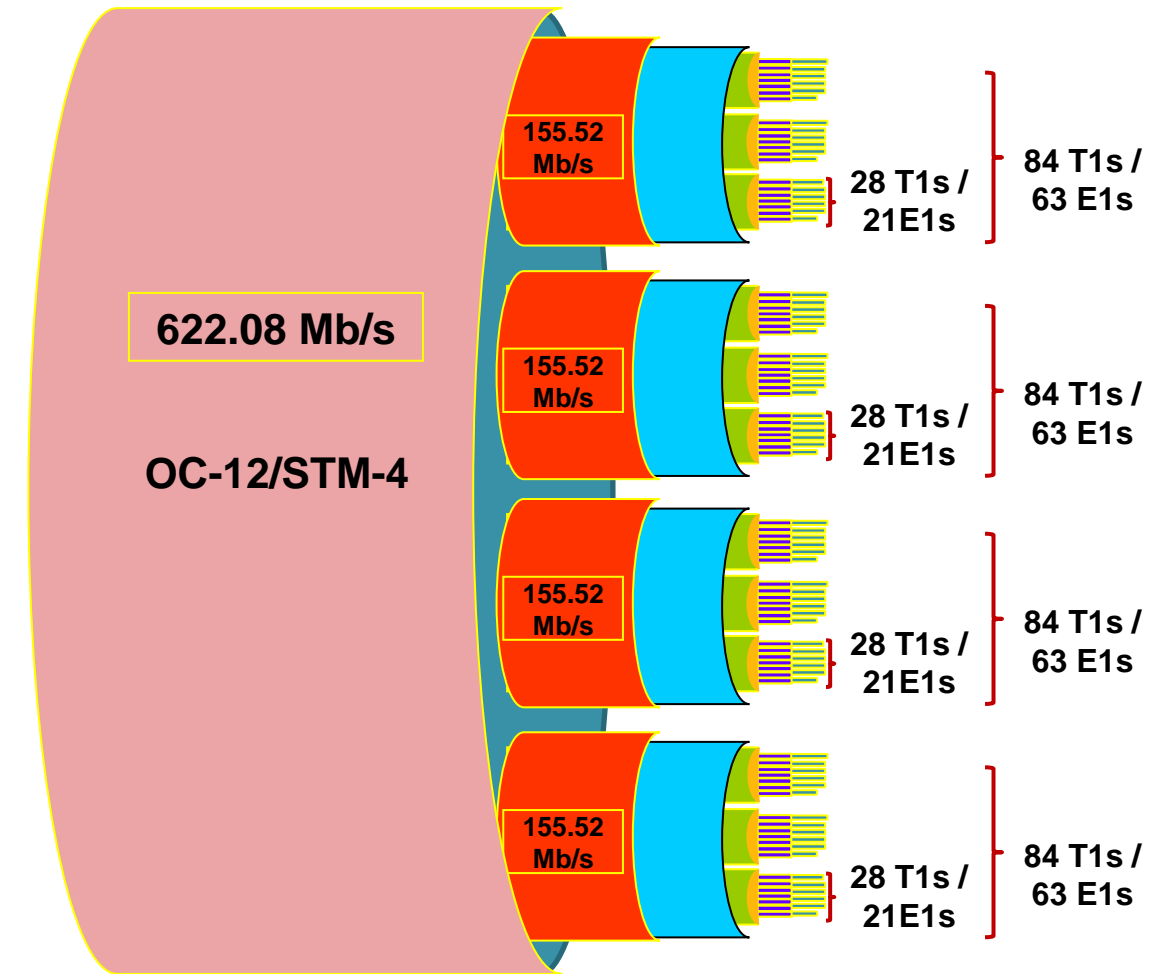

T1 E1 DSO Analysis/Emulation over OC-3/STM-1 OC-12/STM-4 using GL's LightSpeed1000™ (Channelized and Unchannelized)



818 West Diamond Avenue - Third Floor, Gaithersburg, MD 20878
Phone: (301) 670-4784 Fax: (301) 670-9187 Email: info@gl.com
Website: <https://www.gl.com>

Channelized OC-3/12 STM-1/4

- **DS0** = Digital Signal 0 (64 Kbps)
 - Carries digital traffic (including voice)
- **T1** = 24 DS0
- **E1** = 32 DS0
- **STM-1** = 84 T1 or 63 E1
- **STM-4** = 4 STM-1
 - STM-4 = 336 T1
 - STM-4 = 252 E1
- **STM-4/OC-12 can support ~ 8000 data streams (voice calls)**

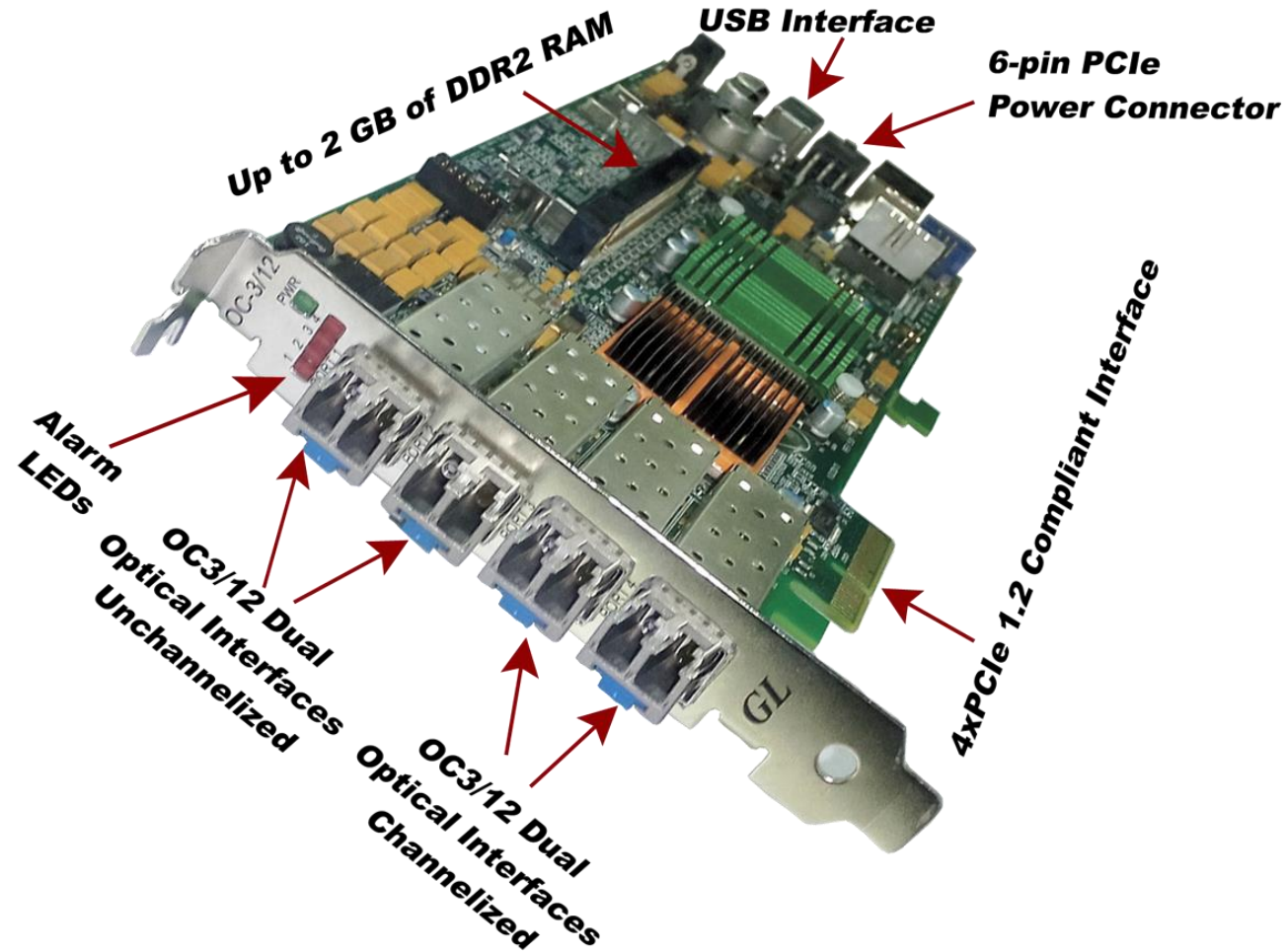


LightSpeed1000™ - Dual OC-3/12, STM-1/4 (Channelized and Unchannelized)

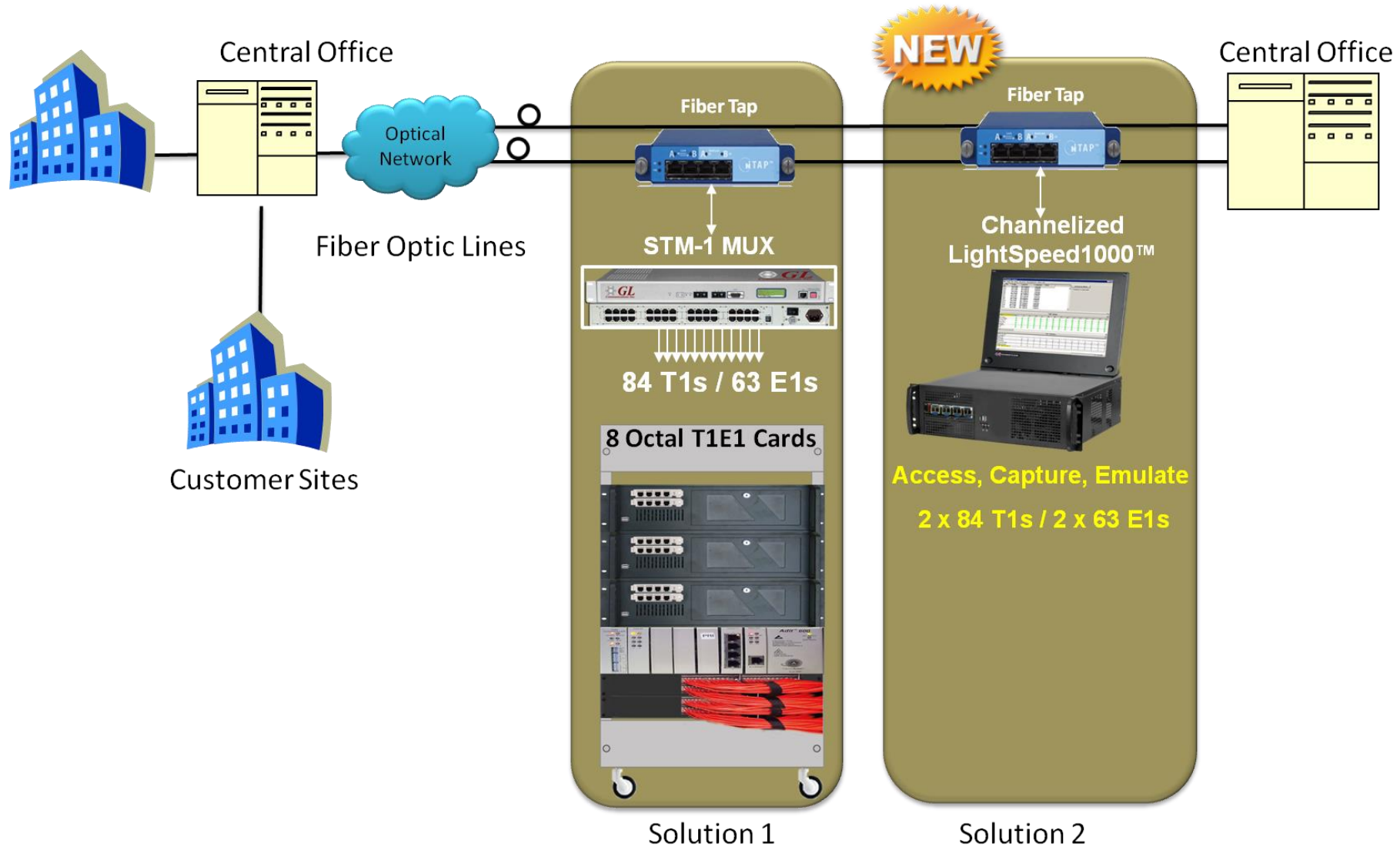


LightSpeed1000™ - Dual OC-3/12, STM-1/4

(Channelized and Unchannelized)

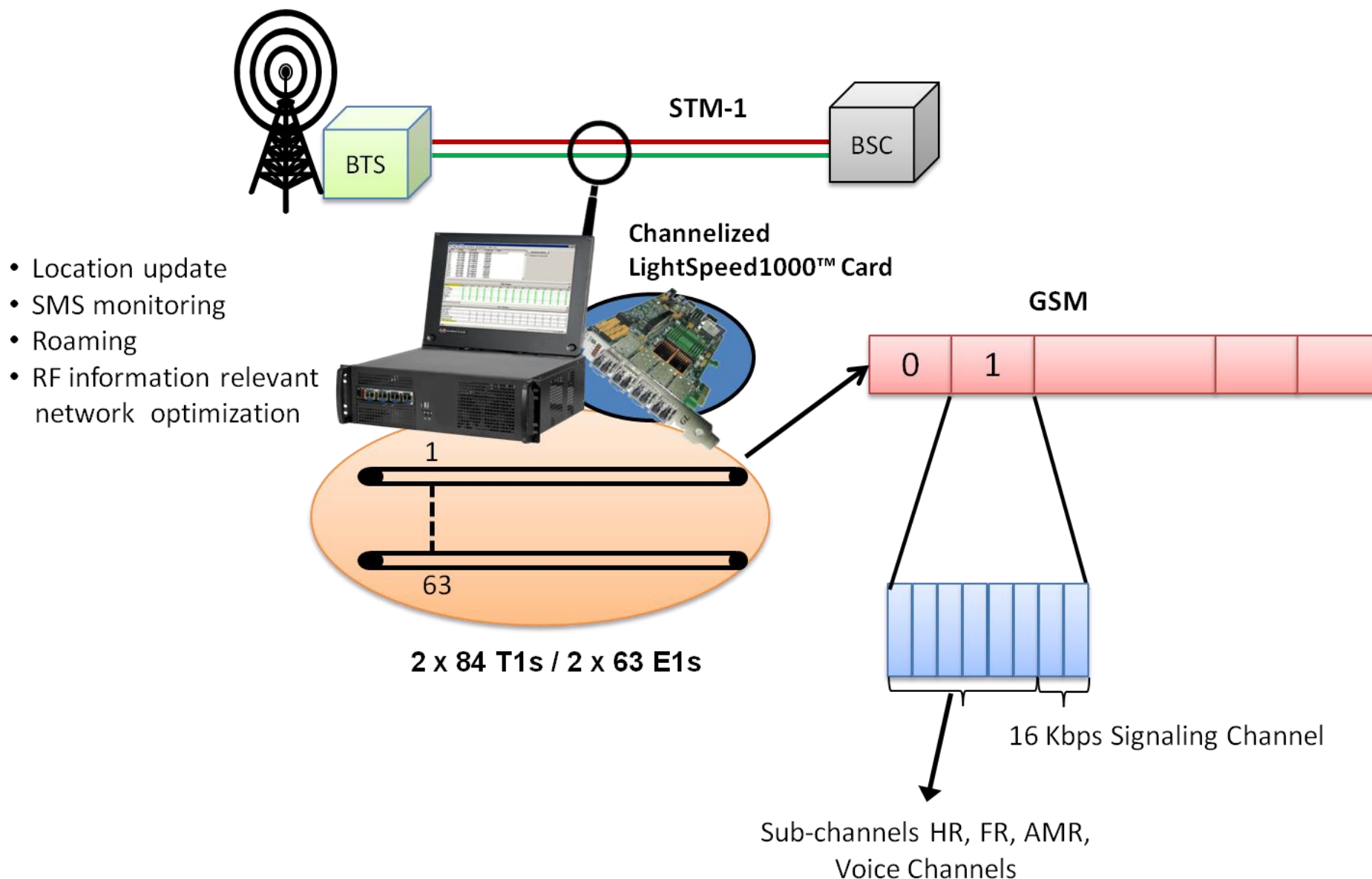


Channelized T1 E1 Emulation & Analysis

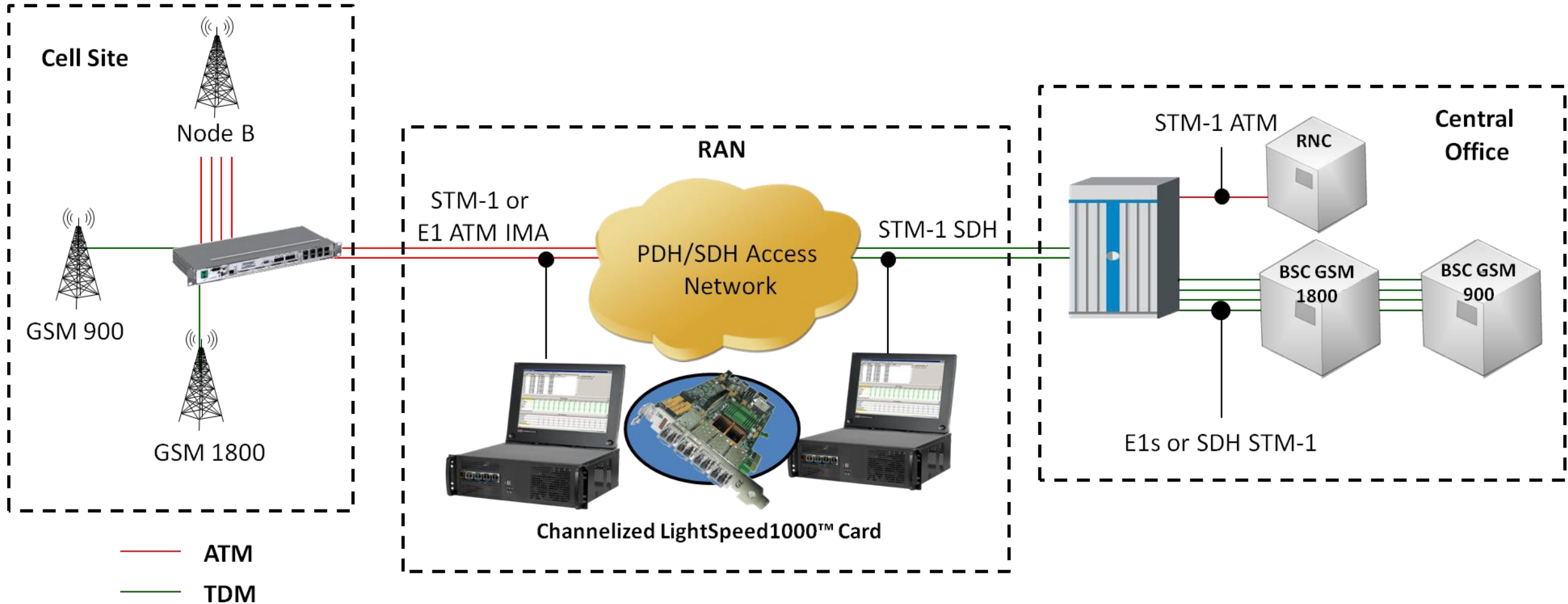


Applications

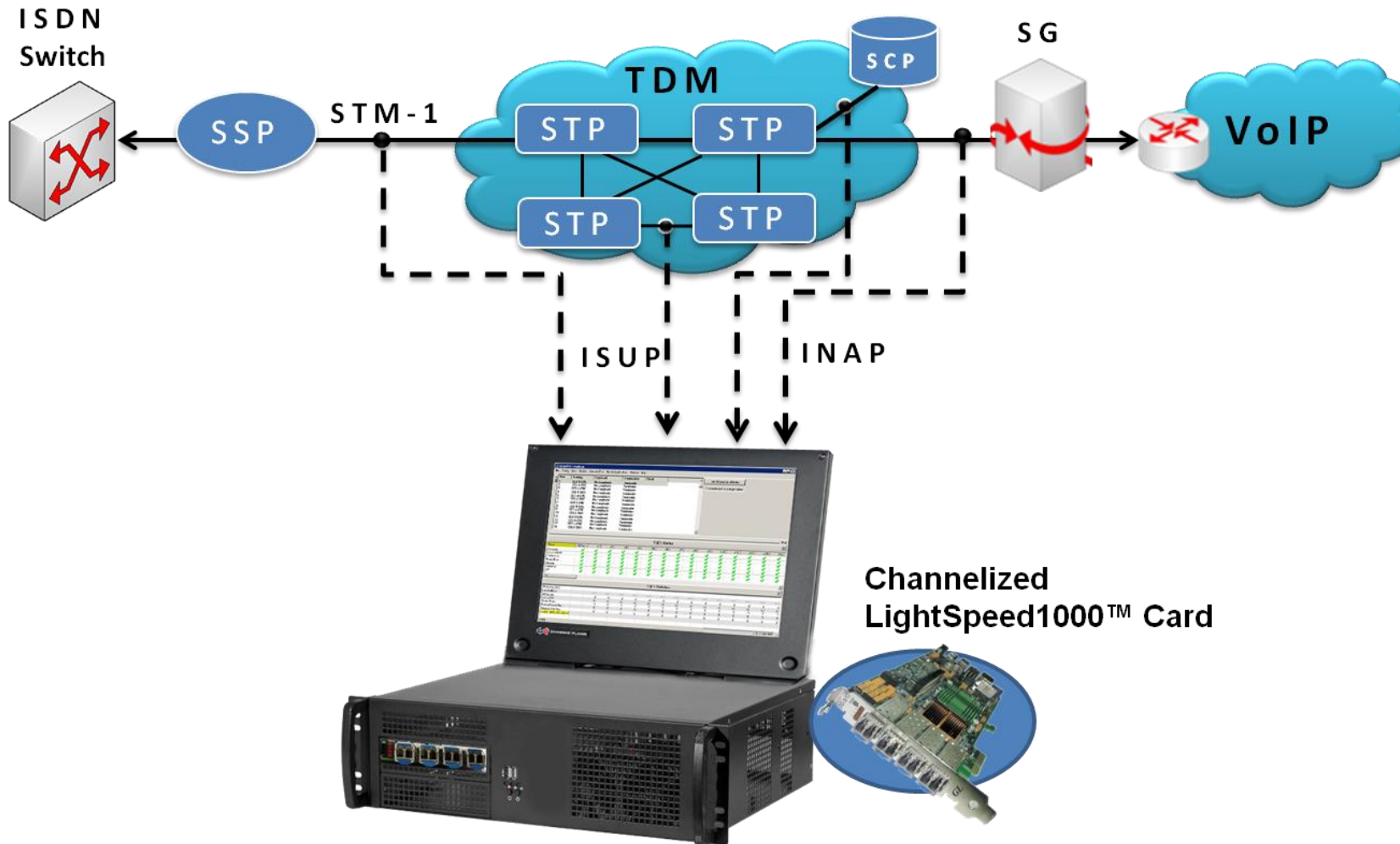
Application #1: Abis Monitoring



Application #2: ATM to TDM in a 3G GSM Network



Application #3: SS7 Monitoring



OC-3 STM-1 SS7 Analyzer / Probe
Signaling and Bearer Analysis

Existing 2-Ports T1/E1 Analyzer

E1 tProbe - Analyzer

File Config View Monitor IntrusiveTest Special Applications Window Help

Port	Framing	Loopback	Termination	Clock	Cross-port
1	CCS & CRC	No Loopback	Terminate	Internal	Normal
2	CCS & CRC	No Loopback	Terminate	Internal	Normal

Set all cards as selected
< Double-click to change values

T1/E1 Alarms

Reset	All Ports	#1	#2
Sync Loss	✓	✓	✓
HDB3 Violation	✓	✓	✓
Carrier Loss	✓	✓	✓
Frame Error	✓	✓	✓
Remote	✓	✓	✓
Distant MF	✓	✓	✓
AIS	✓	✓	✓

T1/E1 Statistics

	2047999	2047999
Frequency (Hz)	-0.446	-0.385
Level (dBdsx)	0	0
BPV Errors	0	0
CRC Errors	0	0
Frame Errors	0	0
Transmit Under Run	0	0
Receive Over Run	0	0
==Bit/Frame Clock Slip==		

T1/E1 Alarms Logging

☐ Alarm Logging C:\Program Files\GL Communications Inc\tProbe E1 Analyzer

Graph

Online Graph Offline Graph

☐ Enable Event Graph

Ready

Card 1

VF (Audio)

Tx (VF In)

Gain(dB)

0.0 dB

TS

1

☐ Insert

☐ Signaling Bits

☐ Speaker

Rx (VF Out)

Gain(dB)

0.0 dB

TS

1

☒ Drop

☐ Speaker

Set 0-dB

VF impd./Mic

600

Drop&Insert TSs

☐ Enable

Start Stop

1 31

T1/E1 Sync Info

OC-3 STM-1 T1 E1 Analyzer

- Supports All 2 x 63 E1 Ports and 2 x 84 T1 Ports per LightSpeed1000™ board
 - 84 T1's x 24 = 2016 Duplex Voice Channels
 - 63 E1's x 30 = 1890 Duplex Voice Channels

E1 - Analyzer

File

Config

View

Monitor

IntrusiveTest

Special Applications

Window

Help

Port

Framing

Loopback

Termination

Clock

1

CAS & CRC

No Loopback

Terminate

2

CAS & CRC

No Loopback

Terminate

3

CAS & CRC

No Loopback

Terminate

4

CAS & CRC

No Loopback

Terminate

5

CAS & CRC

No Loopback

Terminate

6

CAS & CRC

No Loopback

Terminate

7

CAS & CRC

No Loopback

Terminate

8

CAS & CRC

No Loopback

Terminate

9

CAS & CRC

No Loopback

Terminate

10

CAS & CRC

No Loopback

Terminate

11

CAS & CRC

No Loopback

Terminate

12

CAS & CRC

No Loopback

Terminate

13

CAS & CRC

No Loopback

Terminate

14

CAS & CRC

No Loopback

Terminate

15

CAS & CRC

No Loopback

Terminate

16

CAS & CRC

No Loopback

Terminate

17

CAS & CRC

No Loopback

Terminate

Set all cards as selected

< Double-click to change values

T1/E1 Alarms

Reset

All Ports

#1

#2

#3

#4

#5

#6

#7

#8

#9

#10

#11

#12

#13

#14

#15

#16

#17

#18

#19

#20

#21

#22

#23

#24

#25

#26

#27

#28

Sync Loss

HDB3 Violation

Carrier Loss

Frame Error

Remote

Distant MF

ATS

T1/E1 Statistics

Frequency (Hz)

Level (dBm0)

BPV Errors

CRC Errors

Frame Errors

Transmit Un...

Receive Ove...

==BPV Frame...

0

0

0

0

0

0

0

0

0

0

0

0

0

0

0

0

0

0

0

0

0

0

0

0

0

0

0

0

0

0

**Almost All Applications Supported
in OC-3 / STM-1 T1 E1 Analyzer**

Basic Applications

E1 SSTM1 - Analyzer

File Config View Monitor IntrusiveTest Special Applications Window Help

Port	Fra	Termination	C
1	CC	Terminate	
2	CC	Terminate	
3	CC	Terminate	
4	CC	Terminate	
5	CC	Terminate	
6	CC	Terminate	
7	CC	Terminate	
8	CC	Terminate	
9	CC	Terminate	
10	CC	Terminate	

Byte Values
Binary Byte Values
Signaling Bits
Power Level
DC Offset
Frequency
Multiframes
Real-time Multiframes
E1 Data As Real-time Bitmap
Timeslot Window
ASCII Timeslot Display
Oscilloscope
Power Spectral
Audio Monitoring
Active Voice Level

Reset

Sync Loss
HDB3 Violation
Carrier Loss
Frame Error
Remote
Distant MF
AIS

Alarms

#2	#3	#4
✓	✓	✓
✓	✓	✓
✓	✓	✓
✓	✓	✓
✓	✓	✓
✓	✓	✓
✓	✓	✓

T1/E1 Statistics

Frequency (Hz)	Level (dBdsx)	BPV Errors	CRC Errors
---	---	0	0
---	---	0	0

Basic Applications

E1 SSTM1 - Analyzer

File Config View Monitor IntrusiveTest Special Applications Window Help

Port	Framing	mination	Clock
1	CCS & CRC	minate	
2	CCS & CRC	minate	
3	CCS & CRC	minate	
4	CCS & CRC	minate	
5	CCS & CRC	minate	
6	CCS & CRC	minate	
7	CCS & CRC	minate	
8	CCS & CRC	minate	
9	CCS & CRC	minate	
10	CCS & CRC	minate	

BERT
Enhanced BERT
ATM BERT
Transmit Tone
Transmit Gaussian Noise
Transmit Multiframe
Transmit Signaling Bits
Rx-to-Tx Loopback

Reset	All Ports	#1	#2	#3	#4
Sync Loss	✓	✓	✓	✓	✓
HDB3 Violation	✓	✓	✓	✓	✓
Carrier Loss	✓	✓	✓	✓	✓
Frame Error	✓	✓	✓	✓	✓
Remote	✓	✓	✓	✓	✓
Distant MF	✓	✓	✓	✓	✓
AIS	✓	✓	✓	✓	✓

T1/E1 Statistics

Frequency (Hz)	---	---	---	---
Level (dBdsx)	---	---	---	---
BPV Errors	0	0	0	0
CRC Errors	0	0	0	0
Frame Errors	0	0	0	0

Basic Applications

- Intrusive Test Applications
 - Transmit Tone
 - Transmit Gaussian Noise
 - Transmit Multiframe
 - Transmit Signaling Bits
 - Rx to Tx Loopback
- Monitoring Applications
 - Monitor T1E1 Lines
 - Display Byte
 - Display Binary Bytes
 - Signaling Bits
 - Power Level
 - DC Offset
 - Frequency
 - Multiframe
 - Real-time Multiframe
 - Real-time Bit Map
 - Timeslot Window
 - ASCII Timeslot Display
 - Oscilloscope
 - Power Spectral
 - Active Voice Level

Special Applications

E1 SSTM1 - Analyzer

File Config View Monitor IntrusiveTest **Special Applications** Window Help

Port	Framing	Loopba
1	CCS & CRC	No Loop
2	CCS & CRC	No Loop
3	CCS & CRC	No Loop
4	CCS & CRC	No Loop
5	CCS & CRC	No Loop
6	CCS & CRC	No Loop
7	CCS & CRC	No Loop
8	CCS & CRC	No Loop
9	CCS & CRC	No Loop
10	CCS & CRC	No Loop

Reset All Ports

Sync Loss	✓	✓	✓	✓	✓	✓
HDB3 Violation	✓	✓	✓	✓	✓	✓
Carrier Loss	✓	✓	✓	✓	✓	✓
Frame Error	✓	✓	✓	✓	✓	✓
Remote	✓	✓	✓	✓	✓	✓
Distant MF	✓	✓	✓	✓	✓	✓
AIS	✓	✓	✓	✓	✓	✓

T1/E1 Statistics

Frequency (Hz)		----	----	----
Level (dBdsx)		----	----	----
BPV Errors		0	0	0
CRC Errors		0	0	0
Frame Errors		0	0	0
Transmit Under Run		0	0	0
Receive Over Run		0	0	0
==Bit/Frame Clock Slip==				

Protocol Analysis

- Protocol Emulation
 - HDLC Analysis
 - HDLC Playback
 - Protocol Identifier & Classifier
- Windows Client Server (WCS)
 - Record / Playback File
 - Dial Digits
 - Call Capture & Analysis
- Echo Test Solutions
 - MCBERT, HDLC, TRAU
 - AudioBridge, StripChart
 - DCME Analyzer
- Voice Quality Assessment
 - Multiplex/Demultiplex
- ATM Analysis
 - Frame Relay Analysis
 - PPP Analysis
- TRAU Analysis
 - Trau Traffic Playback
 - Trau Toolbox
- Lucent
 - CDMA 2000
- SA Bits HDLC Analysis
 - SA Bits HDLC Playback
 - SSM Analysis
- SS1 Signaling Analysis
 - Signaling Bits Transitions

Special Applications

E1 SSTM1 - Analyzer

File Config View Monitor IntrusiveTest Special Applications Window Help

Port	Framing	Loopba
1	CCS & CRC	No Loop
2	CCS & CRC	No Loop
3	CCS & CRC	No Loop
4	CCS & CRC	No Loop
5	CCS & CRC	No Loop
6	CCS & CRC	No Loop
7	CCS & CRC	No Loop
8	CCS & CRC	No Loop
9	CCS & CRC	No Loop
10	CCS & CRC	No Loop

Reset All Ports

Sync Loss	✓	✓	✓	✓	✓	✓
HDB3 Violation	✓	✓	✓	✓	✓	✓
Carrier Loss	✓	✓	✓	✓	✓	✓
Frame Error	✓	✓	✓	✓	✓	✓
Remote	✓	✓	✓	✓	✓	✓
Distant MF	✓	✓	✓	✓	✓	✓
AIS	✓	✓	✓	✓	✓	✓

T1/E1 Statistics

Frequency (Hz)		----	----	----	----
Level (dBdsx)		----	----	----	----
BPV Errors		0	0	0	0
CRC Errors		0	0	0	0
Frame Errors		0	0	0	0
Transmit Under Run		0	0	0	0
Receive Over Run		0	0	0	0
==Bit/Frame Clock Slip==					

Special Applications

- Protocol Analysis
- Protocol Emulation
 - Windows Client Server (WCS)
 - Record / Playback File
 - Dial Digits
 - Call Capture & Analysis
- Echo Test Solutions
 - MCBERT, HDLC, TRAU
 - AudioBridge, StripChart
 - DCME Analyzer
- Voice Quality Assessment
 - Multiplex/Demultiplex

Clock

- MAPS - ISDN
- MAPS - SS7
- MAPS - SS7/ISUP Conformance Scripts
- MAPS GSM Abis Interface Emulator
- MAPS GSM A Interface Emulator
- MAPS - MAP Emulator
- MAPS - MLPPP Conformance
- MAPS - CAS Emulator
- MAPS - CAS CLI Server
- MAPS - CAP Emulator
- MAPS - FXO/FXS Emulator
- MAPS - INAP Emulator
- MAPS - IUP Emulator
- MLPPP Emulator
- CAS Emulator
- ISDN Emulator
- SS1 Dialer
- MFR Emulator
- IMA Emulator

Bytes Transmitted: 711171 [67%]

Special Applications

- Capture / Transmit Dialed Digits
- Record / Playback
 - Playback from File, Record to File
 - Record from Multiple Cards
 - Automated Record / Playback
 - Automated Continuous Capture
- Call Capture & Analysis
 - Call Capture and Analysis
 - Multiple Call Capture and Analysis
 - Call Data Records
 - Voice Band Analyzer
 - View PCM Files (Adobe Audition / Goldwave)
- Signaling Transitions Recording

Special Applications...

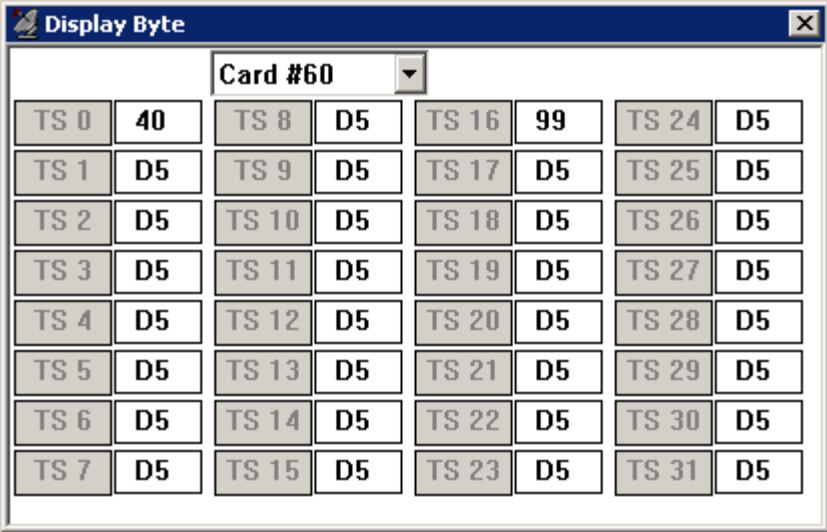
- Protocol Analysis
 - HDLC, ISDN, SS7, Frame Relay, GR-303, ATM, GSM, MLPPP, TRAU, GPRS, CDMA, V5.x, CAS, UMTS, E1 Maintenance Data Link, T1 Facility Data Link, SS1, DCME
- Protocol Emulation
 - ISDN, ISUP, MAP, CAS,
 - GSM , HDLC, TRAU, SS1
 - Multilink Frame Relay, Multi-link PPP, ATM IMA

Special Applications...

- Windows Client / Server Modules
 - File based Record / Playback
 - Transmit / Detect digits
 - Channel Associated Signaling (CAS) Simulation
 - FAX Simulation
 - DSP Functionality
 - Dynamic DSP Capability
 - ISDN Emulation
 - Multi-Channel HDLC Emulation and Analysis
 - File based HDLC Record / Playback & Remote Record / Playback
 - File based High Throughput HDLC Record / Playback
 - PPP, MLPPP, & Multi-Channel (MC) Emulation and Analysis
- Windows Client / Server Modules...
 - File based TRAU Record / Playback
 - Multi-Channel TRAU Tx / Rx Emulation and Analysis
 - File based HDLC Record / Playback over SA-bits
 - File based Record / Playback over FDL
 - Multi-link Frame Relay Emulation
 - Inverse Multiplexing for ATM Emulation
 - Multi-Channel BER Testing
 - T1E1 Traffic Classifier
 - SS7 Decode Agent
 - ISDN Decode Agent
 - SS1 Protocol Emulation

Byte Hex & Byte Binary Values

Displays the data values for each time slot in HEX data format

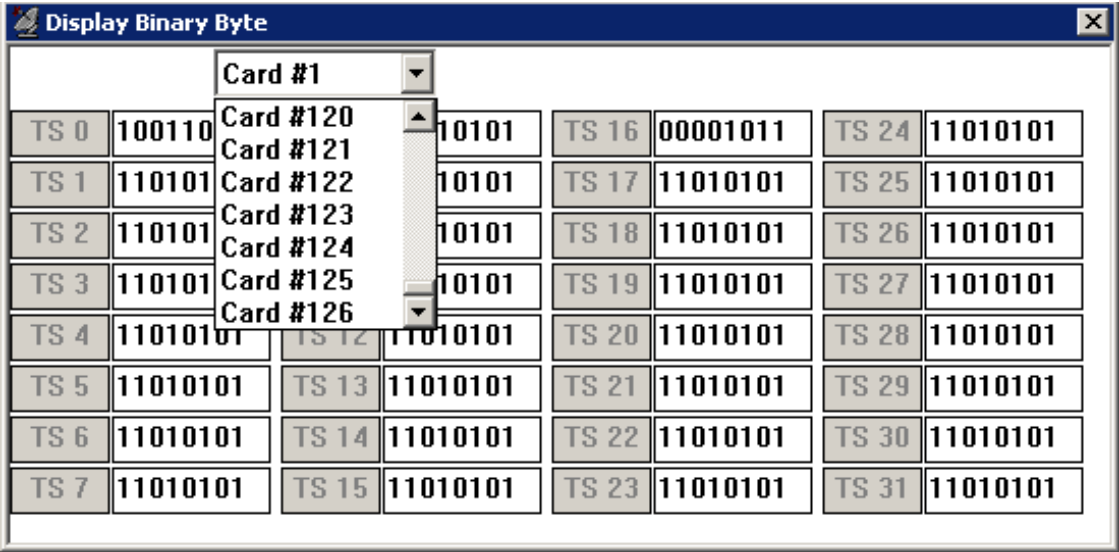


The screenshot shows a window titled "Display Byte" with a dropdown menu set to "Card #60". It displays a grid of 32 time slots (TS 0 to TS 31) arranged in 8 rows and 4 columns. The values are in hexadecimal format.

Card #60			
TS 0	40	TS 8	D5
TS 1	D5	TS 9	D5
TS 2	D5	TS 10	D5
TS 3	D5	TS 11	D5
TS 4	D5	TS 12	D5
TS 5	D5	TS 13	D5
TS 6	D5	TS 14	D5
TS 7	D5	TS 15	D5
TS 16	99	TS 17	D5
TS 18	D5	TS 19	D5
TS 20	D5	TS 21	D5
TS 22	D5	TS 23	D5
TS 24	D5	TS 25	D5
TS 26	D5	TS 27	D5
TS 28	D5	TS 29	D5
TS 30	D5	TS 31	D5

Byte Value

Displays the data values for each time slot in binary data format



The screenshot shows a window titled "Display Binary Byte" with a dropdown menu set to "Card #1". It displays a grid of 32 time slots (TS 0 to TS 31) arranged in 8 rows and 4 columns. The values are in binary format. A list of card numbers (Card #120 to Card #126) is visible in the background of the dropdown menu.

Card #1			
TS 0	100110	TS 16	00001011
TS 1	110101	TS 17	11010101
TS 2	110101	TS 18	11010101
TS 3	110101	TS 19	11010101
TS 4	11010101	TS 20	11010101
TS 5	11010101	TS 21	11010101
TS 6	11010101	TS 22	11010101
TS 7	11010101	TS 23	11010101
TS 8	11010101	TS 24	11010101
TS 9	11010101	TS 25	11010101
TS 10	11010101	TS 26	11010101
TS 11	11010101	TS 27	11010101
TS 12	11010101	TS 28	11010101
TS 13	11010101	TS 29	11010101
TS 14	11010101	TS 30	11010101
TS 15	11010101	TS 31	11010101

Binary Byte Value

Signaling Bits, Power Level, DC Offset, Frequency

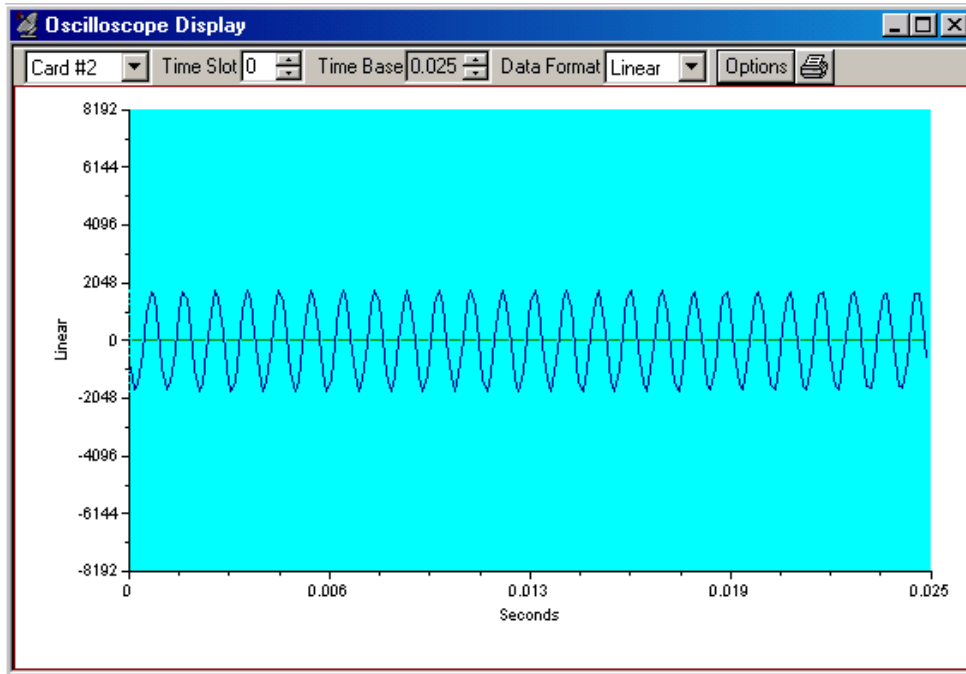
Signaling Bits					
Card #92					
TS 0	—	TS 8	1001	TS 16	—
TS 1	1001	TS 9	1001	TS 17	1001
TS 2	1001	TS 10	0000	TS 18	1001
TS 3	1001	TS 11	1001	TS 19	1001
TS 4	1001	TS 12	1001	TS 20	1001
TS 5	1001	TS 13	1001	TS 21	1001
TS 6	1001	TS 14	1001	TS 22	1001
TS 7	1001	TS 15	1001	TS 23	1001

Power (dBm)					
Card #98					
TS 0	-15.3	TS 16	-12.0	TS 24	IDLE
TS 1	-5.6	TS 17	IDLE	TS 25	IDLE
TS 2	-5.7	TS 18	IDLE	TS 26	IDLE
TS 3	-5.9	TS 19	IDLE	TS 27	IDLE
TS 4	-5.6	TS 20	IDLE	TS 28	IDLE
TS 5	-5.9	TS 21	IDLE	TS 29	IDLE
TS 6	-6.0	TS 22	IDLE	TS 30	IDLE
TS 7	-5.7	TS 23	IDLE	TS 31	IDLE

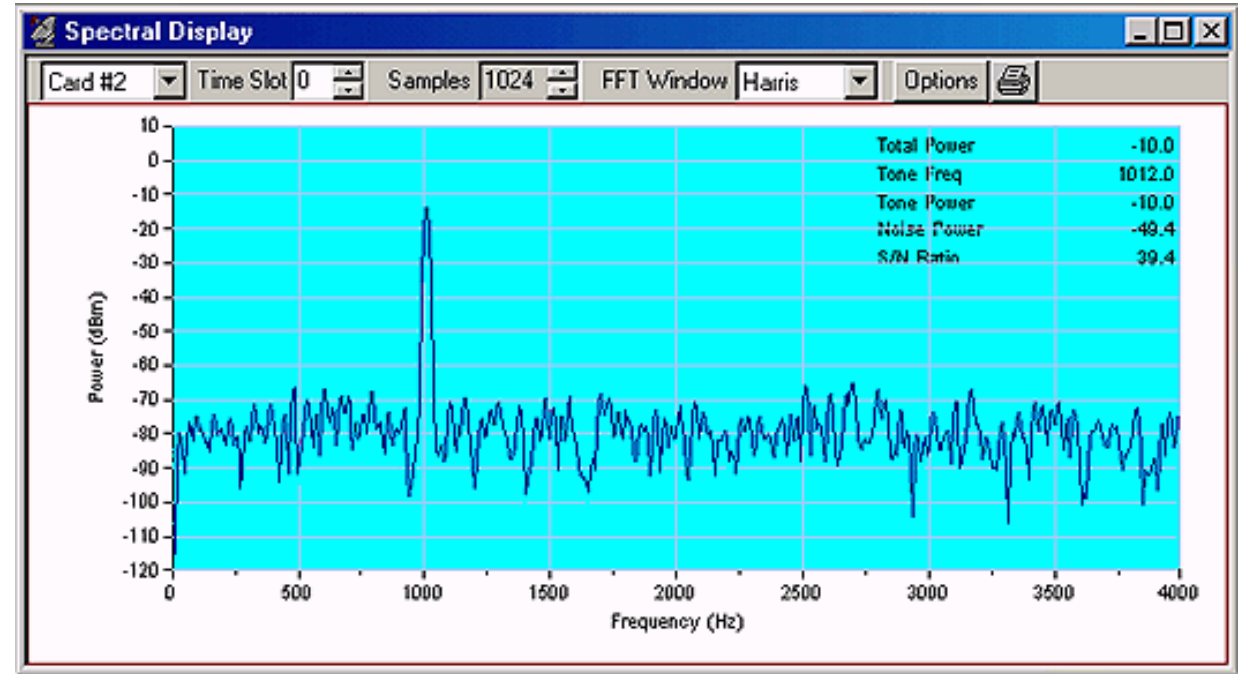
DC Offset (mV)					
Card #94					
TS 0	0	TS 8	5	TS 16	-141
TS 1	6	TS 9	12	TS 17	-0
TS 2	19	TS 10	12	TS 18	-0
TS 3	-1	TS 11	1	TS 19	-0
TS 4	6	TS 12	3	TS 20	-0
TS 5	12	TS 13	15	TS 21	-0
TS 6	13	TS 14	24	TS 22	-0
TS 7	4	TS 15	16	TS 23	-0

Frequency (Hz)					
Card #120					
TS 0	2001	TS 16	499	TS 24	0
TS 1	1248	TS 17	0	TS 25	0
TS 2	1300	TS 18	0	TS 26	0
TS 3	1276	TS 19	0	TS 27	0
TS 4	1250	TS 20	0	TS 28	0
TS 5	1252	TS 21	0	TS 29	0
TS 6	1273	TS 22	0	TS 30	0
TS 7	1315	TS 23	0	TS 31	0

Oscilloscope & Spectral Display



Oscilloscope Display

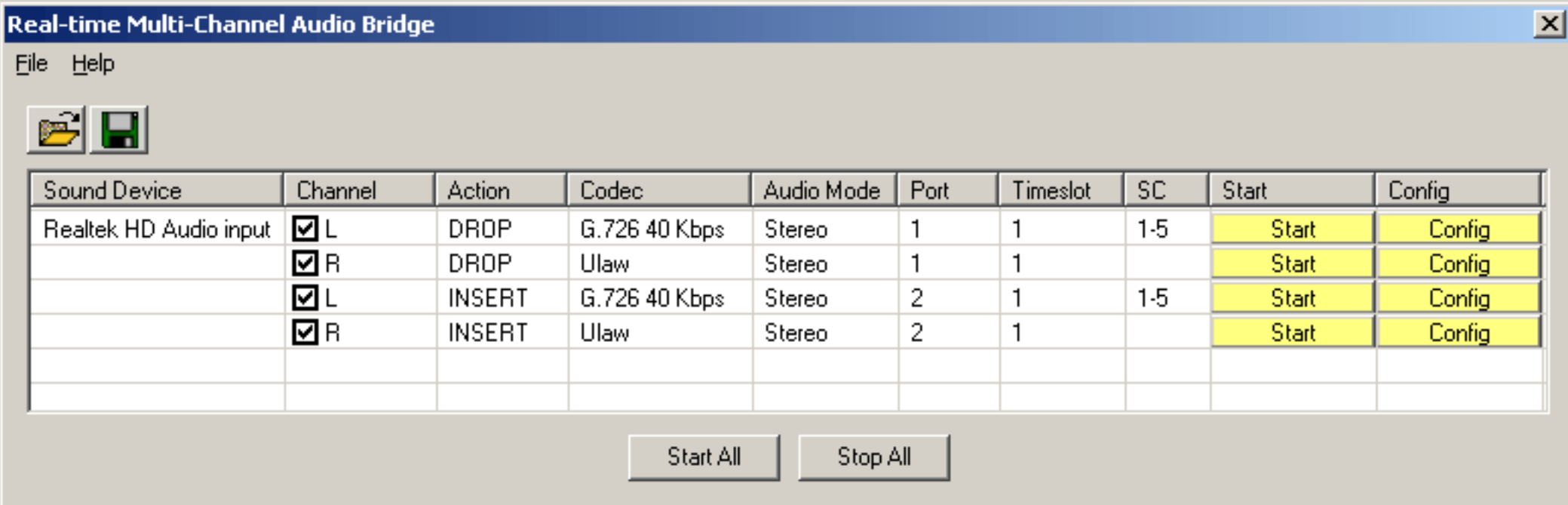


Spectral Display

- Oscilloscope - Displays received data in real-time graphically as a function of time
- Spectral Display - Data received is displayed as a function of frequency

Multi-Channel Audio Monitor

(Listen to Audio from any of thousands of channels)



- Provides a bridge between T1/E1 timeslots and single or multichannel sound card(s)
- Allows users to insert speech onto T1/E1 timeslots using the PC microphone and listen to speech on T1/E1 timeslots using PC speakers or Headphones

Active Voice Level

- Obtain and analyze the source signal in real-time from T1E1 timeslots
- Process signal data captured to files as an offline process

GL ITU-T P.56 Active Voice Level Measurement

Ts	AVL	Act%	Noise	Max	Min
0	---	---	---	---	---
1	-5.63	99.87	-inf	4032	-4032
2	-5.56	99.86	-inf	4032	-4032
3	-5.63	99.86	-inf	4032	-4032
4	-5.67	99.87	-inf	4032	-4032
5	---	---	---	---	---
6	---	---	---	---	---
7	---	---	---	---	---
8	---	---	---	---	---
9	---	---	---	---	---
10	---	---	---	---	---
11	---	---	---	---	---
12	---	---	---	---	---
13	---	---	---	---	---
14	---	---	---	---	---
15	---	---	---	---	---
16	---	---	---	---	---
17	---	---	---	---	---
18	---	---	---	---	---
19	---	---	---	---	---
20	---	---	---	---	---
21	---	---	---	---	---
22	---	---	---	---	---
23	---	---	---	---	---
24	---	---	---	---	---

Line In Data

Select Card Card #97

Timeslots

0	1	2	3	4	5	6	7
8	9	10	11	12	13	14	15
16	17	18	19	20	21	22	23
24	25	26	27	28	29	30	31

Select All Clear All

File Data

Select Browse

Number of channels 1

Data Format

Logging... Power Units dBm Amplitude Units Counts Reset Save... Run

T1 E1 SS7 Analyzer

SS7 Protocol Analysis SS7 ITU

File View Capture Statistics Database Call Detail Records Configure Help

0 GoTo

Dev	TSlot	SubCh	Frame#	ME (Relativ)	Len	Error	DPC MTP3	OPC MTP3	Service Indicator MTP3
✓ 1	1-10		16	00:00:...	108		2.2.2	1.1.1	SCCP
✓ 1	1-10		17	00:00:...	183		1.1.1	2.2.2	SCCP
✓ 1	1-10		18	00:00:...	101		2.2.2	1.1.1	SCCP
✓ 1	1-10		19	00:00:...	102		1.1.1	2.2.2	SCCP
✓ 1	1-10		20	00:00:...	116		2.2.2	1.1.1	SCCP
✓ 1	1-10		21	00:00:...	102		1.1.1	2.2.2	
✓ 1	1-10		22	00:00:...	115		1.1.1	2.2.2	

Card1 TimeSlots=1-10 Frame=16 at 00:00:00.024550 OK Len=108

HDLC Frame Data + FCS

===== MTP2 Layer =====

0000 BSN = .0000101 (5)

0000 BIB = 1..... (1)

0001 FSN = .0000110 (6)

0001 FIB = 1..... (1)

0002 LI = ..111111 MSU Format

===== MTP3 Layer =====

0003 Service Indicator =0011 SCCP

Hex Dump of the Frame Data

```
+-----+-----+-----+-----+
85 86 3F B3 12 50 02 12 09 00 03 0E 19 0B 92 07  II? P
3F 12 04 19 79 88 59 47 15 0B 92 06 3F 12 04 19  ? yIYG ?
69 46 53 89 11 44 62 42 48 04 00 00 00 06 6B 1A  iFS DbBH k
28 18 06 07 00 11 86 05 01 01 01 A0 0D 60 0B A1  ( I i
09 06 07 04 00 00 01 00 13 02 6C 1E A1 1C 02 01  1 I
+-----+-----+-----+-----+
```

Running. Utilization 50.58% C:\Temp\Hdl Captured 20 040 frames

SS7 Protocol Analysis SS7 ETSI

File View Capture Statistics Database Call Detail Records Configure Help

0 GoTo

Dev	TSlot	SubCh	Frame#	ME (Relativ)	Len	Error	DPC MTP3	Message Type ISUP	OPC MTP3	Service Indicator MTP3
✓ 1	23		0	00:00:...	13		5.5.5	Reset Circuit	3.4.6	ISDN User Part
✓ 2	23		1	00:00:...	14		3.4.6	Release Complete	5.5.5	ISDN User Part
✓ 1	23		2	00:00:...	13		5.5.5	Blocking	3.4.6	ISDN User Part
✓ 2	23		3	00:00:...	13		3.4.6	Blocking acknowledgement	5.5.5	ISDN User Part
✓ 1	23		4	00:00:...	13		5.5.5	Unblocking	3.4.6	ISDN User Part
✓ 2	23		5	00:00:...	13		3.4.6	Unblocking acknowledgement	5.5.5	ISDN User Part
✓ 1	23		6	00:01:...	38		5.5.5	Initial address	3.4.6	ISDN User Part
✓ 2	23		7	00:01:...	16		3.4.6	Address complete	5.5.5	ISDN User Part
✓ 2	23		8	00:01:...	14		3.4.6	Answer	5.5.5	ISDN User Part
✓ 1	23		9	00:01:...	18		5.5.5	Release	3.4.6	ISDN User Part
✓ 2	23		10	00:01:...	14		3.4.6	Release Complete	5.5.5	ISDN User Part
✓ 2	23		11	00:05:...	38		3.4.6	Initial address	5.5.5	ISDN User Part

Card1 TimeSlot=23 Frame=0 at 00:00:00.000000 OK Len=13

HDLC Frame Data + FCS

===== MTP2 Layer =====

0000 BSN = .0000001 (1)

0000 BIB = 1..... (1)

0001 FSN = .0000010 (2)

0001 FIB = 1..... (1)

0002 LI = ..001000 MSU Format

===== MTP3 Layer =====

0003 Service Indicator =0101 ISDN User Part

0003 Priority Code = ..00..... Priority Code 0

0003 Sub-service field = 10..... National Network

0004 DPC = 5.5.5(00101101 ..101000)

0005 OPC = 3.4.6(10..... 000010010110)

0007 Signalling Link Code = 0001..... (1)

===== ISUP Layer =====

Hex Dump of the Frame Data

```
+-----+-----+-----+-----+
81 82 08 85 2D A8 09 16 01 00 12 E9 4D  I I- eH
+-----+-----+-----+-----+
```

Off-line Viewing C:\Program Files\GL Communications Inc\Stm T1 Analyzer\SS7\ITU\ 19 Frames

T1 E1 HDLC Analyzer

HDLC Protocol Analysis LAPD

File View Capture Statistics Database Configure Help

Dev
TSlot
SubCh
Frame#
TIME (Relative)
Len
Error
C/R LAPD
CH LAPD

✓ 1	1-5		12	00:00:00.011350	6		Response(User), Command(Network)	Supervisory
✓ 1	1-5		13	00:00:00.014000	6		Response(User), Command(Network)	Supervisory
✓ 1	1-5		14	00:00:00.016650	11		Response(User), Command(Network)	Information
✓ 1	1-5		15	00:00:00.019425	6			
✓ 1	1-5		16	00:00:00.022075	11			
✓ 1	1-5		17	00:00:00.024850	6			

Card1 TimeSlots=1-5 Frame=12 at 00:00:00.011350 OK Len=6
HDLC Frame Data + FCS
----- LAPD Layer -----
0000 C/R =1. Response(User),
0000 SAPI = 000000.. (0)
0001 TEI = 00000000. (0)
0002 Ctl =01 Supervisory
0002 Supervisory Function =00.. RR
0003 P/F =0 (0)
0003 N(R) = 00000001. (1)

Hex Dump of the Frame Data
+-----+-----+-----+-----+
02 01 01 02 BE A5

Running, Utilization 8.02%

C:\Temp\Hdl

Captured 27 239

HDLC Protocol Analysis LAPD

File View Capture Statistics Database Configure Help

Dev
TSlot
SubCh
Frame#
ME (Relative)
Len
Error

✓ 12	1-10		311629	00:00:07.138637	99	
✓ 11	1-10		311630	00:00:07.138637	99	
✓ 10	1-10		311631	00:00:07.138637	99	
✓ 9	1-10		311632	00:00:07.138637	99	
✓ 8	1-10		311633	00:00:07.138637	99	
✓ 7	1-10		311634	00:00:07.138637	99	
✓ 6	1-10		311635	00:00:07.138637	99	
✓ 5	1-10		311636	00:00:07.138637	99	
✓ 4	1-10		311637	00:00:07.138637	99	
✓ 3	1-10		311638	00:00:07.138637	99	
✓ 2	1-10		311639	00:00:07.138637	99	

Card12 TimeSlots=1-10 Frame=311629 at 00:00:07.138637 OK Len=99
HDLC Frame Data + FCS
----- LAPD Layer -----
0000 C/R =1. Response(User),
0000 SAPI = 000000.. (0)
0001 TEI = 00000000. (0)
0002 Ctl =01 Supervisory
0002 Supervisory Function =00.. RR
0003 P/F =0 (0)
0003 N(R) = 00000001. (1)

Hex Dump of the Frame Data
+-----+-----+-----+-----+
02 01 01 02 BE A5

Running, Utilization 8.02%

C:\Temp\Hdl

Captured 27 239

HDLCProtocol Analysis LAPD

Dev	TSlot	SubCh	Frame#	ME (Relativ)	Len	Error	C/R LAPD	Qi LAPD	N(R) LAPD	N(S) LAPD	SAPI LAPD	TEI LAPD
✓ 12	1-10		311629	00:00:...	99		Command(User), R...	Information	64	64	32	64
✓ 11	1-10		311630	00:00:...	99		Command(User), R...	Information	64	64	32	64
✓ 10	1-10		311631	00:00:...	99		Command(User), R...	Information	64	64	32	64
✓ 9	1-10		311632	00:00:...	99		Command(User), R...	Information	64	64	32	64
✓ 8	1-10		311633	00:00:...	99		Command(User), R...	Information	64	64	32	64
✓ 7	1-10		311634	00:00:...	99		Command(User), R...	Information	64	64	32	64
✓ 6	1-10		311635	00:00:...	99		Command(User), R...	Information	64	64	32	64
✓ 5	1-10		311636	00:00:...	99		Command(User), R...	Information	64	64	32	64
✓ 4	1-10		311637	00:00:...	99		Command(User), R...	Information	64	64	32	64
✓ 3	1-10		311638	00:00:...	99		Command(User), R...	Information	64	64	32	64
✓ 2	1-10		311639	00:00:...	99		Command(User), R...	Information	64	64	32	64

```
Card12 TimeSlots=1-10 Frame=311629 at 00:00:07.138637 OK Len=99
HDLCP Frame Data + FCS
***** LAPD Layer *****
0000 C/R                = .....0 Command(User) , Response(Network)
0000 S&PI              = 100000.. (32)
0001 TEI               = 1000000.. (64)
0002 CtI              = .....0 Information
0002 N(S)             = 1000000.. (64)
0003 P                 = .....0 (0)
0003 N(R)            = 1000000.. (64)
```

Hex Dump of the Frame Data

```
+-----+-----+
| 80 80 80 80 80 80 80 80 80 80 80 80 80 80 80 80 | |ccccccccccccc|
| 80 80 80 80 80 80 80 80 80 80 80 80 80 80 80 80 | |ccccccccccccc|
| 80 80 80 80 80 80 80 80 80 80 80 80 80 80 80 80 | |ccccccccccccc|
| 80 80 80 80 80 80 80 80 80 80 80 80 80 80 80 80 | |ccccccccccccc|
| 80 80 80 80 80 80 80 80 80 80 80 80 80 80 80 80 | |ccccccccccccc|
| 80 80 80 80 80 80 80 80 80 80 80 80 80 80 80 80 | |ccccccccccccc|
| 80 80 80 80 80 80 80 80 80 80 80 80 80 80 80 80 | |ccccccccccccc|
| 80 9D 2B                                         | |c+
```

T1 E1 ISDN Analyzer

ISDN Protocol Analysis Q.93x

File View Capture Statistics Database Call Detail Records Configure Help

0 GoTo

TSlot	SubCh	Frame#	TIME (Relative)	Len	Error	Dev	C/R LAPD	Ctl LAPD	Justif Func LAPD	N(R) LAPD	N(S) LAPD
16		5542	00:01:05.480000	6		✓ 1	Command(User), Response(Network)	Supervisory		0	
16		5543	00:01:05.480000	6		✓ 2	Command(User), Response(Network)	Supervisory		0	
16		5544	00:01:05.493250	6		✓ 1	Response(User), Command(Network)	Supervisory		0	
16		5545	00:01:05.493250	6		✓ 2	Response(User), Command(Network)	Supervisory		0	
16		5546	00:01:05.506500	6		✓ 1	Command(User), Response(Ne				
16		5547	00:01:05.506500	6		✓ 2	Command(User), Response(Ne				
16		5548	00:01:05.519750	58		✓ 1	Command(User), Response(Ne				
16		5549	00:01:05.519750	58		✓ 2	Command(User), Response(Ne				
16		5550	00:01:05.539500	6		✓ 1	Command(User), Response(Ne				
16		5551	00:01:05.539500	6		✓ 2	Command(User), Response(Ne				

Card1 TimeSlot=16 Frame=5542 at 00:01:05.480000 OK Len=6

HDLC Frame Data + FCS

===== LAPD Layer =====

0000 C/R =0. Command(User), Response

0000 SAPI = 000000.. (0)

0001 TEI = 0000000.. (0)

0002 Ctl =01 Supervisory

0002 Supervisory Function =00.. RR

0003 P/F =1 (1)

0003 N(R) = 0000000.. (0)

Hex Dump of the Frame Data

00 01 01 01 53 AE S0

Running, Utilization 4.72% C:\Temp.Hdl Capture

ISDN Protocol Analysis Q.93x

File View Capture Statistics Database Call Detail Records Configure Help

0 GoTo

Dev	TSlot	SubCh	Frame#	ME (Relative)	Len	Error	Ctl LAPD	DLCI Q.93x	Message Type Q.93x	SAPI LAPD	TEI LAPD
✓ 1	23		928	00:00...	6		Supervisory			0	0
✓ 1	23		929	00:00...	11		Information		SUSPEND ACKNOWLEDGE	0	0
✓ 1	23		930	00:00...	15		Information		NOTIFY	0	0
✓ 1	23		931	00:00...	6		Supervisory			0	0
✓ 1	23		932	00:00...	6		Supervisory			0	0
✓ 1	23		933	00:00...	14		Information		RESUME	0	0
✓ 1	23		934	00:00...	6		Supervisory			0	0
✓ 1	23		935	00:00...	16		Information		RESUME ACKNOWLEDGE	0	0
✓ 1	23		936	00:00...	15		Information		NOTIFY	0	0
✓ 1	23		937	00:00...	6		Supervisory			0	0
✓ 1	23		938	00:00...	6		Supervisory			0	0
✓ 1	23		939	00:00...	15		Information		DISCONNECT	0	0
✓ 1	23		940	00:00...	6		Supervisory			0	0
✓ 1	23		941	00:00...	15		Information		RELEASE	0	0
✓ 1	23		942	00:00...	6		Supervisory			0	0

Card1 TimeSlot=23 Frame=928 at 00:00:12.490125 OK Len=6

HDLC Frame Data + FCS

===== LAPD Layer =====

0000 C/R =0. Command(User), Response(Network)

0000 SAPI = 000000.. (0)

0001 TEI = 0000000.. (0)

0002 Ctl =01 Supervisory

0002 Supervisory Function =00.. RR

0003 P/F =0 (0)

0003 N(R) = 0000100.. (4)

Hex Dump of the Frame Data

00 01 01 08 92 33 3

Call ID	Call Status	Calling Num	Called Num	Call Start Date & Time	Call Duration	Release Complete Cause	DevNo	TS	CRV
0	completed	8556782101	7685612901	2014-06-11 19:44:12.028250	00:00:00.444250	Normal call clearing	1	23	1
1	completed	8556782101	7685612901	2014-06-11 19:44:12.790750	00:00:00.444375	Normal call clearing	1	23	1
2	completed	8556782101	7685612901	2014-06-11 19:44:13.553375	00:00:00.444250	Normal call clearing	1	23	1
3	completed	8556782101	7685612901	2014-06-11 19:44:14.315875	00:00:00.444250	Normal call clearing	1	23	1
4	completed	8556782101	7685612901	2014-06-11 19:44:15.078375	00:00:00.444375	Normal call clearing	1	23	1
5	completed	8556782101	7685612901	2014-06-11 19:44:15.841000	00:00:00.444250	Normal call clearing	1	23	1
6	completed	8556782101	7685612901	2014-06-11 19:44:16.603500	00:00:00.444375	Normal call clearing	1	23	1
7	completed	8556782101	7685612901	2014-06-11 19:44:17.366000	00:00:00.444375	Normal call clearing	1	23	1
8	completed	8556782101	7685612901	2014-06-11 19:44:18.128625	00:00:00.444250	Normal call clearing	1	23	1
9	completed	8556782101	7685612901	2014-06-11 19:44:18.891125	00:00:00.444375	Normal call clearing	1	23	1

Stopped C:\Temp.Hdl Idle, 960 frames

Ports and Timeslots Selection

Protocol Capture Configuration [Save] [Load] [Default]

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

PORT ACTIONS		P...	00	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	16	1	1	1	2	2	2	2	2	2	2	2
✓	✗	C	P	1																16											
✓	✗	C	P	2																16											
✓	✗	C	P	3																16											
✓	✗	C	P	4																16											
✓	✗	C	P	5																16											
✓	✗	C	P	6																16											
✓	✗	C	P	7																16											
✓	✗	C	P	8																16											
✓	✗	C	P	9																16											
✓	✗	C	P	10																16											
✓	✗	C	P	11																16											
✓	✗	C	P	12																16											

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

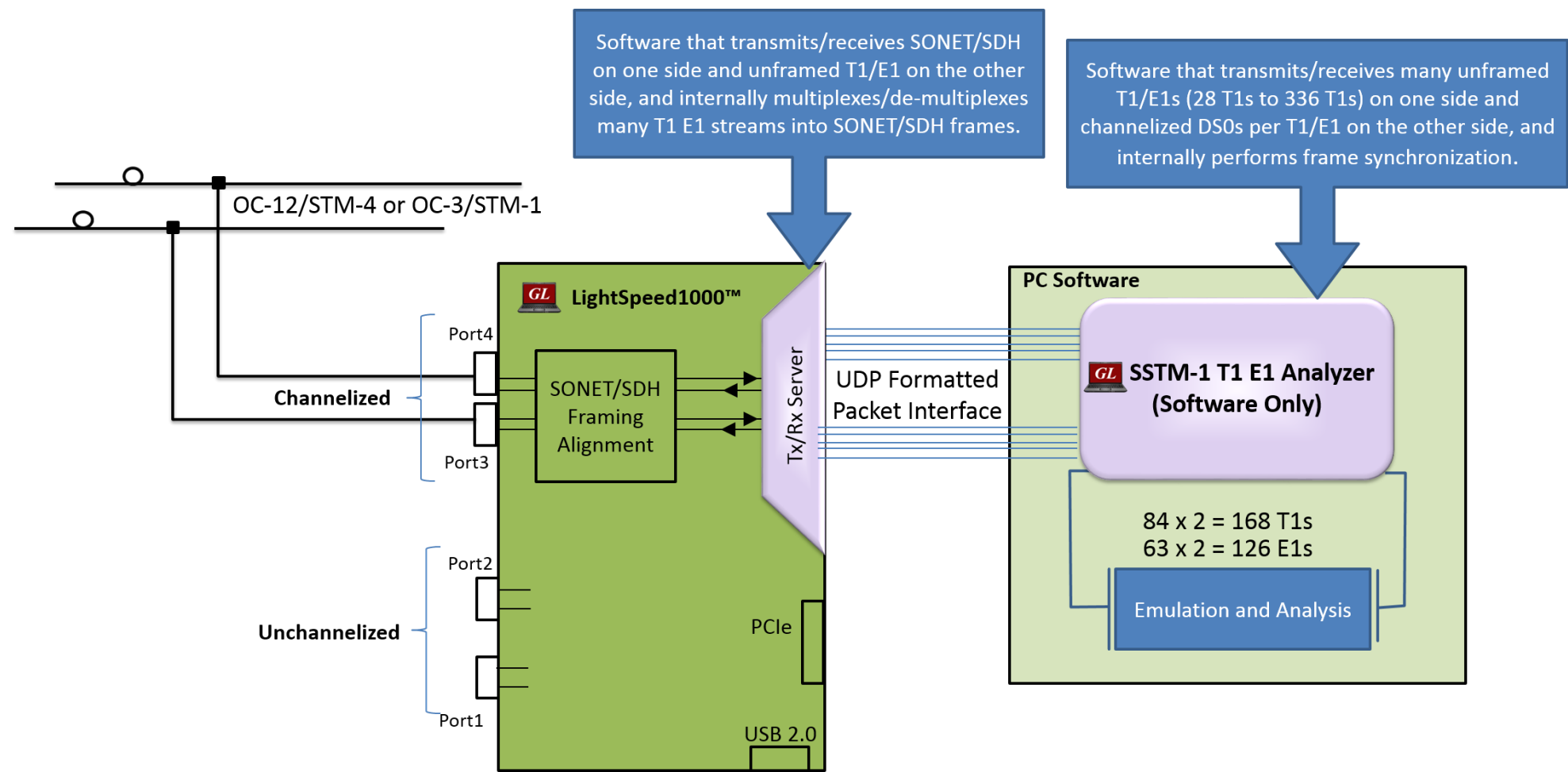
Subchannels 8-56 kbps
☐ 8
☐ 16
☐ 24
☐ 32
☐ 40
☐ 48
☐ 56
DS0 bits
1 2 3 4 5 6 7 8
[All] [None]

All Port Settings
HDLC FCS
☒ 16 bits
☐ 32 bits
☐ None
Interface
☒ User
☐ Network
☐ Bit Inversion 1 <-> 0
☐ Octet Bit Reversion (MSB <-> LSB)

Row (Port) Select, Clear, Paste Oper
Paste operations apply to the clipboard contents created by clicking on a row "C" (copy) button for the port which timeslot selection is served as the source for paste.
Paste Clipboard to Port List

How Does it Work?

Working Principle...



T1 E1 within SONET SDH Testing

Demultiplexing:

- Received OC-3/STM-1 frame mapping is identified and processed to T1/E1 channels accordingly
- Multiple OC-3/STM-1 ports are supported
- Supports all 84 T1 and 63 E1 ports, or user-defined T1/E1 channels only for extraction

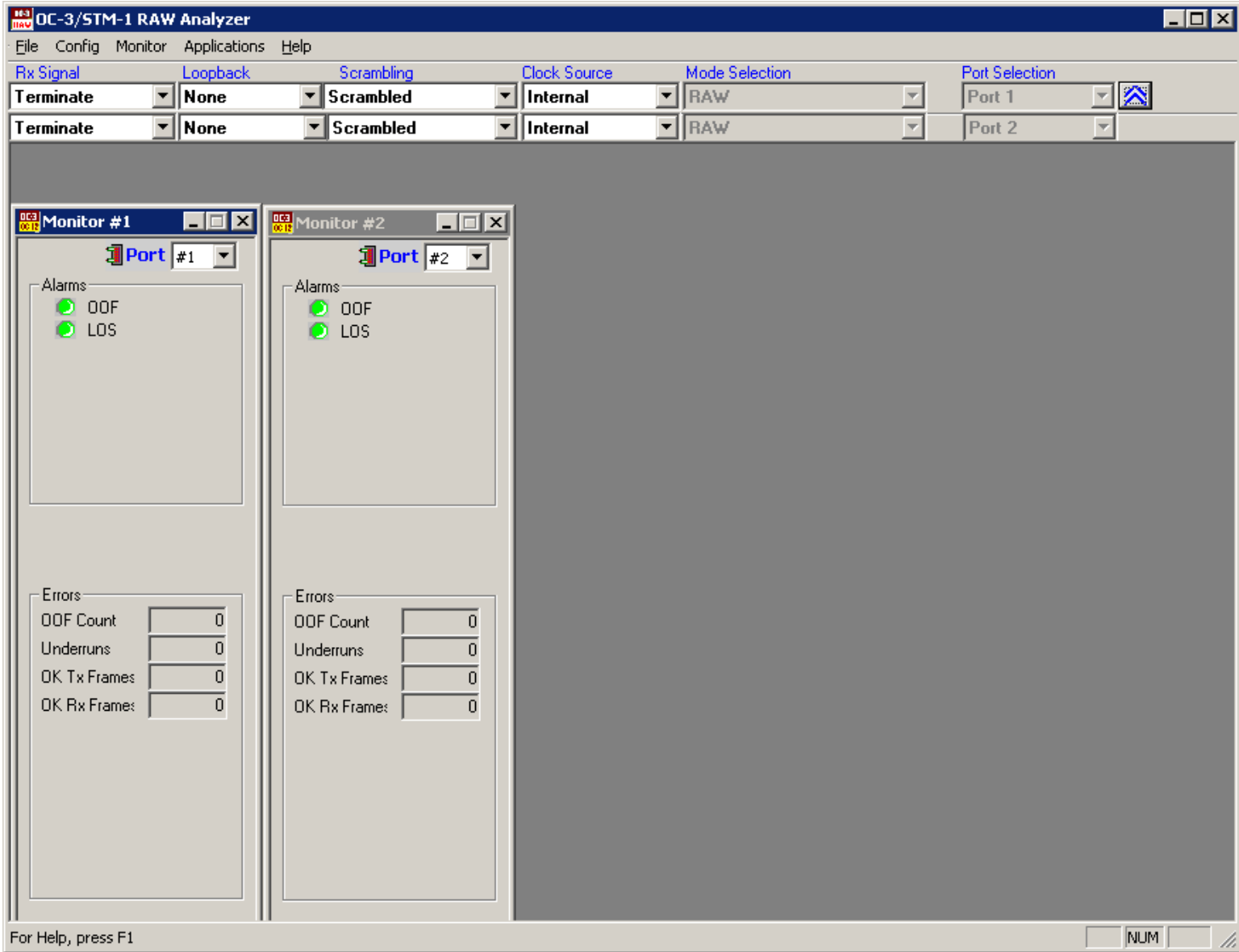
Multiplexing:

- Supports multiplexing multiple T1 or E1 channels to a single channelized OC-3/STM-1 line
- User configurable OC-3/STM-1 mapping – allows user-defined T1 and E1 channels to multiplex. The channel numbering is same as in demultiplexer
- User configurable idle code to fill the channels when the user added channels do not have data to multiplex.
- Unused channels will be treated as unequipped.

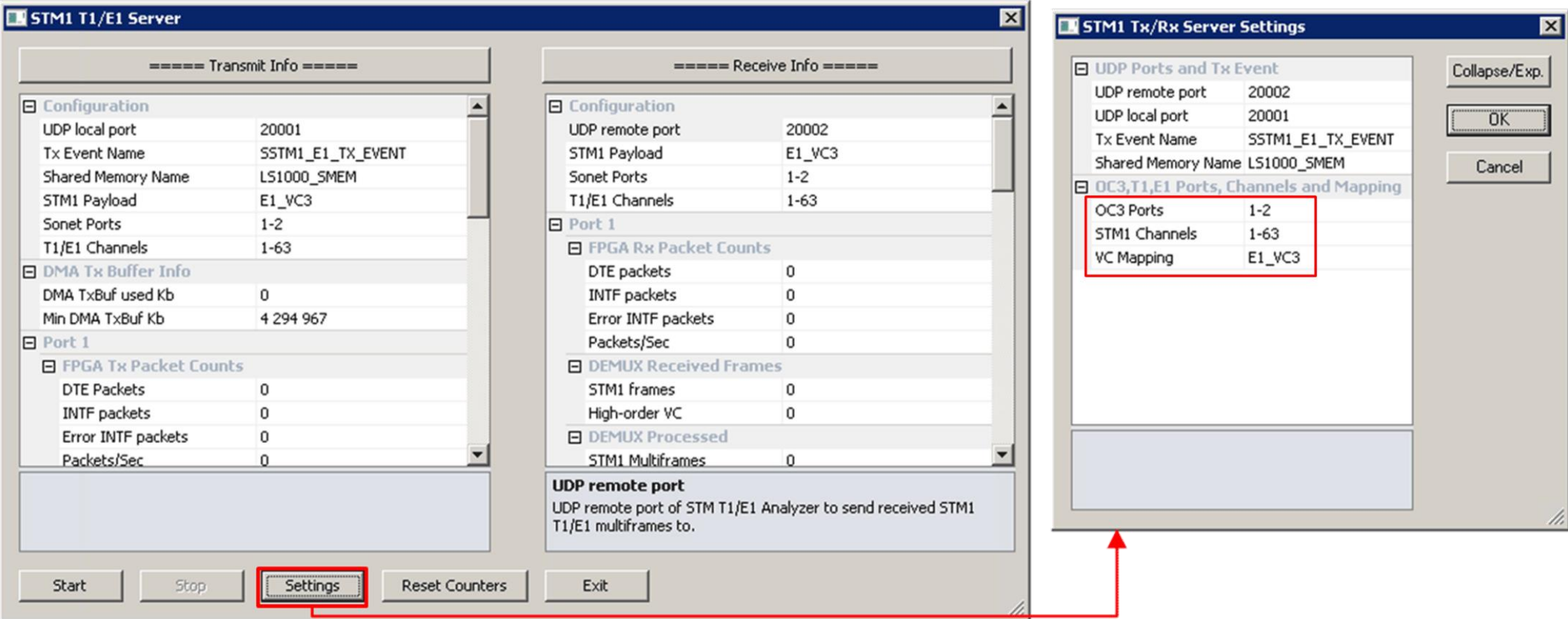
T1 E1 within SONET SDH Testing ...

- Allows to configure the number of T1 E1 channels to be Multiplexed/Demultiplexed to / from OC-3 / STM-1
- Allows direct access to anything and everything on SONET / SDH – Framing and Payload, including structured traffic (T1, E1, STS-1, DS3 etc) or unstructured traffic (ATM, PoS, etc).
- Supports all "**basic applications**" and "**special applications**" for T1 or E1 demultiplexed channels
- Comprehensive analysis / emulation of voice, data, fax, protocol, analog, and digital signals, including echo and voice quality testing
- Supports BERT, and Capture and Playback applications
- Supports Protocol Analysis of structured protocols – HDLC, ISDN, CAS, and more.

OC-3 / STM-1 Channelized Analyzer

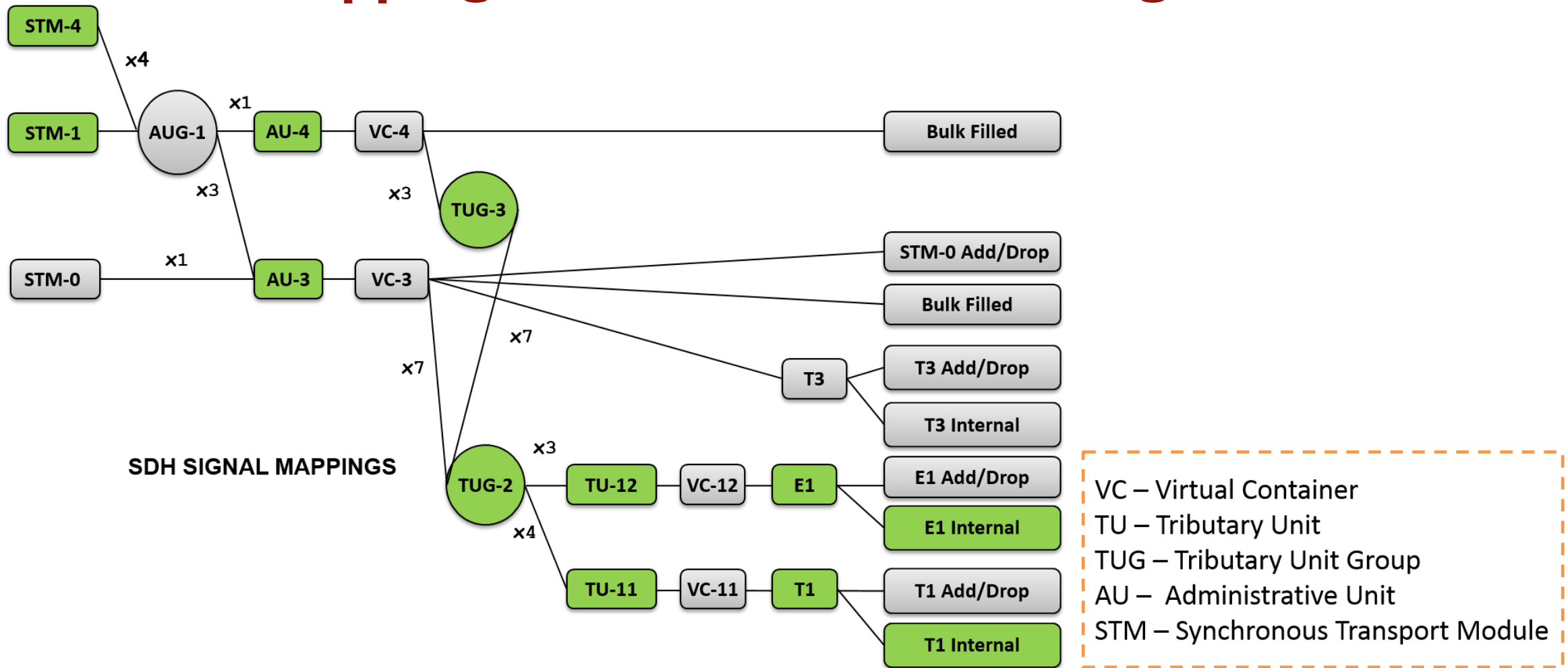


STM-1 T1/E1 Server Settings



- The **STM1 T1/E1 Server** application in the OC-3/STM-1 Channelized Analyzer allows to configure the number of T1 E1 channels to be multiplexed or demultiplexed.

VC Mapping and Channel Numbering Scheme



- The paths colored in green are currently supported on the GL's LightSpeed1000™ hardware

Supported T1 and E1 Mappings within SDH

- E1_VC3 (Mapping path E1 = STM-4 → STM-1 → AUG-1 → AU-3 → VC-3 → TUG-2 → TU-12 → E1)
- E1_VC4 (Mapping path E1 = STM-4 → STM-1 → AUG-1 → AU-4 → VC-4 → TUG-3 → TUG-2 → TU-12 → E1)
- T1_VC3 (Mapping path T1 = STM-4 → STM-1 → AUG-1 → AU-3 → VC-3 → TUG-2 → TU-11 → T1)
- T1_VC4 (Mapping path T1 = STM-4 → STM-1 → AUG-1 → AU-4 → VC-4 → TUG-3 → TUG-2 → TU-11 → T1)

T1 and E1 Channel Numbers within OC-3

Channel Number	VC3/ TUG3	TUG2	TU11	Channel Number	VC3/ TUG3	TUG2	TU11	Channel Number	VC3/ TUG3	TUG2	TU11
1	1	1	1	29	2	1	1	57	3	1	1
2	1	1	2	30	2	1	2	58	3	1	2
3	1	1	3	31	2	1	3	59	3	1	3
4	1	1	4	32	2	1	4	60	3	1	4
5	1	2	1	33	2	2	1	61	3	2	1
6	1	2	2	34	2	2	2	62	3	2	2
7	1	2	3	35	2	2	3	63	3	2	3
8	1	2	4	36	2	2	4	64	3	2	4
9	1	3	1	37	2	3	1	65	3	3	1
10	1	3	2	38	2	3	2	66	3	3	2
11	1	3	3	39	2	3	3	67	3	3	3
12	1	3	4	40	2	3	4	68	3	3	4
13	1	4	1	41	2	4	1	69	3	4	1
14	1	4	2	42	2	4	2	70	3	4	2
15	1	4	3	43	2	4	3	71	3	4	3
16	1	4	4	44	2	4	4	72	3	4	4
17	1	5	1	45	2	5	1	73	3	5	1
18	1	5	2	46	2	5	2	74	3	5	2
19	1	5	3	47	2	5	3	75	3	5	3
20	1	5	4	48	2	5	4	76	3	5	4
21	1	6	1	49	2	6	1	77	3	6	1
22	1	6	2	50	2	6	2	78	3	6	2
23	1	6	3	51	2	6	3	79	3	6	3
24	1	6	4	52	2	6	4	80	3	6	4
25	1	7	1	53	2	7	1	81	3	7	1
26	1	7	2	54	2	7	2	82	3	7	2
27	1	7	3	55	2	7	3	83	3	7	3
28	1	7	4	56	2	7	4	84	3	7	4

T1 and E1 Channel Numbers within STM-1

Channel Number	VC3/ TUG3	TUG2	TU12		Channel Number	VC3/ TUG3	TUG2	TU12		Channel Number	VC3/ TUG3	TUG2	TU12
1	1	1	1		22	2	1	1		43	3	1	1
2	1	1	2		23	2	1	2		44	3	1	2
3	1	1	3		24	2	1	3		45	3	1	3
4	1	2	1		25	2	2	1		46	3	2	1
5	1	2	2		26	2	2	2		47	3	2	2
6	1	2	3		27	2	2	3		48	3	2	3
7	1	3	1		28	2	3	1		49	3	3	1
8	1	3	2		29	2	3	2		50	3	3	2
9	1	3	3		30	2	3	3		51	3	3	3
10	1	4	1		31	2	4	1		52	3	4	1
11	1	4	2		32	2	4	2		53	3	4	2
12	1	4	3		33	2	4	3		54	3	4	3
13	1	5	1		34	2	5	1		55	3	5	1
14	1	5	2		35	2	5	2		56	3	5	2
15	1	5	3		36	2	5	3		57	3	5	3
16	1	6	1		37	2	6	1		58	3	6	1
17	1	6	2		38	2	6	2		59	3	6	2
18	1	6	3		39	2	6	3		60	3	6	3
19	1	7	1		40	2	7	1		61	3	7	1
20	1	7	2		41	2	7	2		62	3	7	2
21	1	7	3		42	3	7	3		63	3	7	3

Thank you