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# GPRS Protocol Analyzer

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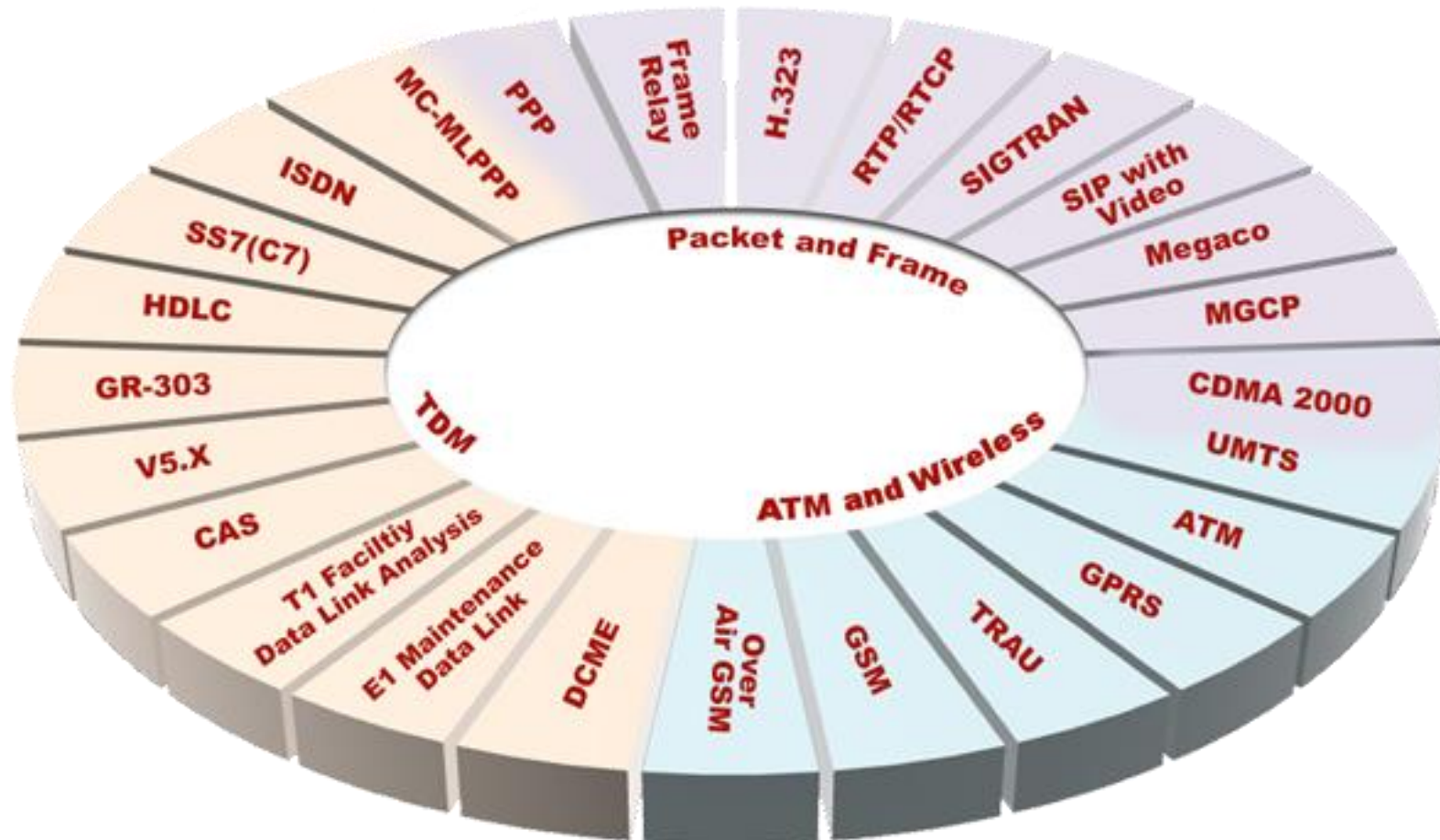
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 ***GL Communications Inc.***

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# TDM, Wireless, and VoIP Protocol Analysis

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



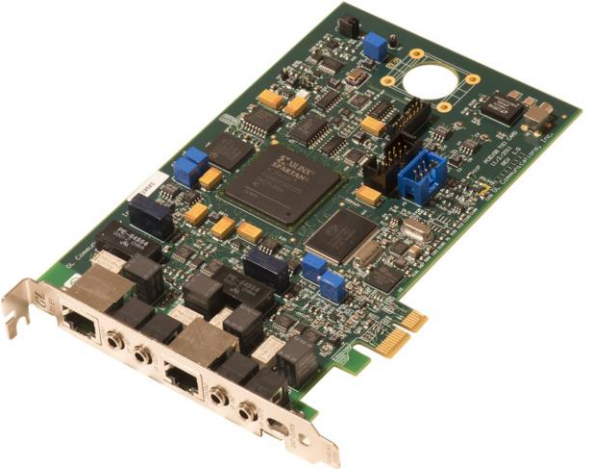
# Supported Platforms



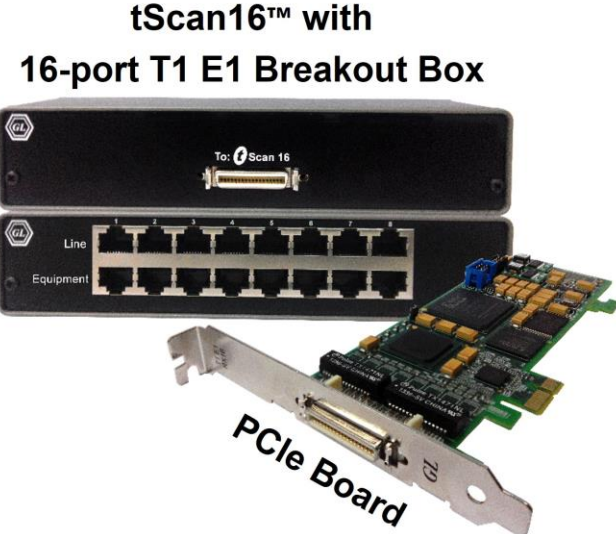
**tProbe™ - Portable USB based T1 E1 VF FXO FXS and Serial Datacom Analyzer**



**Quad / Octal T1 E1 PCIe Card**



**Dual T1 E1 Express (PCIe) Board**

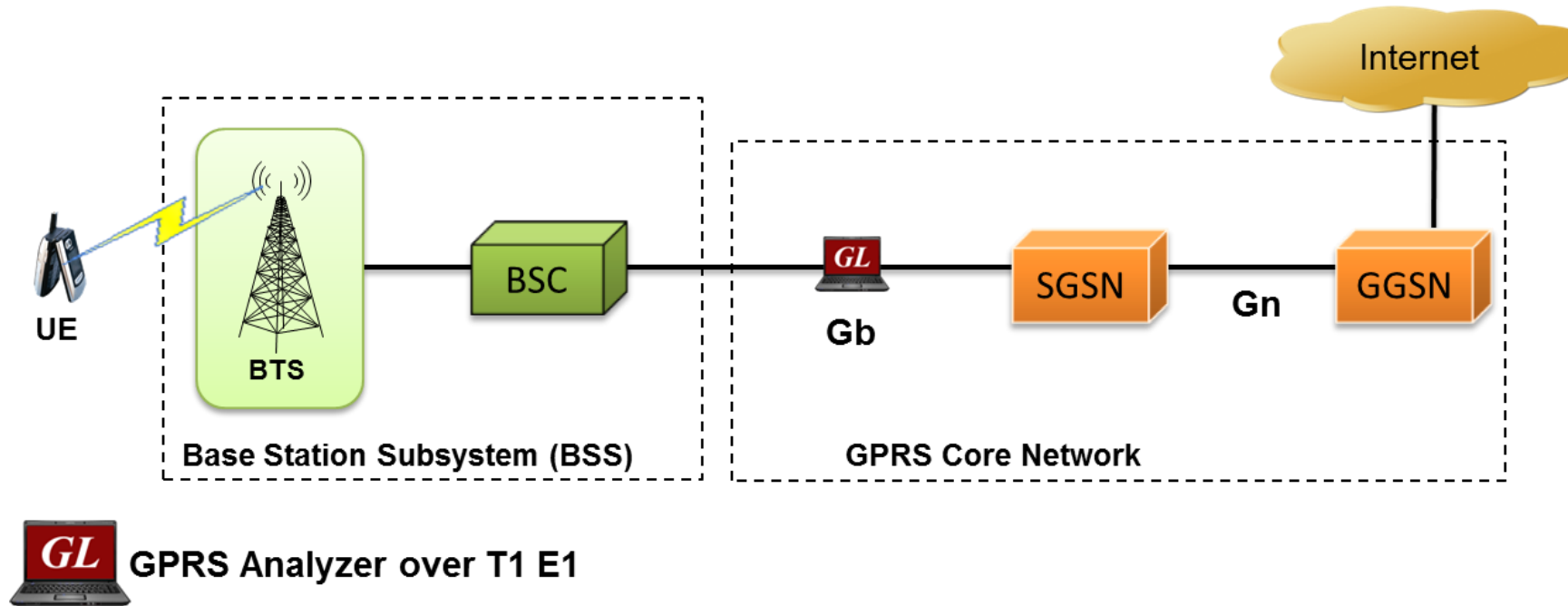


**tScan16™ with 16-port T1 E1 Breakout Box**

**PCIe Board**

# Overview

- GL's GPRS Analyzer performs real time (and offline) analysis across the Gb (T1 E1) interface. The GPRS Analyzer when connected between SGSN and BSS elements of a GPRS network permits the monitoring of Gb interface



# Supported Protocol Standards

| Supported Protocols | Specification Used  |
|---------------------|---|
| LAPF                | Q.922   |
| BSSGP               | 3GPP TS 08.18 V8.10.0   |
| LLC                 | 3GPP TS 04.64 V8.7.0  |
| GMM                 | 3GPP TS 04.08 V7.19.0   |
| SMS                 | 3GPP TS 03.40 V7.5.0 / GSM 03.38 version 7.2.0  |
| TOM                 | 3GPP TS 04.64 V8.7.0 (2001-12)-Annex B  |
| SNDCP               | 3GPP TS 04.64 V8.7.0  |
| SMG                 | 3GPP TS 04.08 V7.19.0   |
| NS                  | GSM 8.16 ETSI TS 101 299 V8.0.0   |
| IP                  | RFC 791   |
| TCP                 | RFC 793   |
| UDP                 | RFC 768   |
| LLC                 | 3GPP TS 04.64 V8.7.0  |
| MAC                 | IEEE 802.3  |
| ICMP                | RFC 792   |
| GTP / GTPv2 / GTP'  | 3GPP TS 09.60 V7.9.0 / 3GPP TS 29.060 V6.5.0 / 3GPP TS 32.005 V3.7.0 and 3GPP TS 32.015 V3.12.0 |

# Features

- Summary View displays GB Interface information such as DLCI, FECN, BECN, SAPI, CTL, Session Mgmt Message etc in a tabular format
- Summary view (Call Quality Matrix) displays complete summary of call information in graphical format, along with a summary of alerts
- Supports filtering and search based on Gb Interface parameters such as Data Link, Network Service, BssGp, LLC, Gprs Mobility/Session Mgmt, SMS, TOM and SNDCCP
- Detail View displays packet by packet statistics for particular call information in tabular format
- Any protocol field can be added to the summary view, filtering, and search features providing users more flexibility to monitor required protocol fields
- Option to combine data from multiple columns under one column
- Option to create multiple aggregate column groups and prioritize the groups as per the requirement to display the summary results efficiently
- Advanced filtering and search based on any user selected protocol fields
- Allows the user to create search/filter criteria automatically from the current screen selection
- Remote monitoring capability using GL's Network Surveillance System





# Different Views

- Summary View displays GB Interface information such as DLCI, FECN, BECN, SAPI, CTL, Session Mgmt Message etc. in a tabular form
- Detail View: This pane displays in detail about a frame in order to analyze and decode by selecting it in the summary view
- Hex Dump View: This pane displays the frame information in HEX and ASCII format
- Statistics View: This pane displays various statistics that are calculated based on the protocol fields



# Offline Analysis

- Off-line analysis is equivalent to 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

The screenshot shows two overlapping windows. The top window is an 'Open' file dialog with 'Look in: GPRS'. It lists three HDL files: Gprs\_Gb\_Capt1.hdl, Gprs\_Gb\_Capt2.HDL, and GPRS\_Gb\_Test1.hdl. The bottom window is the 'GPRS PR GB Protocol Analysis GB Interface 64-bit' GUI. It features a menu bar (File, View, Capture, Statistics, Database, Call Detail Records, Configure, Help) and a toolbar. A table displays captured frames with the following data:

| Dev | TSlot | SubCh | Frame# | TIME (Relative) | Len | Error | TLLI value BssGp | TMSI BssGp | IMSI Identity BssGp | Mobile GH |
|-----|-------|-------|--------|-----------------|-----|-------|------------------|------------|---------------------|-----------|
| 2   | 0-23  |       | 3      | 00:00:00.548666 | 71  |       | 3780573050       |            | 466921201213076     | xE19CD4   |
| 2   | 0-23  |       | 4      | 00:00:00.586213 | 19  |       | 2699313018       |            |                     |           |
| 2   | 0-23  |       | 5      | 00:00:00.764218 | 19  |       | 3779520890       |            |                     |           |
| 2   | 0-23  |       | 6      | 00:00:00.878963 | 26  |       | 3780452986       |            |                     |           |
| 2   | 0-23  |       | 7      | 00:00:01.091817 | 71  |       | 3780475770       |            | 466921304859061     | xE19CE0   |

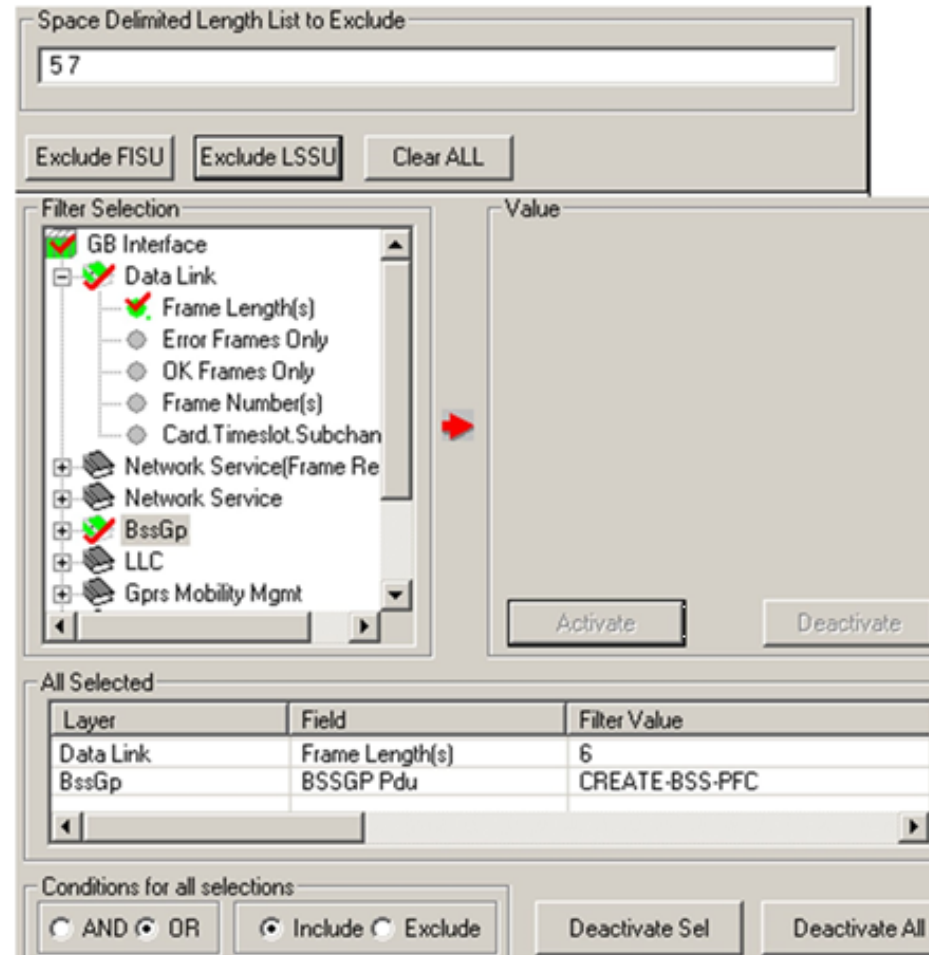
Below the table, the GUI shows 'Card2 TimeSlots=0-23 Frame=3 at 00:00:00.548666 OK Len=71' and 'HDL Frame Data + FCS'. A hex dump of the frame data is displayed, followed by a summary table:

| Device # | Frame Count(Device #) |
|----------|-----------------------|
| 2        | 192                   |
| total 2  | 192                   |

At the bottom, there is a table with columns: Call ID, Call Status, DevNo, TS, Call Start Date & Time, Call Duration, BVCI, TLLI, IMSI, Call Type. The status bar shows 'C:\Program Files\GL Communications\Incl\U: 192 Frames'.

# Filtering and Search

- Isolates required frames from all frames in real-time, as well as offline
- The frames can also be filtered after completion of capture based on Frame Number, Time, C/R, SAPI, CTL and more. Similarly, search capability helps user to search for a particular frame based on specific search criteria



# Filtering Criteria From Screen Selection

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

Use Ctrl, Shift for Extended Selection

|     |      |   |                 |     |            |                   |
|-----|------|---|-----------------|-----|------------|-------------------|
| ✓ 2 | 0-23 | 0 | 00:00:00.000000 | 19  | 3780682106 | (000010010001007) |
| ✓ 2 | 0-23 | 1 | 00:00:00.155843 | 121 | 3747714426 | (000010010001007) |
| ✓ 2 | 0-23 | 2 | 00:00:00.350083 | 18  | 3779291258 | (000010010001007) |
| ✓ 2 | 0-23 | 3 | 00:00:00.548666 | 71  | 3780573050 | (000010010001007) |
| ✓ 2 | 0-23 | 4 | 00:00:00.586213 | 19  | 2699313018 | (000010010001007) |
| ✓ 2 | 0-23 | 5 | 00:00:00.764218 | 19  | 3779520890 | (000010010001007) |

Search Selected Value  
Set Search Criteria as Sel Values  
Set Filter Criteria as Sel Values

BssGp::IMSI Identity  
BssGp::TLLI value

OK Select All Cancel

Analyzer GUI and Protocol Configuration  
Save Load Default

Select summary columns to di...  
Menu checked options  
Protocol standard selection  
Network/User side selection  
Time Format  
View Filter  
View Search  
TCP Connection Options  
Periodic Trace Saving Options  
Startup Options  
Data Link Groups  
View Font Size  
INI Decode Options  
Define Summary Columns  
Aggregate Summary Columns  
Capture Options

Filter Selection  
GB Interface  
Data Link  
LAPF  
NS  
BssGp  
LLC  
GMM  
SM  
SMS  
TOM  
SNDP

Value Selection

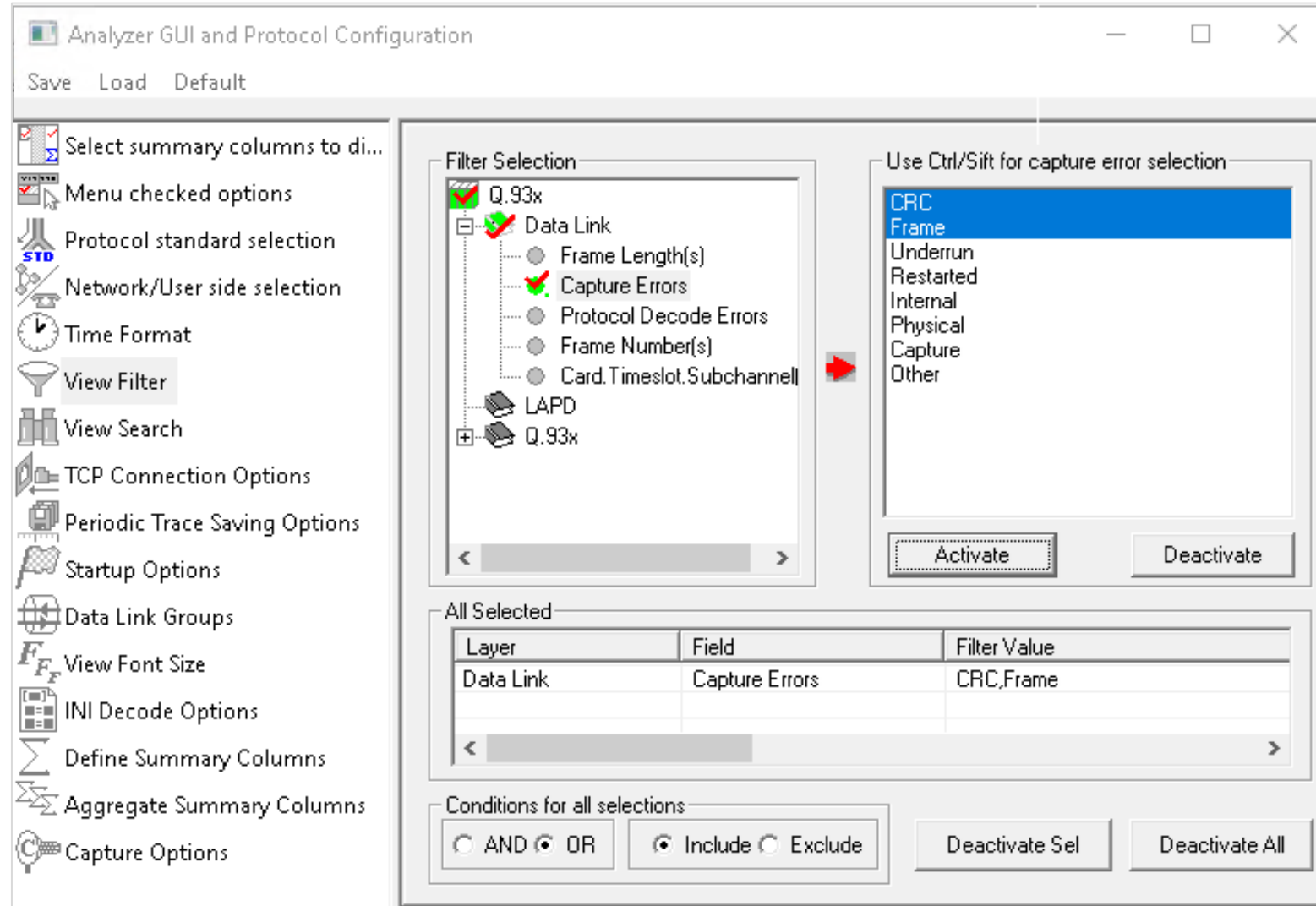
Activate Deactivate

| All Selected |               |                 |
|--------------|---------------|-----------------|
| Layer        | Field         | Search Value    |
| BssGp        | IMSI Identity | 466921304023437 |

Conditions for all selections  
 AND  OR  Include  Exclude Deactivate Sel Deactivate All

# Search Options

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



# Search Criteria From Screen Selection

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

Use Ctrl, Shift for Extended Selection

|   |   |      |   |                 |     |            |                 |
|---|---|------|---|-----------------|-----|------------|-----------------|
| ✓ | 2 | 0-23 | 0 | 00:00:00.000000 | 19  | 3780682106 |                 |
| ✓ | 2 | 0-23 | 1 | 00:00:00.155843 | 121 | 3747714426 | 466921304023437 |
| ✓ | 2 | 0-23 | 2 | 00:00:00.350083 | 18  | 3779291258 |                 |
| ✓ | 2 | 0-23 | 3 | 00:00:00.548666 | 71  | 3780573050 |                 |
| ✓ | 2 | 0-23 | 4 | 00:00:00.586213 | 19  | 2699313018 |                 |
| ✓ | 2 | 0-23 | 5 | 00:00:00.764218 | 19  | 3779520890 |                 |

Search Selected Value  
Set Search Criteria as Sel Values  
Set Filter Criteria as Sel Values

BssGp::IMSI Identity  
BssGp::TLLI value

OK Select All Cancel

Analyzer GUI and Protocol Configuration  
Save Load Default

Select summary columns to di...  
Menu checked options  
Protocol standard selection  
Network/User side selection  
Time Format  
View Filter  
View Search  
TCP Connection Options  
Periodic Trace Saving Options  
Startup Options  
Data Link Groups  
View Font Size  
INI Decode Options  
Define Summary Columns  
Aggregate Summary Columns  
Capture Options

Filter Selection  
GB Interface  
Data Link  
LAPF  
NS  
BssGp  
LLC  
GMM  
SM  
SMS  
TOM  
SNDPCP

Value Selection

Activate Deactivate

All Selected

| Layer | Field         | Search Value    |
|-------|---------------|-----------------|
| BssGp | IMSI Identity | 466921304023437 |

Conditions for all selections:  
 AND  OR  Include  Exclude  
Deactivate Sel Deactivate All

# Statistics

- Statistics is an important feature available in GPRS analyzer and can be obtained for all frames both in real-time as well as offline mode

The screenshot displays the 'Statistics' dialog box in the GPRS PR GB Protocol Analysis GB Interface software. The dialog box is divided into several sections:

- Field Names:** A tree view showing the protocol layers: Physical Link (Device #, Error Code, StartTOrTSc, Time Stamp), Network Service(Frame Relay), Network Service, BssGp (A bit, A5/1-5/7 encryption algorithms, Access Technology Type).
- Device #:** A dropdown menu with 'Total' selected.
- Use Type (single selection):** A dropdown menu with 'Key' selected.
- Statistic Type(s) (calculated, multiple selection):** A list box containing 'Frame Count', 'Frame Percent', 'Byte Count', and 'Byte Percent'.
- Range List:** An empty text box.
- Buttons:** 'Add/Mod' and 'Remove' buttons.
- Selected Statistic Information:** A table with columns: Layer, Field Name, Use Type, Statistic Type, and a 'Remove Sel' button.
 

| Layer        | Field Name | Use Type | Statistic Type |
|--------------|------------|----------|----------------|
| Physical ... | Device #   | Total    | Frame Count    |
| BssGp        | PDU Type   | Key      | Frame Count    |
- Buttons:** 'Remove All' and 'Apply' buttons.

The main interface shows a menu bar (File, View, Capture, Statistics, Database, Call Detail Records, Configure, Help) and a toolbar. Below the toolbar is a frame list table:

| Dev | TS   | Su... | Frame# | TIME (Relative) | Len | DLCI | BE... | FECN | NS... | BS... | C/...  | SAPI  | CTL       |
|-----|------|-------|--------|-----------------|-----|------|-------|------|-------|-------|--------|-------|-----------|
| 2   | 0-23 |       | 0      | 00:00:00.000000 | 19  | 172  | 0     | 0    | NS... | FL... |        |       |           |
| 2   | 0-23 |       | 1      | 00:00:00.155843 | 121 | 172  | 0     | 0    | NS... | DL... | Res... | LL3   | UI For... |
| 2   | 0-23 |       | 2      | 00:00:00.350083 | 18  | 172  | 0     | 0    | NS... | FL... |        |       |           |
| 2   | 0-23 |       | 3      | 00:00:00.548666 | 71  | 172  | 0     | 0    | NS... | DL... | Res... | LLGMM | UI For... |

Below the frame list is a summary table:

| Device # | PDU Type                 | Frame Count(PDU Ty... |
|----------|--------------------------|-----------------------|
| 2        | DL-UNITDATA (0)          | 89                    |
| 2        | SUSPEND-ACK (12)         | 6                     |
| 2        | FLOW-CONTROL-MS-ACK (41) | 55                    |
| 2        | FLUSH-LL (42)            | 39                    |
| total 2  | Total                    | 189                   |

At the bottom, there is a call list table:

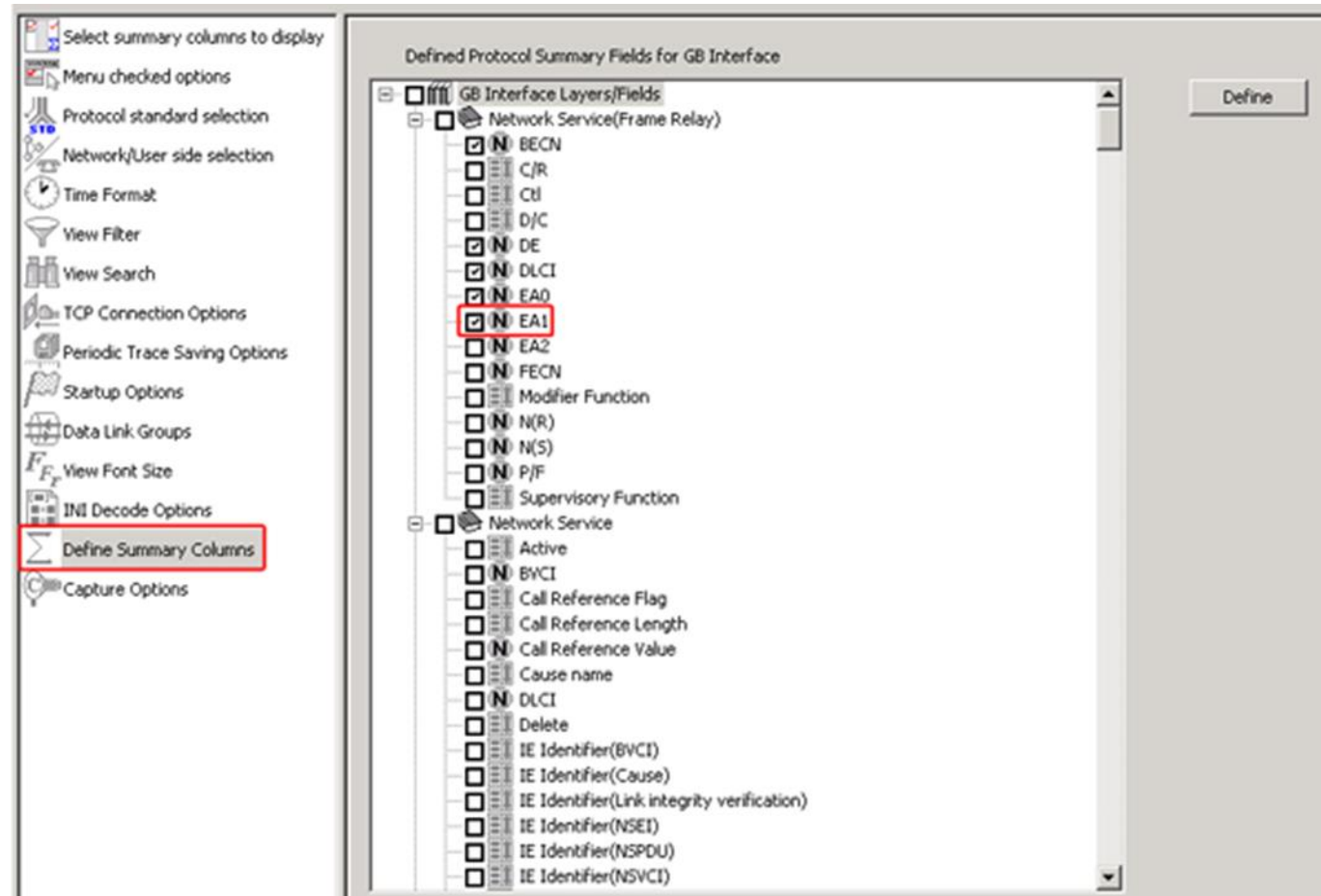
| Call ID | Call Status | DevNo | TS | Call Start Date & Time     | Call Duration   | BVCI | TLLI     | IL |
|---------|-------------|-------|----|----------------------------|-----------------|------|----------|----|
| A 0     | active      | 2     | 0  | 2004-03-03 20:08:19.885645 | 00:00:27.521911 | 116  | 37805... |    |
| A 1     | active      | 2     | 0  | 2004-03-03 20:08:20.428796 | 00:00:26.978760 | 384  | 37804... |    |
| A 2     | active      | 2     | 0  | 2004-03-03 20:08:22.184479 | 00:00:25.223078 | 72   | 37796... |    |
| A 3     | active      | 2     | 0  | 2004-03-03 20:08:23.064062 | 00:00:24.343494 | 402  | 27063... |    |
| A 4     | active      | 2     | 0  | 2004-03-03 20:08:23.166442 | 00:00:24.241114 | 116  | 27071... |    |
| A 5     | active      | 2     | 0  | 2004-03-03 20:08:23.656895 | 00:00:23.750661 | 29   | 27064... |    |

The status bar at the bottom indicates 'D:\Program Files\GL Communicat | 192 Frames'.



# Define Summary Columns

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



# Aggregate Summary Column

- The user can use this option to combine the two or more summary columns and remove unnecessary empty columns into a single Aggregate Summary Column

The screenshot shows the 'Aggregate Summary Columns' dialog box in the foreground. The dialog has a menu on the left with options like 'Select summary columns to di...', 'Menu checked options', 'Protocol standard selection', etc. The main area of the dialog contains a table with the following data:

| Name         | Display Format | Summary Columns                        | Separator |
|--------------|----------------|--|-----------|
| Message Type | Concat         | Message Type_NS<br>IMSI Identity_BssGp | &         |

Below the dialog, the main application window displays a table of protocol analysis data. A red box highlights the 'Message Type' column in the table below:

| Dev | TSlot | SubCh | Frame# | TIME (Relative) | Len | Message Type    | Error | TLLI value BssGp | TMSI BssGp | IMSI Identity BssGp |
|-----|-------|-------|--------|-----------------|-----|-----------------|-------|------------------|------------|---------------------|
| 2   | 0-23  |       | 0      | 00:00:00.000000 | 19  |                 |       | 3780682106       |            |                     |
| 2   | 0-23  |       | 1      | 00:00:00.155843 | 121 | 466921304023437 |       | 3747714426       |            | 466921304023437     |
| 2   | 0-23  |       | 2      | 00:00:00.350083 | 18  |                 |       | 3779291258       |            |                     |
| 2   | 0-23  |       | 3      | 00:00:00.548666 | 71  | 466921201213076 |       | 3780573050       |            | 466921201213076     |
| 2   | 0-23  |       | 4      | 00:00:00.586213 | 19  |                 |       | 2699313018       |            |                     |
| 2   | 0-23  |       | 5      | 00:00:00.764218 | 19  |                 |       | 3779520890       |            |                     |
| 2   | 0-23  |       | 6      | 00:00:00.878963 | 26  |                 |       | 3780452986       |            |                     |
| 2   | 0-23  |       | 7      | 00:00:01.091817 | 71  | 466921304859061 |       | 3780475770       |            | 466921304859061     |
| 2   | 0-23  |       | 8      | 00:00:01.100932 | 18  |                 |       | 3780475770       |            |                     |
| 2   | 0-23  |       | 9      | 00:00:01.328770 | 19  |                 |       | 2700901242       |            |                     |
| 2   | 0-23  |       | 10     | 00:00:01.451817 | 121 | 466921304023437 |       | 3747714426       |            | 466921304023437     |
| 2   | 0-23  |       | 11     | 00:00:02.073760 | 48  | 466921304610519 |       | 2706494330       |            | 466921304610519     |
| 2   | 0-23  |       | 12     | 00:00:02.081062 | 18  |                 |       | 2706494330       |            |                     |
| 2   | 0-23  |       | 13     | 00:00:02.152458 | 18  |                 |       | 2706494330       |            |                     |

Below the table, there is a detailed view of the HDLC frame data for the selected frame (Frame 0):

```

Card2 TimeSlots=0-23 Frame=0 at 00:00:00.000000 OK Len=19
HDLC Frame Data + FCS
----- LAF Layer -----
0000 EA0 = .....0 (0)
0000 C/R = .....0 Command(User), Response(Network)
0000 DLCI = 172 (001010.. 1100....)
0001 EA1 = .....1 (1)
0001 DE = .....0 (0)
0001 BECN = .....0 (0)
0001 FECH = .....0 (0)
----- NS Layer -----
    
```

# Aggregate Summary Column Group

- The user can create multiple aggregate column groups and prioritize the groups as per the requirement to display the summary results efficiently

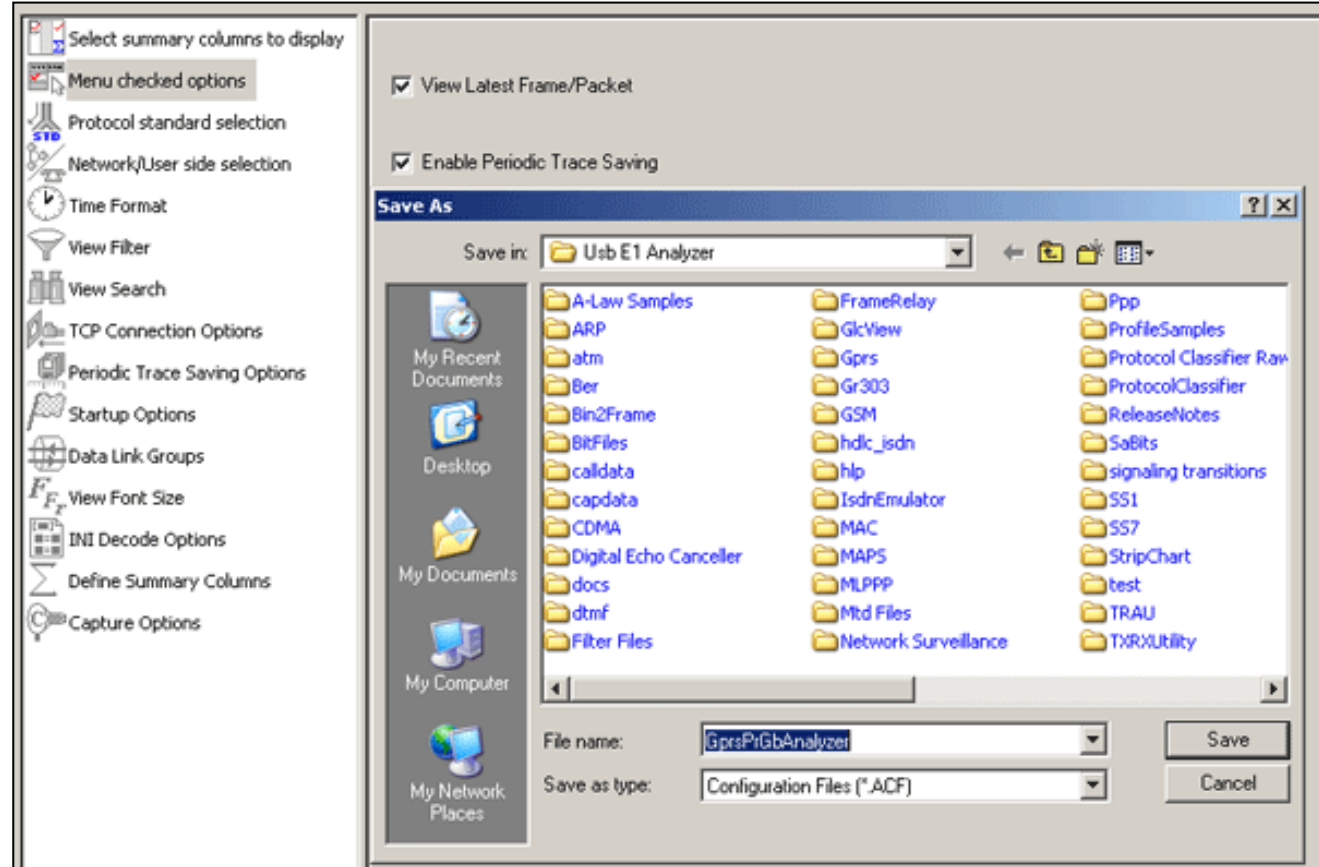
The screenshot shows the 'Aggregate Summary Columns' dialog box in the top left, which allows users to define custom summary columns. The dialog has buttons for 'Add', 'Delete', 'Aliases', 'Reorder', and 'Reverse'. Below these buttons is a table with the following data:

| Name    | Display Format   | Summary Columns                   | Separator |
|---------|------------------|-----------------------------------|-----------|
| Group~0 | Concat           | TMSI_BssGp<br>Mobile Identity_GMM | ---->     |
| Group~1 | Overlay          | IMSI Identity_BssGp               | &         |
| Group~2 | <Col_Alias>Value | Message_Type_NS                   |           |

The main window displays a protocol analysis table with the following columns: Dev, TSslot, SubCh, Frame#, TIME (Relative), Len, Group~0, Error, TLLI value BssGp, TMSI BssGp, and IMSI Identity BssGp. A red box highlights the 'Group~0' column, which contains concatenated values of TMSI and Mobile Identity. Below the table, the packet details for Frame 0 are shown, including HDLC Frame Data and NS Layer details.

# Save/Load All Configuration Settings

- Protocol Configuration window provides a consolidated interface for all the settings required in the analyzer such as protocol selection, filter criteria, search criteria, and so on
- Configuration settings can be saved to a file, loaded from a configuration file, or user may just revert to the default values using the default option



**Thank You!**