD	SAPI LAPD	TEI LAPD	N(R) LAPD
✓ 2	0		0	00:00:00.000000	6			RR	0	0	40
✓ 1	0		1	00:00:00.000037	6			RR			
✓ 2	0		2	00:00:00.000362	6			RR			
✓ 1	0		3	00:00:00.000375	6			RR			
✓ 1	0		4	00:00:00.378362	46						

Layer	Field	Search Value
LAPD	SAPI	0
LAPD	Supervisory Function	RR

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

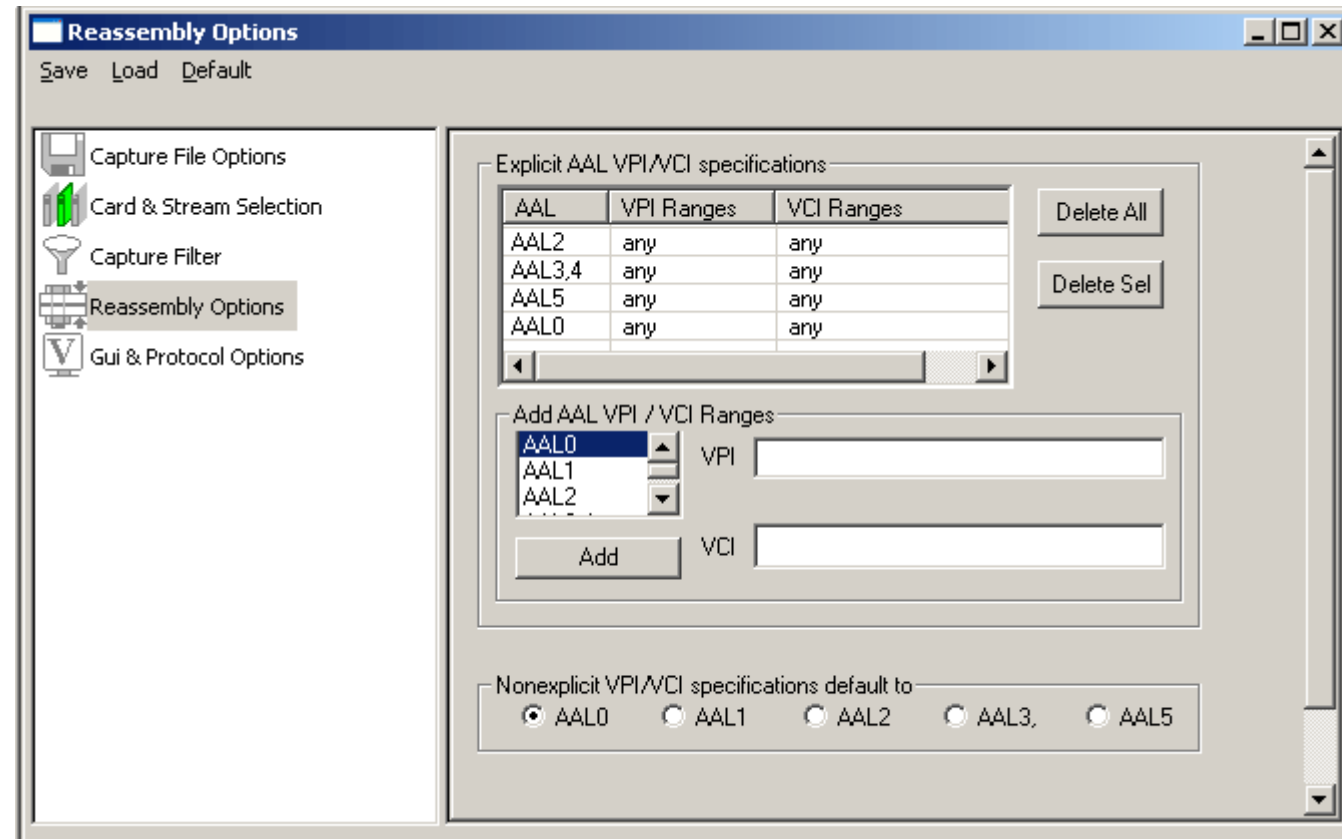
The screenshot displays the 'Statistics' dialog box with the following configuration:

- Field Names:** Layers (checked), Physical Link (checked), Device # (N), Error Code (N), StartTsOrTsSc (N), Time Stamp (S), LAPD (checked), C/R (selected), Ctl, Modifier Function, N(R), N(S), P, P/F, SAPI, Supervisory Function, TEI.
- C/R:** Use Type (single selection): Total, Key, Field. Statistic Type(s) (calculated, multiple selection): Frame Count, Frame Percent, Byte Count, Byte Percent. Value Set: Command(User), Response(Network), Response(User), Command(Network). Radio buttons: Cumulative (unchecked), Separate (checked). Buttons: Add/Mod, Remove.
- Selected Statistic Information:**

Layer	Field Name	Use Type	Statistic Type
Physical ...	Device #	Total	
Physical ...	Time Stamp	Field	Frame Count
LAPD	C/R	Total	

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

ISDN Protocol Analysis 4ESS

File View Capture Statistics Database Call Detail Records Configure Help

0 GoTo

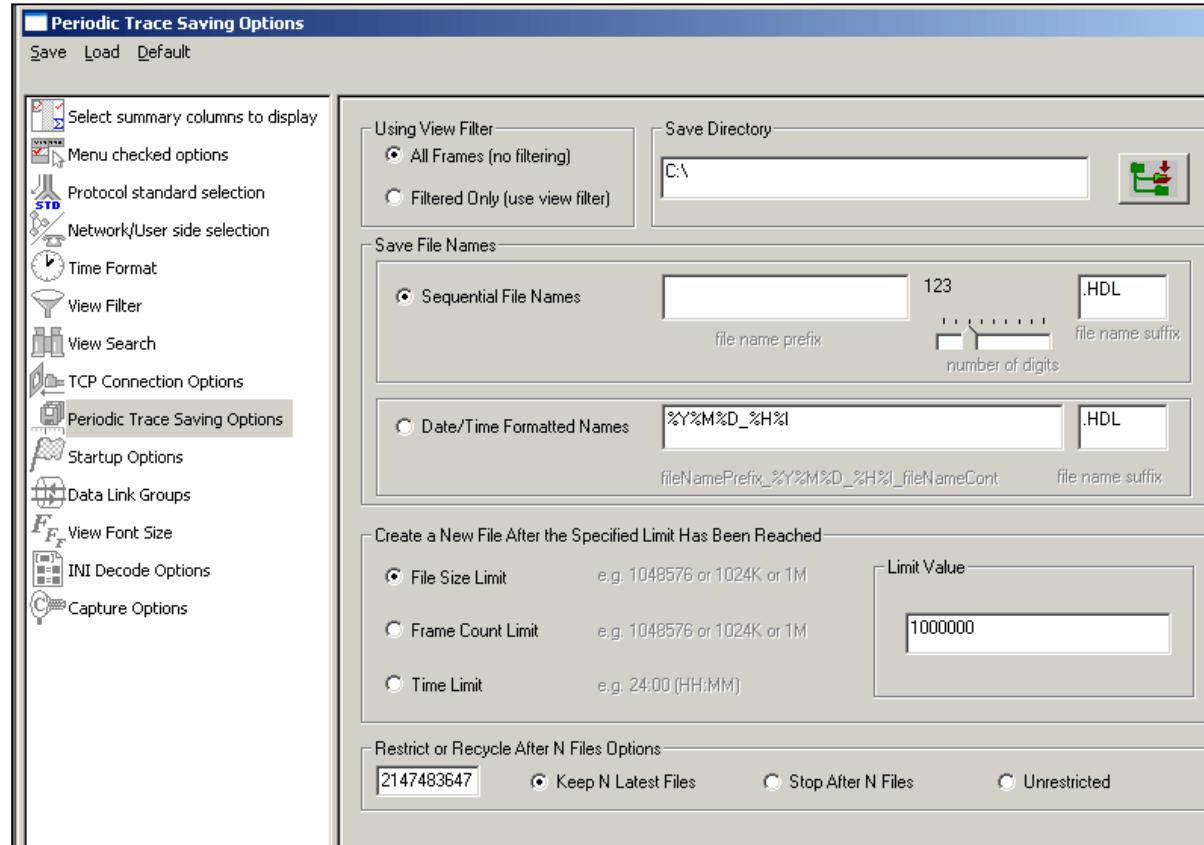
Dev	TSlot	SubCh	Frame#	TIME (Relative)	Len	Error	C/R	SAPI	TEI	CTL	P/F	N(S)	N(R)	FUNC
2	0-23		0	00:00:00.000000	47		Response(User), Comm...	0	0	Infor...	0	16	26	
2	0-23		1	00:00:00.005458	6		Command(User), Respo...	0	0	Sup...	0		27	RR
2	0-23		2	00:00:00.010703	11		Command(User), Respo...	0	0	Infor...	0	55	39	
2	0-23		3	00:00:00.015974	16		Command(User), Respo...	0	0	Infor...	0	56	41	
2	0-23		4	00:00:00.021265	16		Command(User), Respo...	0	0	Infor...	0	57	42	

Call ID	Call Status	Calling Num	Called Num	Call Start Date & Time	Call Duration	Release Complete Cause	DevNo	TS	CRV
0	completed	6697651000	3622251234	2002-04-08 14:53:24.015411	00:00:00.253916	Normal call clearing	2	0	237
1	completed	6697651000	3622251234	2002-04-08 14:53:24.068354	00:00:00.259213	Normal call clearing	2	0	238
2	completed	6697651000	3622251234	2002-04-08 14:53:24.142375	00:00:00.285750	Normal call clearing	2	0	239
3	completed	6697651000	3622251234	2002-04-08 14:53:24.242770	00:00:00.285744	Normal call clearing	2	0	240
4	completed	6697651000	3622251234	2002-04-08 14:53:24.295697	00:00:00.306890	Normal call clearing	2	0	241
5	active	6697651000	3622251234	2002-04-08 14:53:24.348645	00:00:03.469848	Normal call clearing	2	0	242
6	active	6697651000	3622251234	2002-04-08 14:53:24.401557	00:00:03.416937	x00	2	0	243
7	active	6697651000	3622251234	2002-04-08 14:53:24.491406	00:00:03.327088	x00	2	0	244
8	active	6697651000	3622251234	2002-04-08 14:53:24.544406	00:00:03.274088	x00	2	0	245
9	active	6697651000	3622251234	2002-04-08 14:53:24.623687	00:00:03.194807	x00	2	0	246
10	completed	6697651000	3622251234	2002-04-08 14:53:24.676583	00:00:00.269843	Normal call clearing	2	0	233
11	completed	6697651000	3622251234	2002-04-08 14:53:24.718895	00:00:00.275203	Normal call clearing	2	0	234
12	completed	6697651000	3622251234	2002-04-08 14:53:24.766572	00:00:00.296307	Normal call clearing	2	0	235
13	completed	6697651000	3622251234	2002-04-08 14:53:24.824776	00:00:00.296093	Normal call clearing	2	0	236
14	completed	6697651000	3622251234	2002-04-08 14:53:24.909317	00:00:00.253958	Normal call clearing	2	0	237
15	completed	6697651000	3622251234	2002-04-08 14:53:24.962270	00:00:00.259260	Normal call clearing	2	0	238
16	completed	6697651000	3622251234	2002-04-08 14:53:25.036296	00:00:00.285802	Normal call clearing	2	0	239
17	completed	6697651000	3622251234	2002-04-08 14:53:25.136708	00:00:00.285786	Normal call clearing	2	0	240

D:\Program Files\GL Communications Ir\720 Frames

- 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

Data Link Group Specification

Card	Timeslot	Subch
01	00	0
02	01	1
03	02	2
04	03	3
05	04	4
06	05	5
07	06	6
08	07	7
09	08	
10	09	
11	10	
12	11	
13	12	
14	13	
15	14	
16	15	
17	16	
18	17	
19	18	
20	19	

Data Link Group Name: East

Forward Link Direction

Buttons: Add, Odd Cards, Even Cards, All Cards, None, Delete Sel, Delete All, Default

Card	TS	Sc	Dir	Data Link Group Name
1	0	0	-->	West
2	1	1	<--	West
3	2	0	-->	West
4	3	1	<--	West
5	0	0	-->	East
6	1	1	<--	East
7	2	0	<--	East
8	3	1	-->	East

Define Summary Columns

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

The image shows two screenshots from a network analysis tool. The top screenshot is the 'Define Summary Columns' dialog box. On the left is a list of configuration options, with 'Define Summary Columns' highlighted by a red box. On the right is a tree view titled 'Defined Protocol Summary Fields for LAPF'. Under 'LAPF Layers/Fields', the 'EA' field is checked and highlighted with a red box. A red arrow points from this box to the text 'Selection of Summary Column'. The bottom screenshot shows the 'HDLC Protocol Analysis LAPP' analyzer window. It features a table of captured frames with columns for Dev, TSlot, SubCh, Frame#, EA, TIME (Difference), Len, Error, DLCI, DE, BECN, FECC, CTL, and Sequence Nu. The 'EA' column is highlighted with a red box. Below the table, the 'LAPF Layer' details are shown, with a red arrow pointing from the 'EA' field in the table to the 'EA' field in the details, with the text 'Output display in analyzer' below it.

Dev	TSlot	SubCh	Frame#	EA	TIME (Difference)	Len	Error	DLCI	DE	BECN	FECC	CTL	Sequence Nu
✓ 2	0		0	1	00:00:00.000000	6	0	0	0	0	0	Supervisory	
✓ 1	0		1	1	00:00:00.000037	6	0	0	0	0	0	Supervisory	
✓ 2	0		2	1	00:00:00.000325	6	0	0	0	0	0	Supervisory	
✓ 1	0		3	1	00:00:00.000012	6	0	0	0	0	0	Supervisory	
✓ 1	0		4	1	00:00:00.377987	46	0	0	0	0	0	Information	
✓ 2	0		5	1	00:00:00.000775	6	0	0	0	0	0	Supervisory	
✓ 2	0		6	1	00:00:00.000637	11	0	0	0	0	0	Information	

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

The image displays two windows from a network analysis tool. The top window, 'Aggregate Summary Columns', shows a configuration table for three groups. The bottom window, 'HDLC Protocol Analysis LAPD 64-bit', shows a data table with a red box highlighting the 'Group~0' column.

Aggregate Summary Columns Configuration:

Name	Display Format	Summary Columns	Separator
Group~0	Concat	Supervisory Function_LAPD TEI_LAPD	--->
Group~1	Overlay	N(R)_LAPD	
Group~2	<Col_Alias>Value	N(S)_LAPD SAPI_LAPD	&

HDLC Protocol Analysis LAPD 64-bit Data Table:

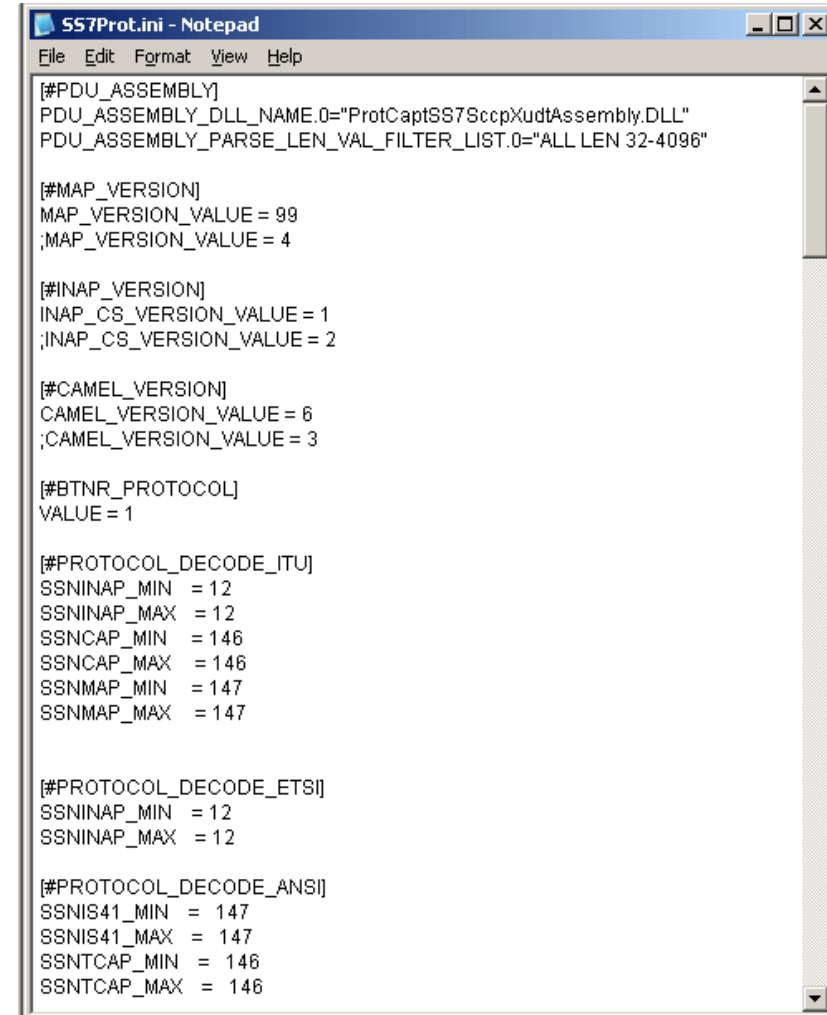
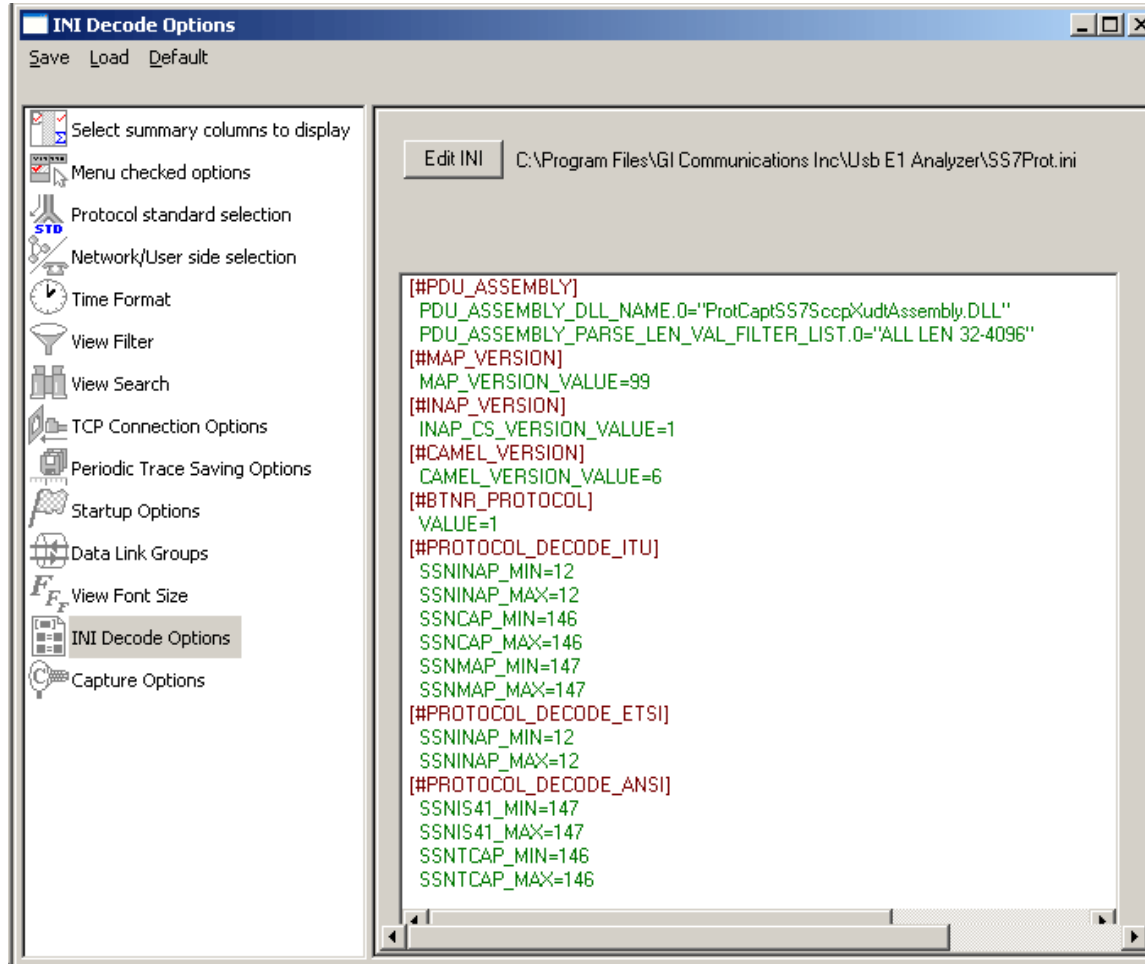
Dev	TSlot	SubCh	Frame#	TIME (Relative)	Len	Group~0	Error	Modifier Function LAPD	Supervisory Function LAPD	SAPI LAPD	TEI LAPD	N(R) LAPD
2	0		23546	00:01:19.145525	6	RR --> 0			RR	0	0	99
1	0		23547	00:01:19.145600	6	RR --> 0			RR	0	0	71
2	0		23548	00:01:19.146000	11	0				0	0	99
1	0		23549	00:01:19.146337	6	RR --> 0			RR	0	0	72
1	0		23550	00:01:19.146675	11	0				0	0	72
2	0		23551	00:01:19.147012	6	RR --> 0			RR	0	0	100
2	0		23552	00:01:19.147487	11	0				0	0	100
2	0		23553	00:01:19.147675	11	0				0	0	100
1	0		23554	00:01:19.147837	6	RR --> 0			RR	0	0	73
1	0		23555	00:01:19.148150	6	RR --> 0			RR	0	0	74
1	0		23556	00:01:19.148562	11	0				0	0	74

The bottom window also shows a detailed view of a frame:

```

Card2 TimeSlot=0 Frame=23546 at 00:01:19.145525 OK Len=6
HDLC Frame Data + FCS
===== LAPD Layer =====
0000 C/R = .....1. Response(User) Command(Network)
0000 SAPI = 000000.. (0)
0001 TEI = 0000000.. (0)
0002 Ct1 = .....01 Supervisory
0002 Supervisory Function = ....00.. RR
0003 P/F = .....0 (0)
0003 N(R) = 1100011.. (99)
    
```

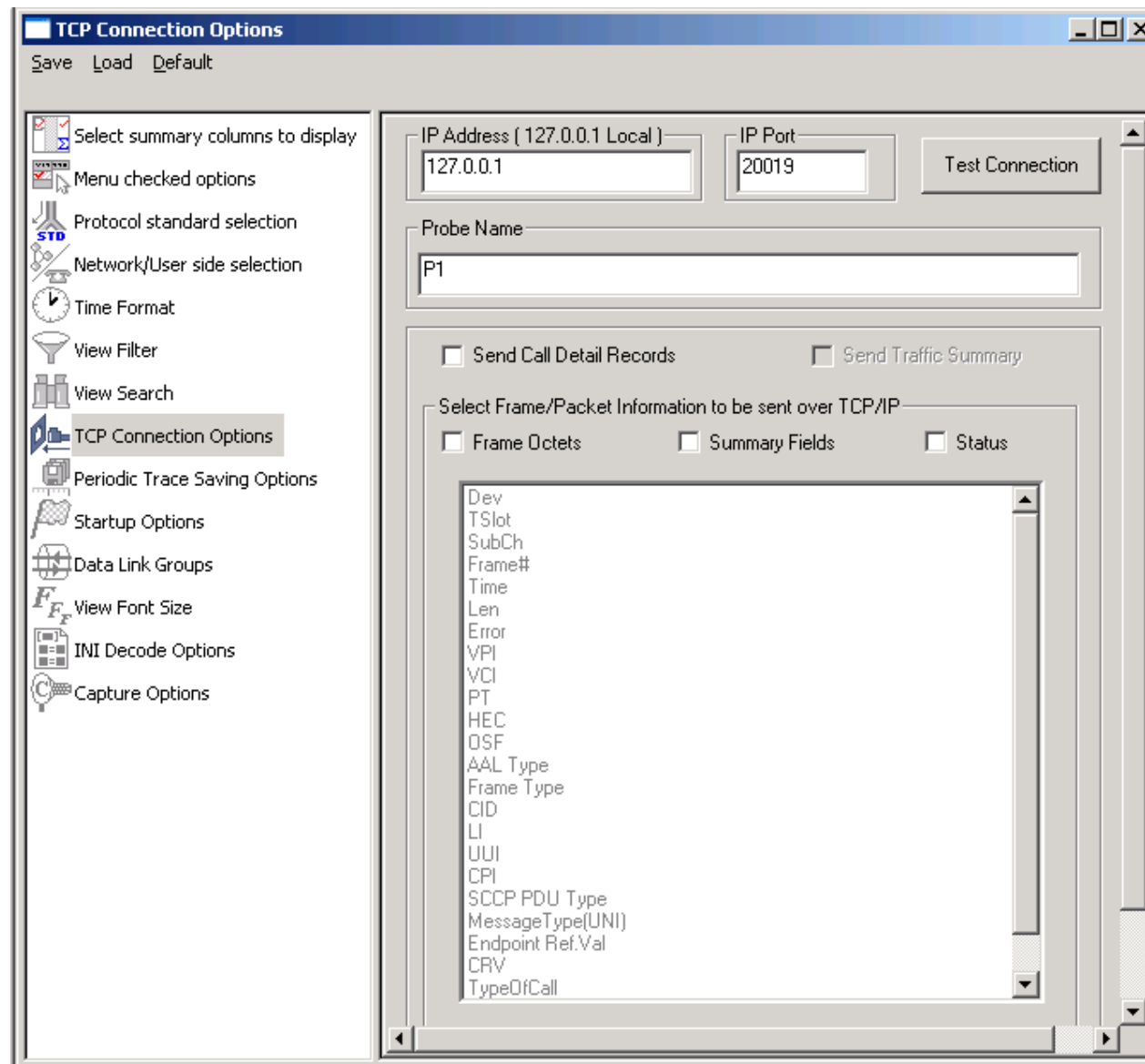
Configuring INI Decode Options



- 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

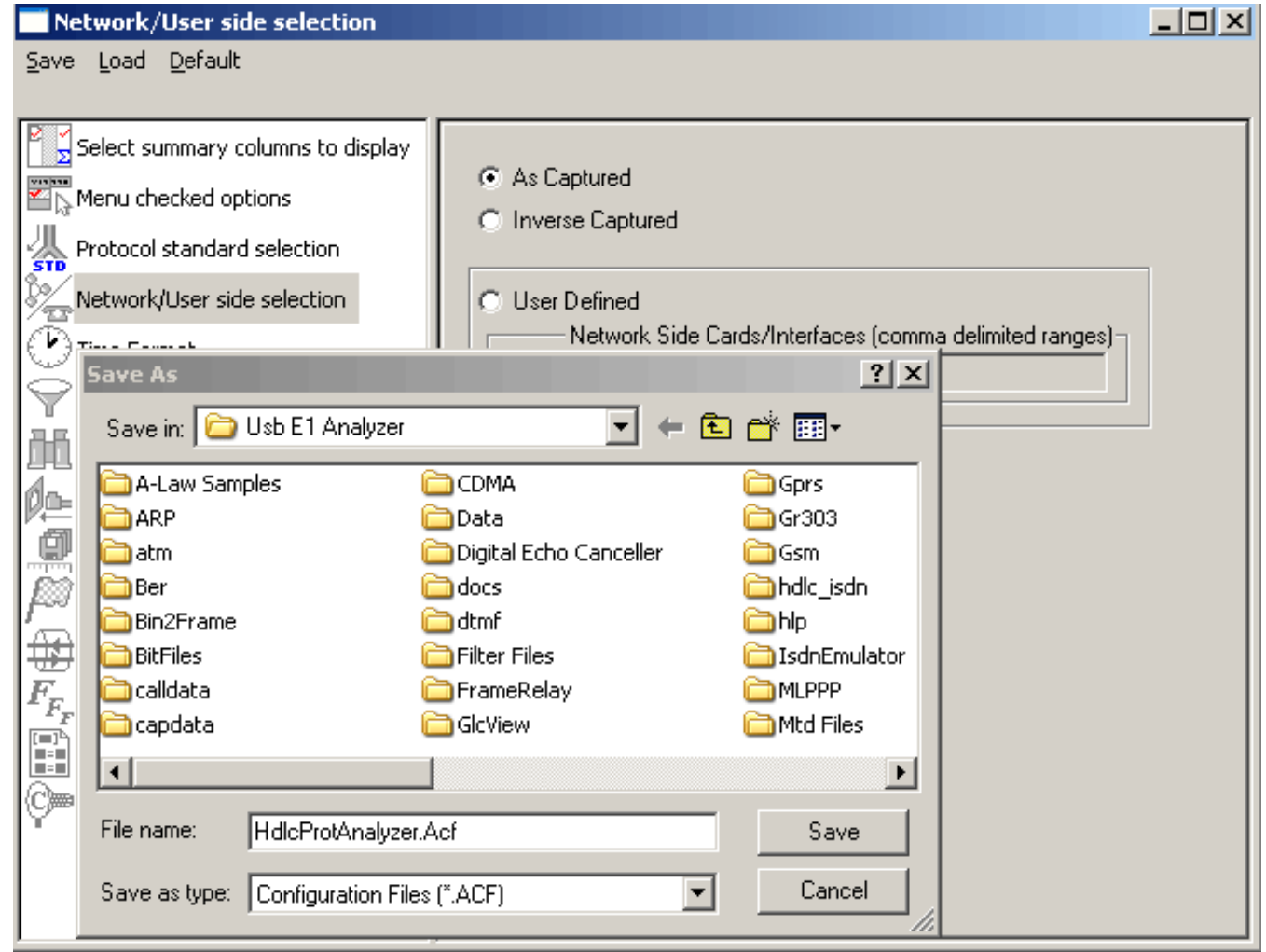
TCP Connection Options

- 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

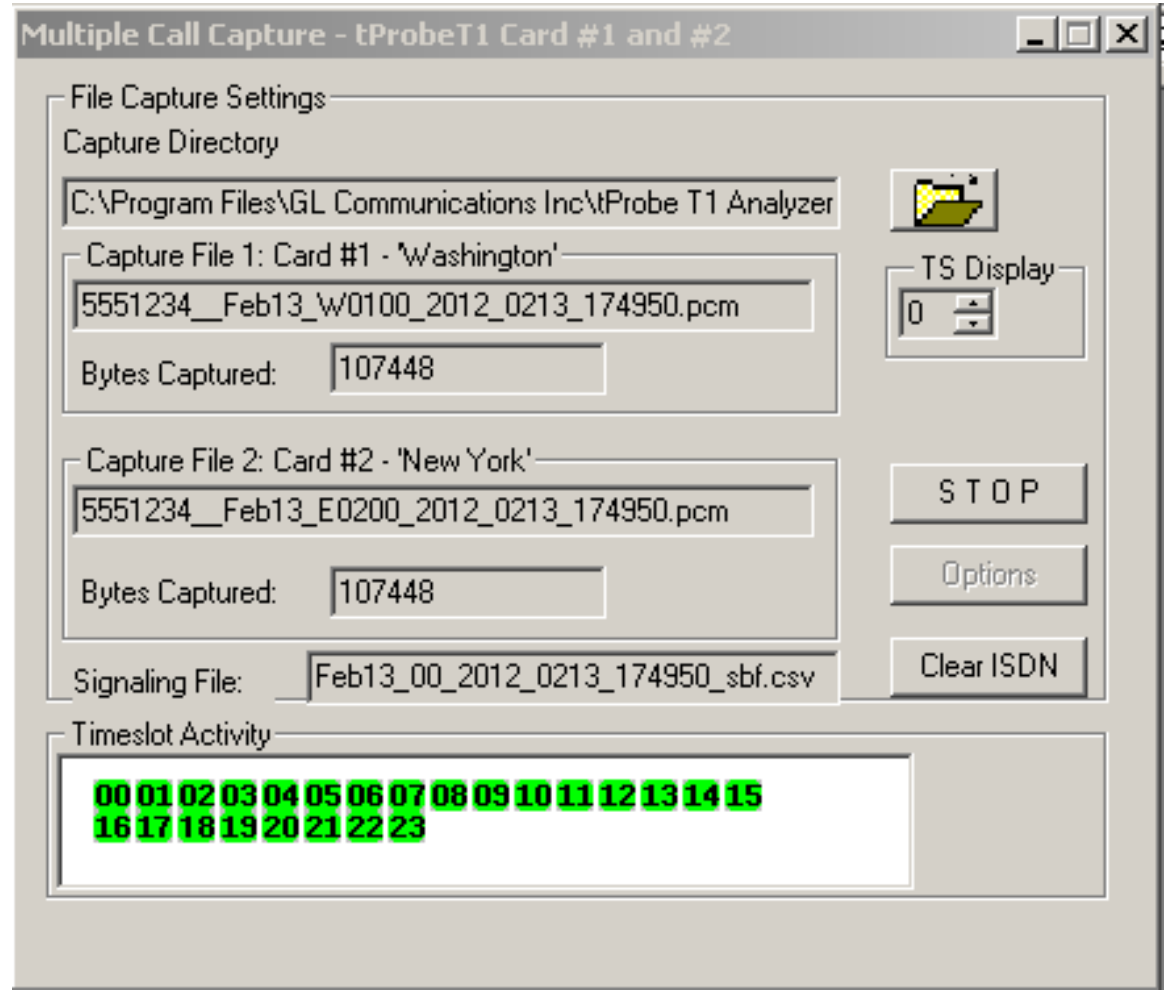
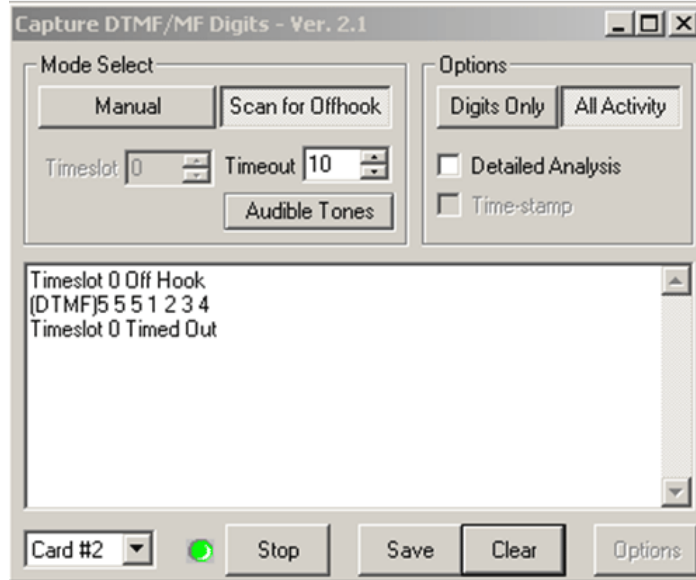
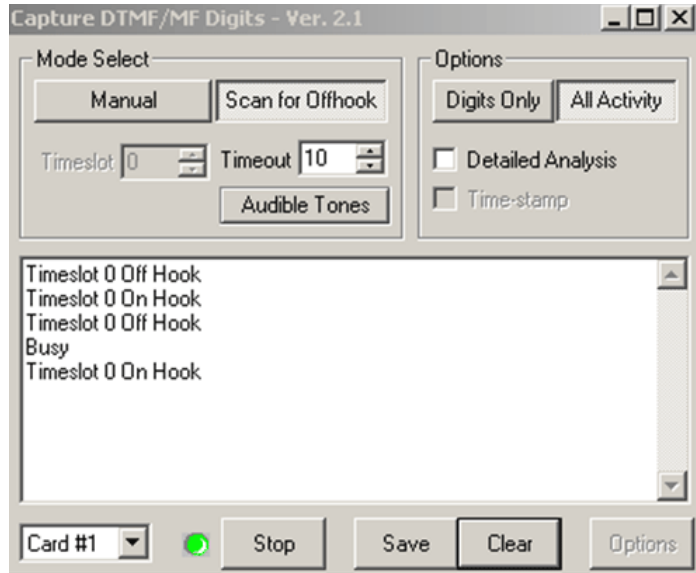
- Provides a consolidated interface for GUI and protocol settings required in the analyzer such as protocol selection, periodic saving options, etc.
- Configuration settings can be saved to a file, loaded from a configuration file, or just revert to the default values using the default option



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



SS1 Analyzer

Short-cut Tool bar

The screenshot displays the SS1 Analyzer software interface. At the top, there is a menu bar with options: Configure, View, Connect, Run, Results, Help. Below the menu bar is a 'Short-cut Tool bar' containing icons for Setup, Load, Save, Connect, Disconnect, View WCS, Run, Stop, Real-Time, From File, Clear, and Help. The main window is divided into two panes. The left pane, labeled 'Tree View', shows a hierarchical tree structure of signal segments. The right pane, labeled 'Tone View', displays a table of signal data.

Seq#	Channel	Time	ID	Freq	Power	Duration	Tot Pwr	S/N
2-1-01	#2:0	18:49:51	SS1/mark	2601	-8.0	100	-8.0	35
2-1-02	#2:0	+0.100	SS1/space	2401	-7.9	42	-7.9	21
2-1-03	#2:0	+0.141	SS1/mark	2601	-8.0	59	-8.0	40
2-1-04	#2:0	+0.201	SS1/space	2401	-8.0	224	-8.0	27
2-2-01	#2:0	+0.425	SS1/mark	2601	-8.0	100	-8.0	30
2-2-02	#2:0	+0.525	SS1/space	2401	-7.9	41	-7.9	23
2-2-03	#2:0	+0.566	SS1/mark	2601	-8.0	59	-8.0	40
2-2-04	#2:0	+0.625	SS1/space	2401	-7.9	41	-7.9	24
2-2-05	#2:0	+0.666	SS1/mark	2601	-8.0	59	-8.0	40
2-2-06	#2:0	+0.726	SS1/space	2401	-8.0	224	-8.0	27
1-1-01	#2:0	18:49:47	SS1/mark	2601	-8.0	100	-8.0	35
1-1-02	#2:0	+0.099	SS1/space	2401	-7.9	42	-7.9	21
1-1-03	#2:0	+0.141	SS1/mark	2601	-8.0	59	-8.0	40
1-1-04	#2:0	+0.200	SS1/space	2401	-7.9	41	-7.9	23
1-1-05	#2:0	+0.241	SS1/mark	2601	-8.0	59	-8.0	40
1-1-06	#2:0	+0.300	SS1/space	2401	-7.9	41	-7.9	21
1-1-07	#2:0	+0.341	SS1/mark	2601	-8.0	59	-8.0	40
1-1-08	#2:0	+0.401	SS1/space	2401	-8.0	224	-8.0	27
1-2-01	#2:0	+0.625	SS1/mark	2601	-8.0	100	-8.0	30
1-2-02	#2:0	+0.725	SS1/space	2401	-7.9	41	-7.9	23
1-2-03	#2:0	+0.766	SS1/mark	2601	-8.0	59	-8.0	40
1-2-04	#2:0	+0.825	SS1/space	2401	-7.9	41	-7.9	24
1-2-05	#2:0	+0.866	SS1/mark	2601	-8.0	59	-8.0	40
1-2-06	#2:0	+0.925	SS1/space	2401	-7.9	41	-7.9	23
1-2-07	#2:0	+0.966	SS1/mark	2601	-8.0	59	-8.0	40
1-2-08	#2:0	+1.026	SS1/space	2401	-7.9	41	-7.9	24
1-2-09	#2:0	+1.066	SS1/mark	2601	-8.0	59	-8.0	40
1-2-10	#2:0	+1.125	SS1/space	2401	-8.0	224	-8.0	27

The status bar at the bottom shows 'Ready', 'Save to CSV File', and the date/time '06/17/10 06:56:04 PM'.

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

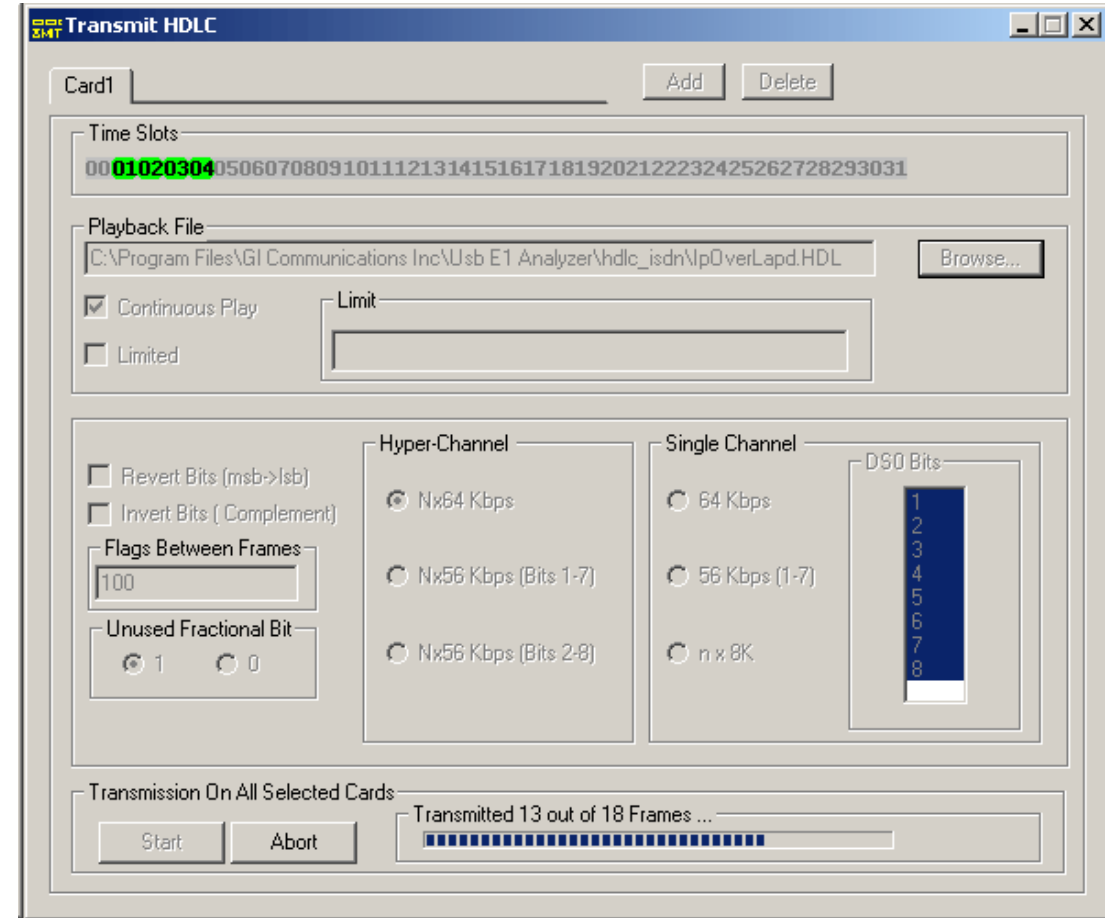
Protocol Simulation

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

The screenshot shows the 'HDLC On-line Transmit or Off-line to HDL File Test' dialog box. It is divided into several sections:

- Deterministic Frame Length with Fixed Flags:** Includes radio buttons for '2 Octets Fixed without FCS', '6 Octets Fix' (selected), and '7-8000 Octets'. Below these are input fields for 'Minimum Length' (7) and 'Maximum Length' (256), and a 'Flags Between Frames' field (100).
- Random Variable Frame Length Bucket:** Includes a 'Define Buckets' button and a table with columns 'Probability %', 'Min_Length', and 'Max_Length'. Below this are 'Min Random Flags' and 'Max Random Flags' fields, both set to 100.
- Output HDL File to Save Frames to:** Includes a 'Browse...' button and checkboxes for 'Continuous Play' and 'Limited'.
- Transmission On All Selected Cards:** Includes 'Start' and 'Stop' buttons.

The screenshot shows the 'HDLC Length Probability and Min-Max Range Buckets' dialog box. It features a table with three columns: 'Len Probability %', 'Min Length', and 'Max Length'. Below the table is a text box with the message: 'Bucket minimum length of random length string: 7..8000, must be <= max'. At the bottom are buttons for 'OK', 'Add', 'Remove', 'Duplicate', and 'Cancel'.

Len Probability %	Min Length	Max Length
20	10	20
30	40	50
50	60	70

- 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

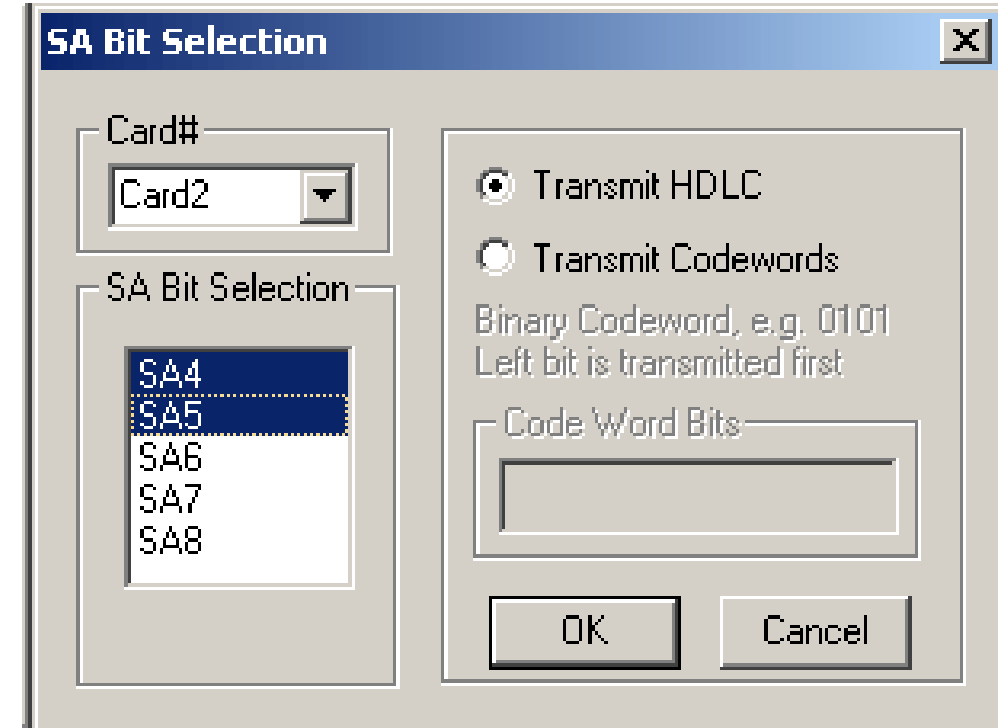
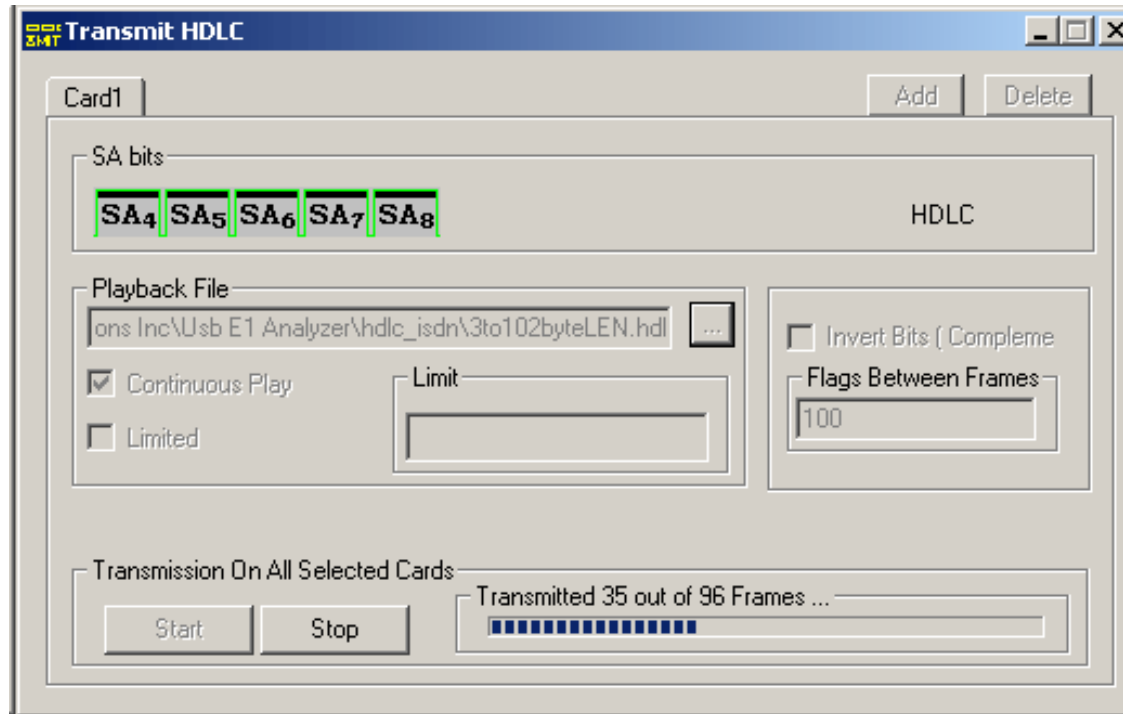
The screenshot shows a software window titled "HDLC On-line Receive or Off-line from HDL File Test". It contains a table with the following data:

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

Below the table, there are control buttons: "On-line" (with sub-buttons "Time Slots", "Start", "Stop"), "Off-line from HDL File", and "Exit".

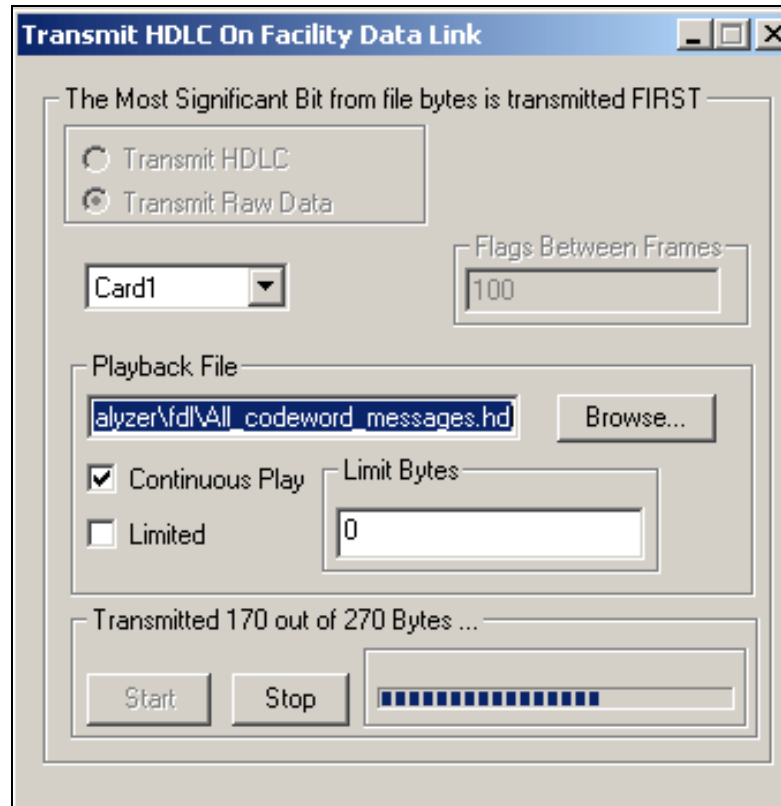
- Receive frames in real-time over T1/E1 or can verify an off-line HDL file for correct frame order and data integrity

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

TRAU ToolBox™

SI no	Xn Rate	Device No	Channel No	Sub Channel	Direction	Type	Codec Type	Status	Profile	Impairments	Actions
1	16kbps	1	1	1-2	DownLink	Tx	EFR	Start	Time Alignment	Impair	Terminate
2	16kbps	2	1	1-2	UpLink	Rx & Tx	EFR	Start	Time Alignment	Impair	Terminate
3	16kbps	1	2	1-2	DownLink	Tx	AMR	Stop	Time Alignment	Impair	Terminate
4	16kbps	2	2	1-2	UpLink	Rx & Tx	AMR	Stop	Time Alignment	Impair	Terminate
5	16kbps	1	1	3-4	UpLink	Tx	GSM 610	Start	Time Alignment	Impair	Terminate
6	16kbps	2	1	3-4	DownLink	Rx	GSM 610	Start	Time Alignment	Impair	Terminate

- 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

The screenshot displays three windows from a software application used for TRAU traffic generation.

- Digit/Tone Generation [Stream ID - 3]:** This window is used for generating DTMF digits and tones. It features a table for digit configuration, control buttons for digits (1-9, *, 0, #, A, B, C, D), and various parameter settings.

Dig	F1	P1	F2	P2	Pwr	Twist	C
5	770	-13.01	1336	-13.01	-10.00	0.00	11
2	697	-13.01	1336	-13.01	-10.00	0.00	11
3	697	-13.01	1477	-13.01	-10.00	0.00	11
6	770	-13.01	1477	-13.01	-10.00	0.00	11
4	770	-13.01	1209	-13.01	-10.00	0.00	11

Digit Power: Power -10 dB, Twist 0. Digit Cadence: On Time 100 ms, Off Time 100 ms. Pause Duration: Short Pause 2000 ms, Long Pause 5000 ms. Generation Parameters: Sample Rate 8000 /sec, Randomize Starting Phase Angle (unchecked), Mix White Noise (unchecked), -10 dB. Continuous Transmission (checked). Status: Sending DTMF Digits.

- Playback From File [Stream ID - 3]:** This window allows for playing back audio files. It includes an 'Audio File' field, a 'Continuous Transmission' checkbox, and options for limiting transmission (Bytes or Time). It also has 'Start' and 'Stop' buttons and a statistics table.

Output Codec Name	AMR_WB
Input Codec Name	PCM
Output Byte Count	97280
Output Packet Count	27405
Input Byte Count	105332

- Talk Using Microphone [Stream ID ...]:** This window is used for real-time voice generation from a microphone. It features 'Talk' and 'Stop' buttons and a statistics table.

Output Codec Name	GSM610
Input Codec Name	PCM
Output Byte Count	495360
Output Packet Count	60662
Input Byte Count	496000

- 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

The image shows three overlapping windows from a software application. The largest window, 'Capture Digits/Tones [Stream ID - 4]', displays a table of captured DTMF events. The table has columns for TimeStamp, Type, Event, On, Power, Freq1/Power1, and Freq2/Power2. Below the table are options for 'Digits Only', 'All Activity', and 'Show Latest', along with a 'Clear' button. At the bottom, there is a 'Save Events' section with a checkbox for 'Captured Event to file' and 'Start', 'Stop', and 'Options' buttons.

The 'Record Data To File [Stream ID - 4]' window is positioned in the middle. It has a 'Format' section with radio buttons for 'PCM (16bit Linear)' (selected) and 'Native'. Below is an 'Audio File' path field showing 'C:\Program Files\GL Communications Inc\Usb E1'. There are also radio buttons for 'None', 'Limit Capture (Bytes)', and 'Limit Capture (Time)'. A 'Synchronize Operation' checkbox is present, with 'Master' and 'Slave' radio buttons below it. 'Start' and 'Stop' buttons are at the bottom.

The 'Play to Speaker [Stream ID - 2]' window is on the right. It features 'Play' and 'Stop' buttons at the top. Below is a table showing playback statistics:

Output Codec Name	PCM
Input Codec Name	GSM610
Output Byte Count	68480
Input Byte Count	7410
Input Packet Count	227
Input Error Packet Count	0

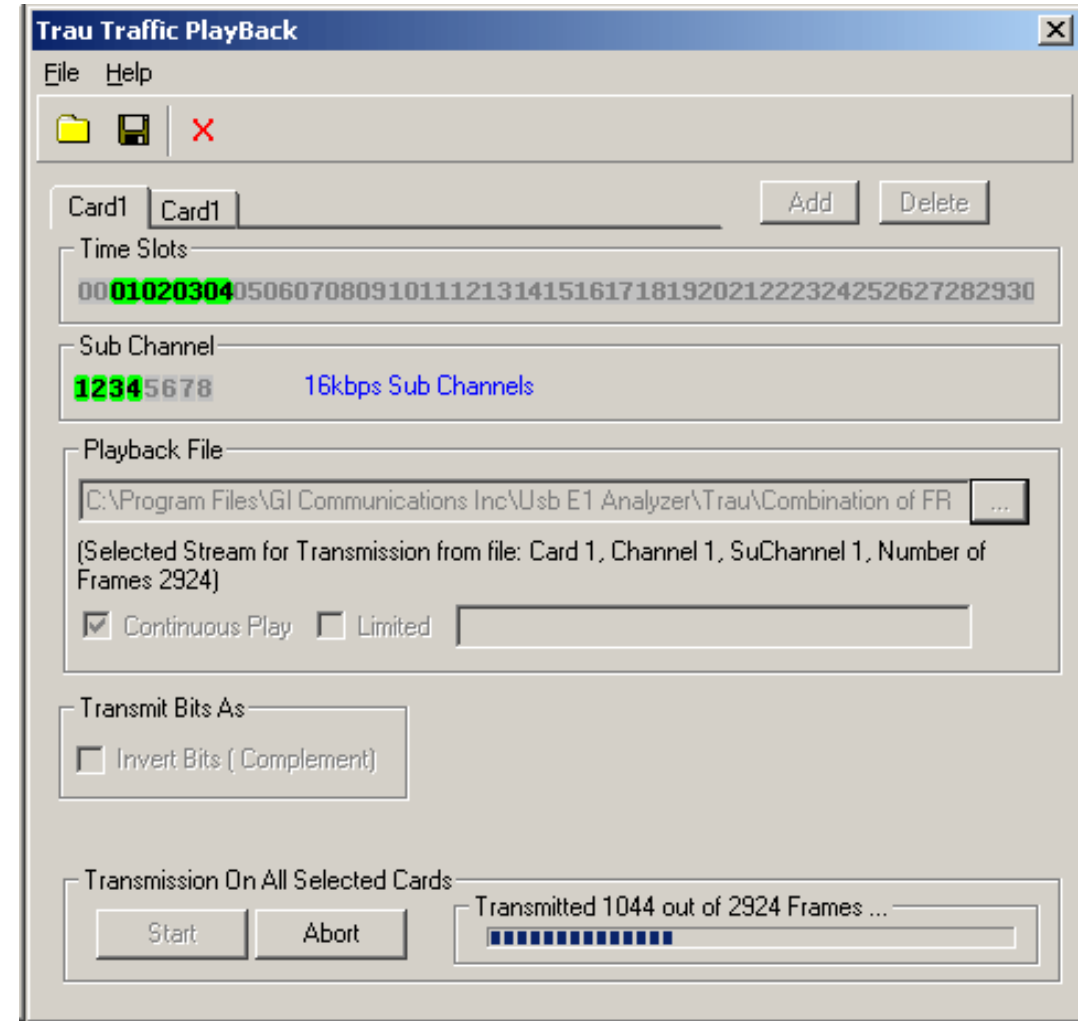
At the bottom of this window, another table shows more statistics:

Output Codec Name	PCM
Input Codec Name	AMR_WB
Output Byte Count	511360
Input Byte Count	48739
Input Packet Count	799
Input Error Packet Count	0

- 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

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

WCS TRAU Emulator - AMR_16kbps_4

File Action Help

Icons: Folder, Save, Help, Close

Sl no	Xn Rate	Device No	Channel No	Sub Channel	Direction	Codec Type	Status
0	16kbps	1	1	1-2	UpLink	AMR	Stop
1	16kbps	1	2	1-2	UpLink	AMR	Stop
2	16kbps	2	1	1-2	DownLink	AMR	Stop
3	16kbps	2	2	1-2	DownLink	AMR	Stop

Buttons: Add, Delete, Start, Stop

Action | TimeAlignment | Impairment | TxRx Verification

TX params

Source Type: SEQNUM

Source Parameters:

Order: MSB, Length: 4

Start: 0, Increment: 1

Duration Spec:

Continuous transmission

Limited frames: 100

EOF

Start Tx

RX params

Sink Type: SEQNUM

Sink Parameters:

Order: MSB, Length: 4

Start: 0, Increment: 1

Duration Spec:

Continuous Reception

Limited frames: 100

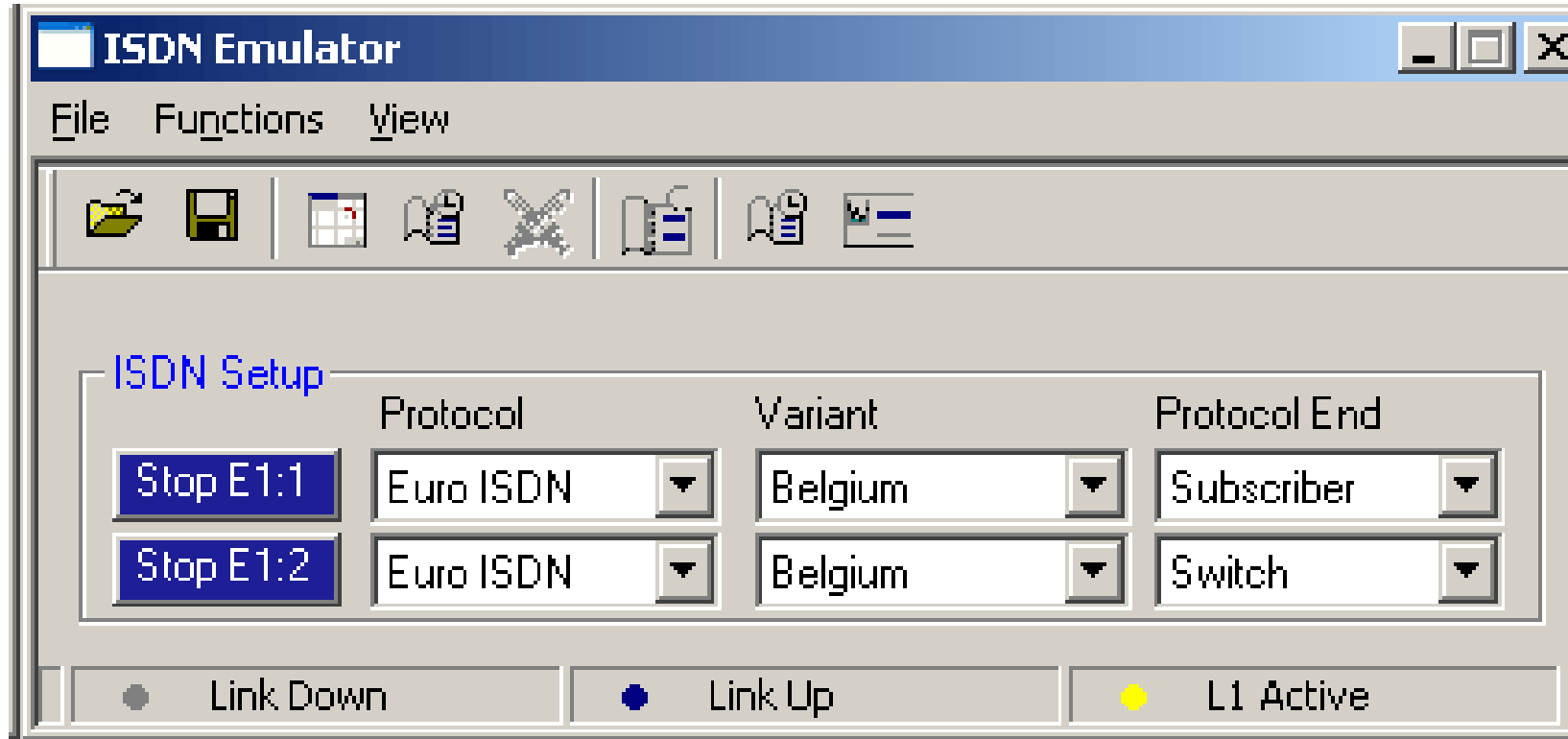
EOF

Start Rx

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

Call Management: Card #1 (E1) - Subscriber End

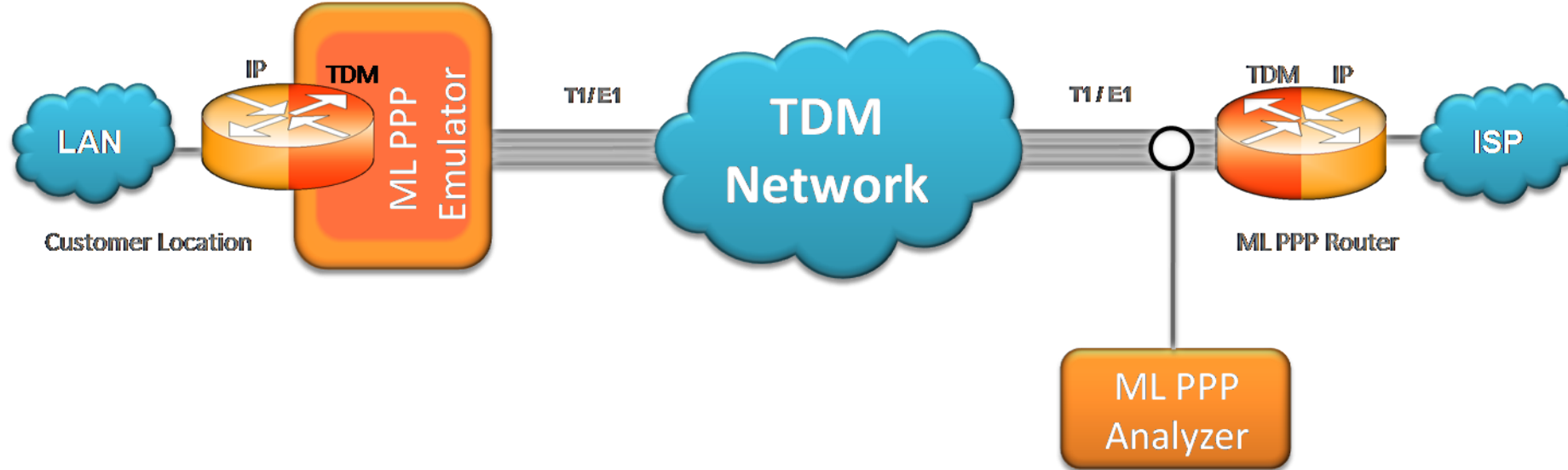
AutoAnswer Card #1 ▾

TimeSlot	Called Nr	Calling Nr	Last Cause	Release Cause
01. PlaceCall	554000	555000	No answer	No Answer
02. Connected	554001	555001		Normal clear
03. Connected	554002	555002		Normal clear
04. Connected	554003	555003		Normal clear
05. Connected	554004	555004		Normal clear
06. Connected	554005	555005		Normal clear
07. Connected	554006	555006		Normal clear
08. PlaceCall	554007	555007	Normal	Normal clear
09. Alerting	554008	555008		Normal clear
10. Alerting	554009	555009		Normal clear
11. Connected	554010	555010		Normal clear
12. Connected	554011	555011		Normal clear
13. Connected	554012	555012		Normal clear
14. Connected	554013	555013		Normal clear
15. Connected	554014	555014		Normal clear
16. UnAvail	554015	555015		Normal clear
17. PlaceCall	554016	555016	Normal	Normal clear
18. AnswerCall	554017	555017		Normal clear
19. Connected	554018	555018		Normal clear
20. AnswerCall	554019	555019		Normal clear
21. PlaceCall	554020	555020	No user resp	No Response
22. Connected	554021	555021		Normal clear
23. AnswerCall	554022	555022		Normal clear
24. Connected	554023	555023		Normal clear
25. Connected	554024	555024		Normal clear
26. AnswerCall	554025	555025	Normal	Normal clear
27. AnswerCall	554026	555026		Normal clear
28. Connected	554027	555027		Normal clear
29. AnswerCall	554028	555028		Normal clear
30. AnswerCall	554029	555029		Normal clear
31. AnswerCall	554030	555030		Normal clear

● Link Up Euro ISDN Belgium Subscriber Active Calls: 26

- 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

The image displays two overlapping windows from the MC-MLPPP Emulator. The background window is the main configuration interface, and the foreground window is a status monitor.

Main Configuration Window:

- Simulation:** MLPPP (selected), PPP
- Link configuration:** Impairments, Statistics, Link Test
- MLPPP Options:** Fragment Format: Long Sequence; Maximum Receive Reconstructed Unit: 1500; Endpoint Discriminator: unchecked; Class: IP Address; Address: 0.0.0.0; Maximum Differential Delay: 250 ms; Multi-Class options: checked; Suspendable classes: 8
- NCP:** Network Control Protocol: IPCP; Ncp Over: MLPPP
- Options:** Option type: IP Address; IP Address: unchecked; Peer IP Address: unchecked

MC-MLPPP Emulator Window:

- Simulation:** MLPPP, PPP (selected)
- Table:**

Link Name	Action	LCP Status	NCP Status	Tx/Rx Status
#1:0-7	Close	Link UP	Link UP	Tx: Not Transmitting , Rx: Not Receiving
#1:14-15,17-18	Close	Link UP	Link UP	Tx: Not Transmitting , Rx: Not Receiving

LCP Configuration: LCP (checked); Maximum Receive Unit: 256; Protocol Field Compression: unchecked; Address and Control Field Compression: unchecked; Magic-Number: 234; Flags: 100; Set Flags

LCP Negotiated Values: PPP Options: MRU = 256, ACFC - Disabled, PFC - Disabled

Transmission and Reception Action

The image displays two instances of the MC-MLPPP Emulator software. The left window shows the 'Action' tab with a 'Select Links to Add' dialog box open, listing links #1:1-7 and #1:8-14. The right window shows the 'Simulation' tab with 'PPP' selected and configuration panels for TX and RX parameters. A red arrow points from the #1:8-14 link in the left window to the #2:8-14 link in the right window. Red boxes highlight the 'Stop Tx' and 'Stop All Tx' buttons in the left window, and the 'Stop Rx' and 'Stop All Rx' buttons in the right window.

MC-MLPPP Emulator (Left Window):

- Simulation: MLPPP PPP
- TX params: Source Type: SEQNUM
- Source Parameters: Order: MSB, Length: 4, Start: 0, Increment: 1
- Duration Spec: Continuous transmission, Limited frames (100), EOF
- Payload Len: 1500
- Multiplex PPP
- Buttons: Stop Tx, Stop All Tx

MC-MLPPP Emulator (Right Window):

- Simulation: MLPPP PPP
- RX params: Sink Type: SEQNUM
- Sink Parameters: Order: MSB, Length: 4, Start: 0, Increment: 1
- Duration Spec: Continuous Reception, Limited frames (100), EOF
- Payload Len: 1500
- Buttons: Start Tx, Start All Tx, Stop Rx, Stop All Rx

Tx Rx Verification

MC-MLPPP Emulator

File Action Help

Simulation

MLPPP PPP

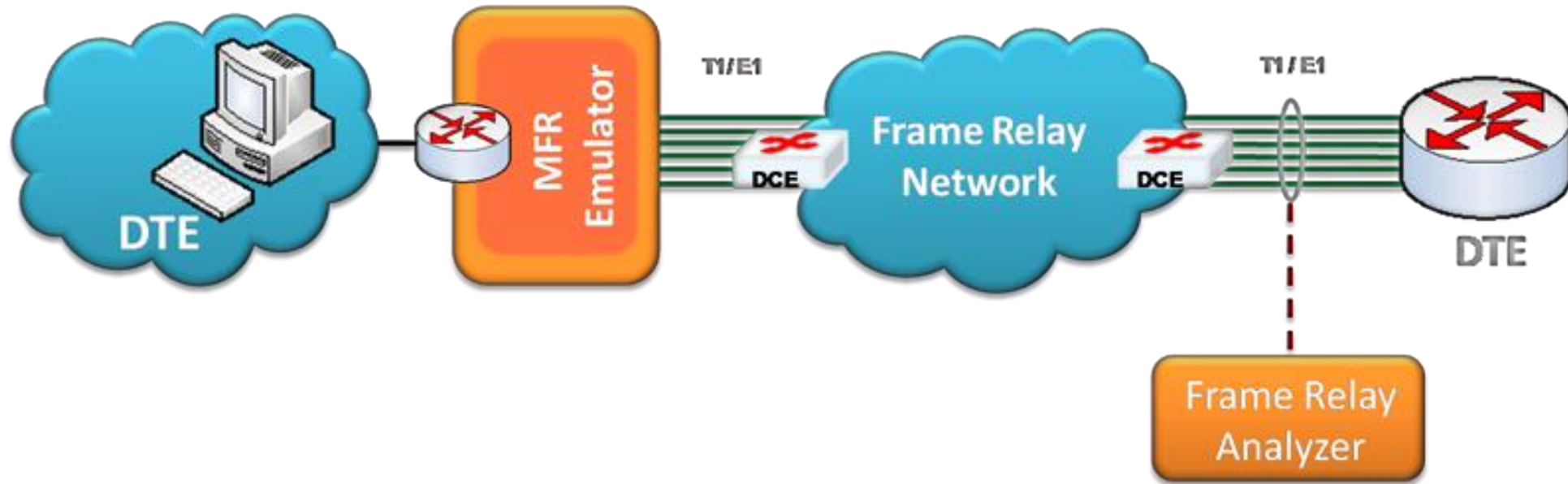
MLPPP View PPP View Action Tx/Rx Verification

Reset

Link Name	Transmitted Frame...	Received Frame Cnt	Matched Frame Cnt	Modified Frame Cnt	Inserted Frame Cnt
#2:0-7	693	678	678	0	0
#2:14-15,...	346	338	336	0	0
Total	1039	1016	1014	0	0

- 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 Emulator - FR Simulation - Untitled

File Action Simulation Help

Server Connection Status ●

Link View Action VC Statistics Tx/Rx Verification

Link Name	Action	Status	
#1:1..10	Open	Down	
#1:11..20	Open	Down	
#1:21..30	Open	Down	

Add Delete Open Close

Link Config Impairments Statistics HDLC Statistics

Fragmentation

Fragment Size

Flags between Hdlc frames

UNI NNI Fragmentation

End to End Fragmentation

MFR Simulation

MFR Emulator - MFR Simulation - Untitled

File Action Simulation Help

Server Connection Status ●

Bundles	Status
1	DOWN
2	No Links

Link View | Action | VC Statistics | Tx/Rx Verification | Bundle Config & Statistics

Link Name	Action	Status
#1:1..5	Open	Down
#1:11..15	Open	Down
#1:6..10	Open	Down

Add Delete Open Close

Link Config | Impairments | Statistics | HDLC Statistics

Fragmentation

Fragment Size

Flags between HdLC frames

UNI NNI Fragmentation

End to End Fragmentation

Bundle ID

Add Delete

Open Close

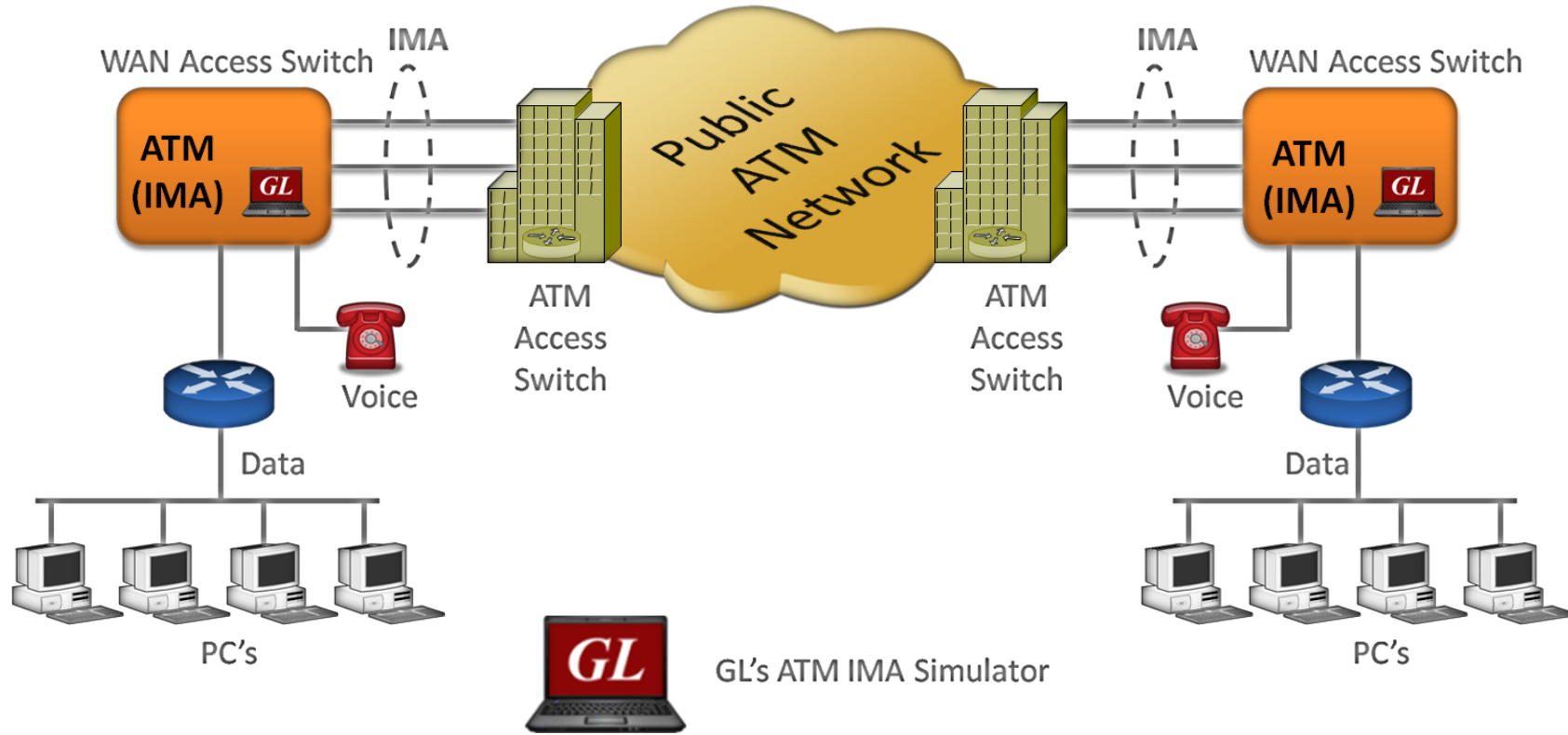
Features

- 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

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



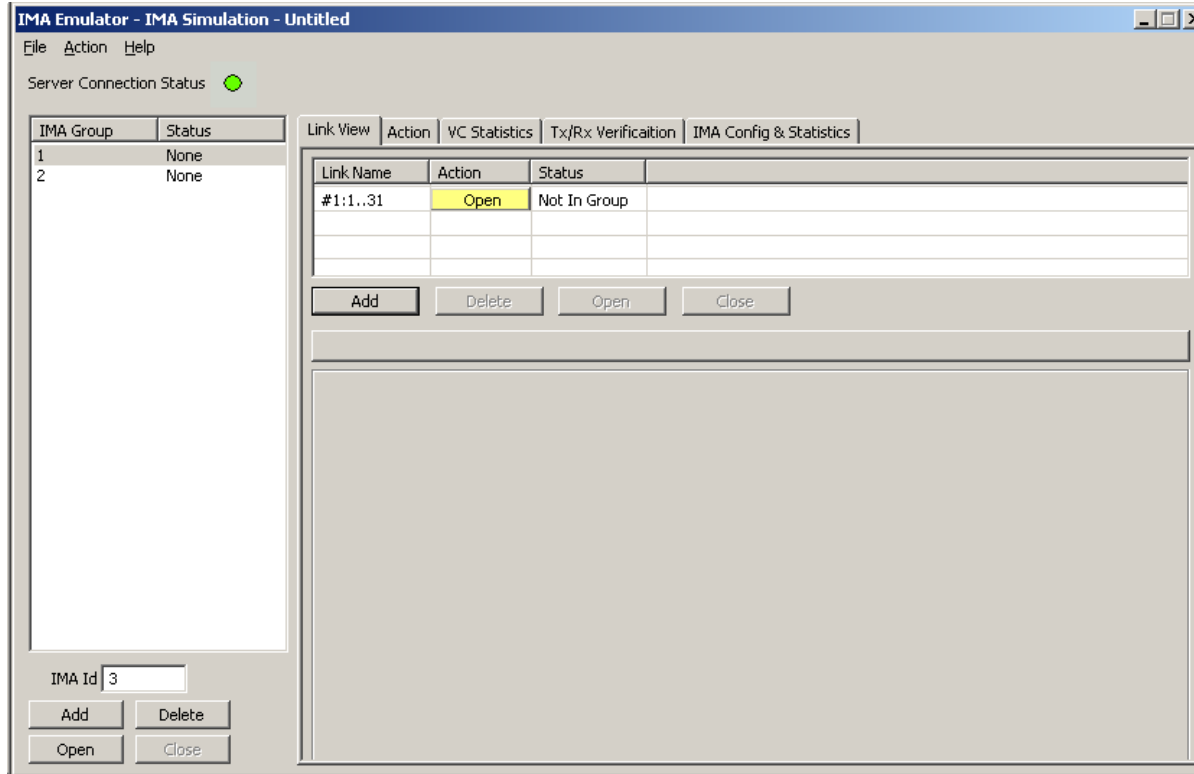
- GUI based WCS client, which simulates IMA Emulation
- Capable of generating and receiving ATM traffic
- Traffic source can be sequence number, HDL files (containing packets/frames), flat binary file, user-defined frames (ASCII HEX file), and Ethernet data

Features

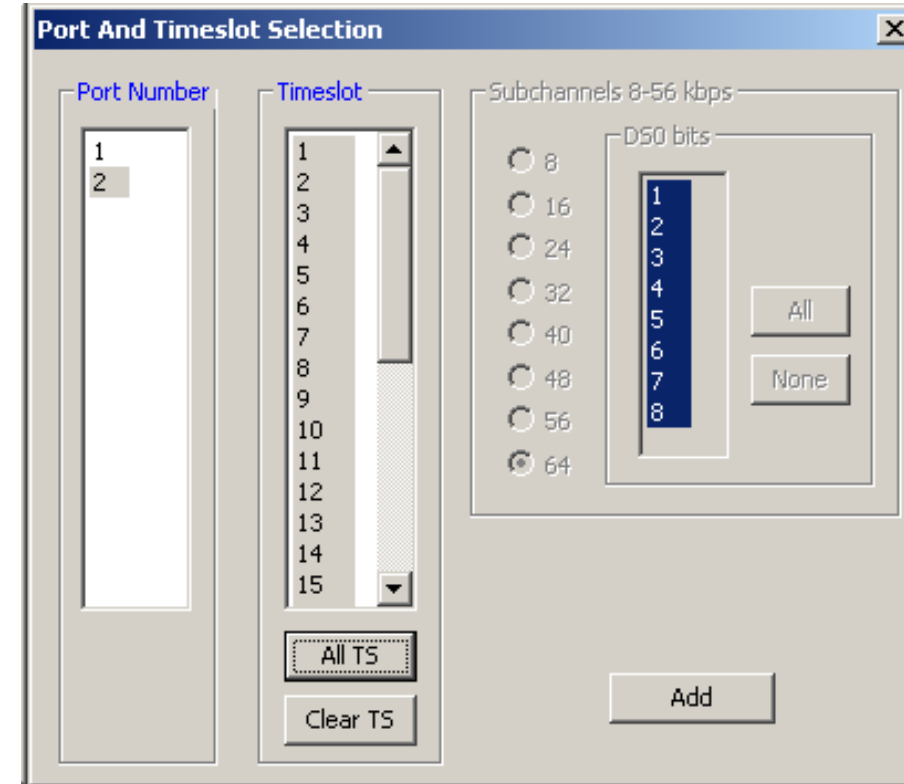
- Performs IMA simulation
- Supports 16 T1/E1 ports
- Support for Full or Fractional Timeslots for ATM Link
- Supports hyper channels with discontinuous (sparse) timeslots
- Supports IMA Frame Length ranging from 32, 64, 128, or 256
- Dynamically add/remove (Open/Close) of ATM links without loss in data
- 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 $n \cdot 64\text{Kbps}$ 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

Client Server Inverse Multiplex for ATM

```

atm script_Hexstr.gls - GLClient
File Edit View Connect Script Log User Help
inform task 1 "START";
OK
run task "AtmlmaServerE1:StartAtmlma";
Task 2: Task 2 started
inform task 2 "ENABLE ICP";
OK
inform task 2 "CONFIG: IMAID 1 IMAFRAMELEN 128 SYMMETRYMODE 0";
OK
inform task 2 "ADDLINK: HC #2:1..31 LINKID 0";
OK
inform task 2 "START";
OK
inform task 1 "Tx: VPI 100 VCI 200 AALTYPE 5 CONT FIXLEN 1500 HEXSTR ABCD";
OK
inform task 2 "Tx: VPI 100 VCI 200 AALTYPE 5 CONT FIXLEN 1500 HEXSTR ABCD";
OK

run task "AtmlmaServerE1:StartAtmlma";
inform task 1 "ENABLE ICP";

inform task 1 "CONFIG: IMAID 2 IMAFRAMELEN 128 SYMMETRYMODE 0";

inform task 1 "ADDLINK: HC #1:1..31 LINKID 0";

inform task 1 "START";

run task "AtmlmaServerE1:StartAtmlma";
inform task 2 "ENABLE ICP";

inform task 2 "CONFIG: IMAID 1 IMAFRAMELEN 128 SYMMETRYMODE 0";

inform task 2 "ADDLINK: HC #2:1..31 LINKID 0";
    
```

ATM Protocol Analysis AAL2,5(UNI3.1)

Dev	TScout	Frame#	TIME (Relative)	Len	Error	VPI	VCI	PT	HEC	OSF	AAL Type	Frame Type
✓ 1	31	27	00:00:00.005556	53		100	200	0	210			ATM-Cell
✓ 1	31	28	00:00:00.005770	53		100	200	0	210			ATM-Cell
✓ 1	31	29	00:00:00.005983	53		100	200	0	210			ATM-Cell
✓ 1	31	30	00:00:00.006197	53		100	200	0	210			ATM-Cell
✓ 1	31	31	00:00:00.006411	53		100	200	0	210			ATM-Cell
✓ 1	31	32	00:00:00.006625	53		100	200	0	210			ATM-Cell
✓ 1	31	33	00:00:00.006838	53		100	200	0	210			ATM-Cell
✓ 1	31	34	00:00:00.007052	53		100	200	0	210			ATM-Cell

Device1 TScout=31 Frame=27 at 00:00:00.005556 OK Len=53

ATM Frame Data

```

----- ATM Layer -----
GFC          = 0000... (0)
VPI          = 100 (...0110 0100....)
VCI          = 200 (...0000 00001100 1000....)
PT           = ...000. (0)
CLP          = .....0 (0)
HEC          = 11010010 (210)
    
```

Hex Dump of the Frame Data

```

+-----+-----+-----+-----+-----+-----+
06 40 0C 80 D2 AB CD AB CD AB CD AB CD AB CD AB  @  !0<I<I<I<I<I<
CD AB CD AB CD AB CD AB CD AB CD AB CD AB CD AB  I<I<I<I<I<I<I<I<I<I<I<I<
CD AB CD AB CD AB CD AB CD AB CD AB CD AB CD AB  I<I<I<I<I<I<I<I<I<I<I<I<
CD AB CD AB CD  I<I<I<I<I<I<I<I<I<I<I<I<I<I<I<I<
    
```

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

GL [Icons]

Signaling Settings Flash Hook

Global Start Global Stop

TimeSlot 5

Enable Signaling

Signaling Script:
 Browse

Edit Signaling Script

0 Send Signaling (O-F) in Current Trunk

State Machine Signaling Status

State Machine Signaling Enabled

State Machine Signaling Activated

Display Binary

Signal Off (1)	Signal Off (9)	Signal Off (18)	Signal Off (26)
Signal Off (2)	Signal Off (10)	Signal Off (19)	Signal Off (27)
Signal Off (3)	Signal Off (11)	Signal Off (20)	Signal Off (28)
Signal Off (4)	Signal Off (12)	Signal Off (21)	Signal Off (29)
Hex 5 (5)	Signal Off (13)	Signal Off (22)	Signal Off (30)
Signal Off (6)	Signal Off (14)	Signal Off (23)	Signal Off (31)
Signal Off (7)	Signal Off (15)	Signal Off (24)	
Signal Off (8)	Signal Off (17)	Signal Off (25)	

**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

[Icons]

Title: **Test Script**

State Machine Components

- State Machine
 - Register Inbound Action
 - Register OutBound Acti
 - Register Tones...
 - State...
 - End State
- Detection
 - Start Signaling Detector
 - Stop Signaling Detector
 - 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=0n,0n,0n,0n;
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	
33	

SS1 Emulator ("SS1 Dialer")

SS1 Dialer #1:0

18:49:51 '23' TS=#1:0 dur=950

- +0.000 '2' TS=#1:0 dur=425
 - +0.000 'Mark' TS=#1:0 dur=100
 - +0.100 'Space' TS=#1:0 dur=42
 - +0.142 'Mark' TS=#1:0 dur=58
 - +0.200 'Space' TS=#1:0 dur=225
- +0.425 '3' TS=#1:0 dur=525
 - +0.425 'Mark' TS=#1:0 dur=100
 - +0.525 'Space' TS=#1:0 dur=42
 - +0.567 'Mark' TS=#1:0 dur=58
 - +0.625 'Space' TS=#1:0 dur=42
 - +0.667 'Mark' TS=#1:0 dur=58
 - +0.725 'Space' TS=#1:0 dur=225

18:49:47 '45' TS=#1:0 dur=1350

Speed Dial

1	'23'	x
2	'45'	x
3	Hank	x
4		+
5		+
6		+
7		+
8		+
9		+
10		+

Run Step Load Save

Clear Display Clear Selection

Dial Mode: 2-Digit Direct Dial

Hide Setup

Mark: Frequency: 2600 Hz, Initial Duration: 100 ms, Nominal Duration: 58 ms

Space: Frequency: 2400 Hz, Nominal Duration: 42 ms, Final Duration: 225 ms

Power: -8 dBm

Tx Channel: Port: Port #1, Timeslot: 0, VF Audio:

Timeout: Remote Timeout: 6 Sec

Space Transmits as Tone

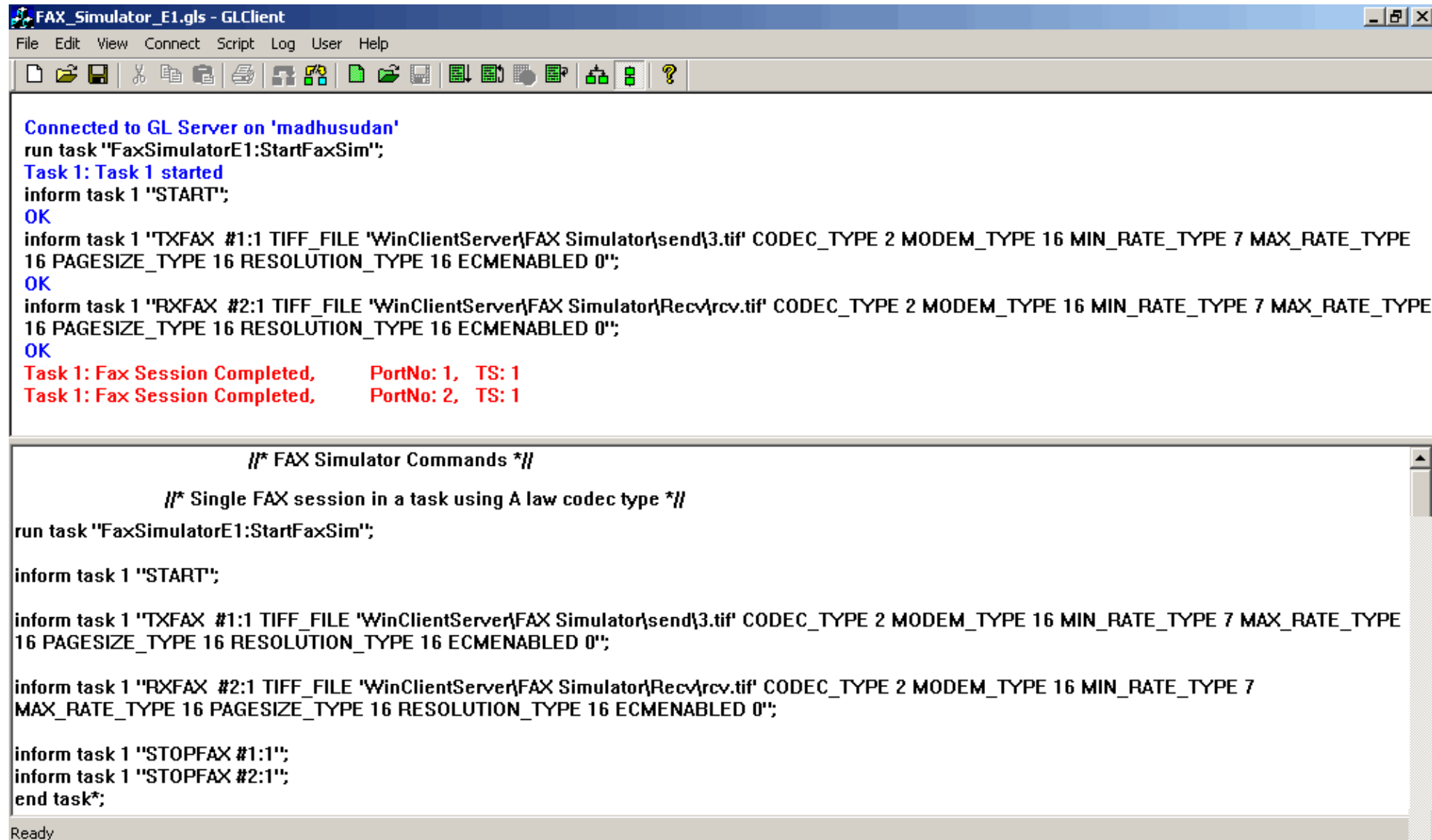
Space Transmits as Idle

Save Setup Load Setup

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



The screenshot shows a window titled "FAX_Simulator_E1.gls - GLClient". The menu bar includes "File", "Edit", "View", "Connect", "Script", "Log", "User", and "Help". The toolbar contains icons for file operations and system functions. The main text area displays the following output:

```
Connected to GL Server on 'madhusudan'  
run task "FaxSimulatorE1:StartFaxSim";  
Task 1: Task 1 started  
inform task 1 "START";  
OK  
inform task 1 "TXFAX #1:1 TIFF_FILE 'WinClientServer\FAX Simulator\send\3.tif' CODEC_TYPE 2 MODEM_TYPE 16 MIN_RATE_TYPE 7 MAX_RATE_TYPE  
16 PAGESIZE_TYPE 16 RESOLUTION_TYPE 16 ECMENABLED 0";  
OK  
inform task 1 "RXFAX #2:1 TIFF_FILE 'WinClientServer\FAX Simulator\Recv\rcv.tif' CODEC_TYPE 2 MODEM_TYPE 16 MIN_RATE_TYPE 7 MAX_RATE_TYPE  
16 PAGESIZE_TYPE 16 RESOLUTION_TYPE 16 ECMENABLED 0";  
OK  
Task 1: Fax Session Completed,      PortNo: 1,  TS: 1  
Task 1: Fax Session Completed,      PortNo: 2,  TS: 1
```

Below the terminal output is a script editor with the following content:

```
/** FAX Simulator Commands **/  
  
/** Single FAX session in a task using A law codec type **/  
run task "FaxSimulatorE1:StartFaxSim";  
  
inform task 1 "START";  
  
inform task 1 "TXFAX #1:1 TIFF_FILE 'WinClientServer\FAX Simulator\send\3.tif' CODEC_TYPE 2 MODEM_TYPE 16 MIN_RATE_TYPE 7 MAX_RATE_TYPE  
16 PAGESIZE_TYPE 16 RESOLUTION_TYPE 16 ECMENABLED 0";  
  
inform task 1 "RXFAX #2:1 TIFF_FILE 'WinClientServer\FAX Simulator\Recv\rcv.tif' CODEC_TYPE 2 MODEM_TYPE 16 MIN_RATE_TYPE 7  
MAX_RATE_TYPE 16 PAGESIZE_TYPE 16 RESOLUTION_TYPE 16 ECMENABLED 0";  
  
inform task 1 "STOPFAX #1:1";  
inform task 1 "STOPFAX #2:1";  
end task*;
```

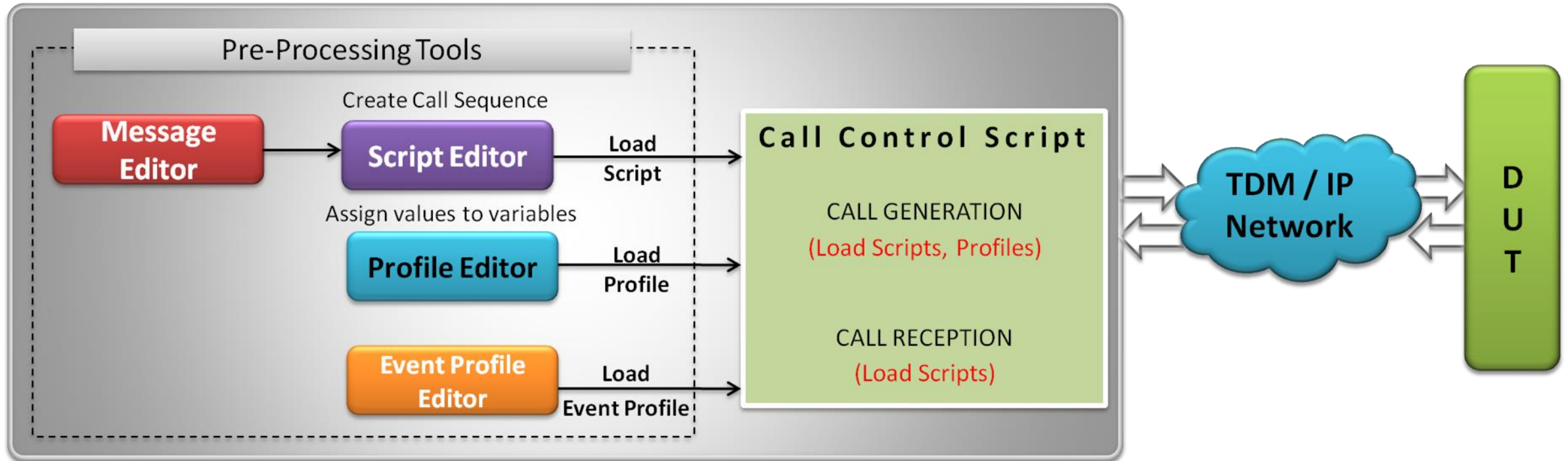
The status bar at the bottom left of the window shows "Ready".

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

Message Automation and Protocol Simulation



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

GL MAPS (Message Automation Protocol Simulation) Subscriber (ISDN ITU) - [Call Generation - BulkCall_Card1]

Configurations Emulator Reports Editor Windows Help

S...	Script Name	Profile	Call Info	Script Execution	Status	Events	Events ...	Result	Total Iteratio...	Completed Iterations
1	Placecall.gls	Card1TS01	1,1	Start	Call Released	None	...	Pass	1	1
2	Placecall.gls	Card1TS02	1,2	Abort	File Sent	DisconnectCall	...	Pass	1	0
3	Placecall.gls	Card1TS03	1,3	Abort	File Sent	DisconnectCall	...	Pass	1	0
4	Placecall.gls	Card1TS04	1,4	Abort	File Sent	DisconnectCall	...	Pass	1	0
5	Placecall.gls	Card1TS05	1,5	Abort	File Sent	DisconnectCall	...	Pass	1	0
6	Placecall.gls	Card1TS06	1,6	Abort	File Sent	DisconnectCall	...	Pass	1	0
7	Placecall.gls	Card1TS07	1,7	Abort	File Sent	DisconnectCall	...	Pass	1	0
8	Placecall.gls	Card1TS08	1,8	Abort	File Sent	DisconnectCall	...	Pass	1	0
9	Placecall.gls	Card1TS09	1,9	Abort	File Sent	DisconnectCall	...	Pass	1	0
10	Placecall.gls	Card1TS10	1,10	Abort	File Sent	DisconnectCall	...	Pass	1	0

Add Delete Insert Refresh Start Start All Stop Stop All Abort Abort All

Save Column Width

MAPS DUT

```

sequenceDiagram
    participant MAPS
    participant DUT
    MAPS->>DUT: SETUP 16:49:32.259000
    DUT->>MAPS: CALL PROCEEDING 16:49:32.607000
    DUT->>MAPS: ALERTING 16:49:32.607000
    DUT->>MAPS: CONNECT 16:49:32.607000
    MAPS->>DUT: CONNECT ACKNOWLEDGE 16:49:32.608000
    MAPS->>DUT: SendFile :: a-law samples\count10.pcm 16:49:52.644000
    MAPS->>DUT: DISCONNECT 16:49:55.076000
    
```

```

===== Q.93x Layer 3 Layer =====
0000 Protocol Discriminator = 00001000 Q.931/I.451 user-network
0001 Call Reference Length = ....0010 2 Bytes
0002 Call Reference Value = 24 (.00000000 00011000)
0002 Call Reference Flag = 0..... FROM side that originated
0004 Message Type = 00000101 SETUP
Bearer capability =
0005 IE Bearer Capability = 00000100 Bearer Capability IE Ident
0006 IE Bearer Capability Length = 3 (x03)
0007 Information Transfer Capability = ...00000 Speech
0007 Coding Standard = .00..... ITU_T (CCITT) standardize
0007 Oct 3 Extension Bit (Oct 3) = 1..... Next Octet Not Present
0008 Information Transfer Rate = ...10000 64 kbit/s
0008 Transfer Mode = .00..... Circuit Mode
0008 Oct 4 Extension Bit (Oct 4) = 1..... Next Octet Not Present
0009 Layer 1 Indent Choice = .01..... Layer 1 Identifier
0009 User Information Layer 1 Protocol (BC) = ...00011 A-law, Rec G.711
0009 Layer 1 Identifier = .01..... Layer 1 Id
    
```

Scripts Message Sequence Event Config Script Flow

Error Events Captured Errors Link Status Up=0 Down=1

Call Reception

GL MAPS (Message Automation Protocol Simulation) Switch (ISDN ITU) - [Call Reception]

Configurations Emulator Reports Editor Windows Help

Sr No	Script Name	Call Info	Script Execution	Status	Events	Events...	Results
1	Recvcall.gls	2,1	Abort	File Sent	DisconnectCall		Pass
2	Recvcall.gls	2,2	Abort	File Sent	DisconnectCall		Pass
3	Recvcall.gls	2,3	Abort	File Sent	DisconnectCall		Pass
4	Recvcall.gls	2,4	Abort	File Sent	DisconnectCall		Pass
5	Recvcall.gls	2,5	Abort	File Sent	DisconnectCall		Pass
6	Recvcall.gls	2,6	Abort	File Sent	DisconnectCall		Pass
7	Recvcall.gls	2,7	Abort	File Sent	DisconnectCall		Pass

Abort Abort All Show Records Auto Trash Trash

Save Column Width

DUT MAPS

```

sequenceDiagram
    participant DUT
    participant MAPS
    DUT->>MAPS: SETUP 16:52:15.860000
    MAPS-->>DUT: CALL PROCEEDING 16:52:15.861000
    MAPS-->>DUT: ALERTING 16:52:15.862000
    MAPS-->>DUT: CONNECT 16:52:15.862000
    DUT->>MAPS: CONNECT ACKNOWLEDGE 16:52:16.208000
    MAPS-->>DUT: SendFile 16:52:35.909000
    
```

```

===== 0.93x Layer 3 Layer =====
0000 Protocol Discriminator = 00001000 Q.931/I.451 user-net
0001 Call Reference Length = ...0010 2 Bytes
0002 Call Reference Value = 35 (.00000000 00100011)
0002 Call Reference Flag = 0..... FROM side that origi
0004 Message Type = 00000101 SETUP
Bearer capability =
0005 IEI Bearer Capability = 00000100 Bearer Capability IE
0006 IE Bearer Capability Length = 3 (x03)
0007 Information Transfer Capability = ...00000 Speech
0007 Coding Standard = .00..... ITU_T (CCITT) standa
0007 Oct 3 Extension Bit (Oct 3) = 1..... Next Octet Not Prese
0008 Information Transfer Rate = ...10000 64 kbit/s
0008 Transfer Mode = .00..... Circuit Mode
0008 Oct 4 Extension Bit (Oct 4) = 1..... Next Octet Not Prese
0009 Layer 1 Indent Choice = .01..... Layer 1 Identifier
0009 User Information Layer 1 Protocol (BC) = ...00011 A-law, Rec G.711
0009 Layer 1 Identifier = .01..... Layer 1 Id
0009 Extension Bit (Oct 5) = 1..... Next Octet Not Prese
Channel identification =
000A IE Identifier = 00011000 Channel Identificati
    
```

Scripts **Message Sequence** Event Config Script Flow

Error Events Captured Errors Link Status Up=0 Down=1

Call Generation and Reception

MAPS (Message Automation Protocol Simulation) SSP (ISUP ITU E1) - [Call Generation - Master Configuration]

Configurations Emulator Reports Editor Windows Help

S...	Script Name	Profile	Call Info	Script Execution	Status	Events	Event...	Result	Total Iterations	Completed Iterations
1	Isup_Call.gls	Card1TS01	1.1.1.2.2.2.1	Start	ISUP Call Released	None		Pass	1	1
2	Isup_Call.gls	Card1TS02	1.1.1.2.2.2.2	Abort	Transmitting File	Terminate Call		Pass	1	0
3	Isup_Call.gls	Card1TS03	1.1.1.2.2.2.3	Abort	Transmitting File	Terminate C				
4	Isup_Call.gls	Card1TS04	1.1.1.2.2.2.4	Abort	Transmitting File	Terminate C				
5	Isup_Call.gls	Card1TS05	1.1.1.2.2.2.5	Abort	Transmitting File	Terminate C				
6	Isup_Call.gls	Card1TS06	1.1.1.2.2.2.6	Abort	Transmitting File	Terminate C				
7	Isup_Call.gls	Card1TS07	1.1.1.2.2.2.7	Abort	Transmitting File	Terminate C				
8	Isup_Call.gls	Card1TS08	1.1.1.2.2.2.8	Abort	Transmitting File	Terminate C				
9	Isup_Call.gls	Card1TS09	1.1.1.2.2.2.9	Abort	Transmitting File	Terminate C				
10	Isup_Call.gls	Card1TS10	1.1.1.2.2.2.10	Abort	Transmitting File	Terminate C				

Add Delete Insert Refresh Start Start All Stop Stop All Abort

Save Column Width

MAPS DUT

```

===== MTP3 Layer =====
0000 Service Indicator
0000 Priority Code
0000 Sub-service field
0001 DPC
0002 OPC
0004 Signalling Link Code
Higher Layer Data
===== ISUP Layer =====
0005 Circuit Identification Code
0007 Message Type
Mandatory Fixed Parameters
Nature Of Connection Indicators Paramet
0008 Satellite indicator
0008 Continuity check indicator
0008 Echo ctrl dev.ind(Nat.Conn.Ind)
Forward Call Indicators Parameter
0009 National/international call ind
    
```

Scripts Message Sequence Event Config Script Flow Capture Events

Error Events

MAPS (Message Automation Protocol Simulation) SSP (ISUP ITU E1) - [Call Reception]

Configurations Emulator Reports Editor Windows Help

Sr No	Script Name	Call Info	Script Execution	Status	Events	Event...	Results
1	SLTM.gls	2.2.2.1.1.1.1	Abort	MTP3 Active	Initiate SLTM		Pass
2	Isup_Call.gls	2.2.2.1.1.1.1	Completed	ISUP Call Released	None		Pass
3	Isup_Call.gls	2.2.2.1.1.1.2	Abort	Transmitting File	Terminate Call		Pass
4	Isup_Call.gls	2.2.2.1.1.1.3	Abort	Transmitting File	Terminate Call		Pass
5	Isup_Call.gls	2.2.2.1.1.1.4	Abort	Transmitting File	Terminate Call		Pass
6	Isup_Call.gls	2.2.2.1.1.1.5	Abort	Transmitting File	Terminate Call		Pass
7	Isup_Call.gls	2.2.2.1.1.1.6	Abort	Transmitting File	Terminate Call		Pass
8	Isup_Call.gls	2.2.2.1.1.1.7	Abort	Transmitting File	Terminate Call		Pass
9	Isup_Call.gls	2.2.2.1.1.1.8	Abort	Transmitting File	Terminate Call		Pass
10	Isup_Call.gls	2.2.2.1.1.1.9	Abort	Transmitting File	Terminate Call		Pass

Abort Abort All Show Records Auto Trash Trash

Save Column Width

DUT MAPS

```

===== MTP3 Layer =====
0000 Service Indicator = ...0101 ISDN User Part
0000 Priority Code = ...00.... Priority Code 0
0000 Sub-service field = 10..... National Network
0001 DPC = 2.2.2(00010010 ..010000)
0002 OPC = 1.1.1(01..... 00000010 ....0010)
0004 Signalling Link Code = 0001.... (1)
Higher Layer Data = x0100010220010A00020907031024567305200A0701116547350220
===== ISUP Layer =====
0005 Circuit Identification Code = 00000001 ....0000 (1)
0007 Message Type = 00000001 Initial address
Mandatory Fixed Parameters =
Nature Of Connection Indicators Parameter =
0008 Satellite indicator = .....10 two satellite circuits in the connection
0008 Continuity check indicator = ....00.. continuity check not required
0008 Echo ctrl dev.ind(Nat.Conn.Ind) = ...0.... outgoing echo control device not included
Forward Call Indicators Parameter =
0009 National/international call ind = .....0 treated as a national call
0009 End-to-end method indicator = .....00. No end-to-end method available
0009 Interworking Indicator = ...0... no interworking encountered (No. 7 signalling
0009 End-to-end infor.ind(ForwardCall Ind) = 0 not available
    
```

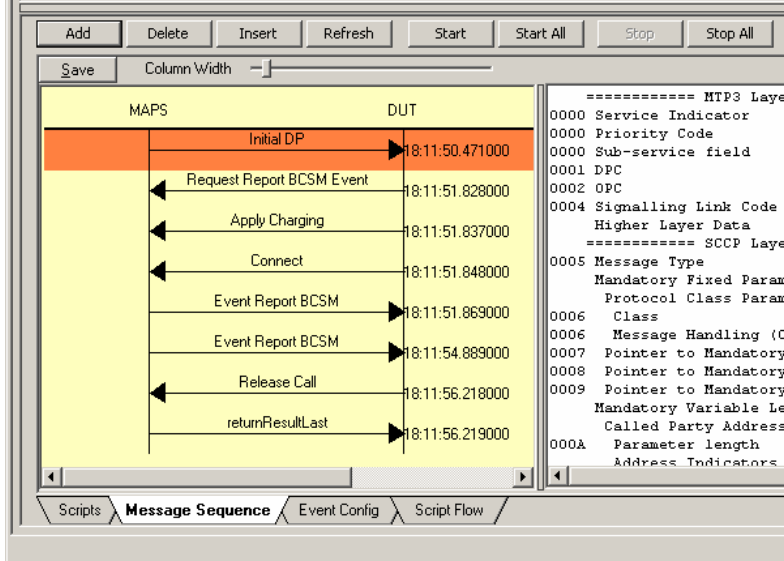
Scripts Message Sequence Event Config Script Flow Capture Events

Error Events Captured Errors Link Status Up=0 Down=1

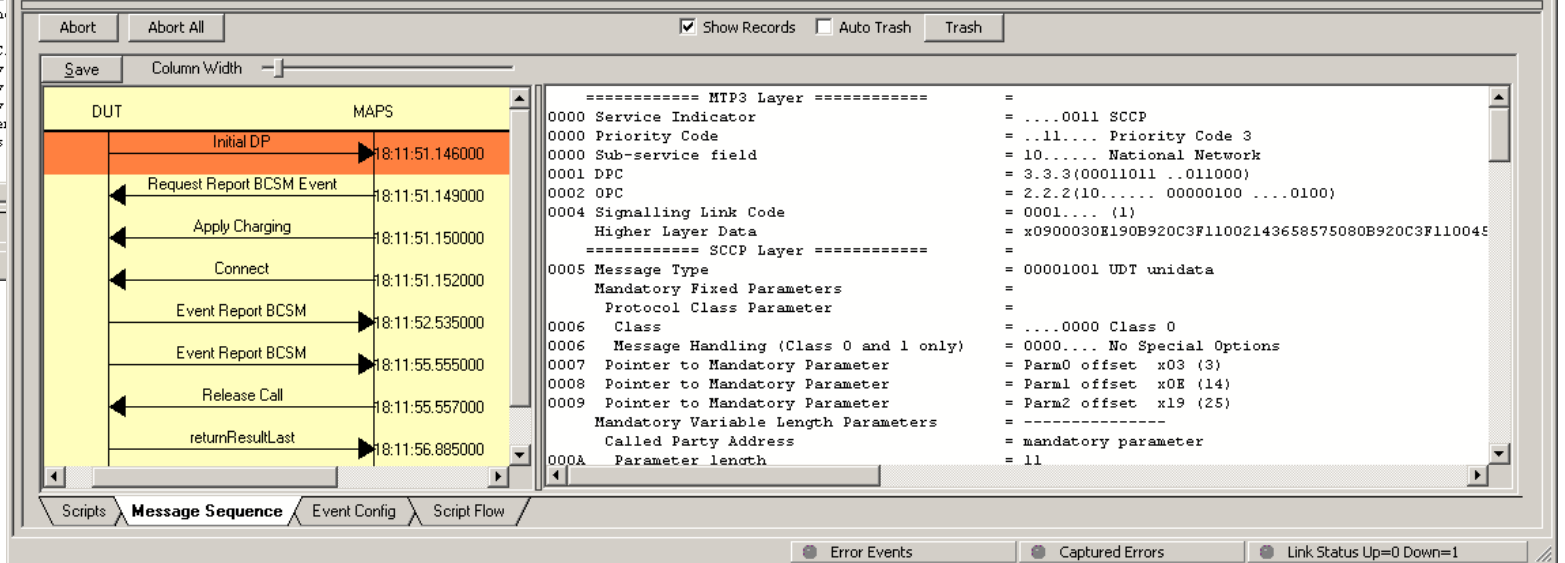
Call Generation and Reception

GL MAPS (Message Automation Protocol Simulation) gsmSSF (INAP 3GPP) - [Call Generation - CallGenDefault]

S...	Script Name	Profile	Call Info	Script Execution	Status	Events	Events...	Result	Total Iterations	Completed Iterations
1	ApplyCharging_SSF.gls	MSPProfile01	0x00000002	Start	Call Released from both side	None	...	Pass	1	1
2	ConnectToResource_SSF.gls	MSPProfile02		Start		None	...	Unknown	1	0
3	EstablishTemporaryConnection_SSF.gls	MSPProfile03		Start		None	...	Unknown	1	0
4	TollFreeCallFlow_SSF.gls	MSPProfile04		Start		None	...	Unknown	1	0



Sr No	Script Name	Call Info	Script Execution	Status	Events	Events...	Results
1	SLTM.gls	3.3.3.2.2	Abort	MTP3 Active	Initiate SLTM		Pass
2	SCMG.gls	1	Abort	Subsystem-Allowed	Initiate SST		Pass
3	ApplyCharging_SCF.gls	0x00000002	Completed	IN Transaction Complete	None		Pass
4	ApplyCharging_SCF.gls	0x00000003	Abort	Apply Charging Sent	None		Unknown



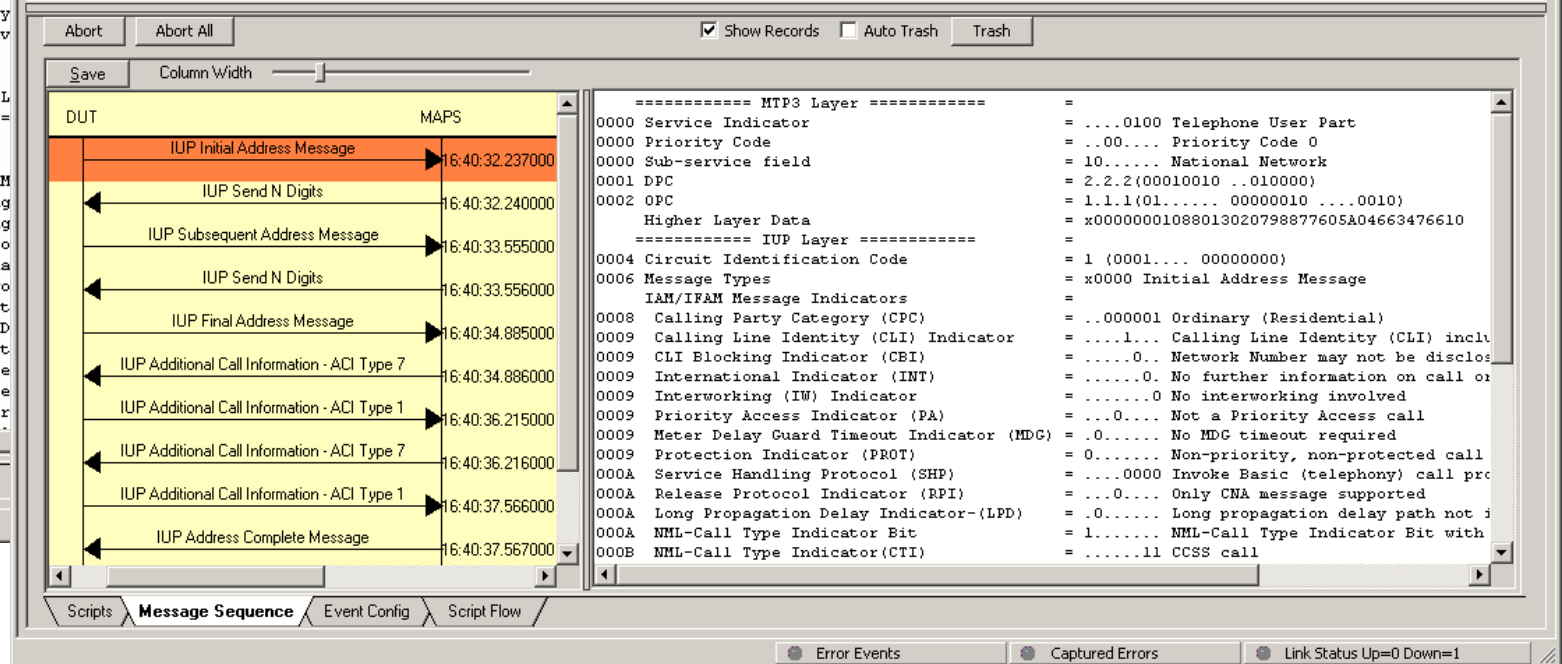
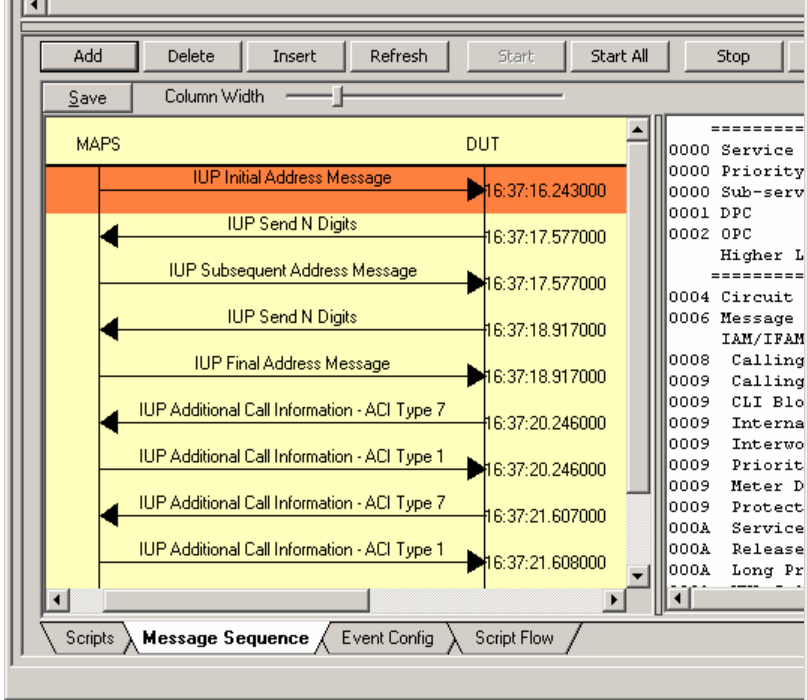
Call Generation and Reception

GL MAPS (Message Automation Protocol Simulation) (IUP UK) - [Call Generation - Untitled]

Sr No	Script Name	Profile	Call Info	Script Execution	Status	Events	Events P...	Result	Total Iterations	Completed Iterations
1	IUP_Call.gls	Card1TS01	1.1.1.2.2.2.1	Abort	Recording File	IUPTerminate		Pass	1	0
2	IUP_Call.gls	Card1TS02	1.1.1.2.2.2.2	Abort	Transmitting Tone	IUPTerminate		Pass	1	0
3	IUP_Call.gls	Card1TS03	1.1.1.2.2.2.3	Abort	Transmitting Tone	IUPTerminate		Pass	1	0
4	IUP_Call.gls	Card1TS04	1.1.1.2.2.2.4	Abort	Transmitting Tone	IUPTerminate		Pass	1	0
5	IUP_Call.gls	Card1TS05	1.1.1.2.2.2.5	Abort	Transm					
6	IUP_Call.gls	Card1TS06	1.1.1.2.2.2.6	Abort	Transm					
7	IUP_Call.gls	Card1TS07	1.1.1.2.2.2.7	Abort	Transm					
8	IUP_Call.gls	Card1TS08	1.1.1.2.2.2.8	Abort	Transm					

GL MAPS (Message Automation Protocol Simulation) (IUP UK) - [Call Reception]

Sr No	Script Name	Call Info	Script Execution	Status	Events	Events...	Results
1	SLTM.gls	2.2.2.1.1.1.1	Abort	MTP3 Active	None		Pass
2	IUP_Call.gls	2.2.2.1.1.1.1	Abort	Digits Transmitted	IUPTerminate		Fail
3	IUP_Call.gls	2.2.2.1.1.1.2	Abort	Transmitting Tone	IUPTerminate		Pass
4	IUP_Call.gls	2.2.2.1.1.1.3	Abort	Transmitting Tone	IUPTerminate		Pass
5	IUP_Call.gls	2.2.2.1.1.1.4	Abort	Transmitting Tone	IUPTerminate		Pass



Call Generation and Reception

MAPS (Message Automation Protocol Simulation) BSC (GsmA GSM900) - [Call Generation - CallGenDefault]

Configurations Emulator Reports Editor Windows Help

Sr No	Script Name	Profile	Call Info	Script Execution	Status	Events	Event...	Result	Total Iterations	Completed Iteration
1	MO.gls	BSC01MS001	IMSI:901700000000601...	Start	SCCP Resources Released	None		Pass	1	1
2	MO.gls	BSC01MS002	IMSI:901700000000602...	Abort	Transmitting File	Terminate				
3	MO.gls	BSC01MS003		Start		None				
4	MO.gls	BSC01MS004		Start		None				
5	MO.gls	BSC01MS005		Start		None				
6	MO.gls	BSC01MS006		Start		None				

Add Delete Insert Refresh Start Start All Stop Stop All Abort Abort All

Save Column Width

RLC release complete → 14:25:51.773000
 CM SERVICE REQUEST → 14:25:51.774000
 ← CC connection confirm 14:25:52.352000
 ← AUTHENTICATION REQUEST 14:25:52.374000
 ← AUTHENTICATION RESPONSE 14:25:52.375000
 ← CIPHER MODE COMMAND 14:25:52.936000
 ← CIPHER MODE COMPLETE 14:25:52.937000
 ← TMSI REALLOCATION COMMAND 14:25:53.505000
 ← TMSI REALLOCATION COMPLETE 14:25:53.506000
 ← CM SERVICE ACCEPT 14:25:54.088000

```

===== MTP3 Layer =====
0000 Service Indicator
0000 Priority Code
0000 Sub-service field
0001 DPC
0002 OPC
0004 Signalling Link Code
Higher Layer Data
===== SCCP Layer =====
0005 Message Type
Mandatory Fixed Parameters
Source Local Reference Parameter
0006 Source Local Reference
Protocol Class Parameter
Class
0009 Message Handling (Class 0 and 1 only)
000A Pointer to Mandatory Parameter
000B Pointer to optional parameters
Mandatory Variable Length Parameters
Called Party Address
000C Parameter length
Address Indicators
    
```

Scripts Message Sequence Event Config Script Flow

Error Events Captured

MAPS (Message Automation Protocol Simulation) MSC (GsmA GSM900) - [Call Reception]

Configurations Emulator Reports Editor Windows Help

Sr No	Script Name	Call Info	Script Execution	Status	Events	Events...	Results
1	SLTM.gls	2.2.2.1.1.1.1	Abort	MTP3 Active	Initiate SLTM		Pass
2	SCMG.gls	1	Abort	Subsystem-Allowed	Initiate SST		Pass
3	MO.gls	IMSI:901700000000601.TMSI:0...	Completed	SCCP Release Initiated	None		Pass
4	MO.gls	IMSI:901700000000601.TMSI:0...	Abort	File Sent	Terminate		Pass

Abort Abort All Show Records Auto Trash Trash

Save Column Width

DUT MAPS

CM SERVICE REQUEST → 14:24:23.131000
 ← CC connection confirm 14:24:23.134000
 ← AUTHENTICATION REQUEST 14:24:23.135000
 ← AUTHENTICATION RESPONSE 14:24:23.718000
 ← CIPHER MODE COMMAND 14:24:23.718000
 ← CIPHER MODE COMPLETE → 14:24:24.288000
 ← TMSI REALLOCATION COMMAND 14:24:24.289000
 ← TMSI REALLOCATION COMPLETE → 14:24:24.872000
 ← CM SERVICE ACCEPT 14:24:24.872000
 ← SETUP → 14:24:25.453000
 ← CALL PROCEEDING 14:24:25.454000
 ← ASSIGNMENT REQUEST

```

===== MTP3 Layer =====
0000 Service Indicator
0000 Priority Code
0000 Sub-service field
0001 DPC
0002 OPC
0004 Signalling Link Code
Higher Layer Data
===== SCCP Layer =====
0005 Message Type
Mandatory Fixed Parameters
Source Local Reference Parameter
0006 Source Local Reference
Protocol Class Parameter
Class
0009 Message Handling (Class 0 and 1 only)
000A Pointer to Mandatory Parameter
000B Pointer to optional parameters
Mandatory Variable Length Parameters
Called Party Address
000C Parameter length
Address Indicators
    
```

Scripts Message Sequence Event Config Script Flow

Error Events Captured Errors Link Status Up=1 Down=0

Call Generation and Reception

MAPS (Message Automation Protocol Simulation) BTS (GsmAbis GSM900) - [Call Generation - Master Configuration]

Configurations Emulator Reports Editor Windows Help

Sr No	Script Name	Profile	Call Info	Script Execution	Status	Events	Event...	Result	Total Iterations	Completed Iterations
1	BTS_MOC.gls	BTSPProfile001	IMSI;.404060000000001.TMSI...	Start	SMS Call Released	None		Pass	1	1
2	BTS_LUC.gls	BTSPProfile002	IMSI;.404060000000002.TMSI...	Start	Released Air Interface Resources	None		Pass	1	1

Add Delete Insert Refresh Start Start All Stop Stop All Abort

Save Column Width

MAPS DUT

```

===== BT
0000 T-bit
0000 Message Group
0001 Message Type
0002 Channel number
0003 IE Identifier
0003 Channel Type
0003 Time Slot #
0004 Request Reference
0005 RA
0006 T3
0007 T1'
0007 T2
0008 Access Delay
0008 IE Identifier
0009 Access Delay
    
```

Scripts Message Sequence Event Config Script Flow

MAPS (Message Automation Protocol Simulation) BSC (GsmAbis GSM900) - [Call Reception]

Configurations Emulator Reports Editor Windows Help

Sr No	Script Name	Call Info	Script Execution	Status	Events	Events...	Results
1	BSC_MOC.gls		Completed		None		Pass
2	BSC_MOC.gls		Completed		None		Pass
3	BSC_MOC.gls	IMSI;.404060000000002.TMSI.0...	Completed	Air Interface Resources Released	None		Pass

Abort Abort All Show Records Auto Trash Trash

Save Column Width

DUT MAPS

```

===== BTSM Layer =====
0000 T-bit = .....0 Non-Transparent Message
0000 Message Group = 0000110. Common Channel Mgmt
0001 Message Type = 00010011 CHANnel ReQuireD
0002 Channel number =
0003 IE Identifier (Ch No) = 00000001 Channel number
0003 Channel Type = 10001... Uplink CCCH (RACH)
0003 Time Slot # = .....000 (0)
0004 Request Reference =
0004 IE Identifier (ReqRef) = 00010011 Request Reference
0005 RA = 00000101 (5)
0006 T3 = 5 (.....000 101.....)
0006 T1' = 00101... (5)
0007 T2 = ...00101 (5)
0008 Access Delay =
0008 IE Identifier (AD) = 00010001 Access Delay
0009 Access Delay = 55 (x37)
    
```

Scripts Message Sequence Event Config Script Flow Capture Events

Error Events Captured Errors Link Status Up=1 Down=0

Call Generation and Reception

MAPS (Message Automation Protocol Simulation) MSC (MAP 3GPP) - [Call Generation - CallGenDefault]

Configurations Emulator Reports Editor Windows Help

Sr No	Script Name	Profile	Call Info	Script Execution	Status	Events	E...	Result	Total Iterations	Completed Iteratio
1	UpdateLocationArg_MSCVLR.gls	MSPProfile04	9017000000006	Start	Location Update Completed	None		Pass	1	1
2	SendAuthenticationInfoArg_VLR.gls	MSPProfile05	9017000000006...	Start	At					
3	AuthenticationFailureArg_MSC.gls	MSPProfile06	9017000000006...	Start	Authen					
4	processUnstructuredSS-RequestArg_M...	MSPProfile07	0x00000005	Start	Proces					
5	ReadyForSMAArg_VLR.gls	MSPProfile08	9017000000006...	Start						
6	PurgeMSArg_MSC.gls	MSPProfile09	9017000000006...	Start	purge					

Add Delete Insert Refresh Start Start All Stop Sto

Save Column Width

MAPS DUT

```

===== MTP3 Layer
0000 Service Indicator
0000 Priority Code
0000 Sub-service field
0001 DPC
0002 OPC
0004 Signalling Link Code
Higher Layer Data
===== SCCP Layer
0005 Message Type
Mandatory Fixed Param
Protocol Class Param
0006 Class
0006 Message Handling (C
0007 Pointer to Mandatory
0008 Pointer to Mandatory
0009 Pointer to Mandatory
Mandatory Variable Le
Called Party Address
000A Parameter length
    
```

Scripts Message Sequence Event Config Script Flow

Error Events

MAPS (Message Automation Protocol Simulation) HLR (MAP 3GPP) - [Call Reception]

Configurations Emulator Reports Editor Windows Help

Sr No	Script Name	Call Info	Script Execution	Status	Events	Events ...	Results
1	SLTM.gls	0.0.1.0.0.6	Abort	MTP3 Active	Initiate SLTM		Pass
2	SCMG.gls	1	Abort	Subsystem-Allowed	Initiate SST		Pass
3	UpdateLocationRes_HLR.gls		Completed		None		Pass
4	SendAuthenticationInfoRes_HLR.gls	901700000000627	Completed	Authentication Success	None		Pass
5	AuthenticationFailureReportRes_HLR.gls	901700000000628	Completed	Authentication Failure Report Response S...	None		Pass
6	processUnstructuredSS-RequestRes_H...	ProtScriptId_3174573-1543-4384	Completed	Process USSD Response Sent	None		Pass
7	readyForSMRes_HLR.gls	901700000000630	Completed	Ready For SMS	None		Pass
8	PurgeMSRes_HLR.gls	901700000000631	Completed	MS Purged	None		Pass

Abort Abort All Show Records Auto Trash Trash

Save Column Width

DUT MAPS

```

===== MTP3 Layer =====
0000 Service Indicator = ...0011 SCCP
0000 Priority Code = ...00.... Priority Code 0
0000 Sub-service field = 10..... National Network
0001 DPC = 0.0.1(00000001 ..000000)
0002 OPC = 0.0.6(10..... 00000001 ....0000)
0004 Signalling Link Code = 0001.... (1)
Higher Layer Data = x0981030C16099206007200545784870A920700110013644763
===== SCCP Layer =====
0005 Message Type = 00001001 UDT unidata
Mandatory Fixed Parameters =
Protocol Class Parameter =
0006 Class = ....0001 Class 1
0006 Message Handling (Class 0 and 1 only) = 1000.... return message on error
0007 Pointer to Mandatory Parameter = Parm0 offset x03 (3)
0008 Pointer to Mandatory Parameter = Parm1 offset x0C (12)
0009 Pointer to Mandatory Parameter = Parm2 offset x16 (22)
Mandatory Variable Length Parameters =
Called Party Address = mandatory parameter
    
```

Scripts Message Sequence Event Config Script Flow

Error Events Captured Errors Link Status Up=1 Down=0

Call Generation and Reception

MAPS (Message Automation Protocol Simulation) gsmSSF (CAMEL 3GPP) - [Call Generation - CallGenDefault]

Sr No	Script Name	Profile	Call Info	Script Execution	Status	Events	Event...	Result	Total Iterations	Completed Iterations
1	ApplyChargingGPRS_SSF.gls	MSProfile01	0x0000000D	Start	Call Charging Report Sent	None	...	Pass	1	1
2	ApplyCharging_SSF.gls	MSProfile02	0x0000000F	Start	Call Released from both side	None	...	Pass	1	1
3	CamelSMS_SSF.gls	MSProfile03	0x0000000A	Start	Call Released from both side	None	...	Pass	1	1
4	BalanceCheck_SSF.gls	MSProfile04	0x00000012	Start	Call Released from both side	None	...	Pass	1	1
5	ConnectToResource_SSF.gls	MSProfile05	0x00000010	Start	Call Released from both side	None	...	Pass	1	1
6	EstablishTemporaryConnection_SSF.gls	MSProfile06	0x00000011	Start	Response Timer Expired	None	...	Pass	1	1

MAPS (Message Automation Protocol Simulation) gsmSCF (CAMEL 3GPP) - [Call Reception]

Sr No	Script Name	Call Info	Script Execution	Status	Events	Events ...	Results
1	SLTM.gls	3.3.3.2.2.2	Abort	MTP3Active	Initiate SLTM		Pass
2	SCMG.gls	1	Abort	Subsystem-Allowed	Initiate SST		Pass
3	ApplyChargingGPRS_SCF.gls		Completed		None		Pass
4	BalanceCheck_SCF.gls	0x00000003	Completed	CAMEL Transaction Complete	None		Pass
5	CamelSMS_SCF.gls	0x00000004	Completed	CAMEL Transaction Complete	None		Pass
6	BalanceCheck_SCF.gls	0x00000005	Completed	CAMEL Transaction Complete	None		Pass
7	BalanceCheck_SCF.gls	0x00000006	Abort	o Disconnect Reported	None		Unknown

MAPS DUT

Calling Address Data

0022 Parameter length

SCCP user data

Optional Variable Length Param

***** CAMEL Rel6 Layer *

0023 CAMEL Package Type

0023 Begin

0024 Length

0025 Originating ID Value

0026 Length

0027 Value

002B DialoguePortion

002C Length

002D Structured Dialogue

002E Length

002F Dialogue-As-ID

0030 Length

0030 Value

0038 Single ASN1 Type

0039 Length

003A Dialogue PDU

MAPS MAPS

initialDPGPRS → 11:28:42.562000

requestReportGPRSEvent ← 11:28:43.162000

eventReportGPRS → 11:28:43.173000

continueGPRS ← 11:28:43.183000

requestReportGPRSEvent ← 11:28:43.798000

applyChargingGPRS ← 11:28:43.810000

continueGPRS ← 11:28:43.832000

applyChargingReportGPRS → 11:28:51.816000

applyChargingGPRS ← 11:28:52.407000

MAPS DUT

initialDPGPRS → 17:40:41.852000

requestReportGPRSEvent ← 17:40:41.922000

continueGPRS ← 17:40:41.961000

eventReportGPRS → 17:40:42.587000

requestReportGPRSEvent ← 17:40:42.621000

applyChargingGPRS ← 17:40:42.642000

continueGPRS ← 17:40:42.645000

applyChargingReportGPRS → 17:40:51.302000

applyChargingGPRS ← 17:40:51.305000

continueGPRS ← 17:40:51.307000

***** MTP3 Layer *****

0000 Service Indicator =0011 SCCP

0000 Priority Code = ..11.... Priority Code 3

0000 Sub-service field = 10..... National Network

0001 DPC = 3.3.3(00011011 ..011000)

0002 OPC = 2.2.2(10..... 000001000100)

0004 Signalling Link Code = 0001.... (1)

Higher Layer Data = x0900030E190B92933F11003141658575080B92923F11C

***** SCCP Layer *****

0005 Message Type = 00001001 UDT unidata

Mandatory Fixed Parameters

Protocol Class Parameter

0006 Class =0000 Class 0

0006 Message Handling (Class 0 and 1 only) = 0000.... No Special Options

0007 Pointer to Mandatory Parameter = Parm0 offset x03 (3)

0008 Pointer to Mandatory Parameter = Parm1 offset x0E (14)

0009 Pointer to Mandatory Parameter = Parm2 offset x19 (25)

Mandatory Variable Length Parameters

Called Party Address = mandatory parameter

000A Parameter length = 11

Address Indicators =

000B Point Code Indicators =0 Address does not contain signalling p

000B SSN Indicators =1. Address contains subsystem number

000B Global Title Indicators = ..0100.. Global title includes translation typ

Call Generation and Reception

MAPS (Message Automation Protocol Simulation) (MLPPP IETF) - [Call Generation - CallGenDefault]

Configurations Emulator Reports Editor Windows Help

Sr No	Script Name	Profile	Call Info	Script Execution	Status	Events	Events Profile	Result	Total Iterations	Completed Iterations
1	OpenStateTest.gls	MLPPPProfile01		Start	Opened	None	EventProfile.xml ...	Pass	1	1

MAPS DUT

```

===== PPP
0000 Address Compression
0000 Address
0001 Ctl
0002 Protocol Field Selection
0002 Protocol
===== Link Control Layer =====
Code Type
0004 Code
0005 Identifier
0006 Length
Magic-Number
0008 IE id
0009 Length of Options
000A Magic-Number
Maximum-Receive-Reconstructed-Unit
000E IE-Id
000F Length of Options
0010 Maximum-Receive-Reconstructed-Unit
PFC
0012 IE-Id
0013 Length of Options
ACFC
0014 IE-Id
0015 Length of Options
    
```

Scripts Message Sequence Event Config Script Flow

MAPS (Message Automation Protocol Simulation) (MLPPP IETF) - [Call Reception]

Configurations Emulator Reports Editor Windows Help

Sr No	Script Name	Call Info	Script Execution	Status	Events	Events...	Results
1	TestLoopBackUsingPeerMagicNumber.gls		Completed		None		Pass

Abort Abort All Show Records Auto Trash Trash

DUT MAPS

```

===== PPP Link Layer =====
0000 Address Compression Choice = 1111... No Address Compression
0000 Address = 11111111 Broadcast Address
0001 Ctl = 00000011 UnSequenced Frame
0002 Protocol Field Selection = .....0 ProtocolField Two Octets
0002 Protocol = 11000000 00100001 Link Control
===== Link Control Layer =====
Code Type
0004 Code = 00000011 Configure-Nak
0005 Identifier = 14 (x0E)
0006 Length = 14 (x000E)
Magic-Number
0008 IE id = 00000101 Magic-Number
0009 Length of Options = 6 (x06)
000A Magic-Number = 31698 (x00007BD2)
Max-Recv-Reconstructed-Unit
000E IE-Id = 00010001 Maximum-Receive-Reconstructed-Unit
000F Length of Options = 4 (x04)
0010 Maximum-Receive-Reconstructed-Unit = 1500 (x05DC)
    
```

Scripts Message Sequence Event Config Script Flow

Error Events ● Captured Errors Link Status Up=0 Down=0

Call Generation and Reception

GL MAPS (Message Automation Protocol Simulation) (CAS) - [Call Generation - Default-R1]

Configurations Emulator Reports Editor Windows Help

S...	Script Name	Profile	Call Info	Script Execution	Status	Events	Events...	Result	Total Iterations	Completed Iterations
1	T1_R1_Place Call.gls	Card1TS00	1,0	Abort	Transmitting File	OutboundReleaseCall	...	Pass	1	0
2	T1_R1_Answer Call.gls	Card2TS00	2,0	Abort	Transmitting File	InboundReleaseCall	...	Pass	1	0
3	T1_R1_Reset Timeslots.gls			Start	Timeslots Restarted	None	...	Pass	1	1

Add Delete Insert Refresh Start Start All Stop Stop All

View Executing Line

Script Contents

```

//// MAPS CAS Emulator: R1 ////

//// Initialization ////
P="1, 1, 1, 1"; //P: Place //
A="1, 1, 1, 1"; //A: Answer //
PR="0, 0, 0, 0"; //PR: Place Release //
AR="0, 0, 0, 0"; //AR: Answer Release //
Idle="0, 0, 0, 0";
SeizureAck="0, 0, 0, 0";
WinkOn="1, 1, 1, 1";
WinkOff="0, 0, 0, 0";
    
```

Scripts Message Sequence Event Config Script Flow Capture Events

Error Ev

Events

Event Log Error Events Captured Errors

Date/Time	Captured Events	Call Trace Id	Script Name	Script Id
2014-8-27 12:57:21.596000	Timeslots Restarted		T1_FGD_Reset Timeslots.gls	CGProtScriptId_94501006-1988-3436
2014-8-27 12:57:49.862000	Timeslots Restarted		T1_R1_Reset Timeslots.gls	CGProtScriptId_94529274-1989-3436
2014-8-27 12:57:56.595000	P: Placing Call...	1,0	T1_R1_Place Call.gls	CGProtScriptId_94535819-1991-3436
2014-8-27 12:57:56.611000	A: CASDetectedSignals = 0, 0, 0, 0	2,0	T1_R1_Answer Call.gls	CGProtScriptId_94535323-1990-3436
2014-8-27 12:57:57.089000	A: Seizure Detected	2,0	T1_R1_Answer Call.gls	CGProtScriptId_94535323-1990-3436
2014-8-27 12:57:57.100000	P: CASDetectedSignals = 0, 0, 0, 0	1,0	T1_R1_Place Call.gls	CGProtScriptId_94535819-1991-3436
2014-8-27 12:57:57.102000	P: CASDetectedSignals = 1, 1, 1, 1	1,0	T1_R1_Place Call.gls	CGProtScriptId_94535819-1991-3436
2014-8-27 12:57:57.296000	A: Seizure Acknowledged	2,0	T1_R1_Answer Call.gls	CGProtScriptId_94535323-1990-3436
2014-8-27 12:57:57.603000	P: CASDetectedSignals = 0, 0, 0, 0	1,0	T1_R1_Place Call.gls	CGProtScriptId_94535819-1991-3436
2014-8-27 12:57:57.603000	P: Seizure Acknowledged	1,0	T1_R1_Place Call.gls	CGProtScriptId_94535819-1991-3436
2014-8-27 12:57:57.603000	RndDialDigitsDID = 5551809	1,0	T1_R1_Place Call.gls	CGProtScriptId_94535819-1991-3436
2014-8-27 12:57:57.603000	RndDialDigitsANI = 4441809	1,0	T1_R1_Place Call.gls	CGProtScriptId_94535819-1991-3436
2014-8-27 12:57:57.603000	P: Dialing	1,0	T1_R1_Place Call.gls	CGProtScriptId_94535819-1991-3436
2014-8-27 12:58:02.096000	A: Digit Type=DTMF	2,0	T1_R1_Answer Call.gls	CGProtScriptId_94535323-1990-3436
2014-8-27 12:58:02.096000	A: digits=5551809*4441809	2,0	T1_R1_Answer Call.gls	CGProtScriptId_94535323-1990-3436
2014-8-27 12:58:02.096000	A: Alerting	2,0	T1_R1_Answer Call.gls	CGProtScriptId_94535323-1990-3436
2014-8-27 12:58:05.188000	A: Call Connected	2,0	T1_R1_Answer Call.gls	CGProtScriptId_94535323-1990-3436
2014-8-27 12:58:05.188000	RndFileSel = 7	2,0	T1_R1_Answer Call.gls	CGProtScriptId_94535323-1990-3436
2014-8-27 12:58:05.188000	A: Tx-FileName: mu-law samples\kerryc...	2,0	T1_R1_Answer Call.gls	CGProtScriptId_94535323-1990-3436
2014-8-27 12:58:05.603000	P: CASDetectedSignals = 1, 1, 1, 1	1,0	T1_R1_Place Call.gls	CGProtScriptId_94535819-1991-3436
2014-8-27 12:58:05.603000	P: Remote User Answered Call	1,0	T1_R1_Place Call.gls	CGProtScriptId_94535819-1991-3436

Save Events

Clear Capture Events to file

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

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

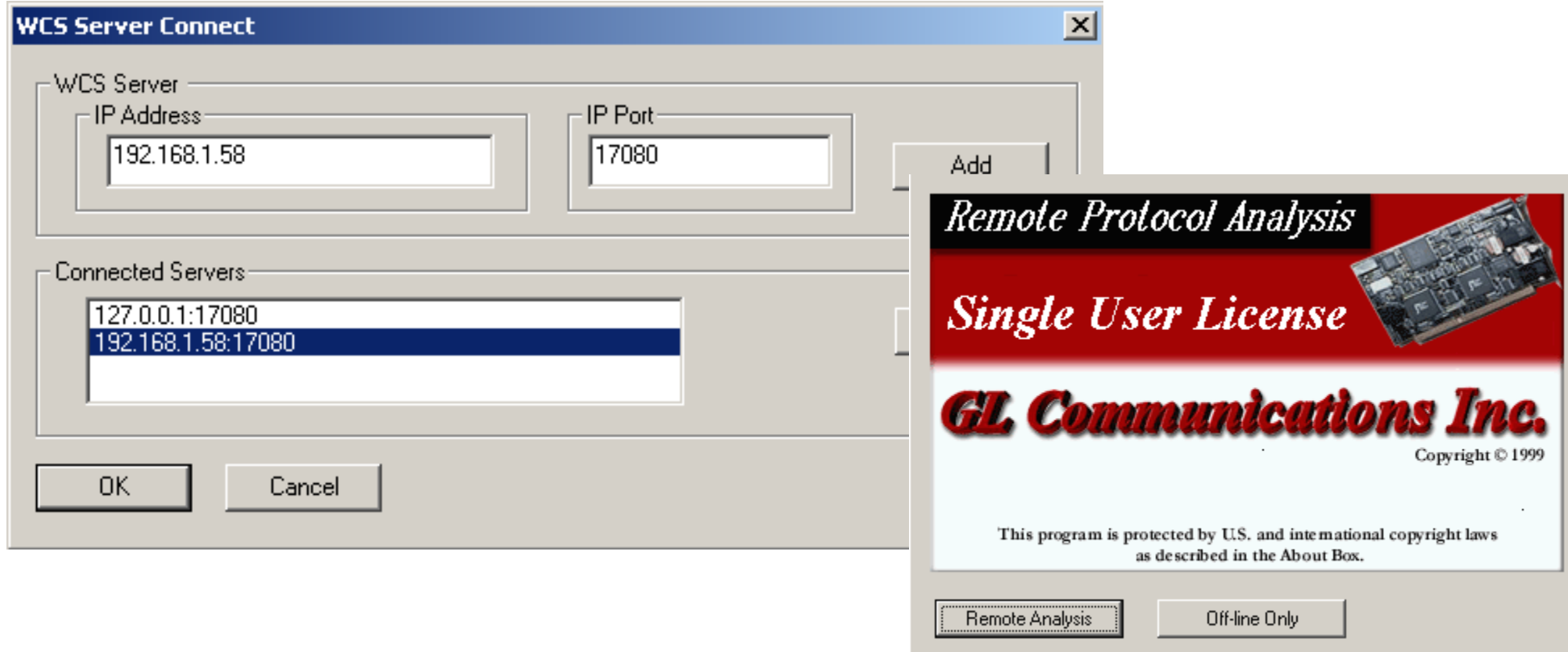
Key Features

- 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

The screenshot shows the 'Protocol Capture Configuration' dialog box. On the left, there is a sidebar with three options: 'Capture File Options', 'Card & Stream Selection' (which is selected), and 'Capture Filter'. The main area is titled 'Port and Time Slot Selection' and contains a table with 24 rows and 4 columns. The columns are labeled 1, 2, 3, and 4. The rows are labeled 00 through 23. The cells in the table contain two-digit numbers from 00 to 23. The cells (01, 01), (02, 02), (03, 03), (04, 04), (05, 05), (06, 06), (07, 07), (08, 08), (09, 09), (10, 10), (11, 11), (12, 12), (13, 13), (14, 14), (15, 15), (16, 16), (17, 17), (18, 18), (19, 19), (20, 20), (21, 21), (22, 22), and (23, 23) are highlighted in blue. Below the table, there are two sections: 'Data Transmission Rate' and 'Subchannels 8-56 kbps'. The 'Data Transmission Rate' section has two sub-sections: 'Single Channel' with radio buttons for '64 kbps' and '56 kbps', and 'Hyper-Channel' with a radio button for 'Nx64 kbps'. The 'Subchannels 8-56 kbps' section has radio buttons for 8, 16, 24, 32, 40, 48, and 56 kbps, and a 'DSO bits' section with a list box containing numbers 1 through 8, and 'All' and 'None' buttons. On the right side of the dialog, there are several buttons: 'All TS', 'Clear TS', 'All as Port1', 'All as Ports1,2', and 'IP Addr / Cards'.

	1	2	3	4
00	00	00	00	00
01	01	01	01	01
02	02	02	02	02
03	03	03	03	03
04	04	04	04	04
05	05	05	05	05
06	06	06	06	06
07	07	07	07	07
08	08	08	08	08
09	09	09	09	09
10	10	10	10	10
11	11	11	11	11
12	12	12	12	12
13	13	13	13	13
14	14	14	14	14
15	15	15	15	15
16	16	16	16	16
17	17	17	17	17
18	18	18	18	18
19	19	19	19	19
20	20	20	20	20
21	21	21	21	21
22	22	22	22	22
23	23	23	23	23

Data Transmission Rate

Single Channel

64 kbps

56 kbps

Hyper-Channel

Nx64 kbps

Subchannels 8-56 kbps

8

16

24

32

40

48

56

DSO bits

1

2

3

4

5

6

7

8

All

None

All TS

Clear TS

All as Port1

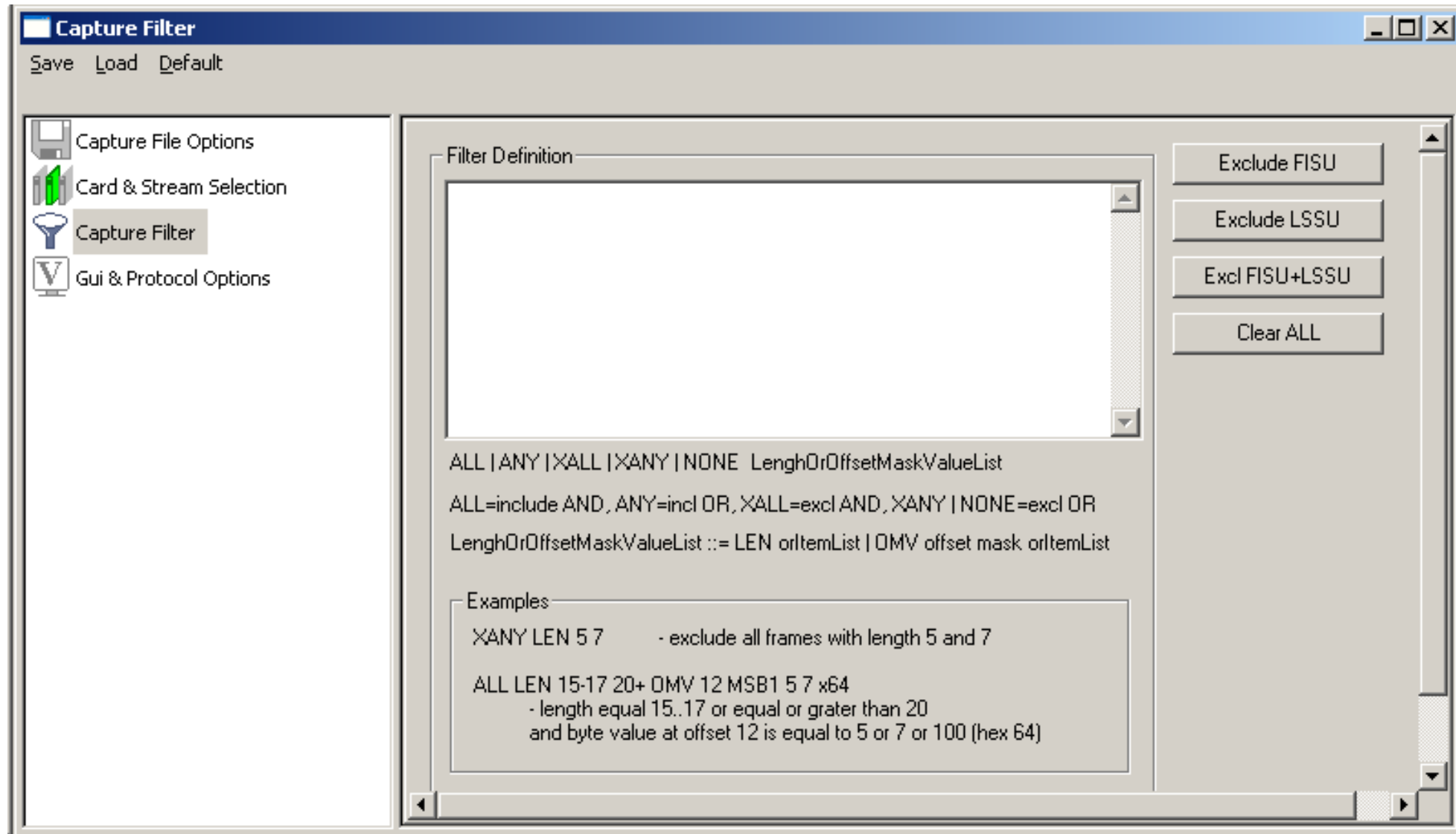
All as Ports1,2

IP Addr / Cards

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 $n \times 64$ 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!