BERT Analysis and Emulation

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Platforms

- T1/E1 Platform
  - Basic BERT
  - Multi-Channel BERT
  - Enhanced BERT
  - ATM BERT
- T3/E3 Platform
  - Enhanced BERT
- OC3/12 STM1/4 Platform
  - PoS BERT
  - ATM BERT

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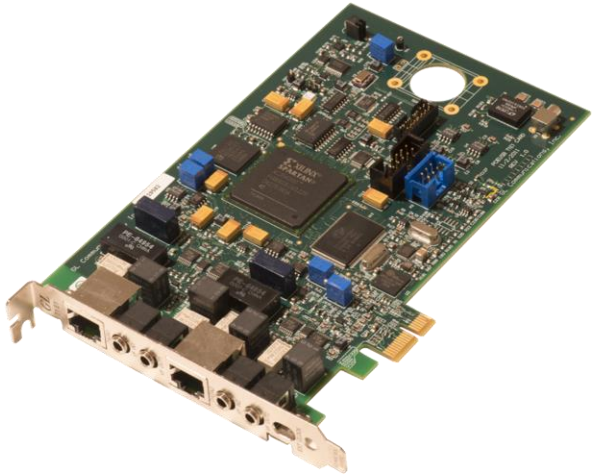
T1 E1 Platforms

Front Panel

Back Panel

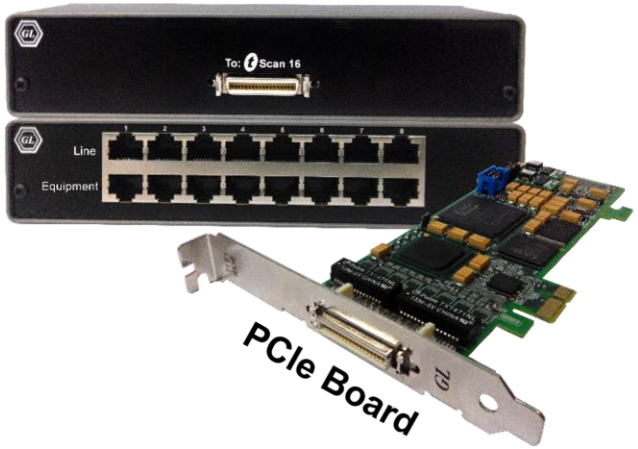
tProbe™ - Portable USB based T1 E1 VF FXO FXS and Serial Datacom Analyzer

Quad / Octal T1 E1 PCIe Card



Dual T1 E1 Express (PCIe) Board

tScan16™ with 16-port T1 E1 Breakout Box



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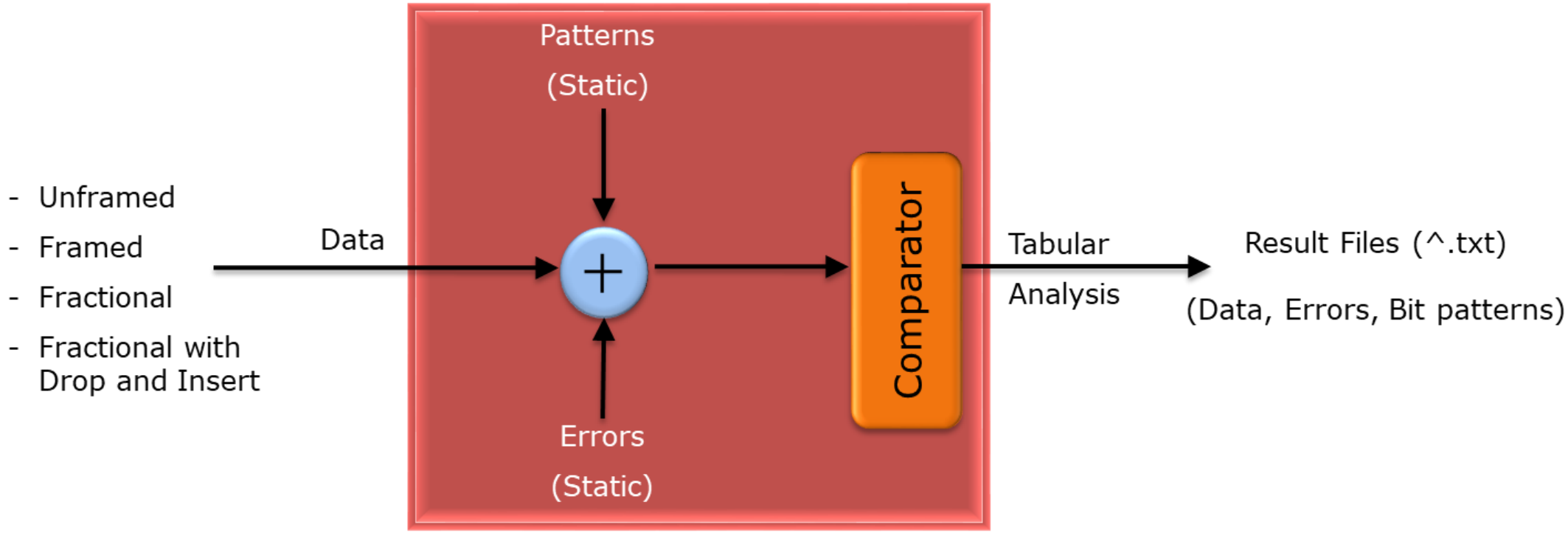
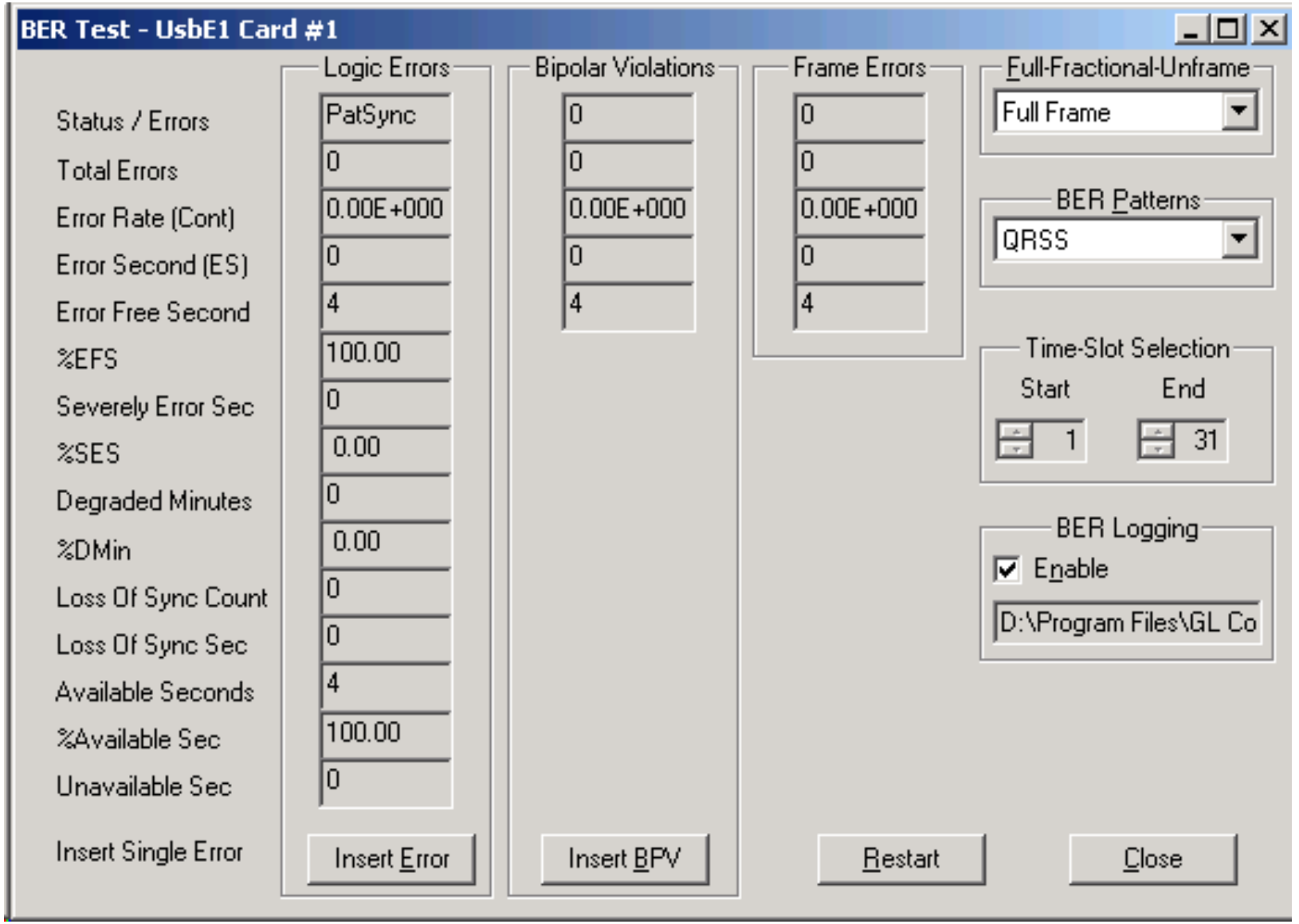
Basic Bit Error Rate Test (BERT)

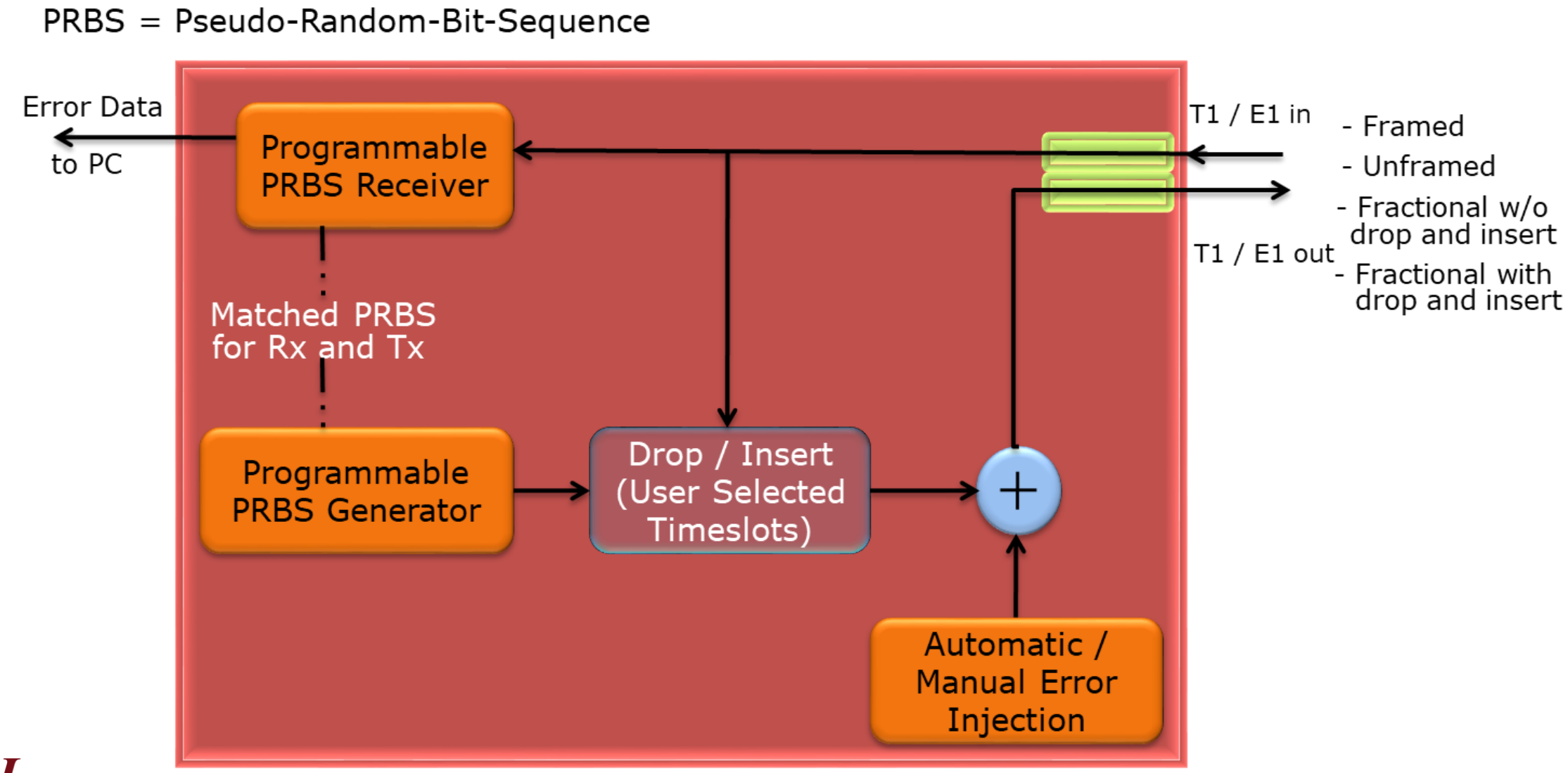


- Measures the correctness of data received on a single unframed, framed, and fractional T1/E1 channel using fixed Pseudo Random Bit Sequence (PRBS) patterns
- Provides drop and insert capability
- Variety of standard data patterns are available for test purposes including static PRBS patterns

Basic BERT


BER Test - UsbE1 Card #1
Logic Errors
Bipolar Violations
Frame Errors
Full-Fractional-Unframe
Full Frame
BER Patterns
QRSS
Time-Slot Selection
Start
End
1
31
BER Logging
Enable
D:\Program Files\GL Co
Status / Errors
Total Errors
Error Rate (Cont)
Error Second (ES)
Error Free Second
%EFS
Severely Error Sec
%SES
Degraded Minutes
%DMin
Loss Of Sync Count
Loss Of Sync Sec
Available Seconds
%Available Sec
Unavailable Sec
PatSync
0
0.00E+000
0
4
100.00
0
0.00
0
0.00
0
0
4
100.00
0
0
0
0.00E+000
0
4
0
0
0.00E+000
0
4
Insert Single Error
Insert Error
Insert BPV
Restart
Close

Real-time Generation and Detection of Patterns



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Real-time Generation and Detection of Patterns (Contd.)

- Supported data patterns –
  - Quasi Random Signal Source
  - 2^6-1 (63)
  - 2^9-1 (511)
  - 2^{11}-1 (2047)
  - 2^{15}-1
  - 2^{20}-1
  - 2^{23}-1
  - CSU (Channel Service Unit) Loop Up Code
  - CSU Loop Down Code
  - NIU Loop Up and Loop Down
  - All Ones
  - All zeros
  - 1:1
  - 1:7
  - 3 in 24

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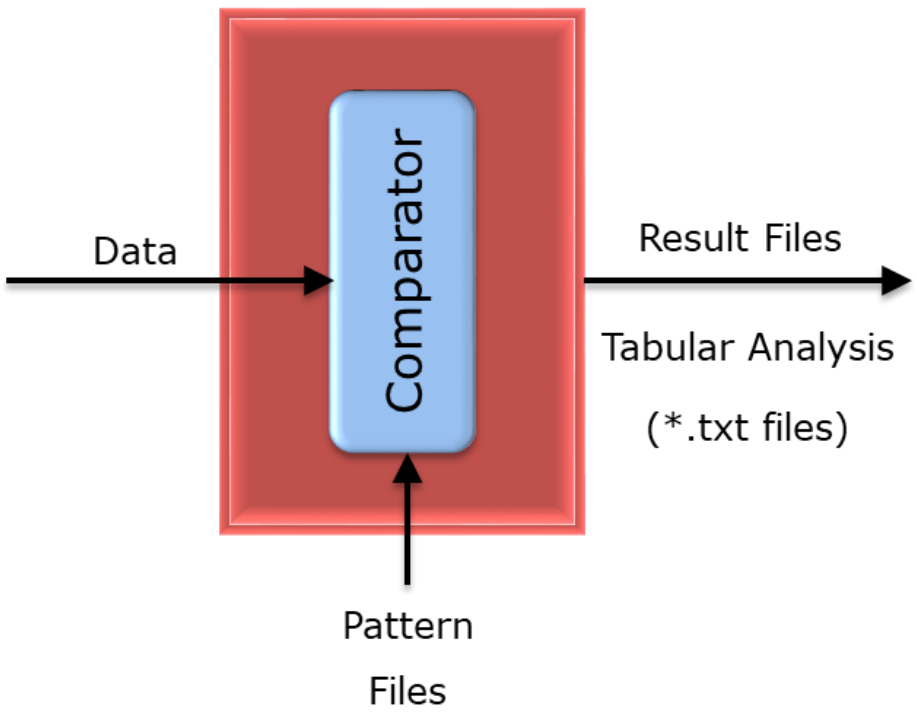
Results

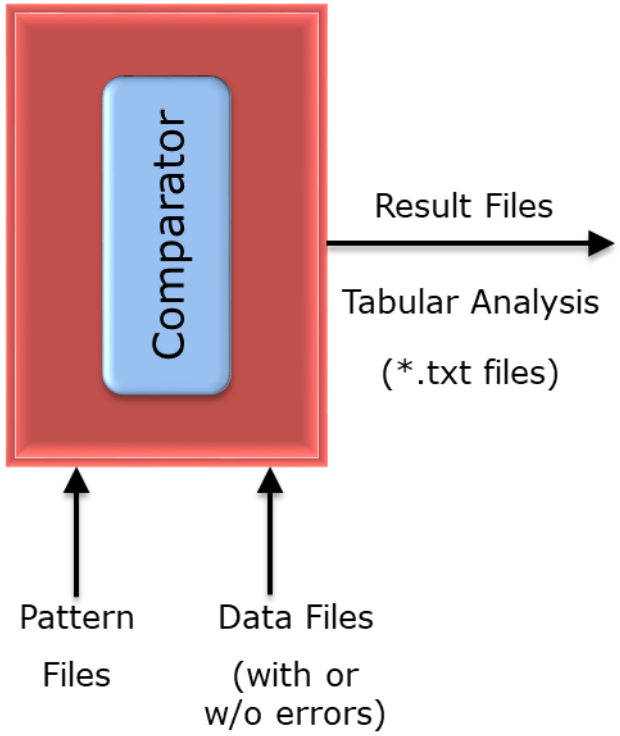
- Provide the following statistics for all Errors (Logic, BPV, Frame errors)
  - BERT Status – No Sync, Pat Sync
  - Error Count
  - Error Rate
  - Error Seconds
  - Error Free Seconds

- Additionally following statistics are displayed for Logic Errors
  - Loss of Sync Count
  - Loss of Sync Seconds
  - Available Seconds
  - Unavailable Seconds
  - Degraded Minutes
  - Severely Error Seconds

MC BERT



Real-time MC BERT



Offline MC BERT

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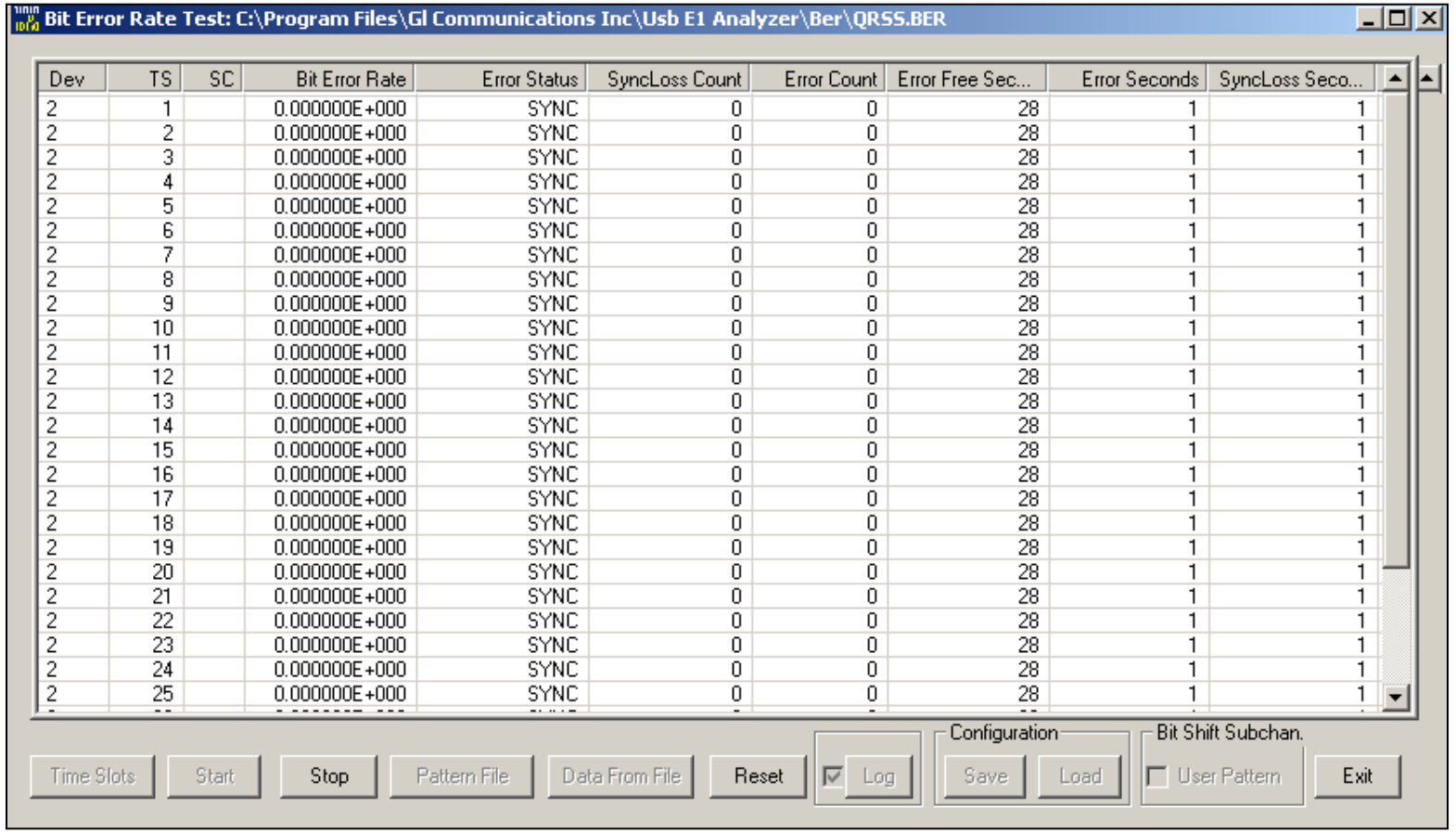
Real-time Analysis



- Multi-channel Bit Error Rate Testing (MCBERT) measures correctness of data received on T1/E1 lines/timeslots with stored data in a reference file
- Application can work in real-time with data currently being received on T1/E1 lines/timeslots, or off-line with data stored in a file

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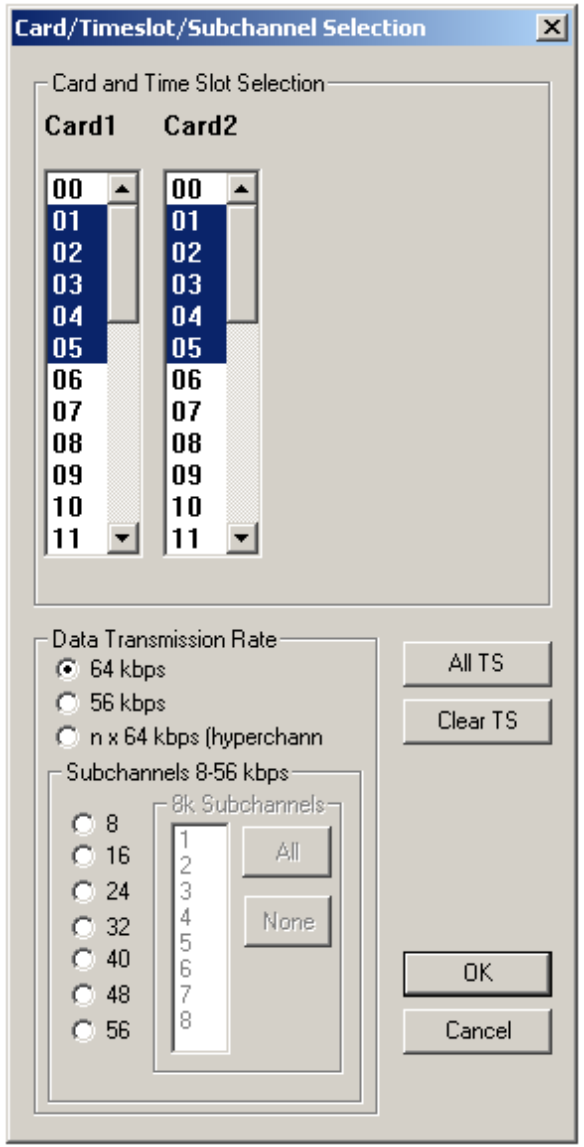
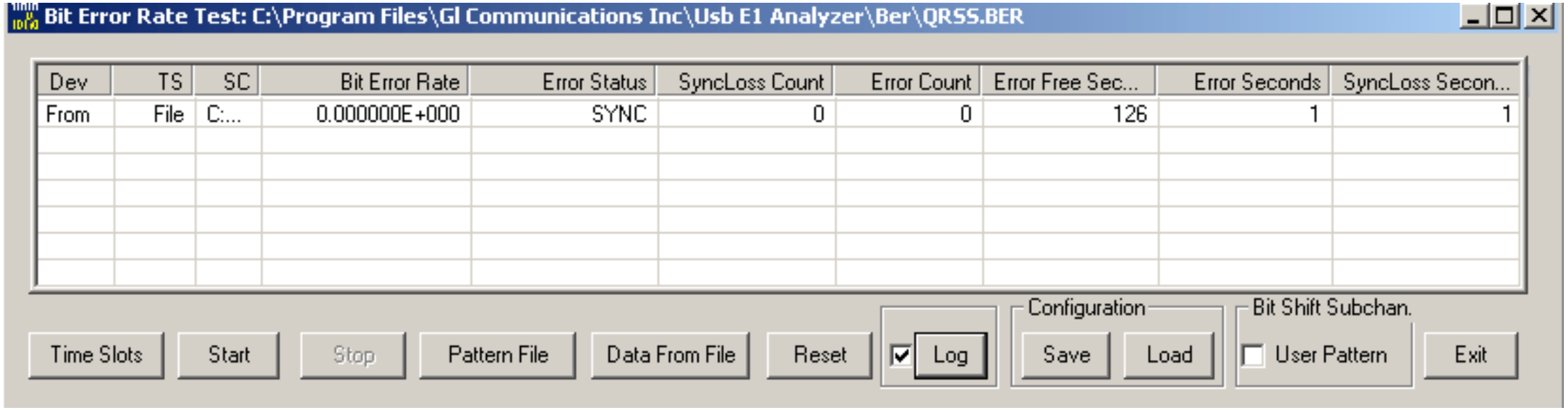
Real-time Analysis (Contd.)

- Real-time T1/E1 testing can be done on full or fractional T1/E1 timeslots
- The following independent streams can be compared in real time to a chosen pattern file:
  - Multiple 64kbps (56kbps) independent stream channels (need NOT be contiguous)
  - A hyper channel per T1/E1 (n x 64kbps timeslots, where n = 1..24 T1, 1..32 E1; contiguous timeslots) line/trunk
  - Multiple subchannels n x 8kbps (8k, 16k, …, 56k)
  - For example, for T1 it could be up to 24 x 8 separate 8kbps subchannels (eight subchannels per timeslot)



Offline Viewing



- Performs offline analysis by selecting BER pattern from ‘Data from File’ option and the reference file is selected using ‘Pattern File’ option
- Data From File compares the data of already captured file with that of the pattern file to do the following:
  - Reading the data from file
  - Comparing to pattern
  - Displaying the results

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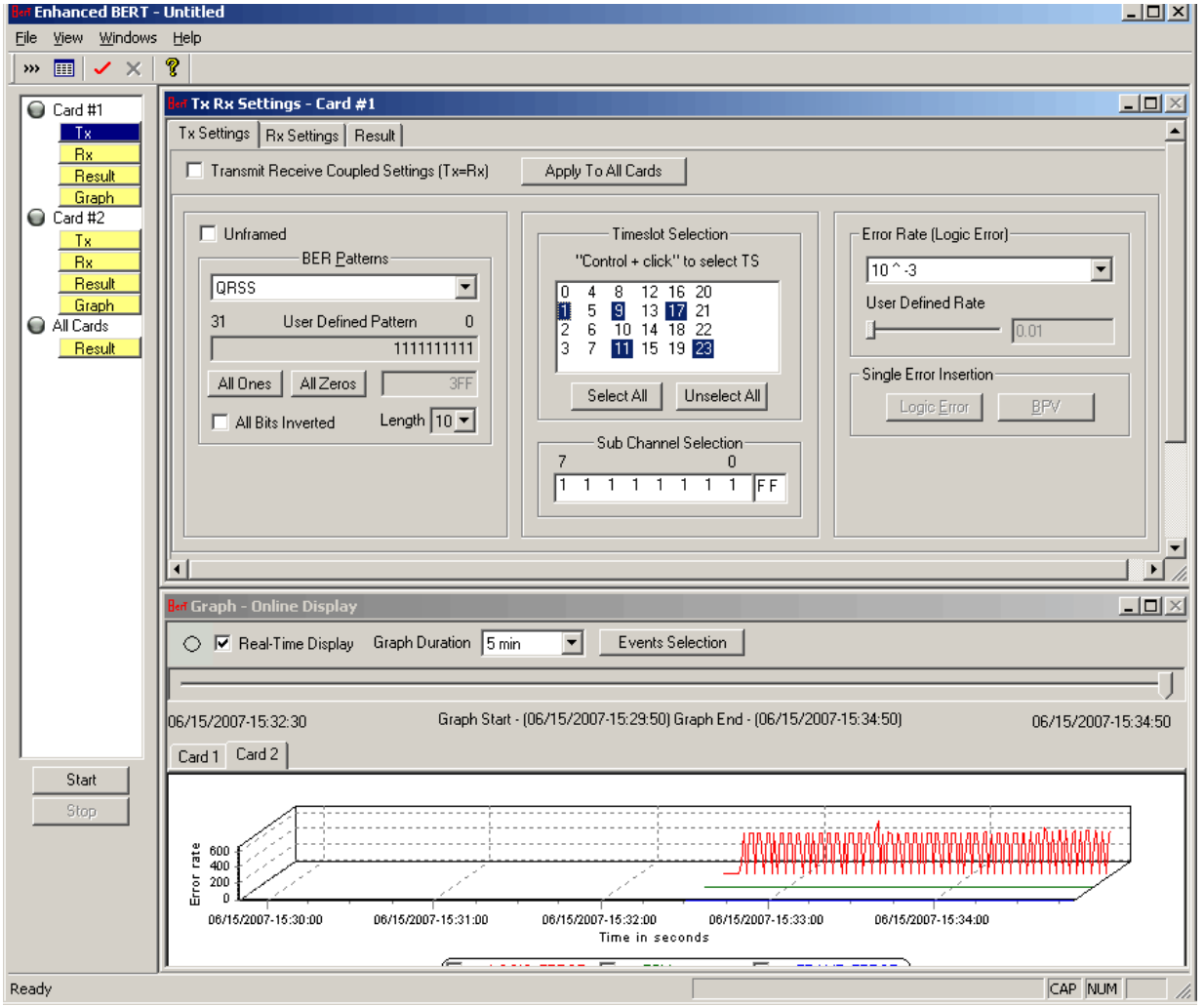
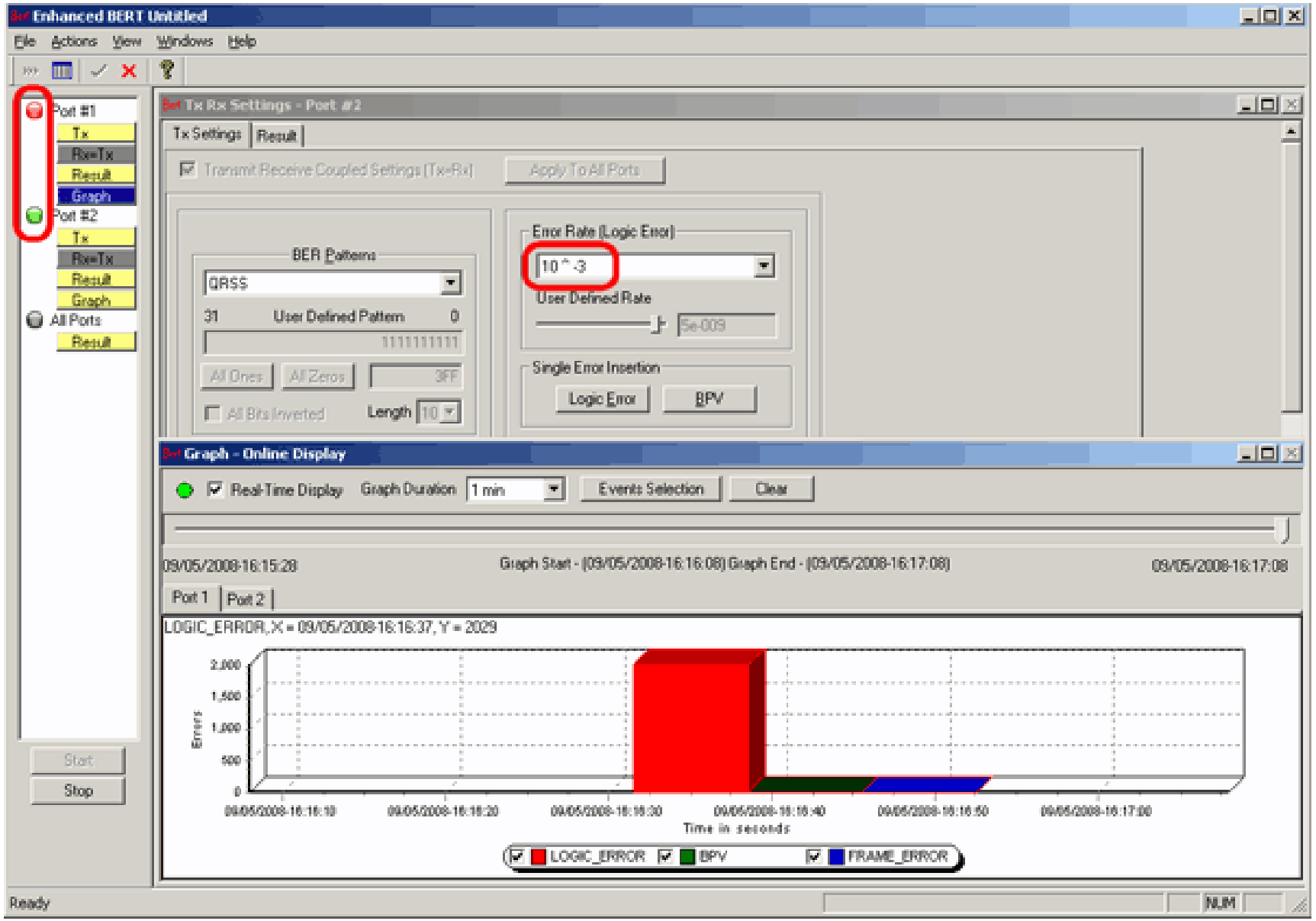
T1 E1 Enhanced BERT

- Measures the correctness of data received on lines (T1/E1/T3/E3) against a repetitive fixed or pseudorandom pattern for the given transmission
- Support for multiple cards, with a consolidated result view
- Non-contiguous timeslots for fractional BER testing, and sub-channel selections for BER testing within a timeslot (applicable to T1/E1 only)
- Bit Error Rate provides a figurative measurement of the number of erroneous bits received for the total number of bits transmitted
- Tx & Rx settings for all the cards can be independently controlled or coupled as per the convenience of the user
- Provides graphical view of the comparison
- Sophisticated logging of events

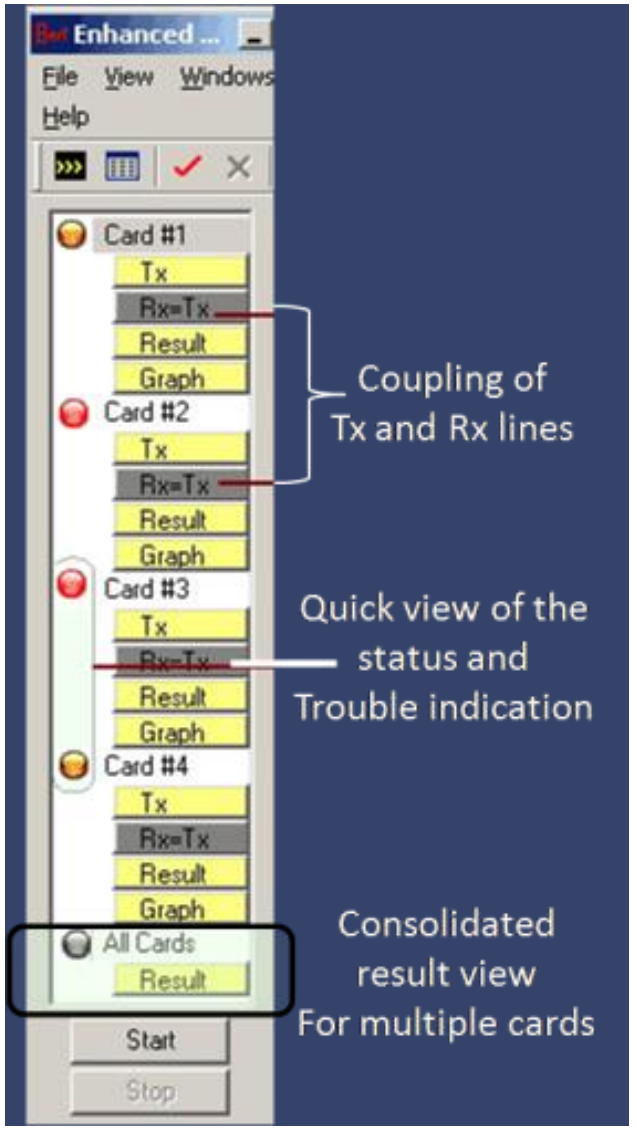


T3 /E3 Enhanced BERT (Contd.)

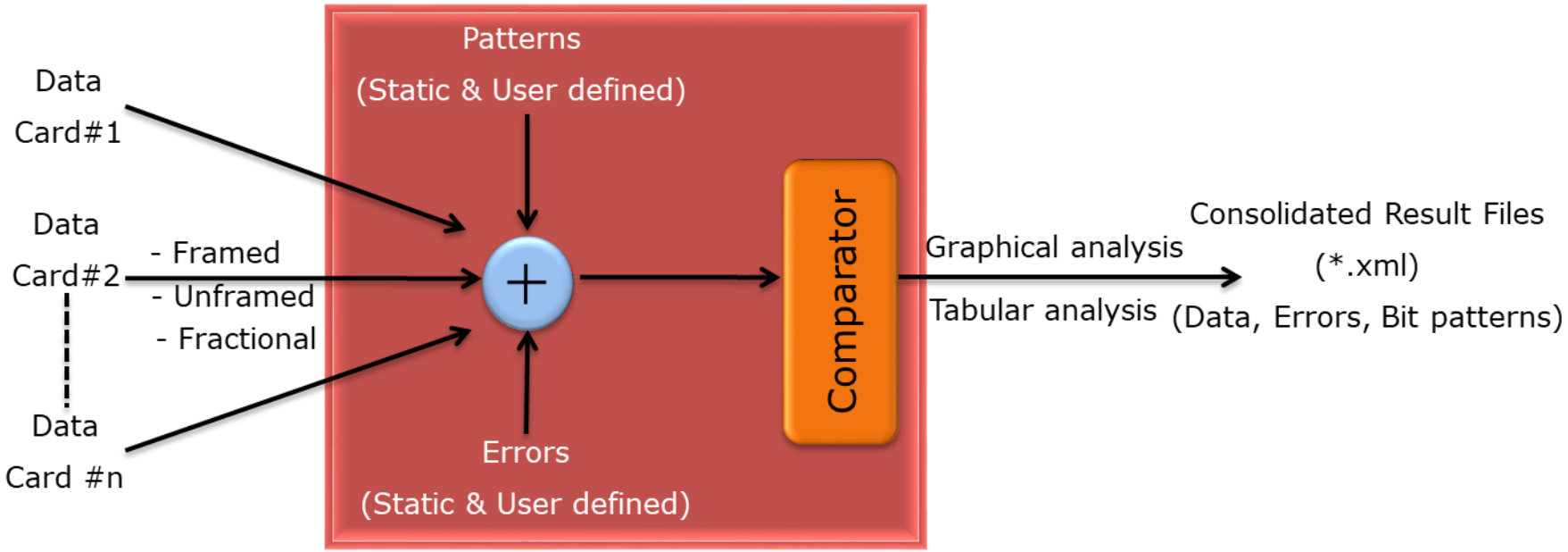


Consolidated View

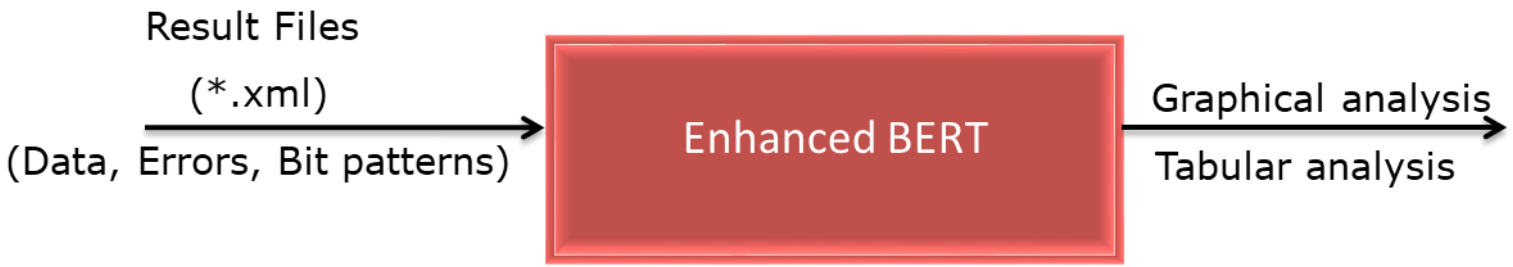
- Supports testing on multiple cards simultaneously with consolidated result view
- Tx and Rx settings for multiple cards can be independently controlled or coupled
- Quick view of the status and trouble indication
- Save and Load configuration settings



Real-time Generation and Detection



Real-time Enhanced BERT (Tx & Rx)



Offline Enhanced BERT

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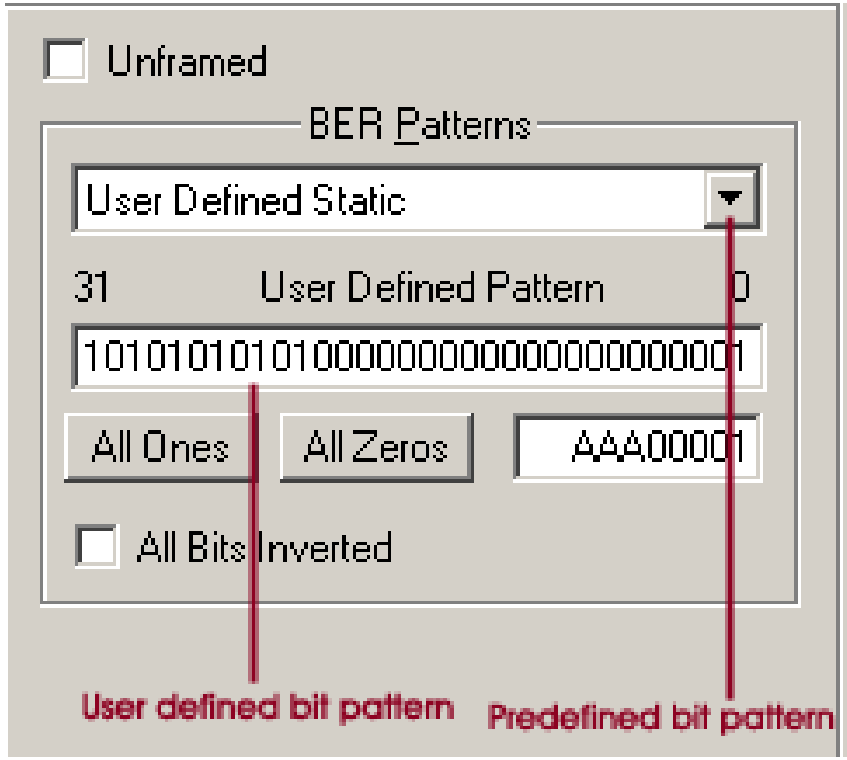
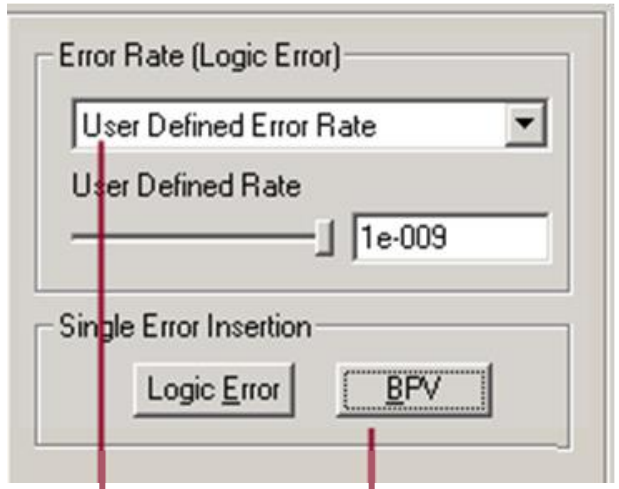
BER Patterns

- Supports Static and User-defined bit patterns
- Generates various static bit patterns such as - QRSS, 2^5-1, 2^9-1, 2^{11}-1, 2^{15}-1, 2^{20}-1, 2^{23}-1, All ones, All zeros, 1:1, 1:7, 3 in 24, CSU Loop-Up (0001), CSU Loop-down (001), NIU Loop-UP (11000), and NIU Loop-Down (11100), and user-defined patterns of size up to 32 bits



Error Insertion

- Insert logic and BPV errors at regular intervals of time (secs)
- Insert just single bit errors into the incoming stream
- Predefined error rate can range from 10^{-2} to 10^{-9} and user defined error rates can range from 0.01 to 1e-009

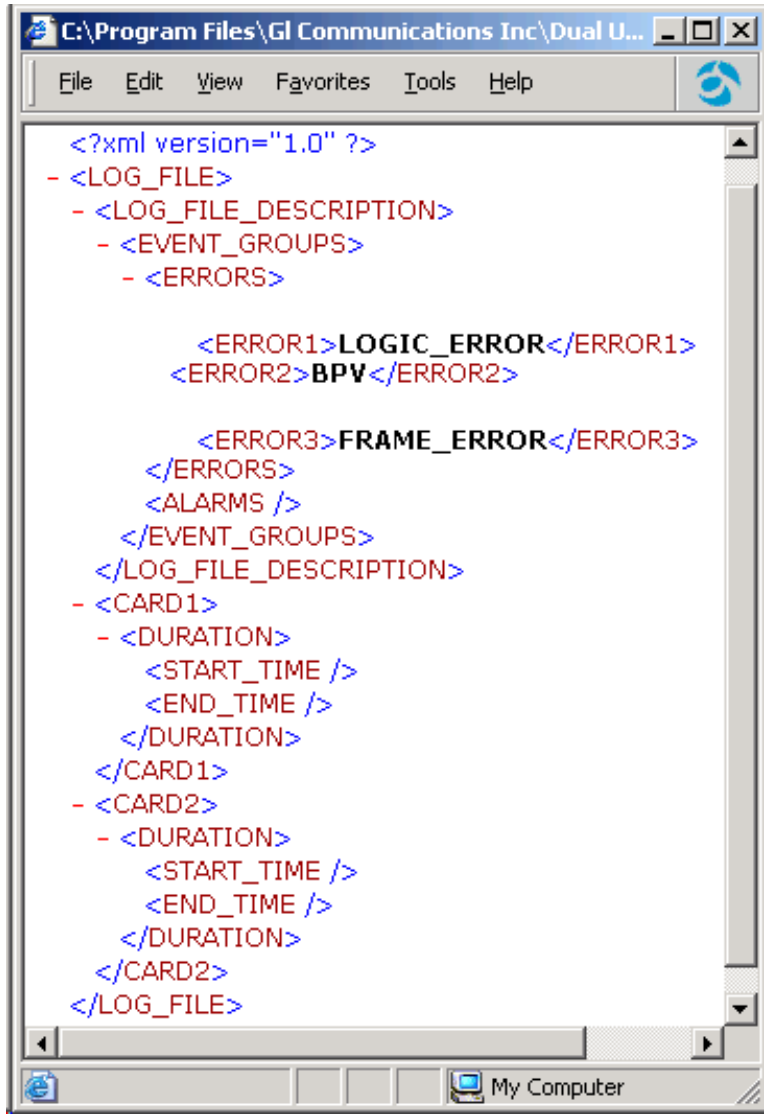


User defined Error Rate

Single Error Insertion

BER Test Logging

- Logs the events for extended periods
- Information is recorded in XML file formats
- Online (real-time) view of events and offline view of saved events are supported through a powerful graphic event viewer application



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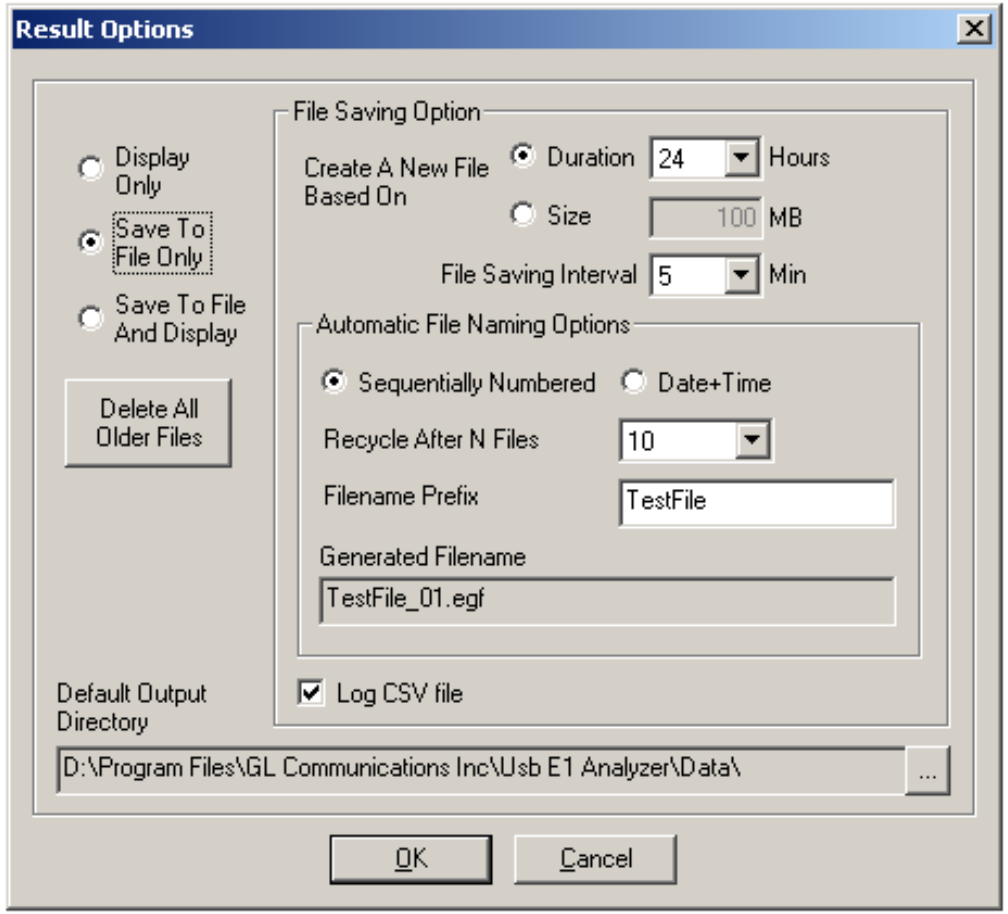
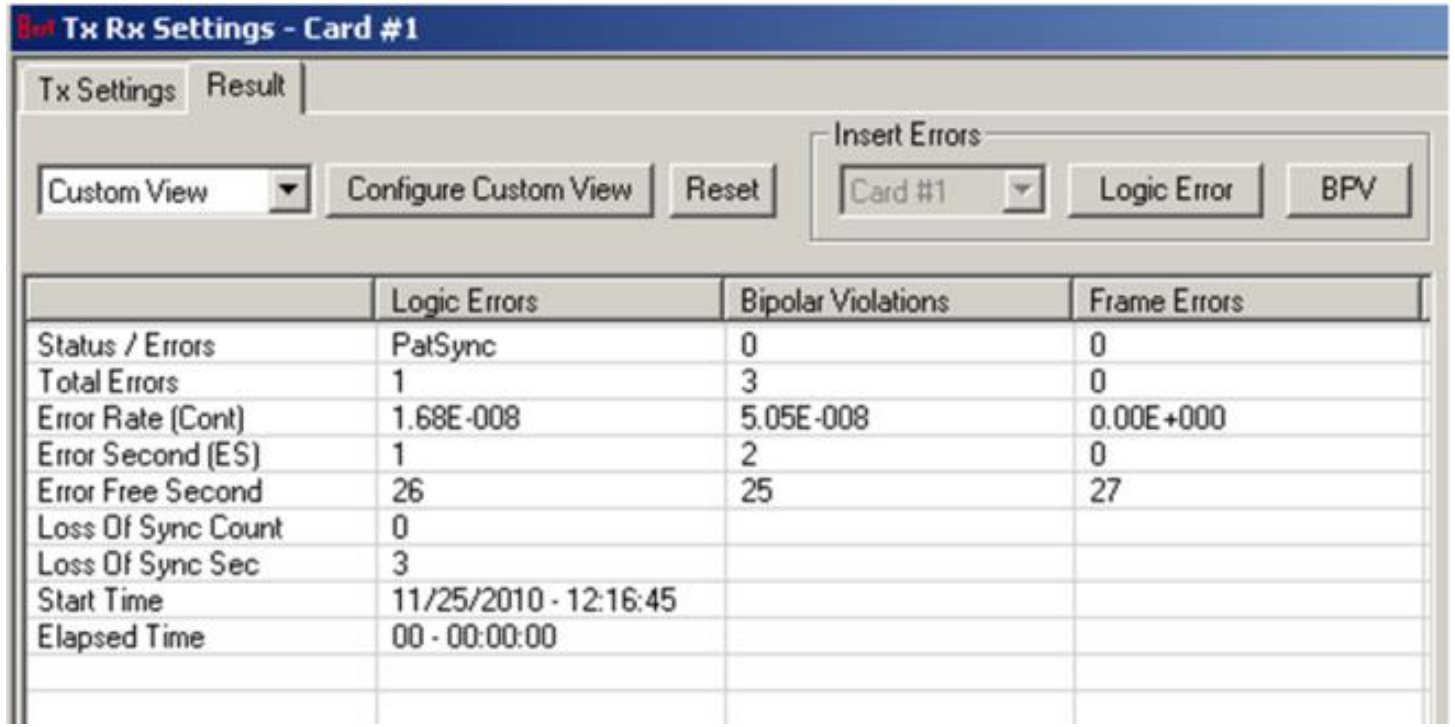
Result Options

- Various options are available to save the transmitted BER patterns and the error rates -
  - ➢ Only display the events in real-time
  - ➢ Only save the events to a file in *.xml format
  - ➢ Save the events to a file and also display in real-time
- Options are available for limiting the length of the file with either the time duration or the file size are also available



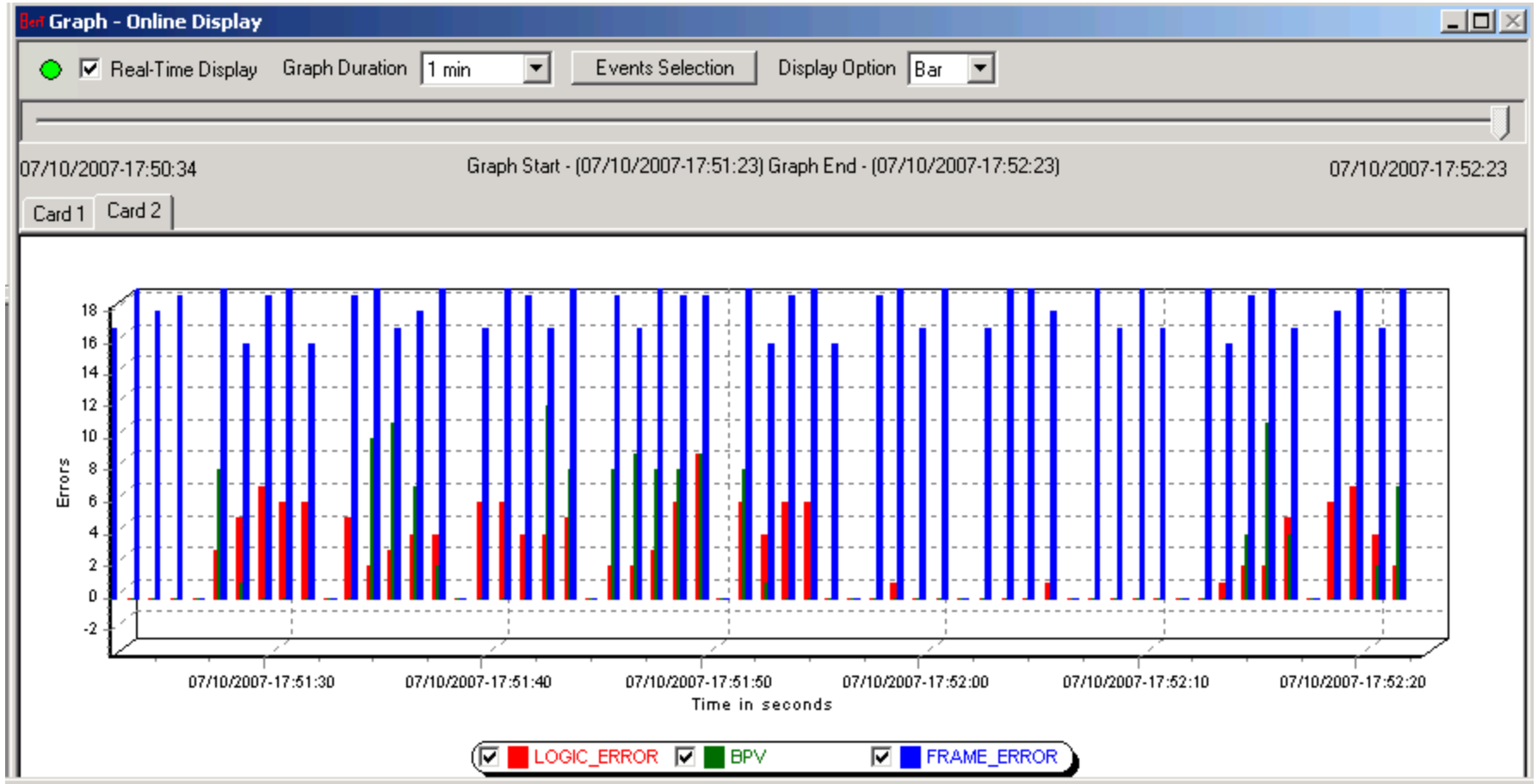
Results – Tabular



	Logic Errors	Bipolar Violations	Frame Errors
Status / Errors	PatSync	0	0
Total Errors	1	3	0
Error Rate (Cont)	1.68E-008	5.05E-008	0.00E+000
Error Second (ES)	1	2	0
Error Free Second	26	25	27
Loss Of Sync Count	0		
Loss Of Sync Sec	3		
Start Time	11/25/2010 - 12:16:45		
Elapsed Time	00 - 00:00:00		

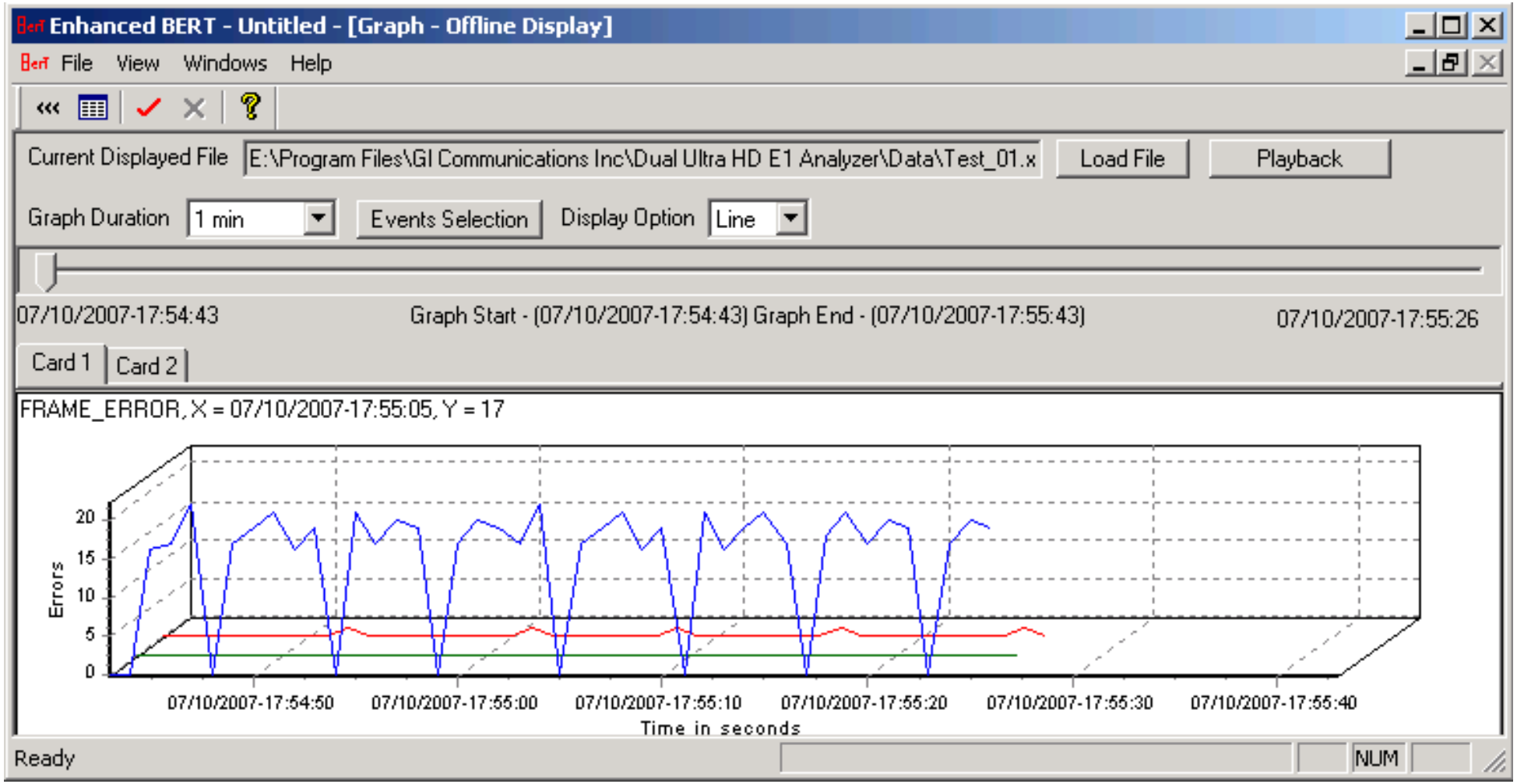
- Displays the status / errors of the BER test along with the total errors, error rate, error second, error free second, loss of sync count, loss of sync sec, start time, and elapsed time
- Also, gives the BPV, logic error and frame count on card 1 and card 2

Results – Real-time Graph



- Displays the Error Rate Vs Time graph of the bit error test results in real-time

Results - Offline Graph



Comparison

Features	BERT	Enhanced BERT	ATM BERT	MC BERT
Frame Format	Framed Unframed Fraction with or without D & I	Framed Unframed Fractional	Framed	
Tx and Rx settings	Internally Coupled	User-selectable	User-selectable	
Support Multiple Card	×	✓	✓	×
Timeslots	Contiguous Timeslots	Contiguous & Non-contiguous timeslots, Sub-channels from 00 to FF		Contiguous & Non-contiguous timeslots, Hyperchannels , Subchannels 8 -56 kb/s
Offline Analysis			×	✓
BER Patterns	16 static PRBS patterns	8 static BER patterns and User-defined Patterns	11 static BER patterns and User-defined pattern	Pattern File Option

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Comparison (Contd.)

Features	BERT	Enhanced BERT	ATM BERT	MC BERT
Error insertion	Logic error BPV errors	Logic error BPV errors User-defined error insertions ranging from 0.01 to 1e-009	Single error User-defined error insertions ranging from 0.01 to 1e-009	
Traffic Rate	×	×	✓	×
ATM Headers Configuration	×	×	✓	×
Scrambling of data	×	×	✓	×
Data inversion	×	✓	✓	×
Results	Tabular analysis	Tabular analysis Real-time and offline Graphical analysis	Tabular analysis	Tabular analysis
Logging	Logs in *.txt files	Logs in *.xml files	×	Logs in *.txt files

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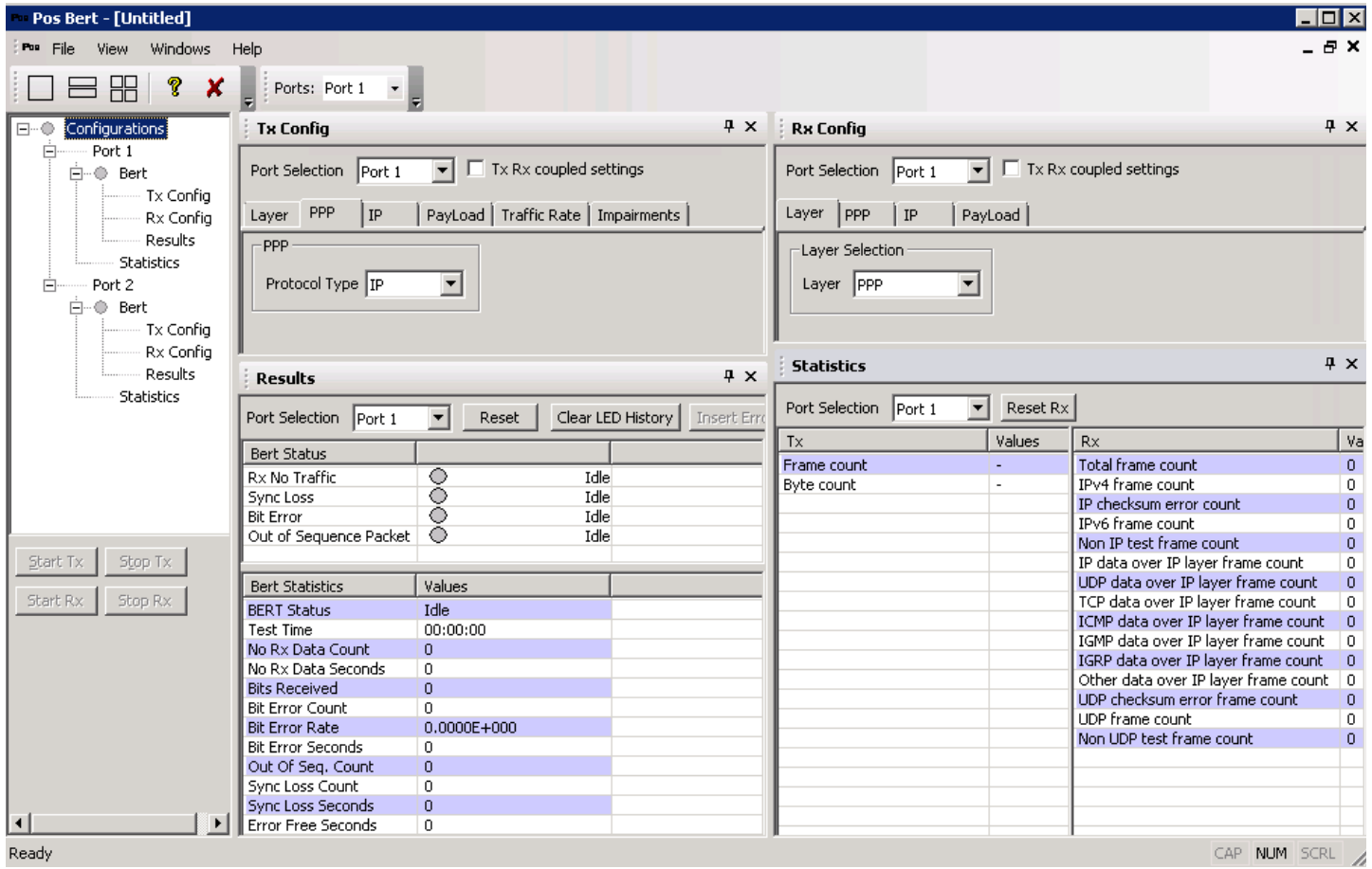
Packet over SONET (PoS) BERT

BER application permits test to run over PPP, IP, or UDP layers.

- User-defined header configuration
- User-defined traffic rate to the accuracy of 0.001% of total bandwidth
- Payload configuration to different PRBS patterns or user-defined patterns. User-defined pattern length can be 2 to 32 bits in length
- User-definable pre-sync achieve, sync loss bits, and sync loss declare options
- Supports sequence number insertion, invert payload data, single bit error insertion, and error rate insertion
- Provides detail statistics, such as Rx/Tx packet count, bit error count, IP and UDP checksum error count
- Provides throughput details, error and alarm LEDs for easy analysis



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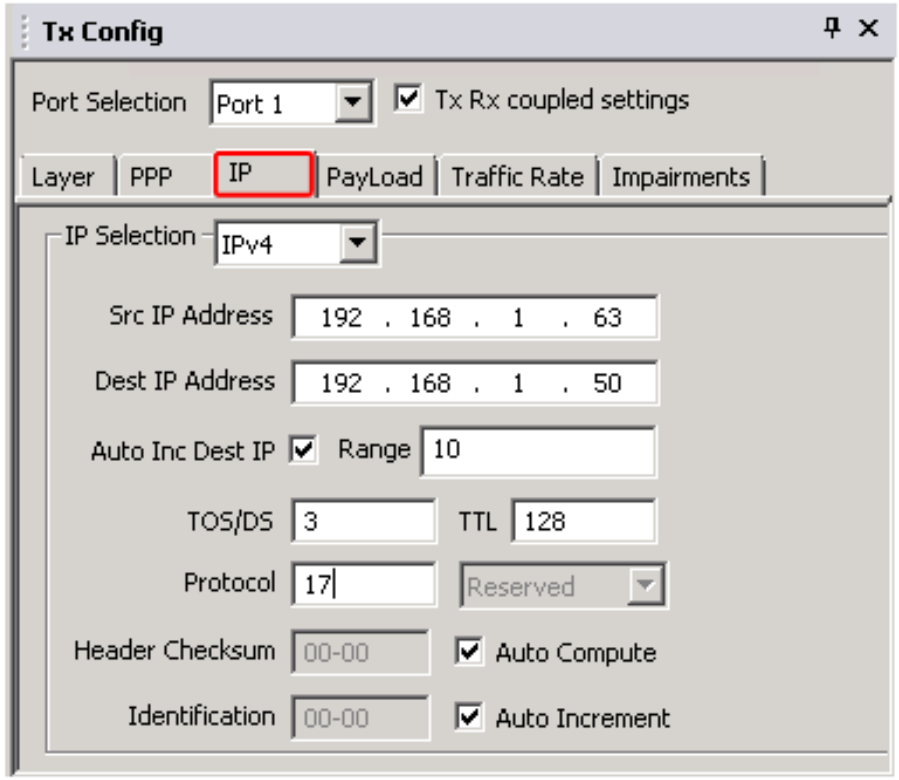
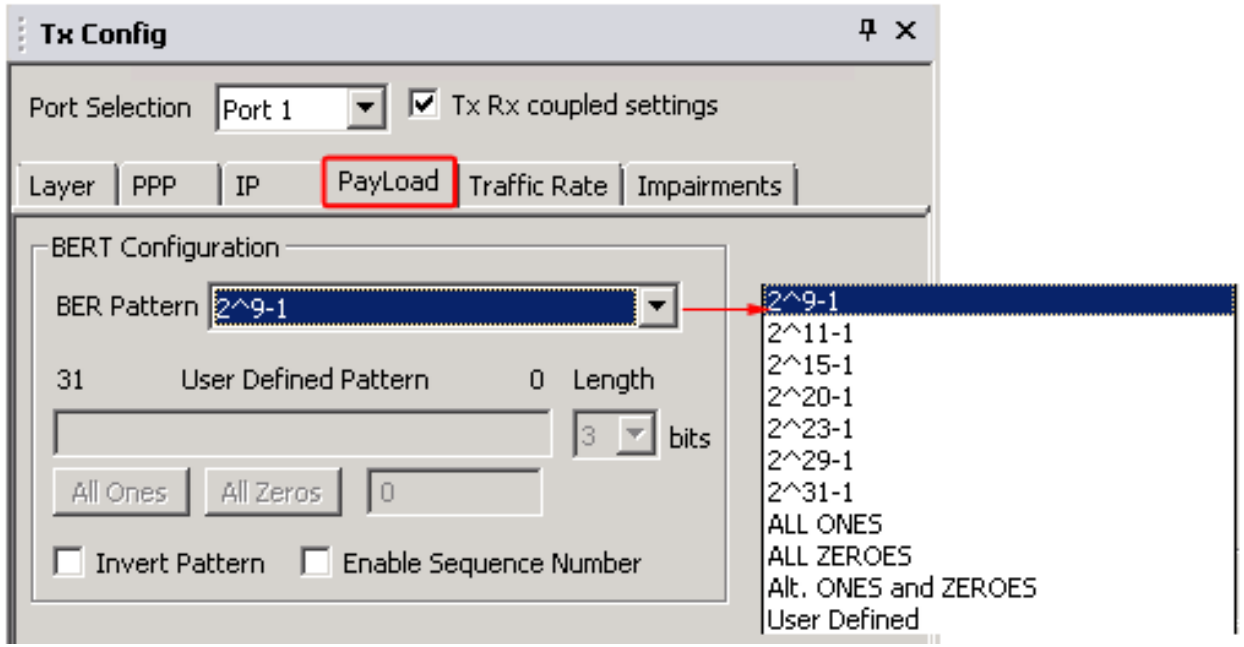
IP Layer



- POS BERT support IPv4 version providing header and data field settings
- Option to configure Src / Dest IP Address, Auto Inc Dest IP, TOS/DS, TTL, Protocol, Header Checksum, and Identification

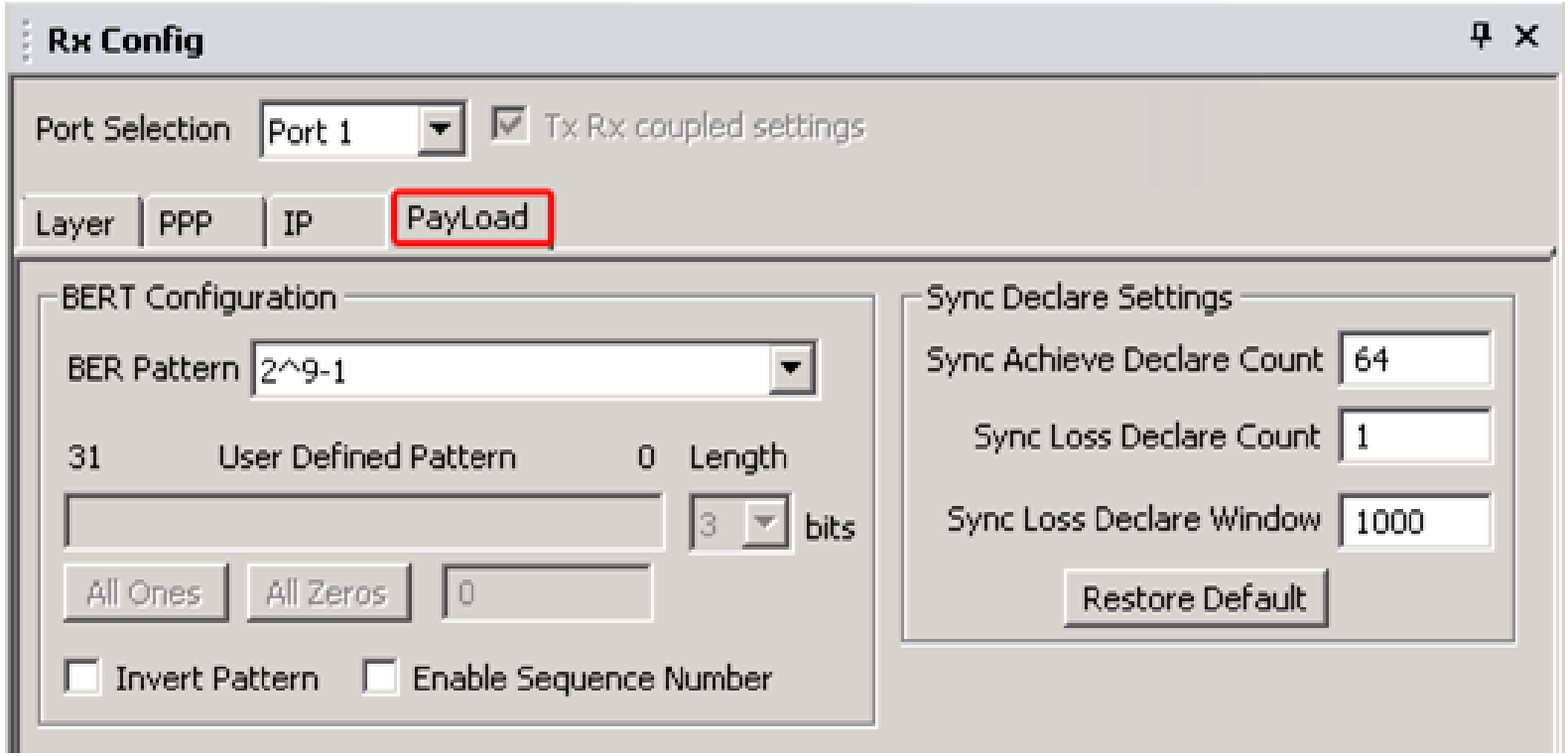
Tx Payload Configuration

- Payload option to select specific Bit Error Rate test pattern for transmission
- Support various BERT patterns; PRBS (2^{9}-1, 2^{11}-1, 2^{15}-1, 2^{20}-1, 2^{23}-1, 2^{29}-1, 2^{31}-1), fixed patterns all ones, all zeros, alternate 1s and 0s, and user-defined patterns
- Rx configuration use these patterns to verify the incoming BERT pattern
- Pattern Sync is achieved only if BERT pattern matches configuration patterns, configurable header lengths and header information
- Invert pattern selection and Sequence Number option are also provided



Rx Payload Configuration

- For Sync status, BERT pattern selection in Rx configuration should match with the BERT pattern in Tx configuration
- Provides Sync Declare Settings such as Sync Achieve Declare Count, Sync Loss Declare Status, Sync Loss Declare Count

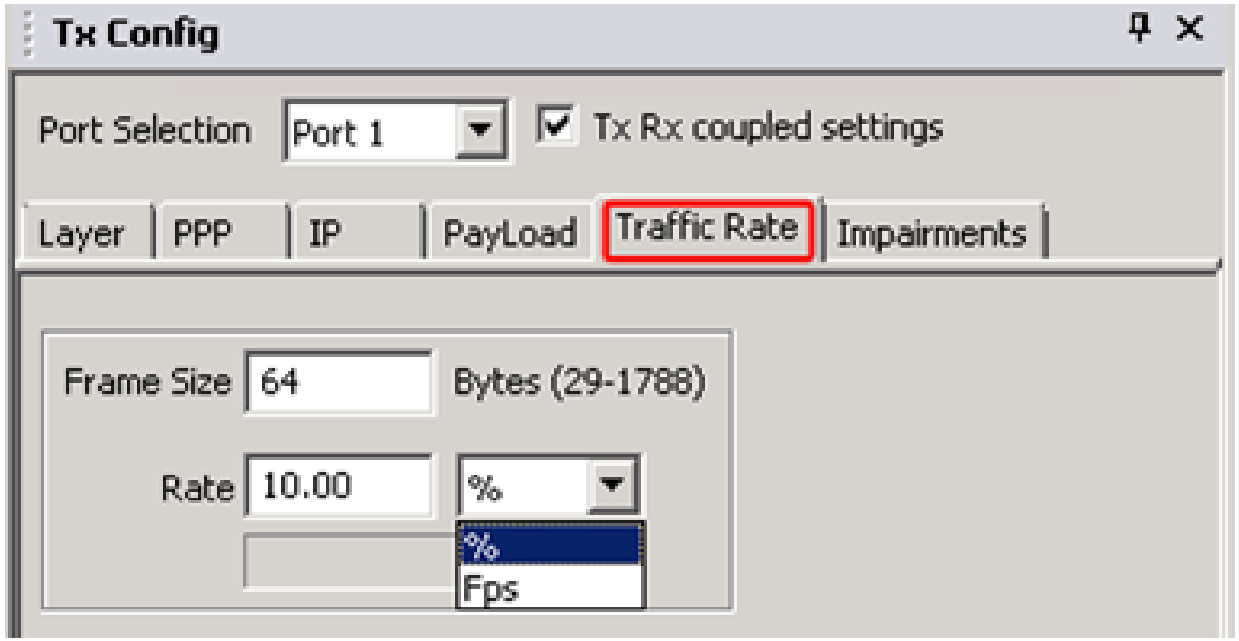


Traffic Rate

The Traffic Rate for **PoS BERT** can be configured with the following –

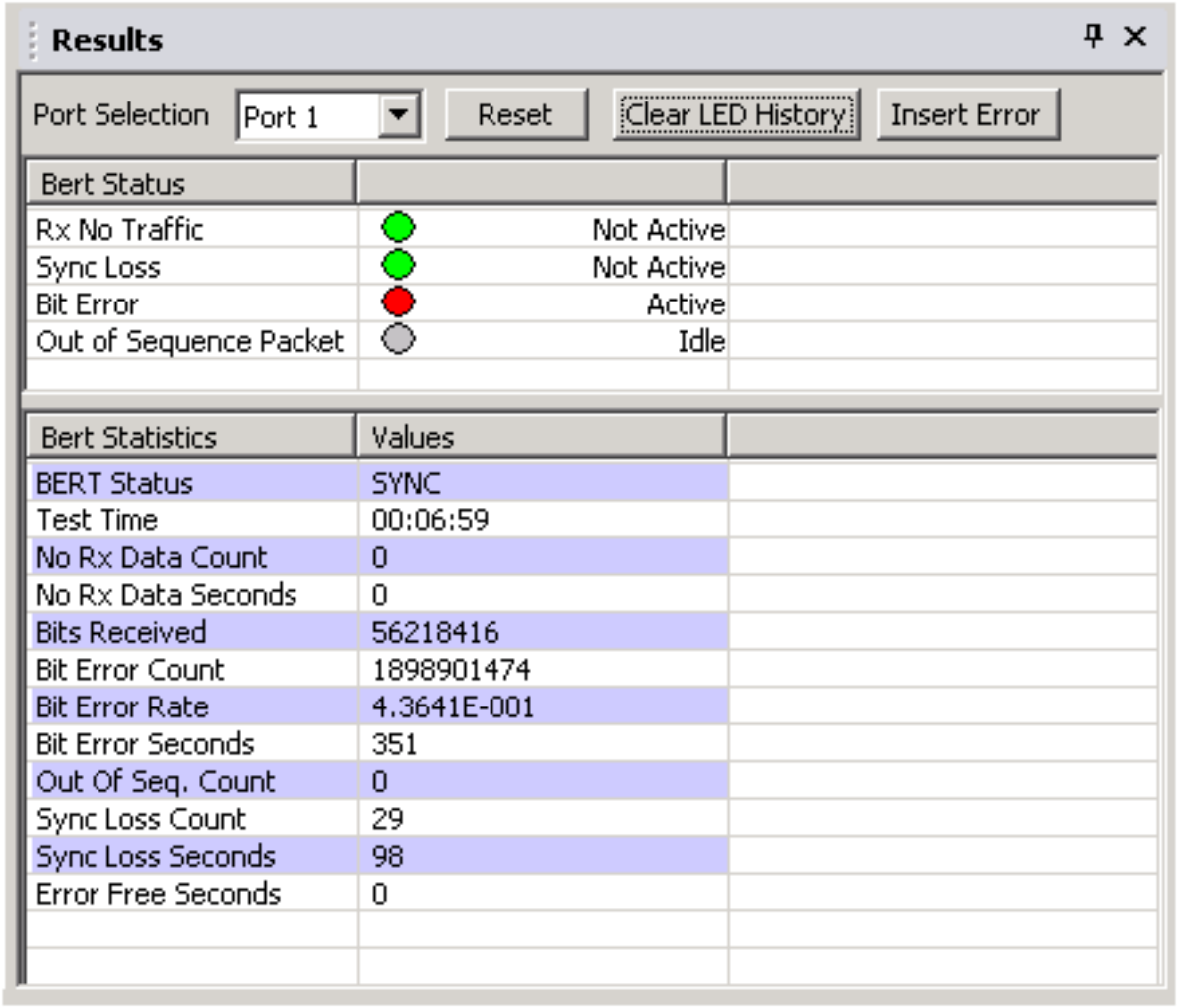
- Frame Length in bytes, ranging from 29 bytes to 1788 for normal frame sizes
- Rate configuration options -
  - % - Bandwidth in Percentage of the Link Speed

    Eg: If the link speed is 1000 Mbps, then 1% would be 10 Mbps
  - Fps – Frames/Sec



Results

- Displays both BERT Status with LEDs and BERT Statistics
- BERT statistics includes BERT status, Test Time, no rx data, no rx data seconds, bits received, bit errors, bit error rate/seconds, Out-of-Seq Count, sync loss count/seconds, and error free seconds
- BERT Status provides a quick view of the test status in the form of Alarm LEDs



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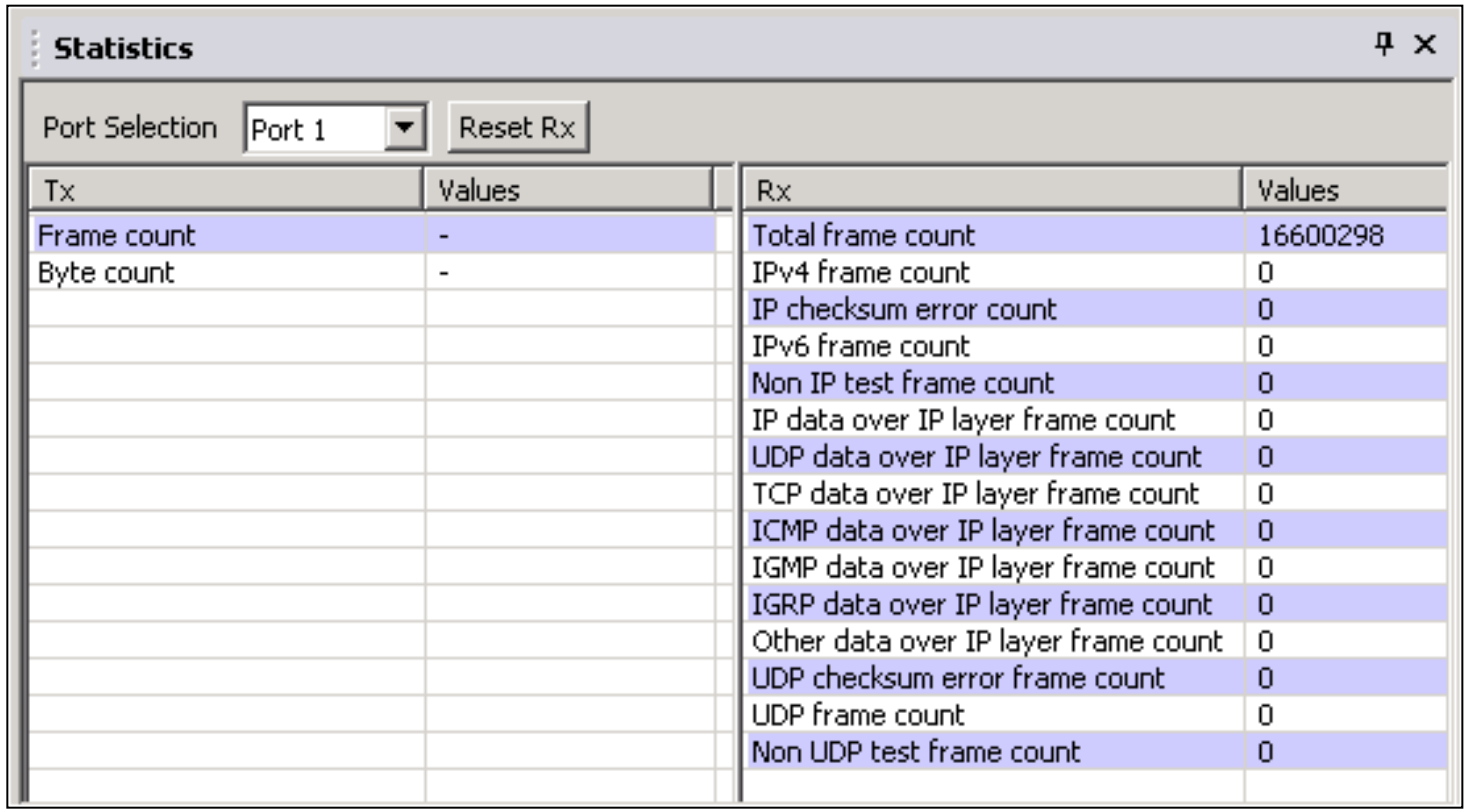
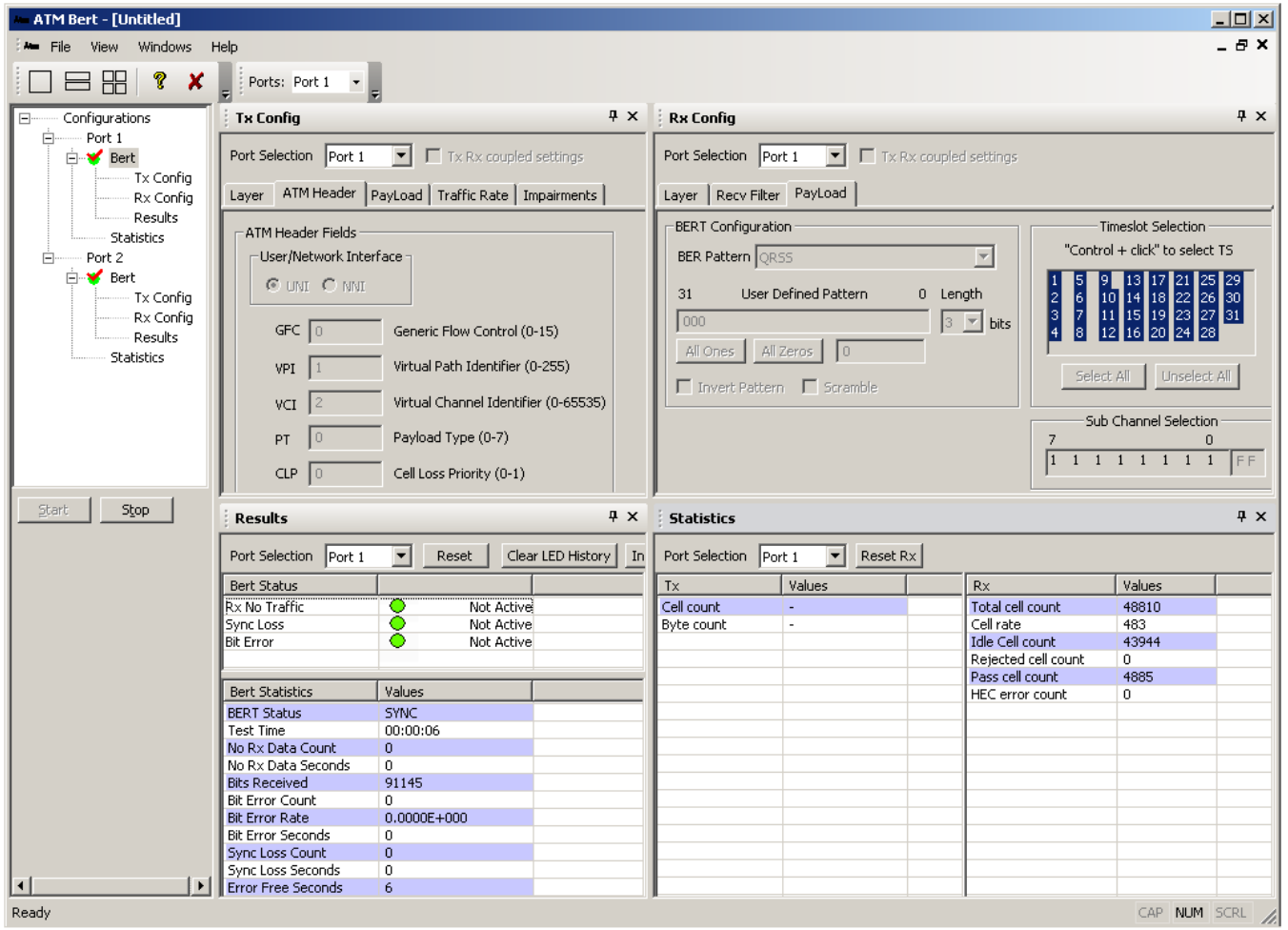
Statistics



- Displays Tx and Rx statistics of the PoS BER test
- Rx statistics includes Total Frame Count, IPv4 Frame Count, IP checksum error count, IPv6 Frame Count, Non IP Test Frame Count, IP data over IP layer, UDP, TCP, ICMP, IGMP, IGRP, Other data over IP layer frame count, UDP checksum error frame count, UDP frame count, Non UDP test frame count

ATM BERT

- Capable of generating /receiving traffic
- Support user-defined ATM header configuration for GFC, VPI, VCI, PT, CLP
- User-defined traffic rate to the accuracy of 1% of total bandwidth
- Supports different QRSS, PRBS patterns 2^9-1, 2^{11}-1, 2^{15}-1, 2^{20}-1, 2^{23}-1, All one's, All zero's, alternate 1's and 0's, 1:1, 1:7, and User -defined pattern (ranging between 3 to 32 bits)
- Supports inverting, and scrambling payload data. Scrambling is according to ITU-T G.804
- Supports single bit error insertion, and error rate insertion
- Provides ATM QoS measurement (bit error count/ rate/seconds, sync Loss, no rx data,…)
- Provides ATM Statistics (total cell count, rejected / pass / idle cell counts, cell rate, and HEC error count)
- Provides throughput details, error, and alarm LEDs for easy analysis
- Supports testing on multiple cards simultaneously with consolidated result view
- Tx and Rx settings for multiple cards can be independently controlled or coupled
- Capable to save and load the configuration settings



Thank you