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# CDMA2000 Protocol Analyzer

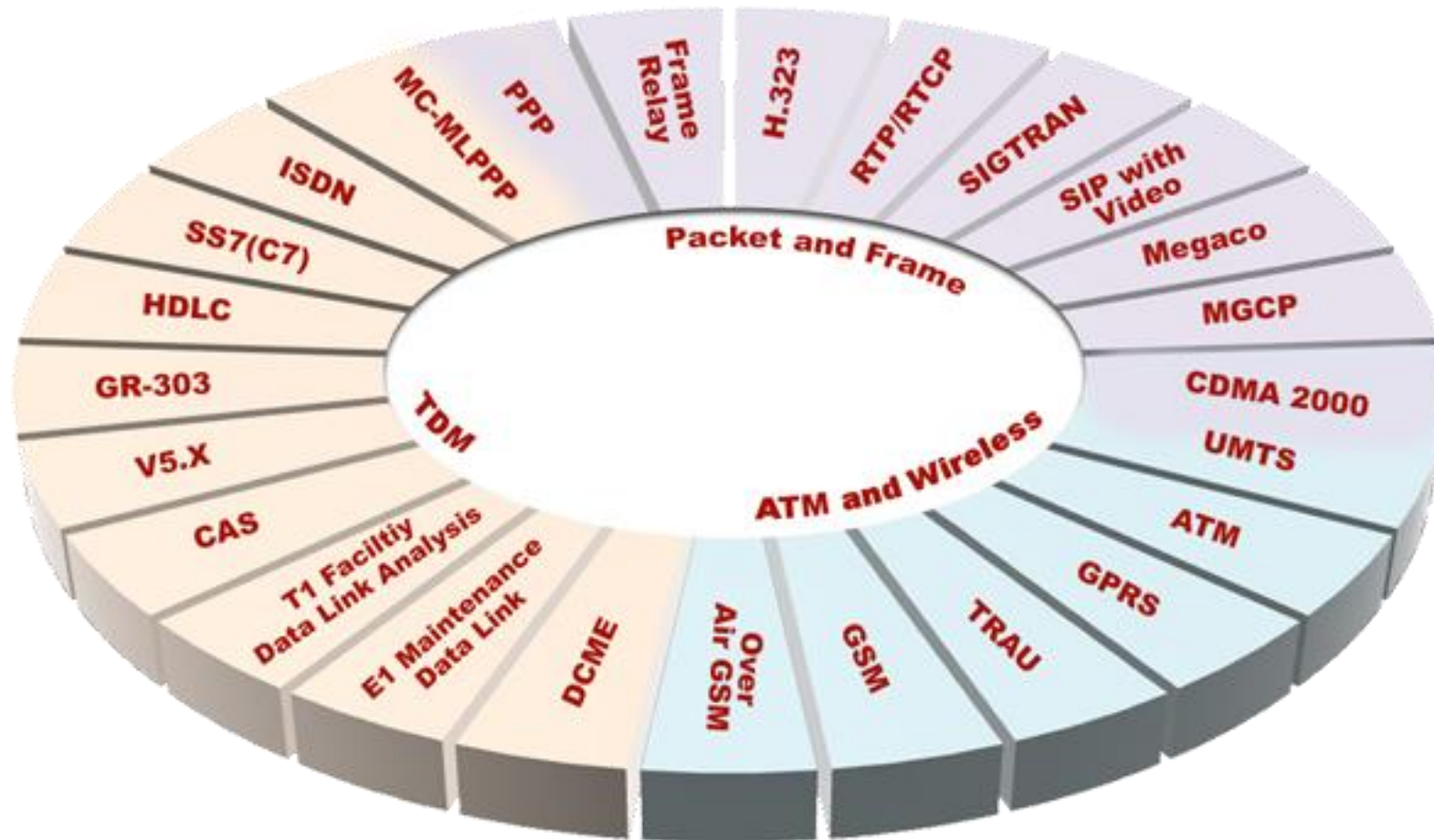
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# TDM, Wireless, and VoIP Protocol Analysis

- 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



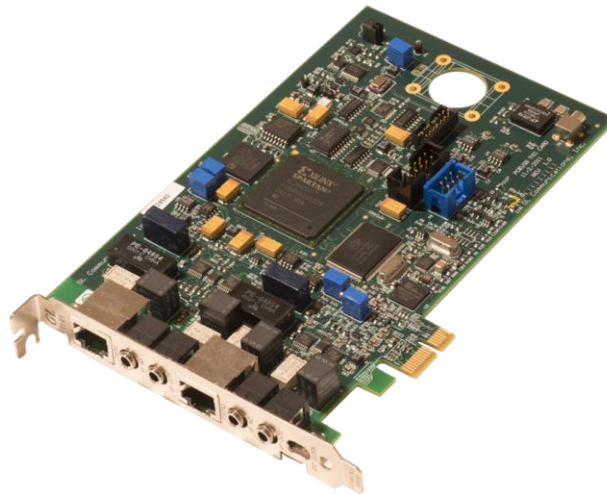
Front Panel

Back Panel

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

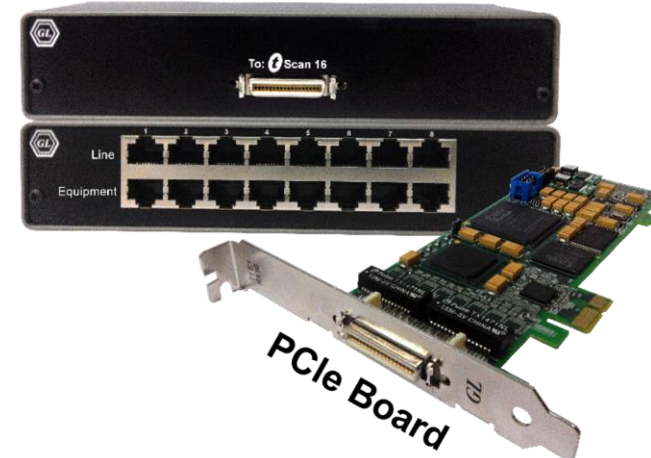


**Quad / Octal T1 E1 PCIe Card**



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

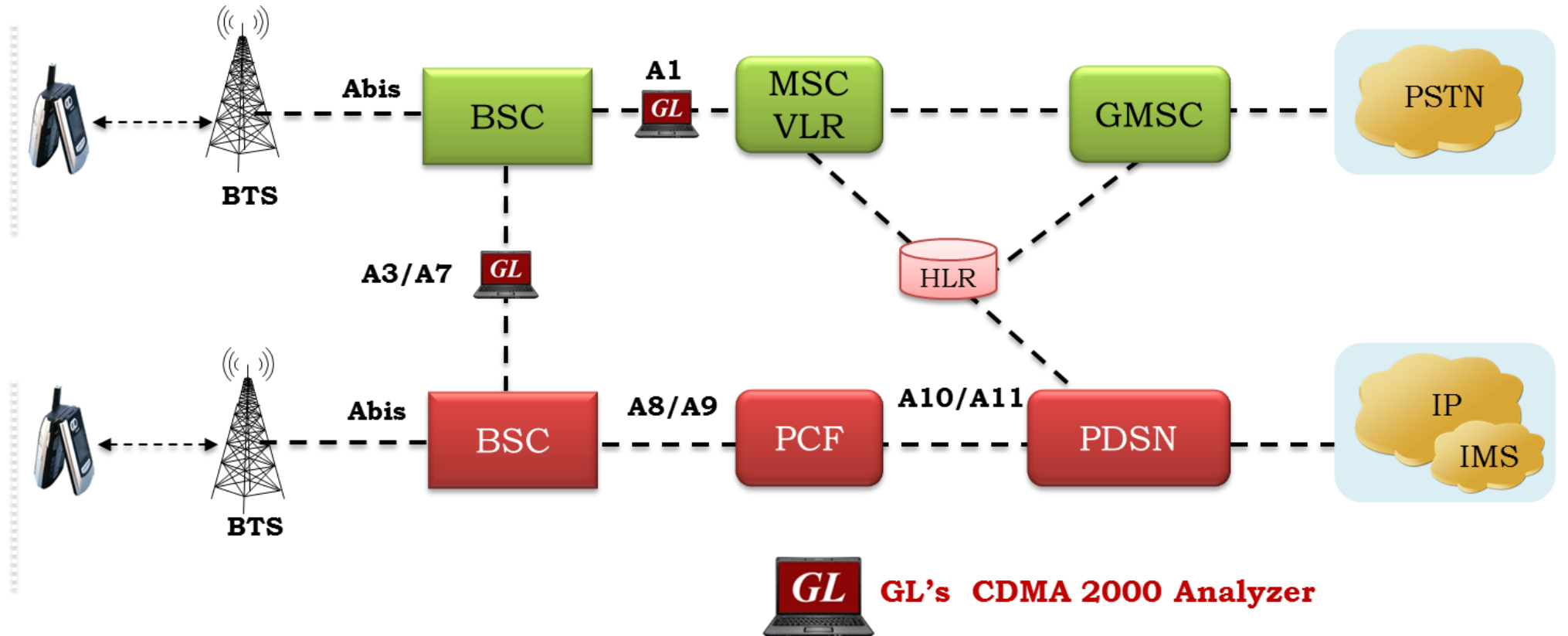
**tScan16™ with  
16-port T1 E1 Breakout Box**



**PCIe Board**

# Overview

GL's CDMA analyzer is used to analyze and view protocols across A, Ater, Aqinter, and Aquater signaling interfaces



# Supported Protocols

- BSAP, MTP2 (ITU), MTP3 (ITU)
- MTP3 (ANSI), SCCP Management
- SCCP ITU, SCCP ANSI
- Test and Network Management Messages (ITU)
- Test and Network Management Messages (ANSI)

Available Standards	Supported Protocols	Specification Used
A1 Interface (ANSI)	BSAP	3GPP2 A.S0014-A, Version 2.0.1 July 2003
A1 Interface (ITU)	MTP2 (ITU)	ITU-T Q.703
A3/A7 Interface	MTP3 (ITU)	ITU-T Q.704
	MTP3 (ANSI)	ANSI T1.111-1996
	SCCP Management	ITU-T Q.711 (07/96)
	SCCP ITU	ITU-T Q.711 to Q.714
	SCCP ANSI	ANSI T1.112
	Test & Network Management Messages (ITU)	ITU-T Q.703, Q.704
	Test & Network Management Messages (ANSI)	ANSI T1.111.4, ANSI T1.111.7
	A3/A7 Interface	3GPP2 A.S0015-C, Version 1,0 February 2005
	ATM	ITU-T I.361
	AAL	ITU-T I.363
	SSSAR	ITU-T I.366.1
	AAL2	Class B (ITU-T I.363.2)
	AAL5	Class C & D (ITU-T I.363.5)
	IP	RFC 791
	TCP	RFC 793
	MAC	IEEE 802.3
	IP	RFC 791
	TCP	RFC 793
	UDP	RFC 768

# Features

- Summary View displays Device Number, Time Slots: Sub channels, Frame number, Time, Frame length, and 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
- 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

# Features (Contd.)

- For A1 interface, streams can be captured on the selected time slots (contiguous or non-contiguous), sub-channels or full bandwidth
  - Frames captured can be filtered real-time based on length of frames (FISSU – Length as 5 and LSSU – Length as 7) can be set
  - Data transmission rate starting from 8kbps to N\*64kbps is supported
  - Timeslot's selection can be contiguous or non – contiguous
  - Supports decoding of frames with FCS of 16 bits and 32 bits, or none
  - Call Detail Recording feature includes 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
- For A3 A7 interface, Streams may be captured on the selected time slots (contiguous or non-contiguous) and on full bandwidth
  - Captures, decodes, filters, and reassembles (with or without Inverse Multiplexing option) AAL-2 and AAL-5 frames in real-time, from within the ATM cells according to user defined VPI/VCi
  - Real-time capturing requires user to specify timeslots, bit inversion, octet bit reversion, user/network side, ATM mapping, scrambling, and inverse multiplexing options
  - Streams may be captured on the selected time slots (contiguous or non-contiguous) and on full bandwidth
  - Unscrambling of ATM cells based on SDH X43 + 1 algorithm



# Real-time Analysis

CDMA Protocol Analysis A1 Interface(ANSI) 64-bit

File View Capture Statistics Database Call Detail Records Configure Help

Dev TSlot SubCh Frame# TIME (Relative) Len Error BSMAP Message Type BSAP DTAP Message Type BSAP Type of Identity BSAP Electronic Serial Number BSAP

Dev	TSlot	SubCh	Frame#	TIME (Relative)	Len	Error	BSMAP Message Type BSAP	DTAP Message Type BSAP	Type of Identity BSAP	Electronic Serial Number BSAP
✓ 1	17-18		0	00:00:00.000000	86		Complete Layer 3 Information	CM Service Request	ESN	1190078268
✓ 2	17-18		1	00:00:00.000000	22					
✓ 2	17-18		2	00:00:00.000000	55		Assignment Request			
✓ 1	17-18		3	00:00:00.000000	36		Assignment Complete			

Card1 TimeSlots=17-18 Frame=0 at 00:00:00.000000 OK Len=86

HDLCL Frame Data + FCS

----- MTP2 Layer -----

0000 BSN = .1101000 (104)

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

0001 FSN = .0011001 (25)

0001 FTR = 1 (1)

Hex Dump of the Frame Data

Hex	ASCII
E8 99 3A 83 FE A3 D3 E9 A3 D3 0D 01 48 03 F0 02	èl:lpéOééO H 8
02 04 02 C1 FC 04 05 C3 DE E9 A3 D3 0F 36 00 34	Äü ÄpééO 6 4
57 05 03 02 FF F6 17 2C 03 00 24 91 0F 42 00 47	W yö , \$' B G
00 02 01 FF 02 03 01 04 07 02 09 05 08 1E 23 45	y #E
67 89 AB CD EF 5E 06 A5 01 23 45 67 89 0D 05 05	gll<fi^ #Eg
46 EF 27 3C 4C 23	Fi'<L#

Device #	Frame Count(Device #)
1	5
total 1	5
2	5
total 2	5

Call ID	Call Status	Call Start Date & Time	Call Duration	DevNo	TS	OPC	DPC	Call Type	Mob.Identity	Called Number	Release Cause
0	completed	47776-62623-00 3704:6232...	00:00:00.000000	1	17	211....	211....	Mobile Ori...	132547698bad...	1032547698	SCCP user origi...

C:\Program Files\GL Communications Inc\U: 10 Frames

Summary View

Detail View

Hex Dump View

Statistics View

Call Trace View



# Different Views

- Summary View: This pane displays the columns that contain Card Number, Timeslots, Frame Number, BSMAP Message Type, DTAP Message Type Frame Error Status, 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
- 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 displays the 'Open' dialog box on the left and the main analysis window on the right.

**Open Dialog:**

- Look in: CDMA
- Files of type: HDLC Files (\*.\*)
- File name: A1\_Cdma\_Call.hdl
- ☐ Open as read-only

**CDMA Protocol Analysis A1 Interface(ANSI) 64-bit Main Window:**

Dev	TSlot	SubCh	Frame#	TIME (Relative)	Len	Error	BSMAP Message Type BSAP	DTAP Message Type BSAP	Type of Identity BSAP	Electronic Serial No. BSAP
✓ 1	17-18		0	00:00:00.000000	86		Complete Layer 3 Information	CM Service Request	ESN	1190078268
✓ 2	17-18		1	00:00:00.000000	22					
✓ 2	17-18		2	00:00:00.000000	55		Assignment Request			
✓ 1	17-18		3	00:00:00.000000	36		Assignment Complete			
✓ 2	17-18		4	00:00:00.000000	29			Connect		
✓ 1	17-18		5	00:00:00.000000	30		Clear Request			
✓ 2	17-18		6	00:00:00.000000	30		Clear Command			
✓ 1	17-18		7	00:00:00.000000	24		Clear Complete			
✓ 2	17-18		8	00:00:00.000000	22					
✓ 1	17-18		9	00:00:00.000000	20					

Card1 TimeSlots=17-18 Frame=0 at 00:00:00.000000 OK Len=86

HDLC Frame Data + FCS

```
----- MTP2 Layer -----
0000 BSN = .1101000 (104)
0000 BIB = 1..... (1)
0001 FSN = .0011001 (25)
0001 FIB = 1..... (1)
0002 LI = ..111010 MSU Format
----- MTP3 ANSI Layer -----
0003 Service Indicator = ....0011 SCCP
0003 Priority Code = ..00.... Priority Code 0
0003 Sub-service field = 10..... National Network
0004 DPC = 211.163.254(11111110 10100011 11010011)
0007 OPC = 211.163.233(11101001 10100011 11010011)
```

Off-line Viewing. C:\Program Files\GL Communications Inc\U: 10 Frames

# Decode Settings

Configuration Editor of CDMA-A3A7 Analyzer. C:\Program Files (x86)\GL Com...

Configuration Attributes

▲ A3

VPI:	110
VCI:	25399
SIGNO:	2
A3IOSIP.0:	17.34.51.68
A3IOSPORT.0:	43707
A3IOSIP.1:	18.19.20.21
A3IOSPORT.1:	61183

▲ A7

VPI:	15
VCI:	24570

Configuration Attributes

Apply Default Expand Collapse Exit

Configuration Editor of CDMA-A1 Analyzer. C:\Program Files (x86)\GL Commun...

Configuration Attributes

▲ CDMA-A1

Point Code Notation:	DOT
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Configuration Attributes

Apply Default Expand Collapse Exit

# Filtering and Search

- Isolates required frames from all frames in real-time, as well as offline
- For A1, real-time capturing filter based on length of frames can be set. For A3 and A7 interfaces, users can also specify custom VPI, VCI, and PT type values to filter and reassemble frames during real-time capture

The screenshot displays a software interface for filtering and searching data frames. It is divided into several sections:

- Space Delimited Length List to Exclude:** A text input field containing the value "5 7". Below it are three buttons: "Exclude FISU", "Exclude LSSU", and "Clear ALL".
- Filter Selection:** A tree view showing a hierarchy of protocol layers. The "A1 Interface(ITU)" is expanded, showing sub-items: "Data Link", "MTP2", "BSN", "BIB", "FSN", "FIB", and "Status Field". "MTP2", "BSN", and "BIB" are checked with green checkmarks. A red arrow points from this section towards the "BIB Value" field.
- BIB Value:** A text input field containing the value "1". Below it are "Activate" and "Deactivate" buttons.
- All Selected:** A table showing the selected filters and their values.

Layer	Field	Filter Value
MTP2	BSN	25
MTP2	BIB	1

Below the table is a section for "Conditions for all selections" with radio buttons for "AND" (selected) and "OR", and "Include" (selected) and "Exclude". At the bottom right are "Deactivate Sel" and "Deactivate All" buttons.

# Filtering Criteria From Screen Selection

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

The screenshot illustrates the process of creating filter criteria from a screen selection in a network analyzer. It shows a table of network events, a dialog box for selecting filter criteria, and the main analyzer GUI with the filter applied.

**Table 1: Network Events**

✓	1	17-18	0	00:00:00.000000	86	Complete Layer 3 Information	CM Service Request	ESN
✓	2	17-18	1	00:00:00.000000	22			
✓	2	17-18	2	00:00:00.000000	55	Assignment Request		
✓	1	17-18	3	00:00:00.000000	36	Assignment Complete		
✓	2	17-18	4	00:00:00.000000	29			
✓	1	17-18	5	00:00:00.000000	30	Clear Request		
✓	2	17-18	6	00:00:00.000000	30	Clear Command		

**Dialog Box: Use Ctrl, Shift for Extended Selection**

BSAP::BSMAP Message Type

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**

- ✓ A1 Interface(ANSI)
  - Data Link
    - MTP2
    - MTP3 ANSI
    - SCCP
    - Sccp Management
    - ✓ BSAP
      - SLTM
      - SSNM

**Value Selection**

Activate Deactivate

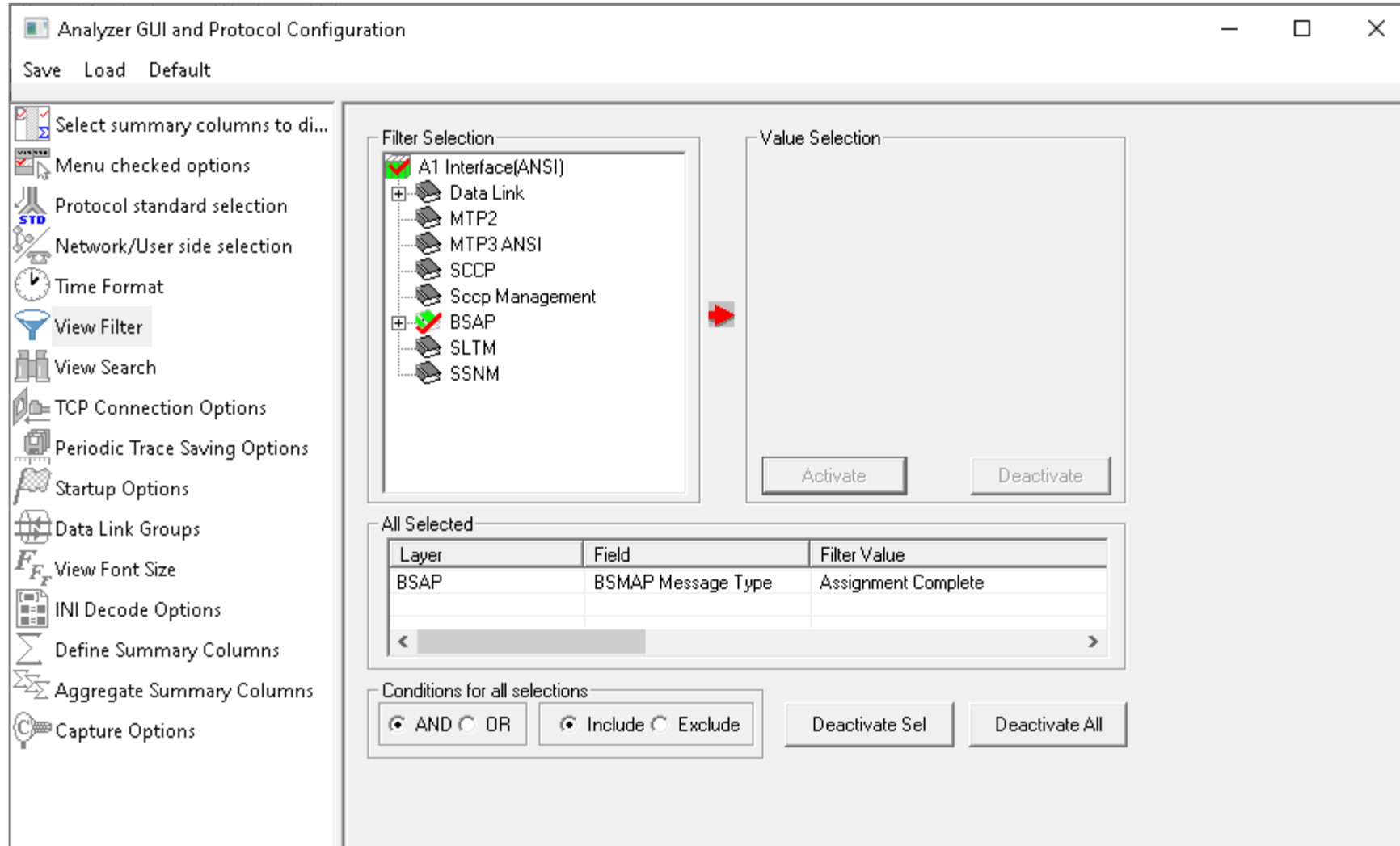
**All Selected**

Layer	Field	Filter Value
BSAP	BSMAP Message Type	Assignment Complete

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

The diagram illustrates the process of creating search criteria from a screen selection. It begins with a table of data, followed by a context menu, a dialog box, and finally the main application window with the filter configuration.

	1	17-18		0	00:00:00.000000	86	Complete Layer 3 Information	CM Service Request
✓	2	17-18		1	00:00:00.000000	22		
✓	2	17-18		2	00:00:00.000000	55	Assignment Request	
✓	1	17-18		3	00:00:00.000000	36	Assignment Complete	
✓	2	17-18		4	00:00:00.000000	29		
✓	1	17-18		5	00:00:00.000000	30	Clear Request	
✓	2	17-18		6	00:00:00.000000	30	Clear Command	
✓	1	17-18		7	00:00:00.000000	24	Clear Complete	

Context Menu:

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

Dialog Box: Use Ctrl, Shift for Extended Selection

BSAP::BSMAP Message Type

Buttons: 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

- A1 Interface(ANSI)
- Data Link
- MTP2
- MTP3 ANSI
- SCCP
- Sccp Management
- BSAP
- SLTM
- SSNM

Value Selection

Activate Deactivate

All Selected

Layer	Field	Filter Value
BSAP	BSMAP Message Type	Assignment Complete

Conditions for all selections

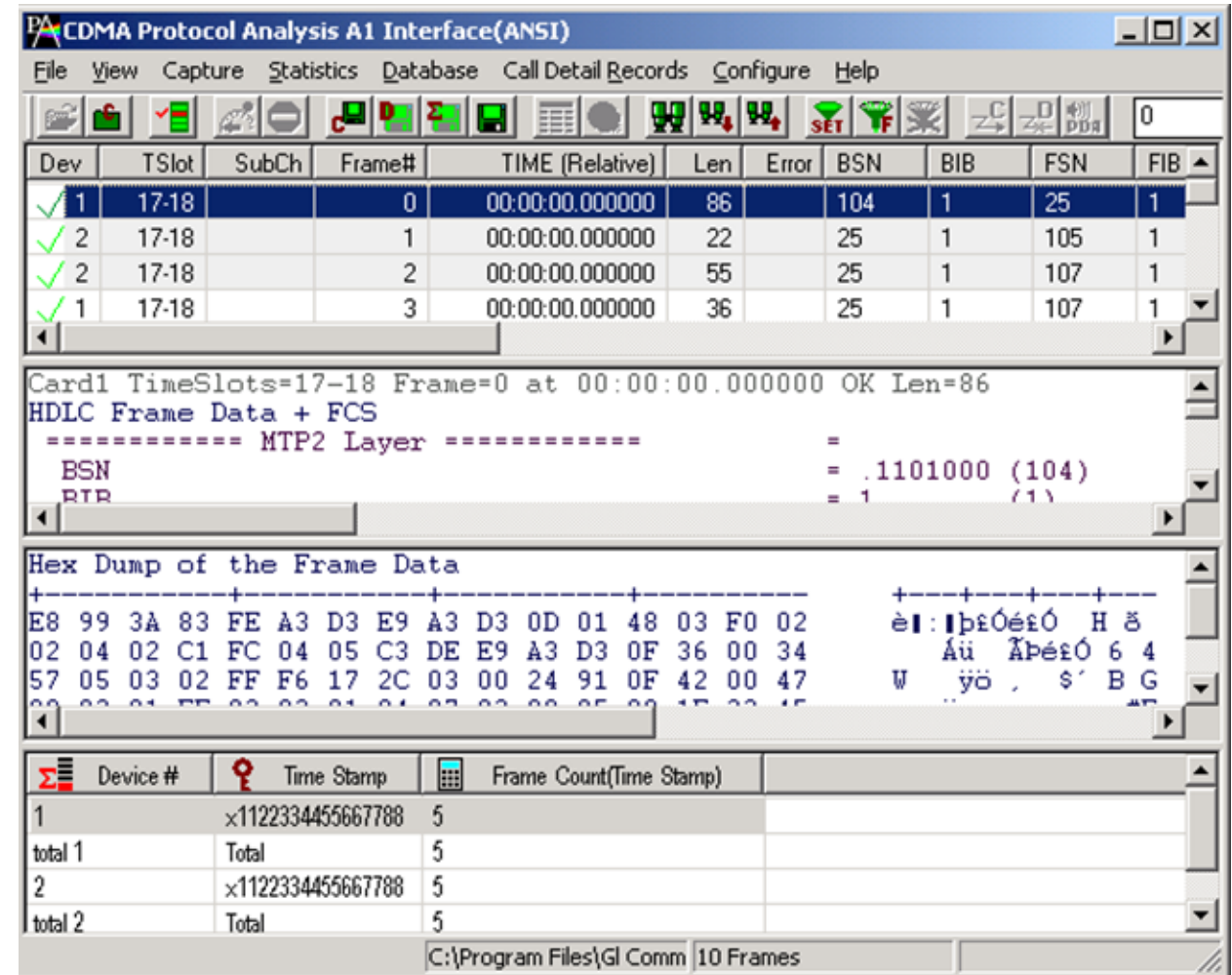
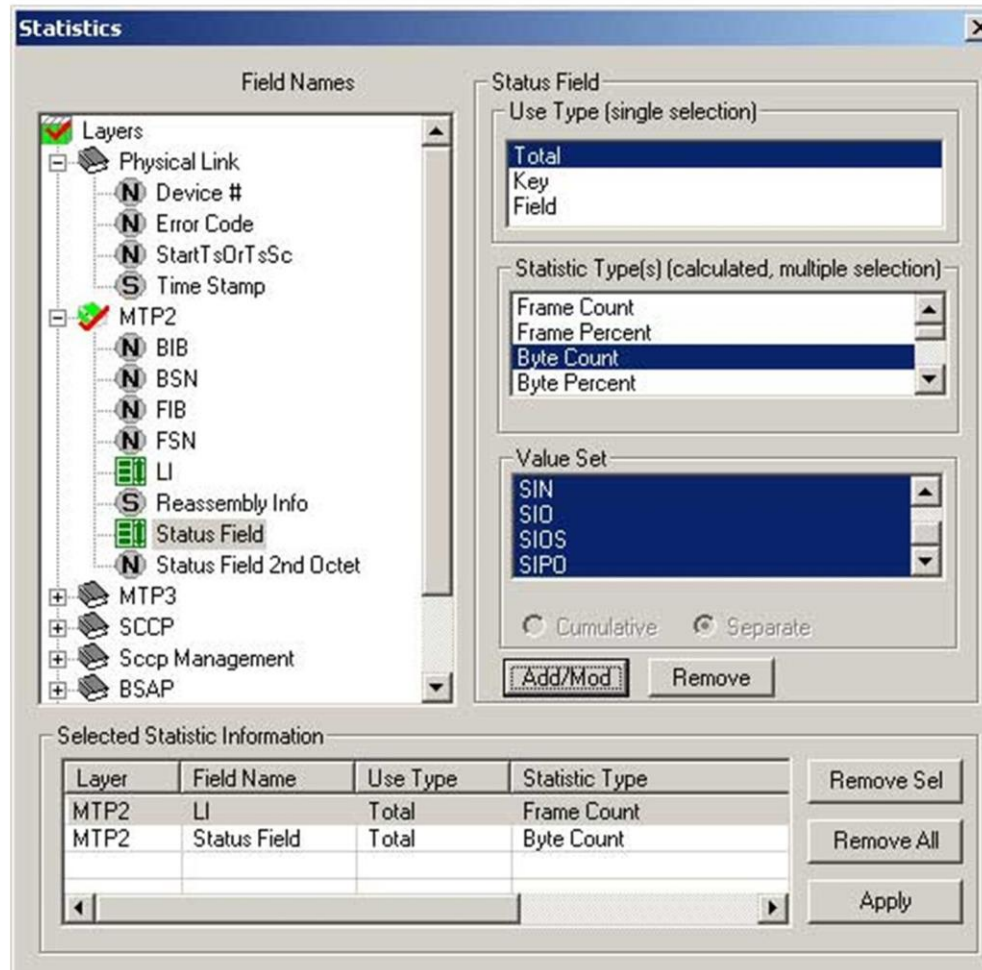
AND OR Include Exclude

Deactivate Sel Deactivate All



# Statistics

- Statistics is an important feature available in CDMA2000 analyzer and can be obtained for all frames both in real-time as well as offline mode



# Saving a File

- 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

**Periodic Trace Saving Options**  
Save Load Default

☒ Select summary columns to display  
☒ 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  
 Capture Options

**Using View Filter**  
☒ All Frames (no filtering)  
☐ Filtered Only (use view filter)

**Save Directory**  
C:\

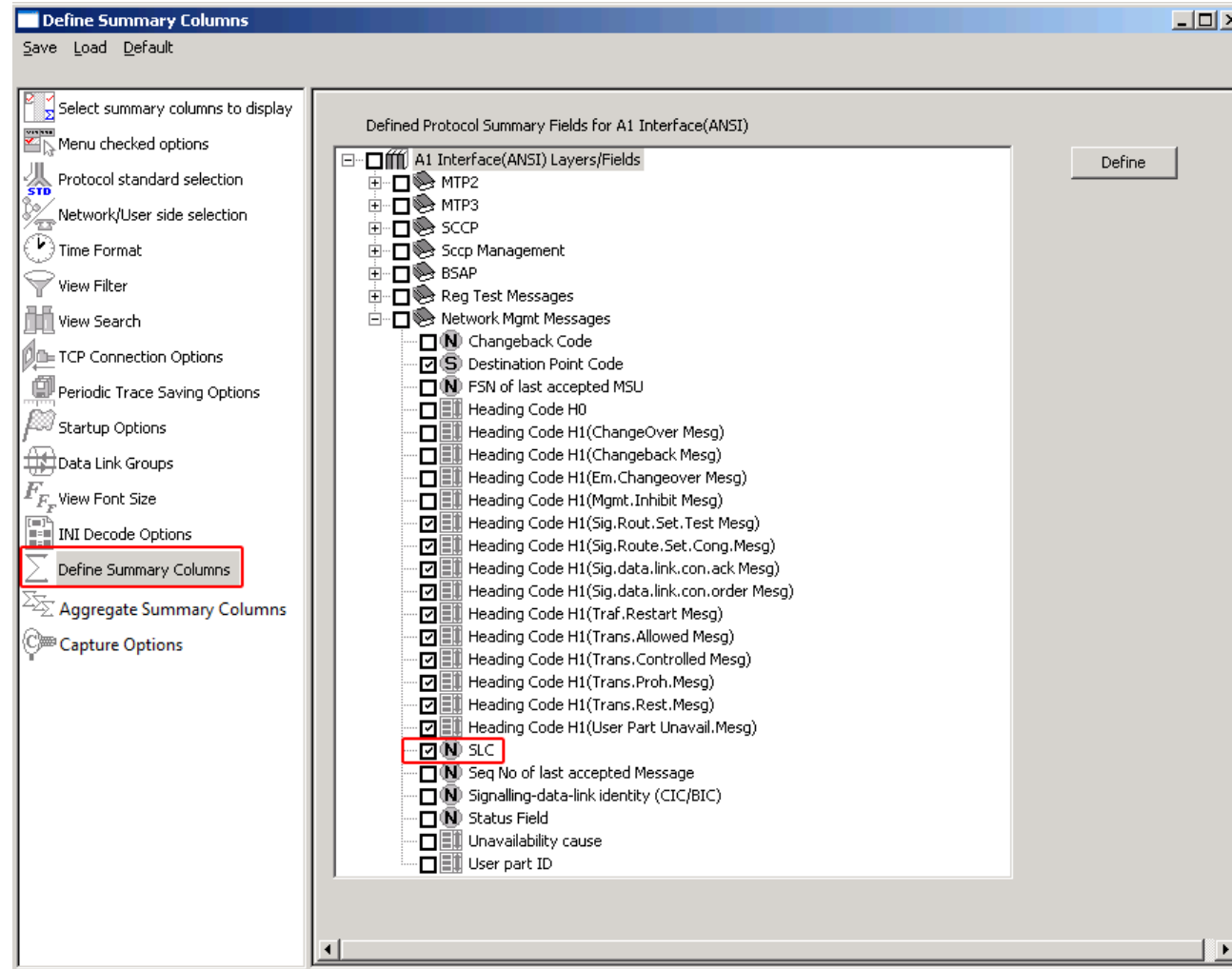
**Save File Names**  
☒ Sequential File Names  123  .HDL  
file name prefix number of digits file name suffix  
☐ Date/Time Formatted Names %Y%M%D\_%H%i  .HDL  
fileNamePrefix\_%Y%M%D\_%H%i\_fileNameCont file name suffix

**Create a New File After the Specified Limit Has Been Reached**  
☒ File Size Limit e.g. 1048576 or 1024K or 1M Limit Value   
☐ Frame Count Limit e.g. 1048576 or 1024K or 1M  
☐ Time Limit e.g. 24:00 (HH:MM)

**Restrict or Recycle After N Files Options**  
 2147483647 ☒ Keep N Latest Files ☐ Stop After N Files ☐ Unrestricted

# 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 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 screenshot displays the 'Aggregate Summary Columns' dialog box and the 'CDMA Protocol Analysis A1 Interface(ANSI) 64-bit' window. The dialog box allows users to configure summary columns for different groups. The main window shows a table of network events with an aggregate summary column highlighted by a red box.

**Aggregate Summary Columns Dialog:**

Name	Display Format	Summary Columns	Separator
Group~0	<Col_Alias> Value	BSMAP Message Type_BSAP Identity_BSAP	&
Group~1	Concat	Type of Identity_BSAP	
Group~2	Overlay	DTAP Message Type_BSAP	--->

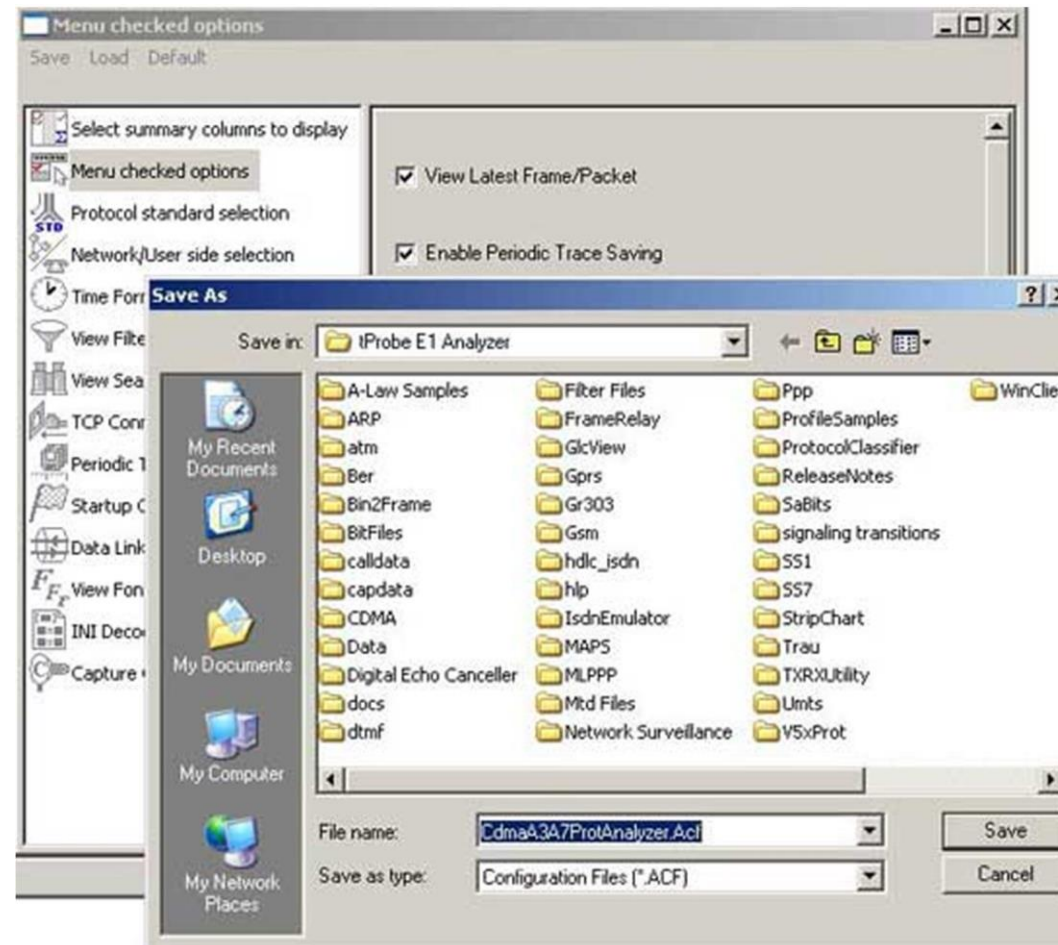
**CDMA Protocol Analysis A1 Interface(ANSI) 64-bit Window:**

Dev	TSlot	SubCh	Frame#	TIME (Relative)	Group~0	Len	Error	BSMAP Message Type_BSAP	DTAP Message Type_BSAP
✓ 1	17-18		0	00:00:00.000000	<BSMAP Message>Complete Layer 3 Information	86		Complete Layer 3 Information	CM Service Request
✓ 2	17-18		1	00:00:00.000000		22			
✓ 2	17-18		2	00:00:00.000000	<BSMAP Message>Assignment Request	55		Assignment Request	
✓ 1	17-18		3	00:00:00.000000	<BSMAP Message>Assignment Complete	36		Assignment Complete	
✓ 2	17-18		4	00:00:00.000000	Connect	29			Connect
✓ 1	17-18		5	00:00:00.000000	<BSMAP Message>Clear Request	30		Clear Request	
✓ 2	17-18		6	00:00:00.000000	<BSMAP Message>Clear Command	30		Clear Command	
✓ 1	17-18		7	00:00:00.000000	<BSMAP Message>Clear Complete	24		Clear Complete	
✓ 2	17-18		8	00:00:00.000000		22			

Card1 TimeSlots=17-18 Frame=0 at 00:00:00.000000 OK Len=86  
HDLC Frame Data + FCS  
\*\*\*\*\* MTP2 Layer \*\*\*\*\*  
0000 BSN = .1101000 (104)  
0000 BIB = 1..... (1)  
0001 FSN = .0011001 (25)  
0001 FIB = 1..... (1)  
0002 II = ..111010 MSU Format  
\*\*\*\*\* MTP3 ANSI Layer \*\*\*\*\*  
0003 Service Indicator = ....0011 SCCP  
0003 Priority Code = ..00.... Priority Code 0  
0003 Sub-service field = 10..... National Network  
0004 DPC = 211.163.254(11111110 10100011 11010011)  
0007 OPC = 211.163.233(11101001 10100011 11010011)  
000A Signalling Link Selection = 00001101 (13)  
\*\*\*\*\* SSCP Layer \*\*\*\*\*  
000B Message Type = 00000001 CR connection request  
\*\*\*\*\* Mandatory Fixed Parameters \*\*\*\*\*

# 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



# Call Detail Record (CDR)

- The Call Detail Record isolates call specific information for each individual call from the captured data and display the information in an organized fashion

CDMA Protocol Analysis A1 Interface(ANSI)

FileViewCaptureStatisticsDatabaseCall Detail RecordsConfigureHelp

<



# Inverse Multiplexing in CDMA A3A7

- The CDMA Analyzer can capture and reassemble frames that were transmitted with Inverse Multiplexing option
- With Inverse Multiplexing over ATM (IMA) feature, up to 8 T1 E1 links can be configured to form a high-speed connection
- ATM cells are transmitted across multiple interfaces in a cyclical fashion, and recombined to form the original stream

## Captured ATM Frames with IMA in A3A7 Interface

The screenshot shows the CDMA Analyzer interface with the following components:

- Frame Table:** A table listing captured frames. Frame 14465 is selected.
 

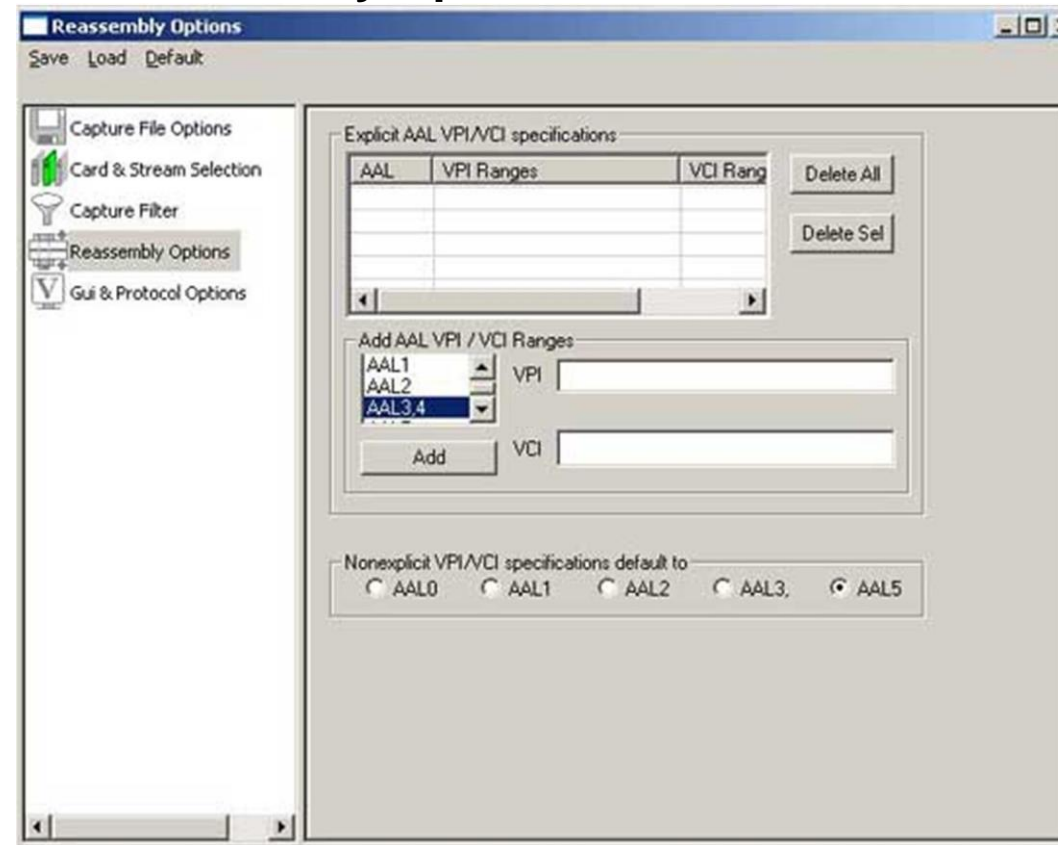
Dev	TS	Frame#	TIME (Date)	Len	OSF	AAL Type	Frame T	QoS	U	UII	CPI	Me	End
✓	4	24	14459	2007-10-18 11:31:58	245		AAL5	CPS Fia			0		
✓	2	24	14460	2007-10-18 11:31:58	53		AAL5	ATM-Cell					
✓	4	24	14461	2007-10-18 11:31:58	53		AAL5	ATM-Cell					
✓	1	24	14462	2007-10-18 11:31:58	53		AAL5	ATM-Cell					
✓	3	24	14463	2007-10-18 11:31:58	53		AAL5	ATM-Cell					
✓	3	24	14464	2007-10-18 11:31:58	53		AAL5	ATM-Cell					
✓	3	24	14465	2007-10-18 11:31:58	245		AAL5	CPS Fia			0		
- Frame Details:** A detailed view of Frame 14465 (Len=245).
  - ATM Layer:** Shows VPI, VCI, PT, CLP, and HEC. A callout indicates "Cells recombined into single ATM stream".
  - AAL5 Reassembly (CPCS-PDU) Layer:** Shows Payload, Padding, CPCS User-to-User Indication (CPCS-UUI), Common Part Indicator (CPI), and Length. A callout indicates "Cells recombined into single ATM stream".
  - Hex Dump of the Frame Data:** A hex dump of the frame data, showing the recombined stream.



# Reassembly in CDMA A3A7

- Using reassembly option user can specify VPI /VCI value to reassemble using the segmentation and reassembly rules defined by the specified AAL type

## Reassembly Options in A3A7 Interface



**Thank You!**