INTERCELL SMALL CELL PROTOCOL STACK
LOG VIEWER TOOL GUIDE

Revision History

Revision	Date	Change Description
Rev 1.0.0	11/12/15	Initial release
Rev 1.0.1	12/09/15	Add log server start/stop
Rev 1.0.2	05/09/16	Add log analyzer, update to 1.4.2

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Section 1: Introduction

Purpose and Scope

This document describes the log viewer tool for the Intercell's LTE small cell protocol stack software. The guide is intended to be used by customers who wish to evaluate Intercell's LTE small cell protocol stack software and/or to develop around it.

This document discusses all the components that make up the log viewer tool.

✎   **Note:** the document is based the current version of the tool, in case of any contradiction between this document and the log viewer tool you have received from Intercell, please contact Intercell for the latest guide document.

✎   **Note:** The log viewer tool is developed for the LTE protocol stack software, so for the customers who wish to evaluate and/or use Intercell LTE L1 software and hardware only, please use another tool named ePerview. And because the log file format is same, so the Tool can open the log file captured by the ePerview as well as vice versa.

Glossary of Terms

Table 1: Glossary of Terms

Term	Description
LTE	Long Term Evolution
PM	performance management module of protocol stack
KPI	Key Performance Indicator
PS	Protocol Stack
ePerview	Debug tool for BRCM LTE L1 software and hardware
NAS	Non Access Stratum
S1	Interface between Femto cell and MME
X2	Interface between Femto cells
RRC	Radio Resource Control
RLC	Radio Link Control
MAC	Medium Access Control
PDCP	Packet Data Convergence Control
Wireshark	free software to capture/analyze packet, it is used to decode the S1/X2/NAS/RRC message

System overview

The log viewer tool application enables debugging, monitoring and validating the Intercell LTE Femtocell Protocol stack and L1/DSP/PHY software/hardware. The application is referred to throughout the document as Tool.

The Tool runs on a Windows PC, is connected to the LTE Femto Cell board using an Ethernet connection. The Tool communicates to the log service thread which runs on the CPUH core within the BCM617xx Device.

The Tracer thread runs within CPUH and Tracer thread runs within CPUL collect the log and send the log to the log service thread, the log service thread then sends the log to the Tcp server within the Tool using TCP socket.

Figure 1: System arch of log viewer tool
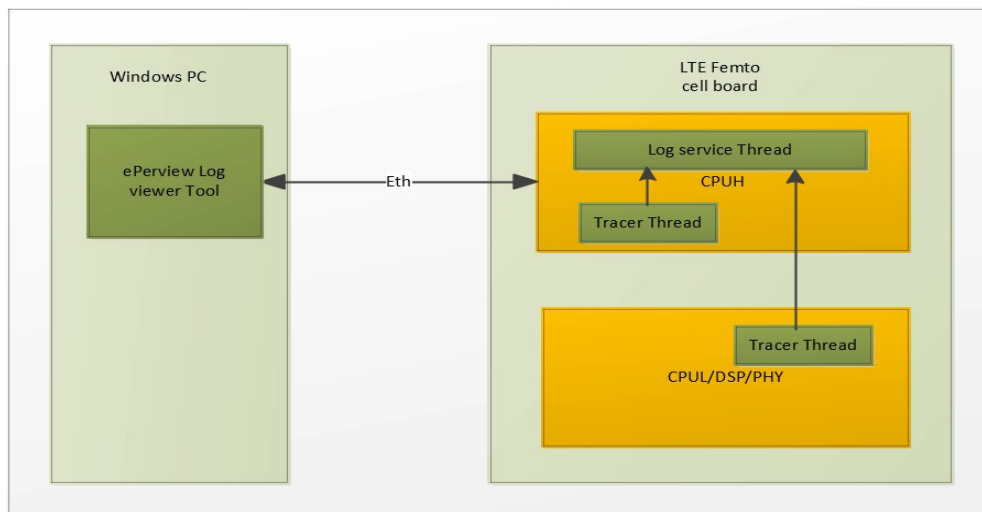
The Tool application consists of five main modules:

1. GUI module which displays all the user interface elements, such as Menu bar, tool bar, tracer windows and status bar

2. Log server module which listens the TCP port for CPUL tracer connection and CPUH tracer connection. And the module manages multi TCP connections from different boards.

3. Log auto save module which saves the log received from log server to local hard disk or FTP server

4. Log analyzer module which analyze the received log records and generate report according to the pre-defined configuration

5. log decode DLL records all the information of message structure of PS/L1 and it provides the message decode APIs to log view tool

Figure 2: Soft overview of the Tool
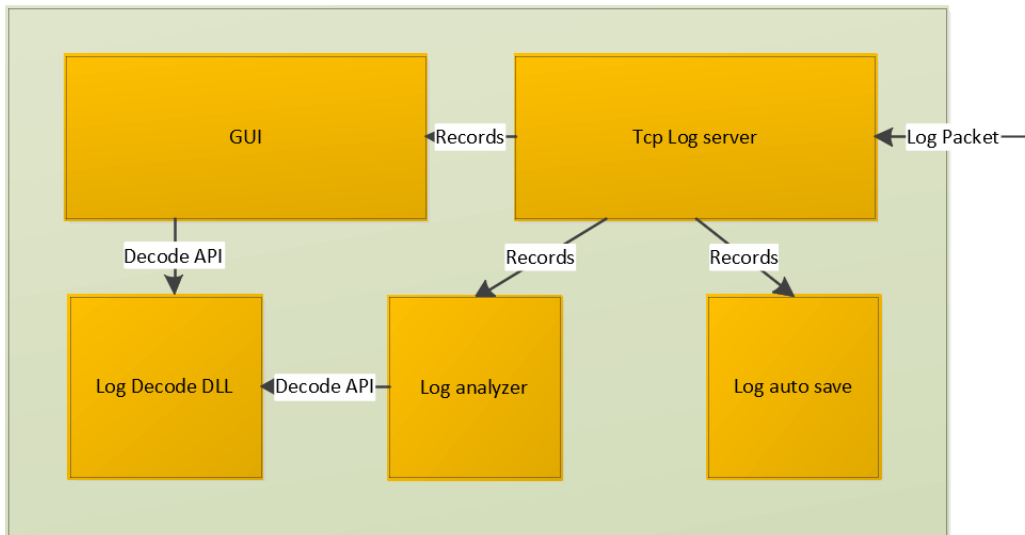
The log DLL is generated by the Struct parser application developed with C#. The parser application uses the C header files and Config files as inputs and outputs a XML file which contains the structure information of all the messages. Finally the XML file and the C# API source files are compiled into a single DLL file.

Figure 3: overview of Log DLL

C Header files

Config files

Struct parser
Application

Database
XML file

Struct print
C# source files

C# compiler

DLL File
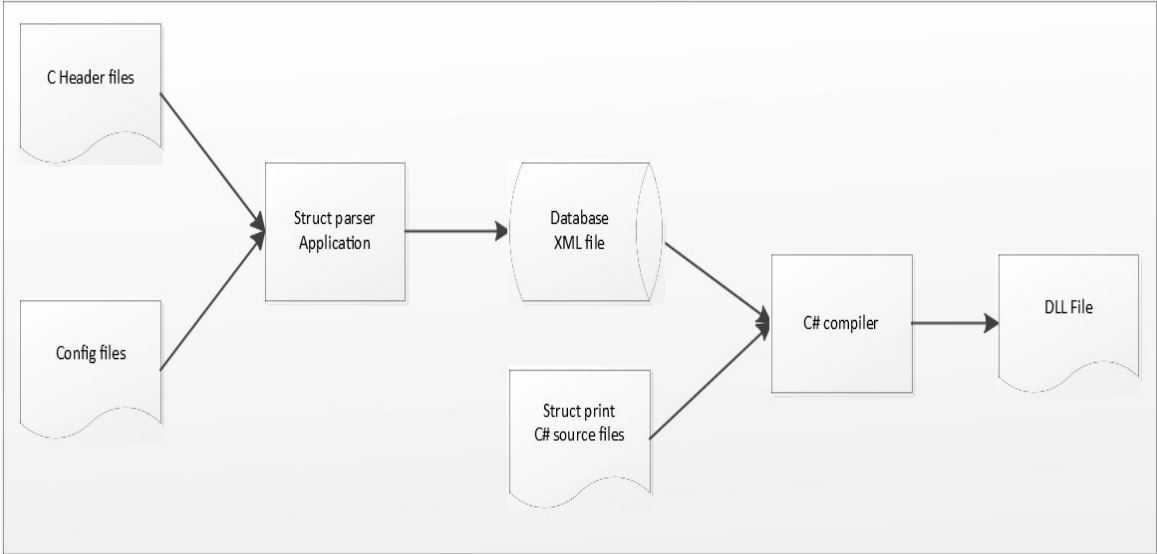
Section 2: Getting started

Installation of Tool

No installer for the Tool, so just copy the release folder to the Windows PC, and run the ePerviewLogViewer.exe file under the release folder.

Multi versions can be run on one PC, no need to uninstall the old version.

Installation of wireshark

To decode the S1/X2/RRC/NAS message, please make sure Wireshark is installed on the PC. If no Wireshark installed, please download latest version from www.wireshark.org and install it on the PC.

Installation of Microsoft .NET Framework

The Tool needs the Microsoft .NET Framework 4.5 or later version. Please download from the Microsoft website and install it.

Firewall setting

The tool listens the TCP ports 7777/1111/5555 for CPUH, CPUL and Log analyzer. So make sure that the Tool is allowed to communicate through Windows Firewall.

Figure 4: firewall setting
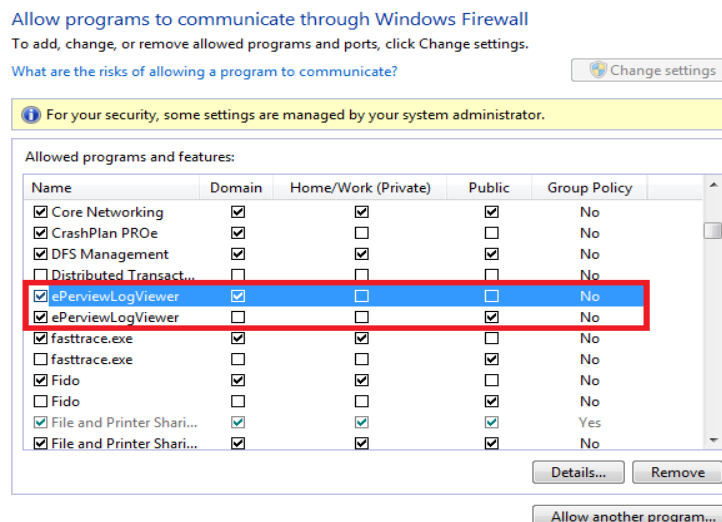
Section 3: Main User interface

The Tool supports multi online and/or offline trace sessions. Online log session is created by the log server automatically. To open a new offline trace session, please click "Windows"->"New Trace windows" menu item.

Each trace session has an independent user interface. Following Figure shows the general log/tracer user interface structure which consists of three areas:

- Main Tracer windows to show the event name along with its index, the time stamp, the SFN counter and the data of the trace string and structured messages
- Main Event windows to show the index and event name of the main events
- Structure Description Window to show the detailed info of the selected message

Figure 5: Main User interface
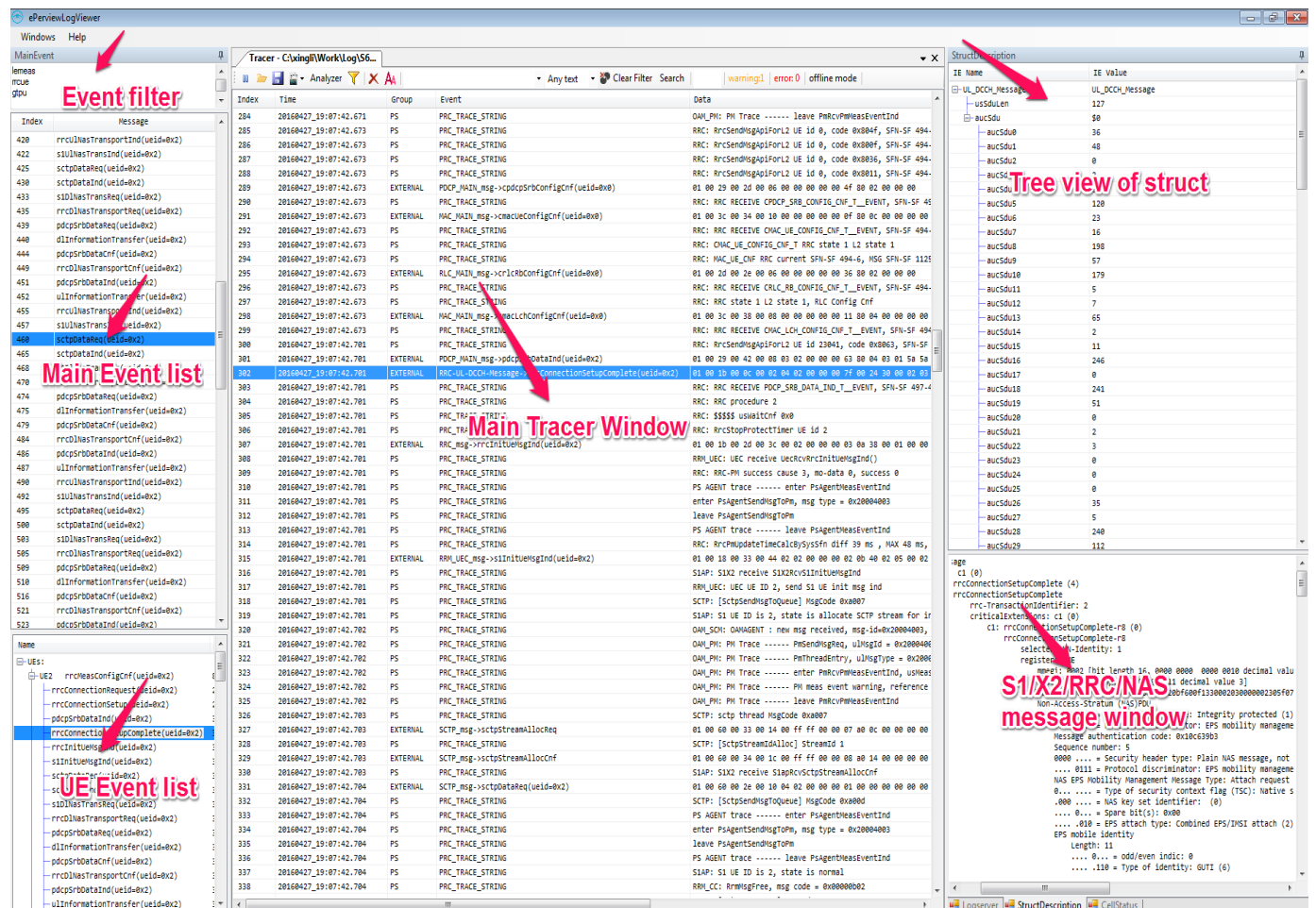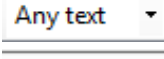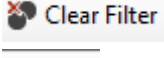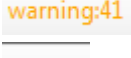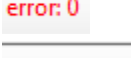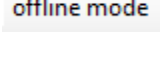
Main Tracer Window

This window is to display all the records included in the Trace/log files.

Toolbar

The tool bar of main tracer windows contains the following buttons:

Pause or resume online display, for online mode only

Open one or multi Trace files

Save trace records to a file

Open file from recent file list

Analyzer   Start offline Log analyzer

Offline filter button

Clear all records

Font setting

Filter select/input box

Any text   Filter option selection list

Clear Filter   Clear Filter

Search   Search button

Go to line number box

warning:41   Warning numbers in the traces

error: 0   Error numbers in the traces

offline mode   Offline/online mode status

File open

There are three ways to open one or multi Trace files.
1. Click the File open icon then select one or multi files
2. Drop one or multi files to the Trace window
3. Click the Recent file list icon then select one

The records of opened files will be appended to the end of the current record list.

Records Clear

To clear the current all records, clicking the Clear all button. It clear the displayed records only, the opened files are not cleared.

File Save

To save the records of current tracer window, clicking the File save button and select the file name from the File Save Dialog.

Filtering

The filtering tool supports to display the messages match the search text.

Figure 6: Filtering interface
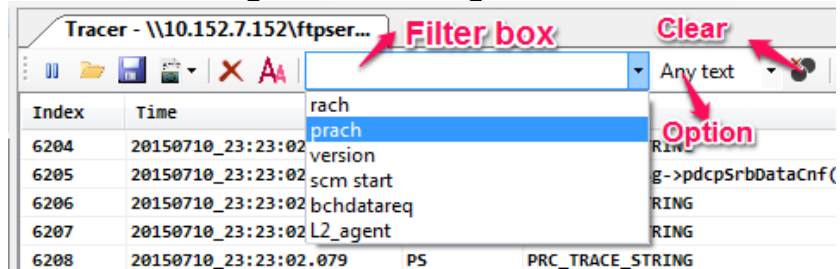
The Clear button is to clear the filtering operation.
The Filter input box can record max 24 history records.

Hotkey: Enter key

Three Filter options:
- Any Text: no any restriction
- Prefix: to search the string start from search text
- Regex: to search with Regex expression

Regex expression is very powerful for the string search. Its detailed guide is out of the scope of this document. Please find the reference of C# Regex expression from the following Microsoft URL:

https://msdn.microsoft.com/en-us/library/az24scfc.aspx

Following are the simple examples:
(req|cnf)$ find the messages end with "Req" or "Cnf"
(req|cnf)   find the messages contain "Req" or "Cnf"

Figure 7: simple example of Regex expression
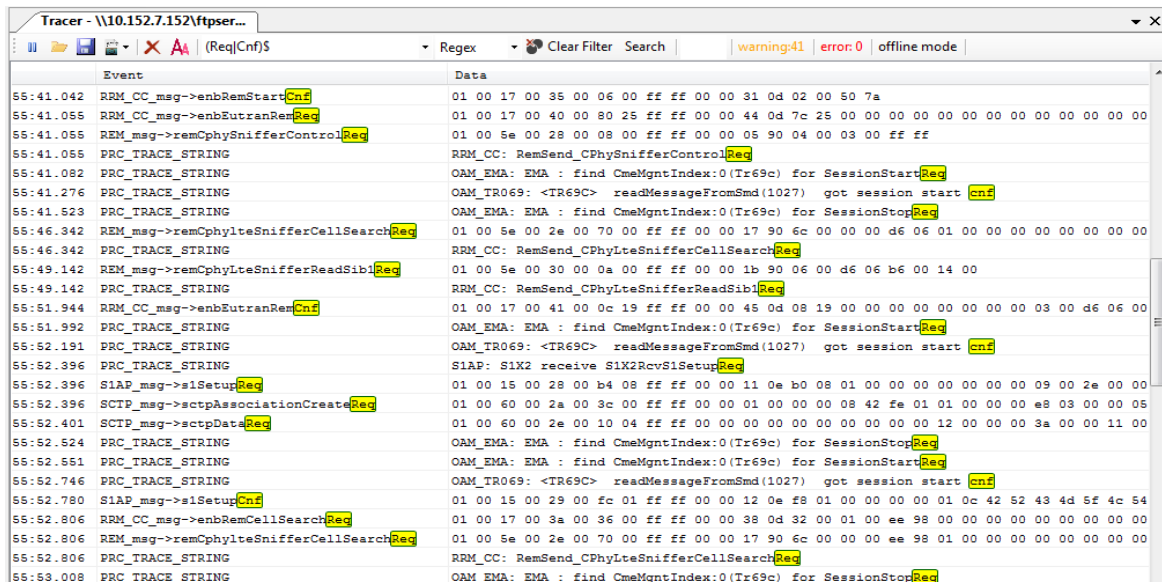
Following is a complex example to filter the S1/X2 and DCCH message of ueid=0x2.
(sctpDataReq\(ueid=0x2\)|sctpDataInd\(ueid=0x2\)|DCCH-Message.*\(ueid=0x2\))$

Figure 8: complex example of Regex expression
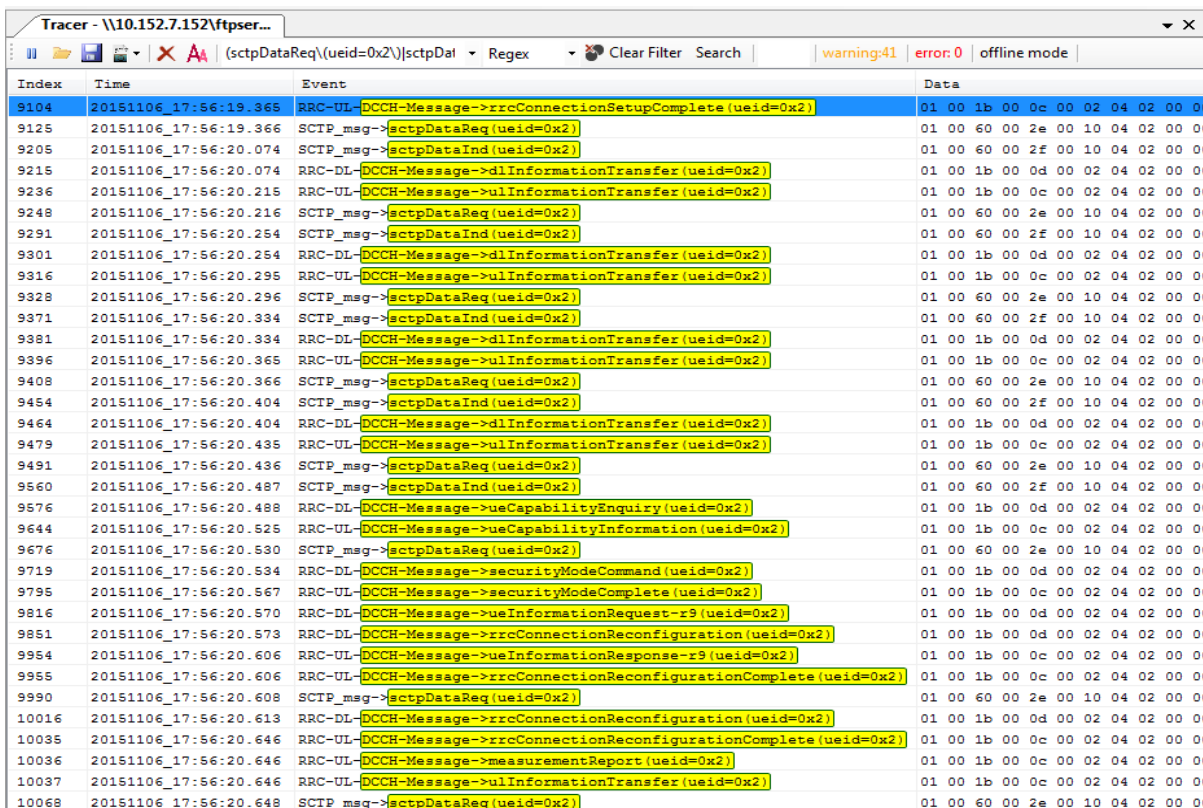
Search Tool

The search tool supports finding string from the displayed event name/trace sting and finding a specific field from the structured messages data buffer.

Three options to search a string from the displayed trace string
- Wrap Around: If the string is not found, the search wraps around to the other end of the file and continues the search when next/previous button is pressed
- Rrc asn1: to search the string within RRC message too
- Sctp asn1: to search the string within s1/x2 message too

Figure 9: search string from the displayed event name/trace string
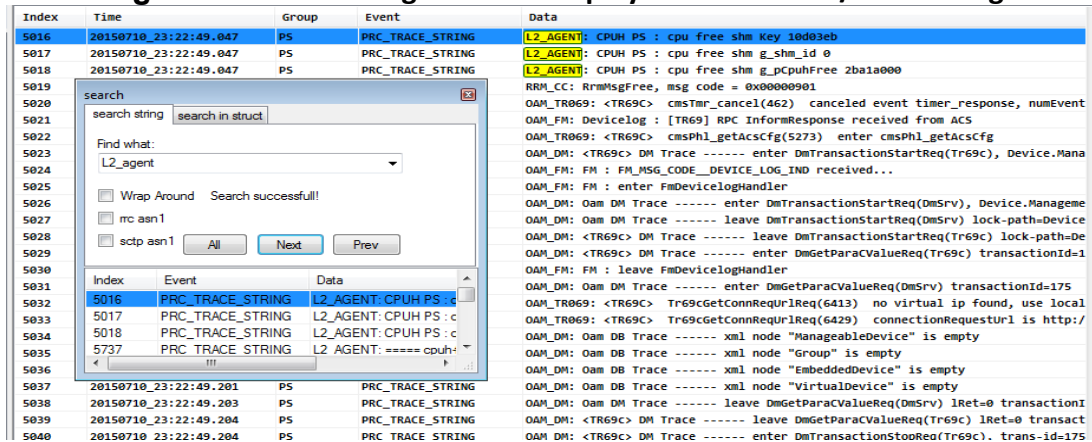
Figure 10: search specific field from message buffer
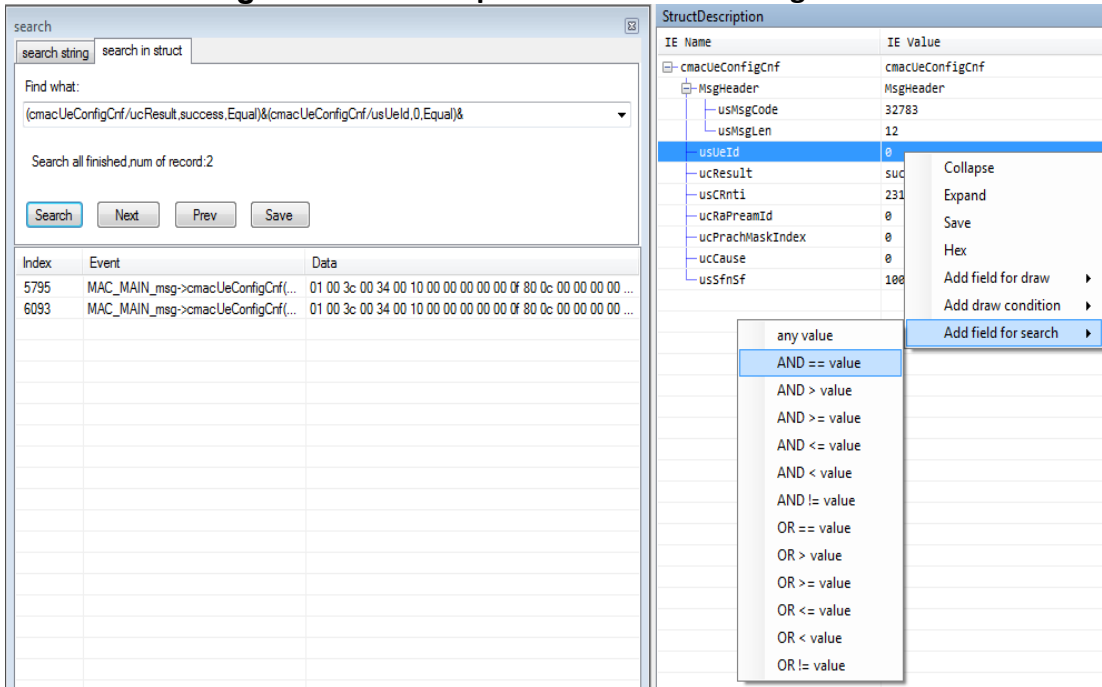
The search format of field search: Search path, value, search condition
- Search path: the path of the field in the Struct, start from the Struct name,
    for example: PHY_DL_CONFIG_REQ/DciNum
- value: the value of the searched field
- Search condition: only the field satisfy the condition will be displayed

✓ None   : any value is ok, no condition
✓ Equal   : == the selected value
✓ Greater   : > the selected value
✓ GreaterEqual   : >= the selected value
✓ LessEqual   : <= the selected value
✓ Less   : < the selected value
✓ NotEqual   : != the selected value

And Search tool supports multi search fields within one Struct. Multi AND and OR conditions are supported and all the OR conditions are treated as one AND condition. Only the messages that satisfy the conditions will be displayed. The AND condition ends with '&' and OR condition ends with '|'. For example:

(PHY_DL_CONFIG_REQ/DciNum,1,GreaterEqual)& (PHY_DL_CONFIG_REQ/SfnSf,3845,None)&

✎   **Note:** The search Tool does not support to search the fields of different Structs.

Please add the search field from the tree list view window by following steps:
1. Open the message in tree list view
2. Select the field and click the right button of Mouse, then select the "Add field for search"
3. Select one or multi search conditions if exist
4. Modify the search text manually if necessary

Click Search button then the search Tool starts the search processing.
Save button can save all the searched records to a file.

Hot Key:
- ctrl+F to open the search window
- F3 to find the next
- Shift + F3 to find the previous

Excel-like column filtering

The Tool supports the excel-like column filtering
- All the columns except Index can be hidden/displayed
- All the messages of every column can be hidden/displayed

Figure 11: column and message filtering
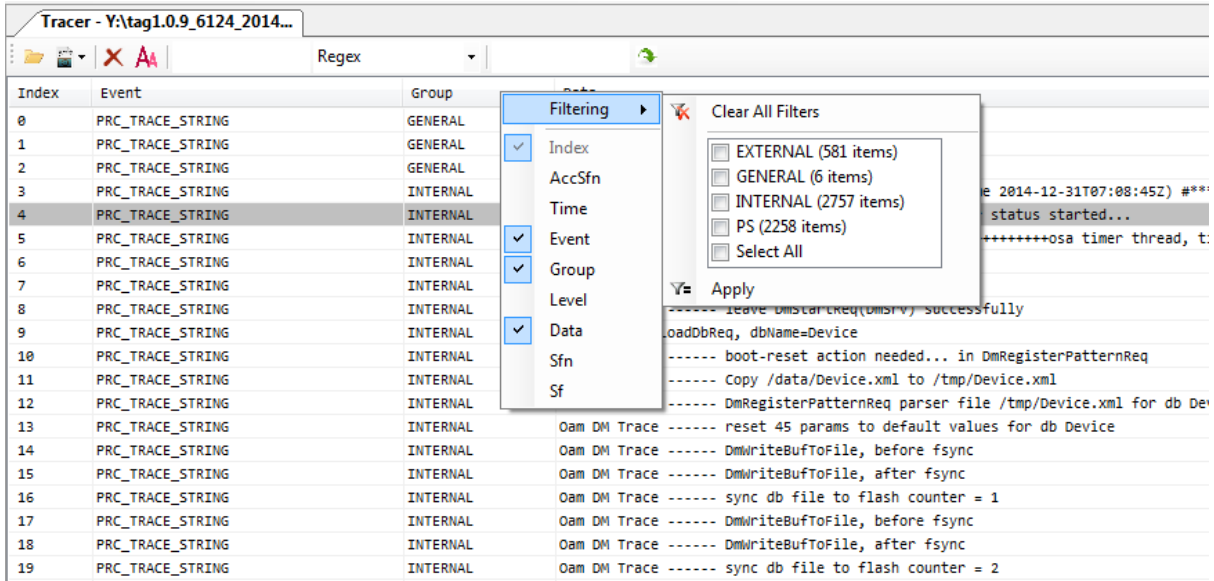
Goto line

The Tool supports to jump to specific line by input line number to the Go to line number box and press Enter key.

Hot Key: Go to line number box will get focus by using ctrl+g or ctrl+G

Line Mark

A line/record can be marked with yellow color and be navigated by the hot keys.

Hot Keys:

- ctrl+m or ctrl+M or ctrl+F2   : mark/clear the current line
- shift+M or shift+m or shift+F2 : jump to the previous marked line
- M or m or F2   : jump to the next marked line

Main Event Window

Main Event is to display the Main Event message included in the Trace/file.
Currently main Events include

- messages between the modules of PS
- messages between PS and L1/DSP

Main Event filter

The main event filter list determines which message will be displayed or which message will not be displayed. So there are two kinds of filters:

- Include filter: only the records which contain the filter text will be displayed. The filter text string starts with prefix "+".
  For example:
  > "+RRC-UL-CCCH-Message" to display UL-CCCH message
  > "+RRC-DL-CCCH-Message" to display DL-CCCH message
  > "+RRC-UL-DCCH-Message" to display UL-DCCH message
  > "+RRC-DL-CCCH-Message" to display DL-DCCH message
  > "+SCTP_Msg" to display S1/X2 message

- Exclude filter: do not display the records which contain the filter text. The filter text string starts with prefix"-" or no prefix.
  For example:
  > "l2meas" do not display all the records which contain "l1meas"

📝 **Note:** Include filter has higher priority, if include filters exist, the exclude filter will be ignored.

📝 **Note:** Input only one filter text string in each line. The new setting will be applied after mouse leaves the Text box area.

Main Event Message list

This area is used to display all or filtered Main event messages with a list.
It is a navigation list of the Main trace window, only index and event name are displayed.
By double clicking on the specific event, the Main trace window will jump to that event.

UE specific Message list

This area is used to display the Main event messages of every UE. It is convenient to trace the procedures of a specific UE.

Struct description Window

The Struct description is to display the decoded content of the one structured event. It consists of two areas: tree view of message and S1/X2/NAS Message decoder.

Tree view of Message

Double clicking a message in Main Event or Main trace window, the detailed decoded description of the message will be displayed in the tree view window and S1/X2/RRC/NAS message windows if exist.

Figure 12: Struct Description Window
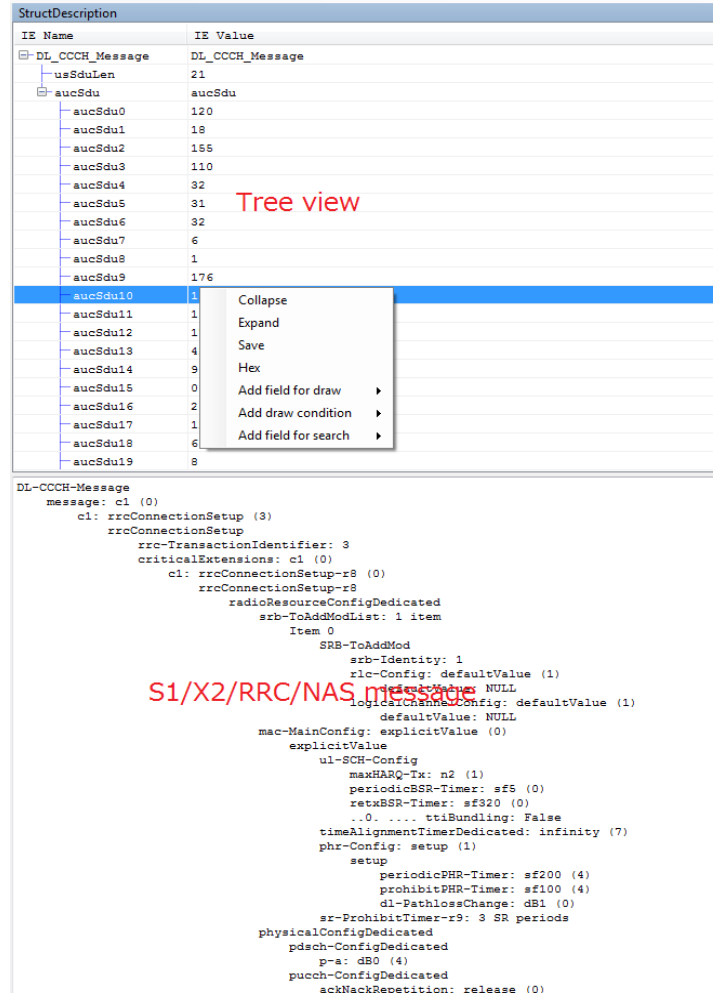
Items of the submenu of the Tree view window.

- Collapse: collapse the tree view
- Expand: expand the tree view
- Save: Save the tree view to a XML file
- Hex/Dec: Display the value with Hex or Dec format
- Add field for draw: for User graph draw
- Add draw condition: for User graph draw
- Add field for search: for Field Search in the struct

Hot Key: ctrl+c to save one line of the tree view to system clip board

S1/X2/NAS Message decoder

The s1/X1 included in the sctp data and the NAS message included in the RRC message will be decoded to this window.

Hot Key: ctrl+a to select all the contents and ctrl+c to save the decode contents to the system clip board

> **Note:** It is impossible to decode the ciphered NAS message. So for debug purpose please disable the NAS encryption if possible.

User Graph

The Tool supports to draw the graph of any fields in an event from struct description window. Two operations for the user graph draw:

- Add field for draw: the selected field of the records which meet all the condition will be drawn in the graph
- Add draw condition: just add a draw condition, the selected field will not be drawn in the graph

Following is an example in which PHY_UL_DCI_PDU0/Mcs is drawn with the two conditions: rnti==63 and sfnsf <= 3960

Figure 13: User Graph example
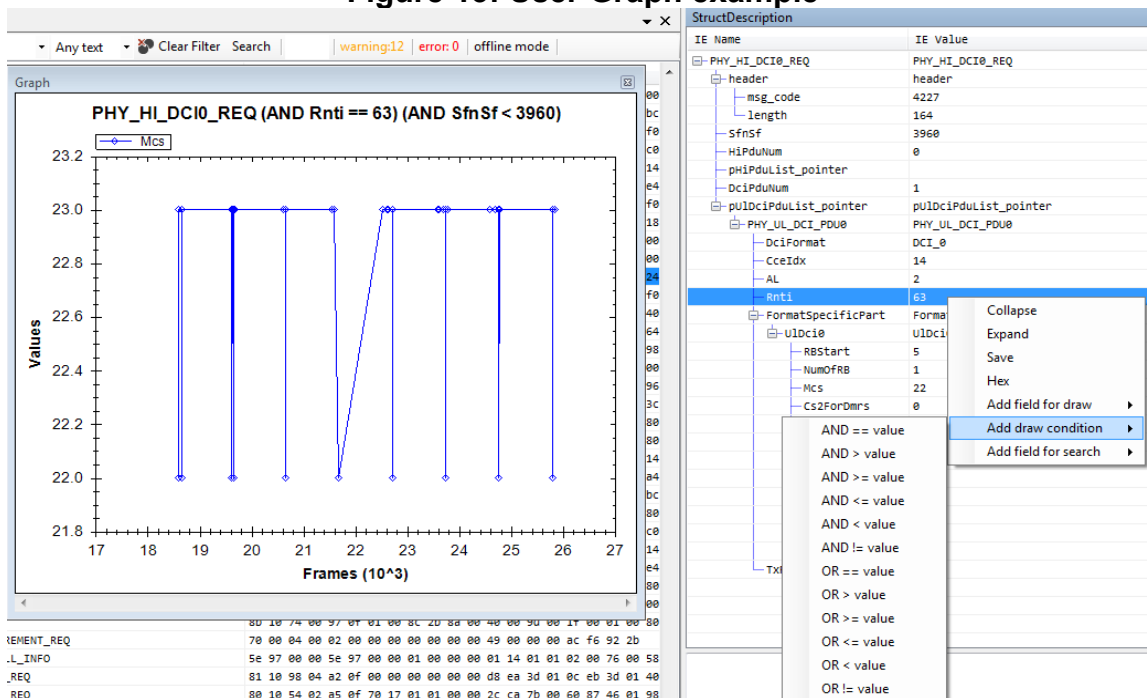
Section 4: Log server

The Tool provides the log server function to manage the connections between the tool and one or multi boards.

Functions of log server

The main features of the log server:

- Support multi connections with many boards simultaneously. The boards should have different OUI + Serial number
- Auto save log to the local files or to remote ftp server
- Support the online display of received logs
- Support the pause/resume of online display
- Support online board filter change

Figure 14: Log server window
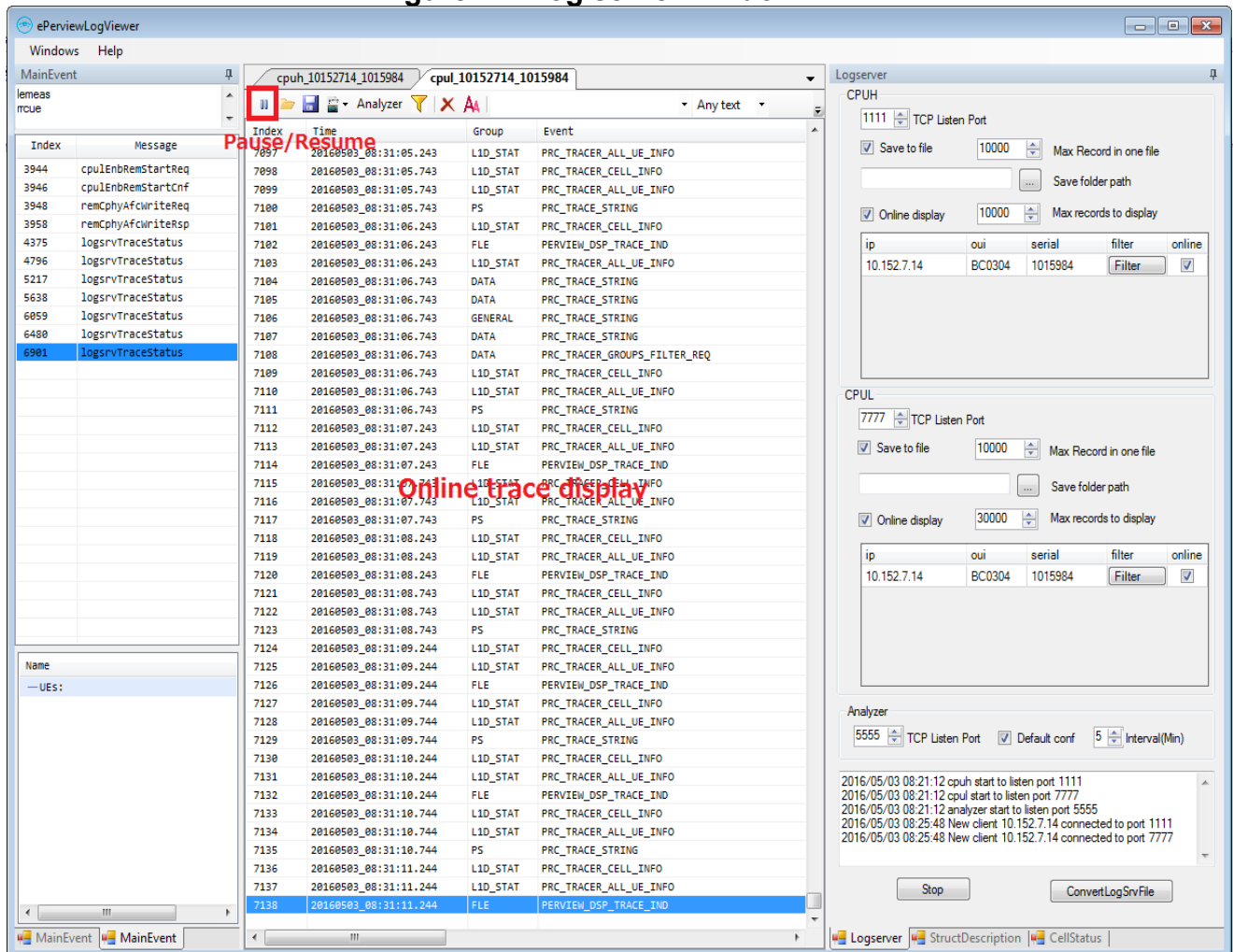
Start/Stop log server

To start the log server, click the "Start" button on Log server Tab.
To stop the log server, click the "Stop" button on Log server Tab.

Options of the log server

The log server listen one TCP port defined by the "TCP listen port" for CPUL connection, one TCP port defined by the "TCP listen port" for CPUH connection and one TCP port defined by the "TCP listen port" for the online log analyzer.

When a new TCP connection arrives, the Tool opens a new Trace window to display the received the log records if "Online display" option enabled. By changing the "online" check box it possible to disable or enable the online display of a specific connection.

The Tool saves the records to files if "Save to file" option enabled.

The "Max Records in one file" option determines the size of one log file. A new log file will be created after the record number reaches the threshold.

The "Max Records to display" option determines the max size of online display. The main tracer window will clear all the records and start from index 0 after the record number reaches the threshold.

The "Save folder path" option is used to set a default folder for the CPUH/CPUL log files.

Configuration of the board

The path in the Device.xml is /Device/X_OUI_DebugMgmt/Traces/LogServer

Table 2: Parameters for the Tool connection

Parameter	Description
ConnectingPolicy	When to connect to logserver,
	"Always": try to connect to log server since power on.
	"ConfigChanged":do not connect to log server until new configuration available
IPAddress	IP of Host PC on which the Tool runs
CpuhPort	TCP listen port of CPUH
CpulPort	TCP listen port of CPUL
CpuhDestPath	CPUH Log files save path
CpulDestPath	CPUL Log files save path
CpuhFileSize	unused parameter
CpulFileSize	unused parameter

CPUH or CPUL log file save path can be:

- folder of local windows PC, for example:
  <CpulDestPath>C:\log\cpul\</CpulDestPath>
- remote folder, for example :
  <CpuhDestPath>\\10.152.7.152\LTE\logs\cpuh\</CpuhDestPath>
- ftp folder with format ftp://username:password@url, for example:
  <CpuhDestPath>ftp://guest:guest@10.152.7.152/ftpserver/cpuh/</CpuhDestPath>

How to determine the log save path:

1. If no valid folder is configured in Device.xml, "Save folder path" option apply

2. If no path is configured in "Save folder path" option, log will be saved to the same folder as ePerviewView.exe

3. If the ftp path does not exist or is not reachable, the log will be saved to the same folder as ePerviewView.exe

Priority between LogViewer and log server

The log service thread on the board supports both log viewer tool described in this document and ePerview tool developed by the L1/DSP team.

And the log viewer tool has higher priority the log server, so if the log viewer tool connects to the board, no trace is sent to server.

Open dump log file

When the board reboot suddenly, the logs in the log buffer will be dumped by the PS and saved to one or more dump log files.

To open the dumped log file, click the "ConvertLogSrvFile" button from the Log Server panel and select the file from the open file dialog. The tool will open a new main trace window to display the records saved in the dump log file.

Online filter setting

The filter setting of online board can be changed by click "Filter" button of CPUH or CPUL. The Tool reads and displays the current board setting, then you can change the filter setting. After changing the filter setting, press "Write to board" button then new setting will be applied.

Figure 15: Online filter setting
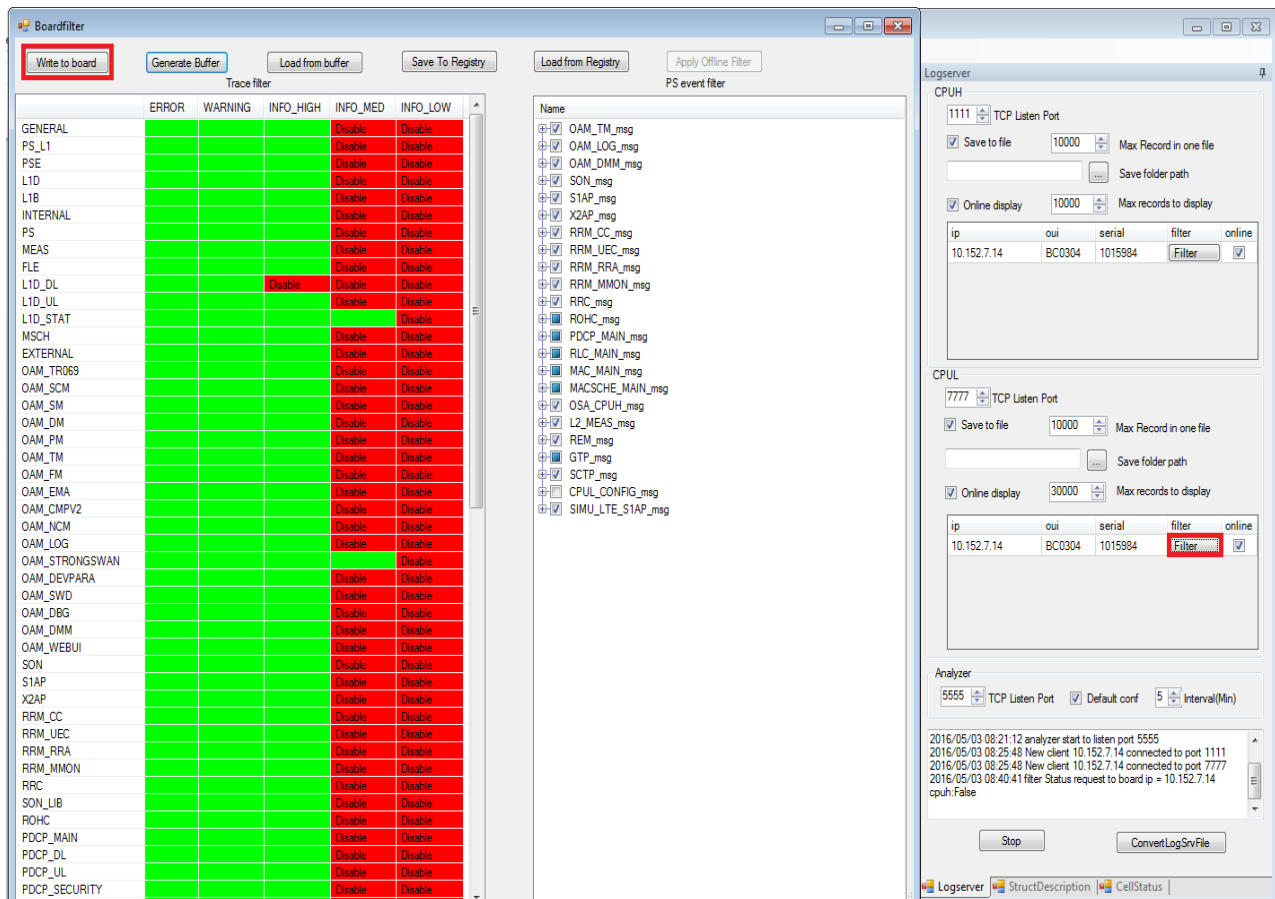
The default setting of filter is saved in Device.xml, the path is

        /Device/X_OUI_DebugMgmt/TraceFilter/PsFilter

The online setting will not be saved to Device.xml, to change the default setting in Data model, press "Generate buffer" button, it will generated the new filter setting buffer and copy it to the PsFilter item in Device.xml.

Figure 16: Save the default filter setting
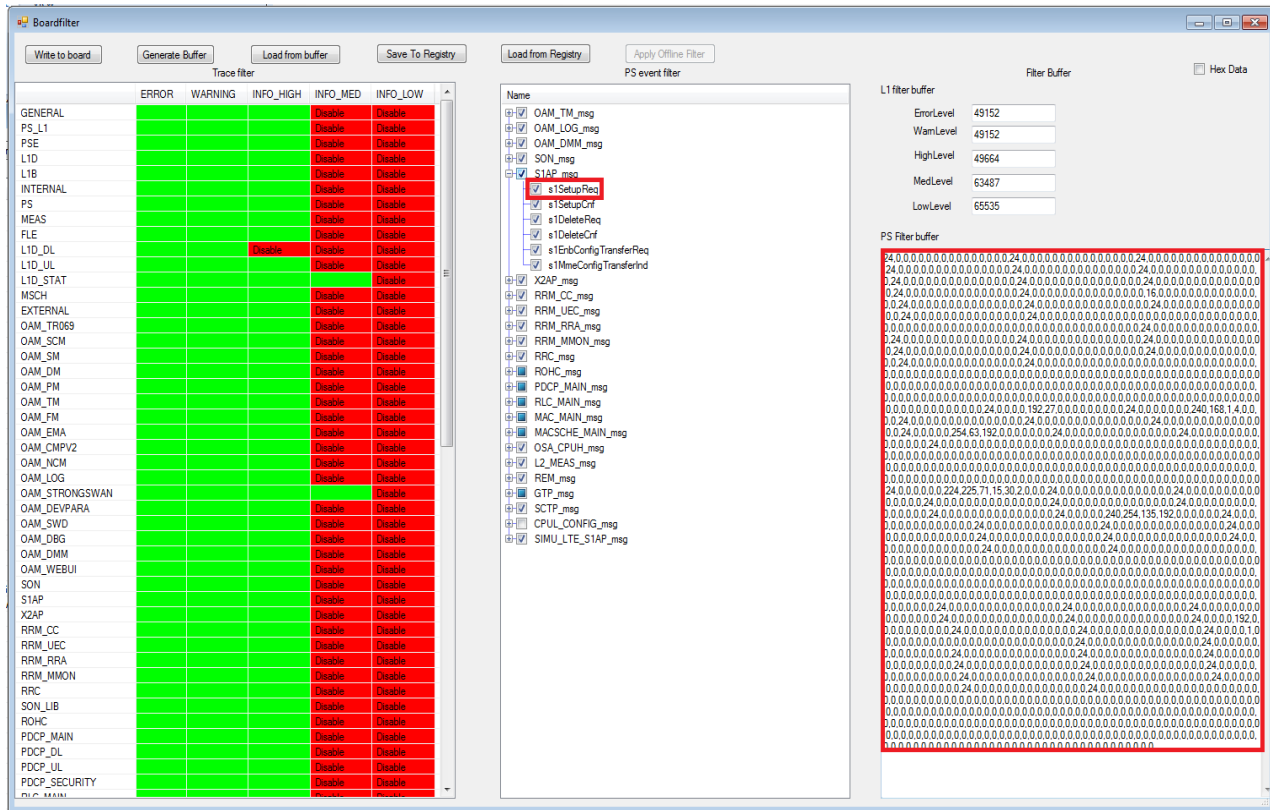
Section 5: Cell status display

Cell Status window is used to display the statistics information of L1 and L2. There are 6 tab pages to display the Phy, Mac, Mac1, LCH, Erab and ROHC information. Cell#1 of Phy page and Mac1 tab page are for the second cell of carrier aggregation or dual carriers.

Figure 17: Cell status display

And the Tool supports the graph draw of one or multi-fields of one page (except PHY page), right-click the mouse then select Draw graph, then the graph will be displayed. Graph works on online mode and offline mode.

Figure 18: graph display of multi fields
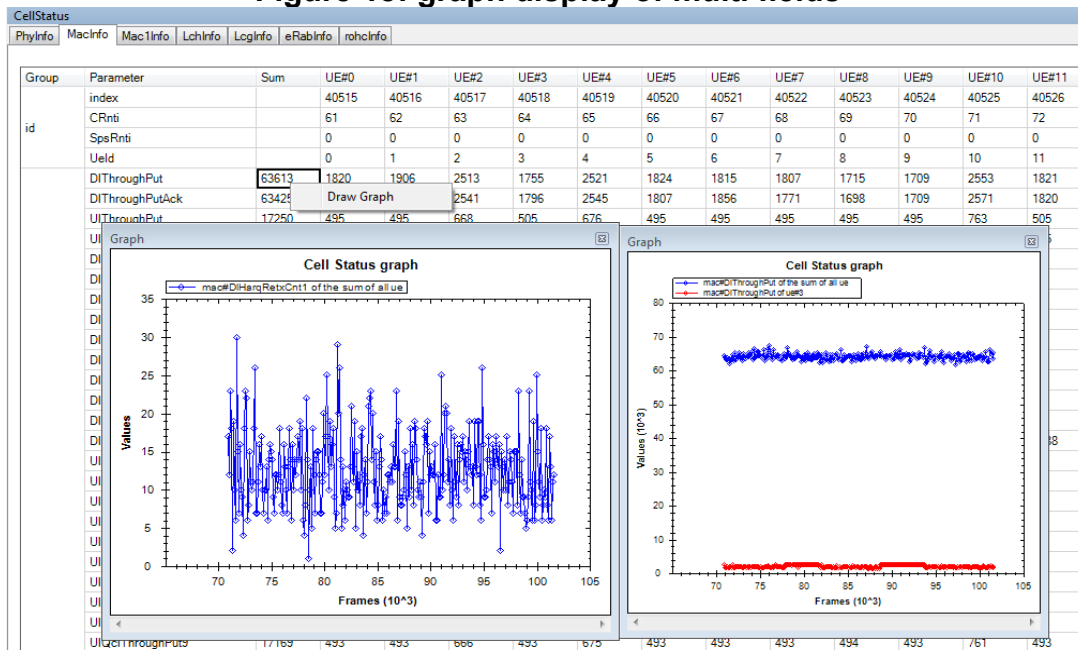
Section 6: PM report

The tool supports the PM report file analyze.
The main features are:

- Supports to open one or multi PM report files one time: Windows->Open PM report and select one or multi PM report files from the Open file dialog.
- Supports multi sessions/parser in parallel
- Support text filter: only the PM counters which contain the text will be displayed

- Support filter file: a collection of text filter, the last selected filter file will be loaded automatically next time. To disable the filter file, please clear the file name and click filter button.
- Analyze the Max/Min/Sum of each PM counter from all the PM report files
- Copy to clip board by ctrl-c
- Save result to an excel file

Figure 19: PM report analyze window
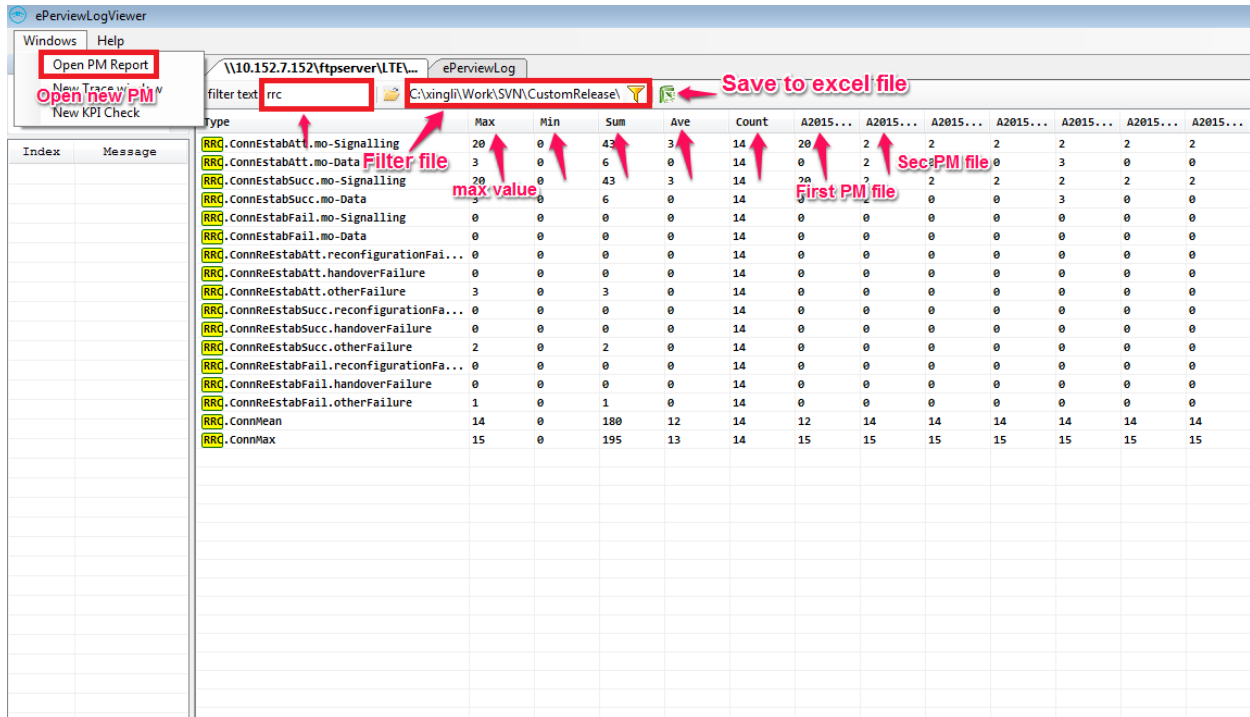
Section 7: KPI analyze

The KPIs are formulated to measure the network performance in terms of Accessibility, Integrity, Mobility, Retainability and Subscriber perceived quality.

Functions of KPI analyze module

The main features of the KPI analyze module:

- Manage the KPI template

- Check the KPI result
- Manage multi KPI test results

KPI template management

A KPI item is defined with a KPI template which includes a name, the description and a formula. The formula indicates how to calculate the KPI value based on some PM counters.

For different test cases, the thresholds of each KPI item are different, so the template defines the thresholds for every test case. For example, for the FDD 3M case the MAC downlink throughput range is [15000,23000]kbps and for the FDD 20M case the pass range is [135000,15000]kbps.

Figure 20: KPI template example

KPI	Description	Paramter(s)/Formula	FDD_3M_Default_Thp	FDD_20M_Default_Thp
reboot	Counter of board reboot	number of board reboot	0,0	0,0
rrc_mo-signalling_succ_rate	RRC setup success rate for MO-signalling	RRC.ConnEstabSucc.mo-Signalling,/,RRC.ConnEstabAtt.mo-Signall	1,1	1,1
rrc_mo-data_succ_rate	RRC setup success rate for MO-data	RRC.ConnEstabSucc.mo-Data,/,RRC.ConnEstabAtt.mo-Data	1,1	1,1
rrc_mt-access_succ_rate	RRC setup success rate for MT-access	RRC.ConnEstabSucc.mt-Access,/,RRC.ConnEstabAtt.mt-Access	1,1	1,1
rrc_reestab_other	RRC conn reestablishment beause of other failure	RRC.ConnReEstabAtt.otherFailure	0,0	0,0
rrc_reestab_succ_rate	RRC conn reestablishment success rate	(,RRC.ConnReEstabSucc.reconfigurationFailure,+,RRC.ConnReEstal	N/A	N/A
processor_usage_cpuh_mean	mean cpuh processor usage	EQPT.MeanProcessorUsage.CPU-H-0	0,50	0,75
processor_usage_cpul0_mean	mean cpul0 processor usage	EQPT.MeanProcessorUsage.CPU-L-0	0,50	0,75
processor_usage_cpul1_mean	mean cpul1 processor usage	EQPT.MeanProcessorUsage.CPU-L-1	0,50	0,75
gtpu_thp_dl	DL throughput of Gtpu	GTPU.ThroughputDl	15000,23000	135000,150000
gtpu_thp_ul	UL throughput of Gtpu	GTPU.ThroughputUl	4000,7000	40000,50000
rlc_thp_dl	DL throughput of RLC	RLC.ThroughputDl	15000,23000	135000,150000
rlc_thp_ul	UL throughput of RLC	RLC.ThroughputUl	4000,7000	40000,50000
mac_thp_dl	DL throughput of MAC	MAC.ThroughputDl	15000,23000	135000,150000
mac_thp_ul	UL throughput of MAC	MAC.ThroughputUl	4000,7000	40000,50000

The KPI templates are managed with an Excel file. The Tool imports the Excel file and analyzes the template items for the KPI result check.

To open a new KPI check Window, please click Windows -> New KPI check menu.
To open a KPI template file, please click the Open File toolbar and select the Excel file, the Tool will import the templates.

Figure 21: Open template file
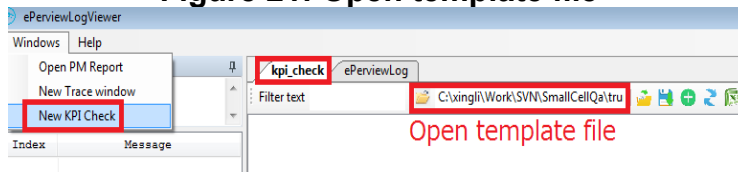
Check the KPI

The Tool reads the PM report files generated and uploaded by the board and checks the KPI result with specific KPI check items. And the Tool supports the PM report files generated by the log analyzer too.

To add one KPI check item, please click the Add button on the toolbar, following form will be displayed. There are two pages: "Add one item" is used to add one check item manually and "Batch Add" is used to add multi check items automatically.

Figure 22: Add a KPI item
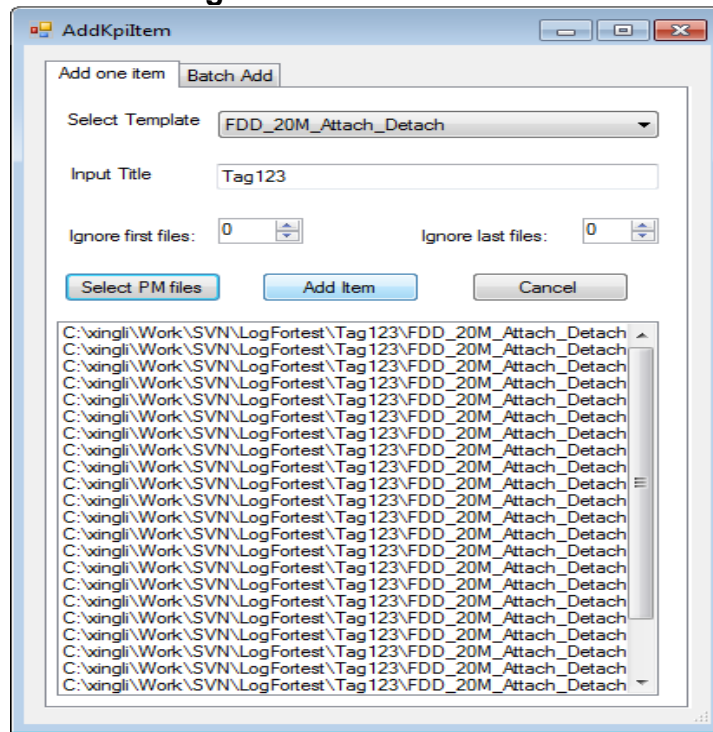
Steps to add a KPI check
1. Select a specific template from the list, for example "FDD_20M_Attach_Detach"
2. Input a title for the item, for example "Tag123"
3. Select PM report files
4. Click "Add item" button, the KPI check result will be add to the Tab page "FDD_20M_Attach_Detach"

Figure 23: Result of the KPI check

Type	KPI	algo...	prio...	Threashold	tag123	Tag122
pmpara	rrc_mo-signalling_succ_rate	sum	critical	[0.99,1]	1510/1510=1	1561/1561=1
pmpara	rrc_reestab_reconfigfail	sum	critical	[0,0]	0	0
pmpara	rrc_reestab_other	sum	critical	[0,0]	0	0
pmpara	rrc_conn_esttime_mean_mo_sig	ave	critical	[0,60]	48	48
pmpara	rrc_conn_esttime_mean_mo_data	ave	critical	[0,60]	0	0
pmpara	rrc_conn_esttime_mean_mt_access	ave	critical	[0,60]	0	0
pmpara	rrc_conn_esttime_max_mo_sig	max	normal	[0,100]	103	67
pmpara	rrc_conn_esttime_max_mo_data	max	normal	[0,100]	0	0
pmpara	rrc_conn_esttime_max_mt_access	max	normal	[0,100]	0	0
pmpara	ue_context_abnormal_rel	sum	critical	[0,0]	0	0
pmpara	erab_qci9_setup_succ_rate	sum	critical	[0.99,1]	1510/1510=1	1561/1561=1
pmpara	erab_qci9_estab_time_mean	ave	critical	[0,150]	134	184
pmpara	erab_qci9_estab_time_max	max	normal	[0,200]	155	636
pmpara	s1_conn_succ_rate	sum	critical	[1,1]	1510/1510=1	1561/1561=1
pmpara	processor_usage_cpuh_mean	ave	critical	[0,40]	26	26
pmpara	processor_usage_cpul0_mean	ave	critical	[0,40]	8	8
pmpara	processor_usage_cpul1_mean	ave	critical	[0,40]	10	9
pmpara	processor_usage_cpul2_mean	ave	critical	[0,40]	8	7
pmpara	processor_usage_cpul3_mean	ave	critical	[0,40]	8	9
pmpara	processor_usage_cpuh_max	max	normal	[0,85]	71	69
pmpara	processor_usage_cpul0_max	max	normal	[0,85]	8	10
pmpara	processor_usage_cpul1_max	max	normal	[0,85]	11	12
pmpara	processor_usage_cpul2_max	max	normal	[0,85]	9	9
pmpara	processor_usage_cpul3_max	max	normal	[0,85]	9	10

Note: The Red items are the Fail items, the orange items are the Warning items

Note: Multi versions are supported for one template

Figure 24: Batch add items
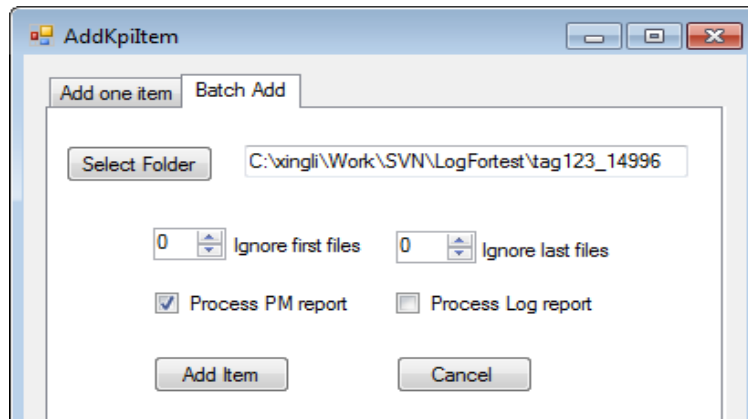
Steps to add a "batch" check
1. Select the root log folder
2. Check/uncheck Process PM report or/and Process log Report
3. Click "Add item" button, the test items under the root log folder will be added

To generate test report automatically with Tool, please follow the log folder naming rules:
1. The top level is the version: for example tag123_rev14996
2. The folder name of each test case should start with KPI title(For example: FDD_20M_Perf_TCP_1300_1UE_2015_08_14_17_24_09)

3. Some additional information elements can be added to the folder name

    UE number: _16ue_
    No Ipsec: _noipsec_   or _no_ipsec_
    AES algorithm: _aes_
    ZUC algorithm: _zuc_
    UDP: _udp_
    Any other customized info: _specialname_
4. Folder name end with date (_20***)
5. The HeNB folder start with HeNB(like HeNB_1857162) or eNodeB (like eNodeB_2051837)
6. The PM Report folder start with PmReport

Example of batch log folder:

Figure 25: Log folder example for batch process
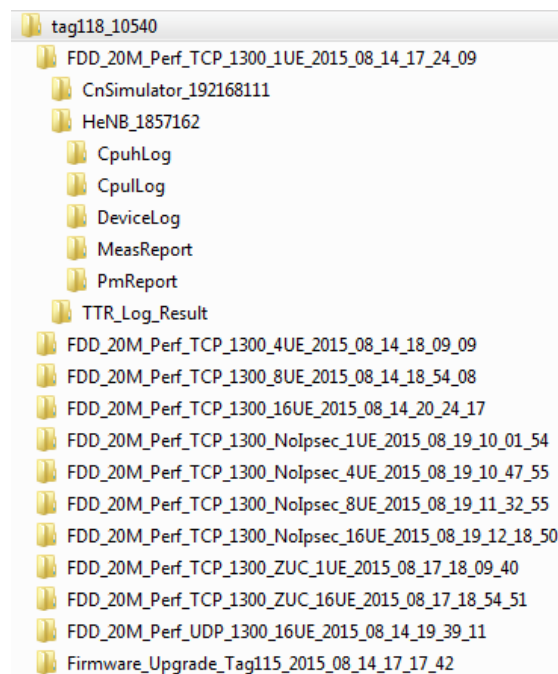
Management of KPI test results

The Tool supports

- multi KPI templates and multi KPI check items of one template
- refresh the result with new KPI Excel template file
- save the results to a XML file
- open the results from a XML file

- display filter
- save the results to an excel file

Figure 26: KPI result management
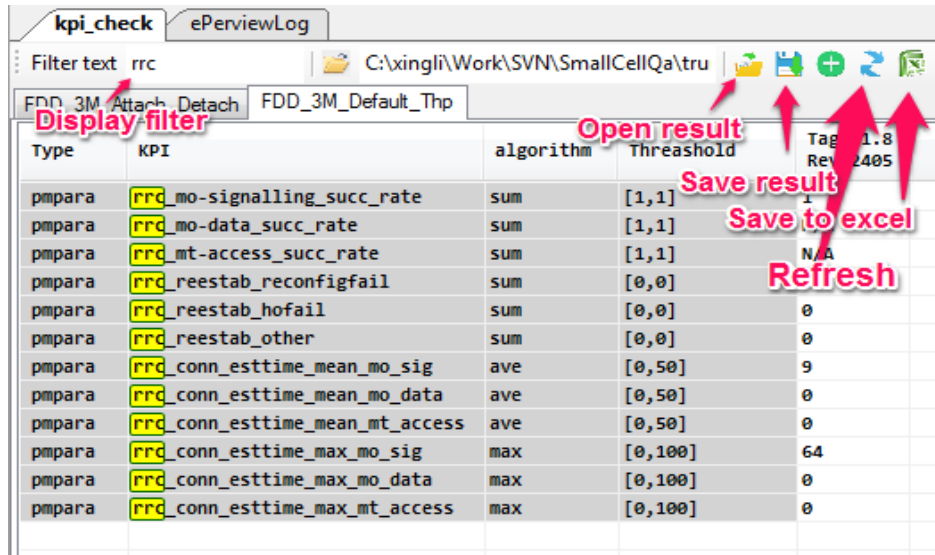
When the result is saved to the Excel file, the summary of the report will be generated. The report includes the KPI check result summary, the critical KPI result and the detailed KPI result of each test case. It will jump to the detailed result by clicking the 'Click me' cell.

Figure 27: Kpi result summary

KPI check result summary							
		tag123_14996					
Category	Test Case	Duration(m)	UE Num	Pass	Fail	Warn	Detail
Service	TDD_SF1_20M_Attach_Detach	125	Unknown	52	0	1	Click me
	TDD_SF1_20M_Default_Thp	125	Unknown	49	3	1	Click me
	TDD_SF1_20M_Default_Volte	135	Unknown	45	3	5	Click me
	TDD_SF1_20M_HO_Inter_Freq_s1_default_volte	160	Unknown	42	8	3	Click me

Critical kpi result of tag123_14996											
Category	Test Case	Duration(m)	UE Num	FDD/TDD	BS(Mhz)	IPSec	Cipher	Traffic	Pkt size	rrc_mo-signalling_succ_rate	rrc_mo-data_succ_rate	rrc_mt-access_succ_rate
Service	TDD_SF1_20M_Attach_Detach	125	Unknown	TDD SF1	20	Enable	SNOW-3G	TCP	1300	1510/1510=1	N/A	N/A
	TDD_SF1_20M_Default_Thp	125	Unknown	TDD SF1	20	Enable	SNOW-3G	TCP	1300	32/32=1	N/A	N/A
	TDD_SF1_20M_Default_Volte	135	Unknown	TDD SF1	20	Enable	SNOW-3G	TCP	1300	33/33=1	N/A	N/A
	TDD_SF1_20M_HO_Inter_Freq_s1_default_volte	160	Unknown	TDD SF1	20	Enable	SNOW-3G	TCP	1300	57/59=0.966	106/112=0.946	5/5=1

Section 8: Log analyzer

Log analyzer is a module which analyses the received log records and generate report according to the pre-defined configuration. It is the core component of the automation test setup.

Functions of Log analyzer

The main features of the log analyzer module:
- Flexible configuration
- Online mode to receive configuration and generate report
- Offline mode to analyze one log folder
- Offline mode to analyze multi log folders
- Integrate with PM report analyzer module
- Integrate with KPI check module

Configuration of Log analyzer

The configuration is saved in an xml file. It contains the configuration of L2 measurement configuration and counters configuration.

L2 Measurement configuration

In default, the CPUL outputs the L1/L2 statistics information to log Tool per second. The L2 configuration defines which measurement metrics are enabled for log analysis. It includes the RACH info, MAC info, LCH Info, LCG info, ERAB info and ROHC info. The L2 configuration is for U-plane KPI check (for example, throughput, delay, CQI, PHR…) and only valid for CPUL log.

Figure 28:L2 measurement configuration example
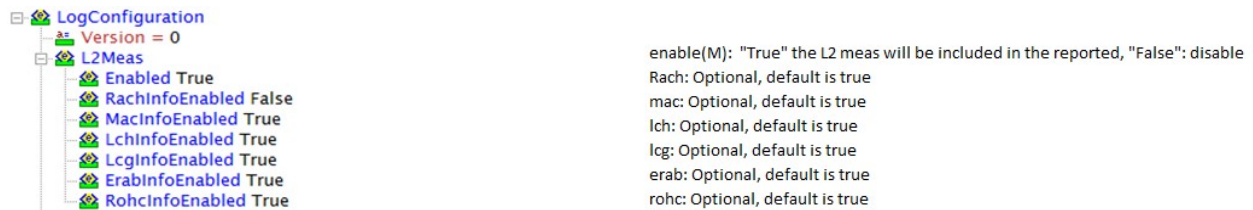
Counter Measurement configuration

Counter is for C-plane KPI check, for example RRC connection SUCC rate. There are three kinds of counter:
- String
- Event
- Sequence

String type counter

String type counter is for the counter of a specific string.

Figure 29: String type counter configuration example

Type: "LogCounterRawString"/"LogCounterSingleEvent"/"LogCounterFixedSequence"

Detail_enable: "enable" means the detailed report will be included in the report

field(M): "event" or "data" or "event,data"
eventname(O):"none" or specified Eventname, the default is "none"
stringtowatch(M): search str
option(O): "any", "prefix", "regex", default is "any"
level(O): default is "none", or level name string"error/warning/high/med/low"
ueid(O): default "none" and "0-96"
rrc(O): "enable" search in RRC message, default "disable": do not search rrc message
s1(O): "enable" search in s1 message, default "disable": do not search s1 message

Event type counter

Event type counter is for the counter of a specific field in a structure. And one or multi-conditions can be added to the counter.

Figure 30: Event type counter configuration example

fieldname: the field(name and path) of counter

conditions: options for the field search
conditiontype: "Equal","NotEqual","largethan","largeorequal","lessthan","lessorequal"
conditionvalue: string of value
ueid(O): default "none" and "0-96"

Sequence type counter

Sequence type counter is for the counter of a specific message sequence. The success and fail conditions have to be configured. The main id or UE ID is used to identify a sequence.

Figure 31: Sequence type counter configuration example

```
LogCounter
    Type = LogCounterFixedSequence
    Name rrc_conn_sequence
    DetailedInd Enable
    Type FixedSequence                        For sequence, the success sequence and failure condition have to be configured.
    Value
        Success
            Events
                LogCounterSequenceEvent
                    EventName rrcUserAccessInd      mainid is the ID for the Sequence
                    MainId /ulUeReferenceId         ueid: "none" means no condition. "any" means the sequence should has same UE id if configured and UE id is got from message header
                    UeId None                       if path is configured(for example: /u/UserAccessGrantInfo/usUeId), UE id is got from message body,  "0-96" means specified ueid
                LogCounterSequenceEvent
                    EventName rrcUserAccessRsp
                    MainId /ulUeReferenceId
                    UeId /u/UserAccessGrantInfo/usUeId
                    Conditions                      optional conditions
                        LogCondition
                            FieldName /ucAccessResult
                            ConditionType Equal
                            ConditionValue grant
                LogCounterSequenceEvent
                    EventName rrcConnectionSetupComplete
                    MainId None
                    UeId any
        Failure
            Timeout 1000                        for the sequence failure
            Events
                LogCounterSequenceEvent
                    EventName rrcUserAccessRsp
                    MainId /ulUeReferenceId
                    UeId any
                    Conditions
                LogCounterSequenceEvent
                    EventName rrcConnectionReject
                    MainId None
                    UeId any
                LogCounterSequenceEvent
                    EventName rrcConnectionRelease
                    MainId None
                    UeId any
```
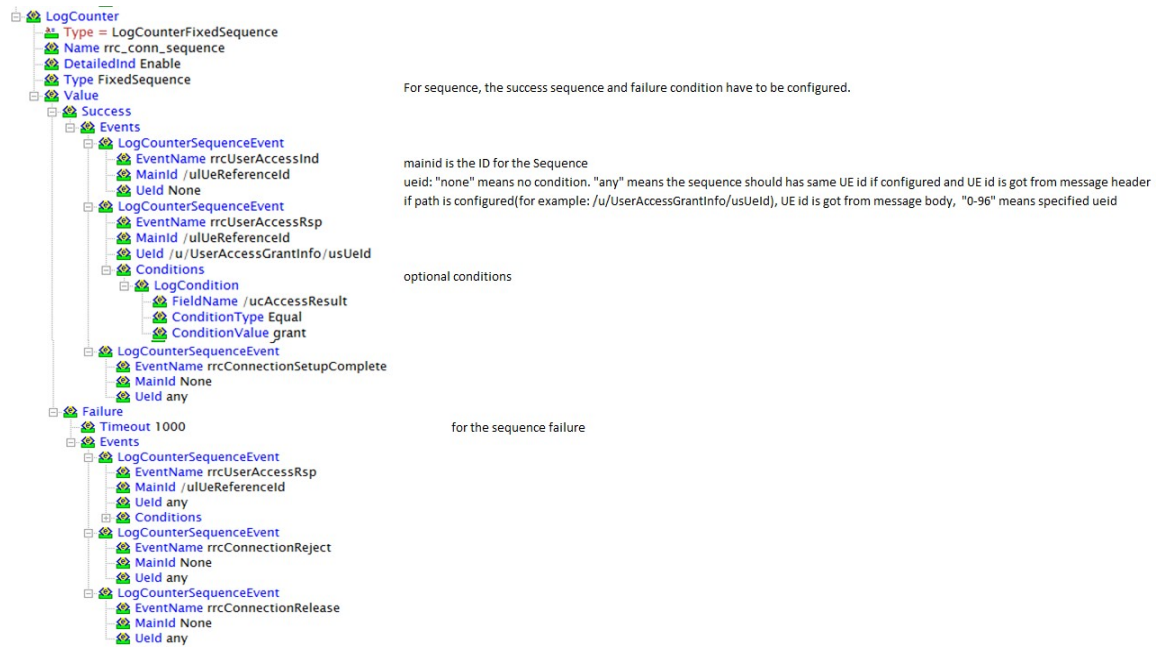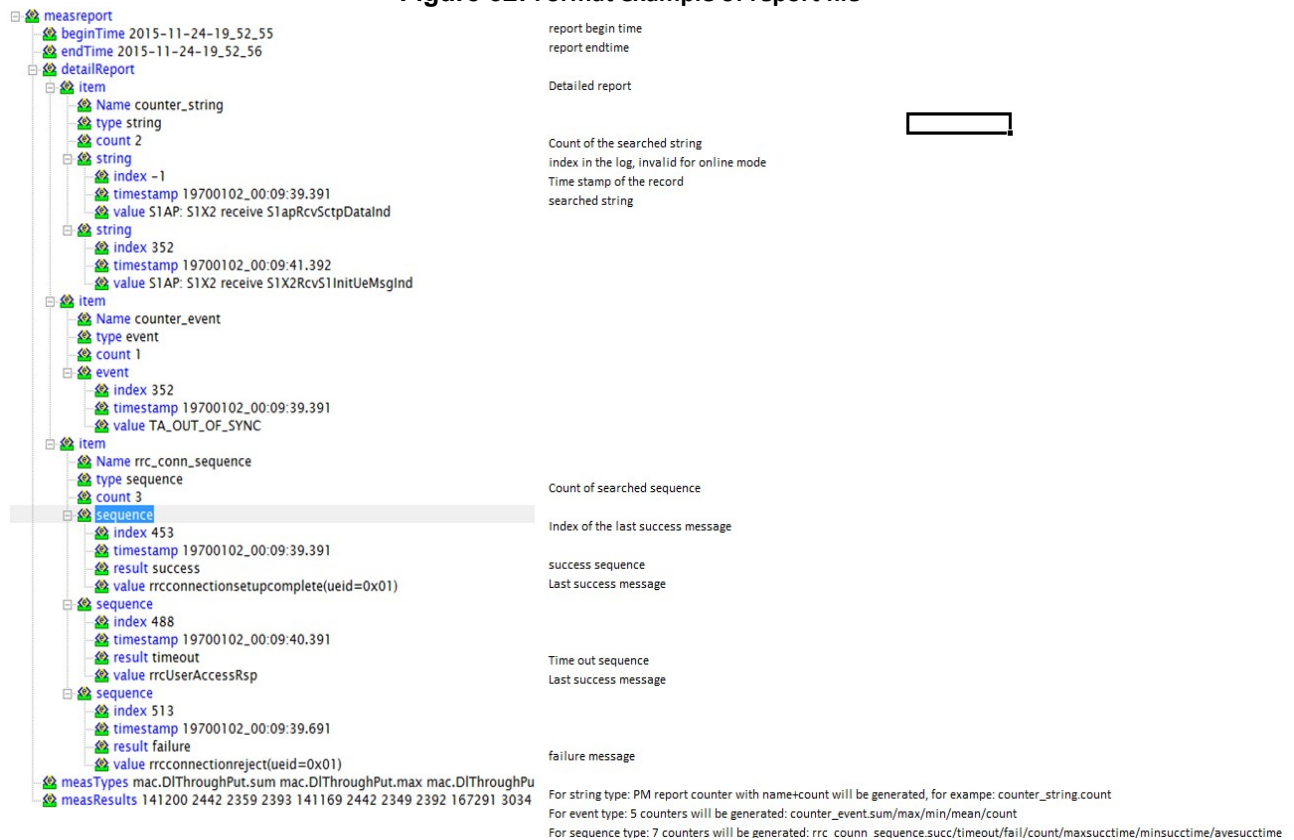
Report generation of Log analyzer

Log analyzer generates a report file when required by external module or generates a report file periodically. The XML report file includes the counters and detailed report if configured.

Figure 32: Format example of report file

```
measreport
    beginTime 2015-11-24-19_52_55          report begin time
    endTime 2015-11-24-19_52_56            report endtime
    detailReport
        item                               Detailed report
            Name counter_string
            type string
            count 2                         Count of the searched string
            string                          index in the log, invalid for online mode
                index -1                    Time stamp of the record
                timestamp 19700102_00:09:39.391   searched string
                value S1AP: S1X2 receive S1apRcvSctpDataInd
            string
                index 352
                timestamp 19700102_00:09:41.392
                value S1AP: S1X2 receive S1X2RcvS1InitUeMsgInd
        item
            Name counter_event
            type event
            count 1
            event
                index 352
                timestamp 19700102_00:09:39.391
                value TA_OUT_OF_SYNC
        item
            Name rrc_conn_sequence
            type sequence
            count 3                         Count of searched sequence
            sequence                        Index of the last success message
                index 453
                timestamp 19700102_00:09:39.391
                result success              success sequence
                value rrcconnectionsetupcomplete(ueid=0x01)   Last success message
            sequence
                index 488
                timestamp 19700102_00:09:40.391
                result timeout              Time out sequence
                value rrcUserAccessRsp      Last success message
            sequence
                index 513
                timestamp 19700102_00:09:39.691
                result failure              failure message
                value rrcconnectionreject(ueid=0x01)
    measTypes mac.DlThroughPut.sum mac.DlThroughPut.max mac.DlThroughPu   For string type: PM report counter with name+count will be generated, for exampe: counter_string.count
    measResults 141200 2442 2359 2393 141169 2442 2349 2392 167291 3034   For event type: 5 counters will be generated: counter_event.sum/max/min/mean/count
                                                                          For sequence type: 7 counters will be generated: rrc  counn  sequence.succ/timeout/fail/count/maxsucctime/minsucctime/avesucctime
```

Online control of the analyzer

When the Tool runs with online mode, the analyzer can analyze the log records and generate the reports with the default configuration file and specific interval. The generated report files will be saved to the same folder of CPUH or CPUL log.

Figure 33: Online server setting
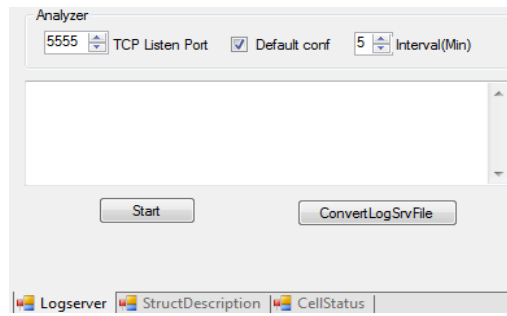
And after the "Start" button of log server is clicked, the analyzer listens a TCP port (Default port is 5555) to receive the control commands. The received configuration will overwrite the default configuration.

Commands send from TTR to log analyzer:
- Set command to set/reset URL of configuration file. A session is defined with OUI + Serial +CPUH/L
  Example: set,BC0304,1839196,cpuh,ftp://admin:admin@192.168.0.100/ftpserver/config_cpuh.xml
- Get command to require report file
  Example: get,BC0304,1839196,cpul,ftp://admin:admin@192.168.0.100/ftpserver/result_cpul.xml
- Reset command to restart the log analyzer(only the saved results are cleared)
  Example: reset,BC0304,1839196,cpul
- Delete command to remove the configuration and to stop the session of analyzer
 Example: delete,BC0304,1839196,cpul

Response commands send from analyzer to TTR:
- Set response:
  Success example: set,BC0304,1839196,cpuh,ok
  Fail example: set,BC0304,1839196,cpuh,failed
- Get response
  Success example: get,BC0304,1839196,cpuh,ok
  Fail example: get,BC0304,1839196,cpuh,failed
- Reset response
  Success example: reset,BC0304,1839196,cpuh,ok
  Fail example: reset,BC0304,1839196,cpuh,failed
- Delete response
  Success example: delete,BC0304,1839196,cpuh,ok
  Fail example: delete,BC0304,1839196,cpuh,failed
- Unknown command response
  Example: error,unknown command, set,BC0304,1839196,cpu

Offline control of the analyzer

The analyzer can analyze the opened log records or saved log files too. The Analyzer window will be showed when you click the "Analyzer" button.

Figure 34: Offline analyzer window
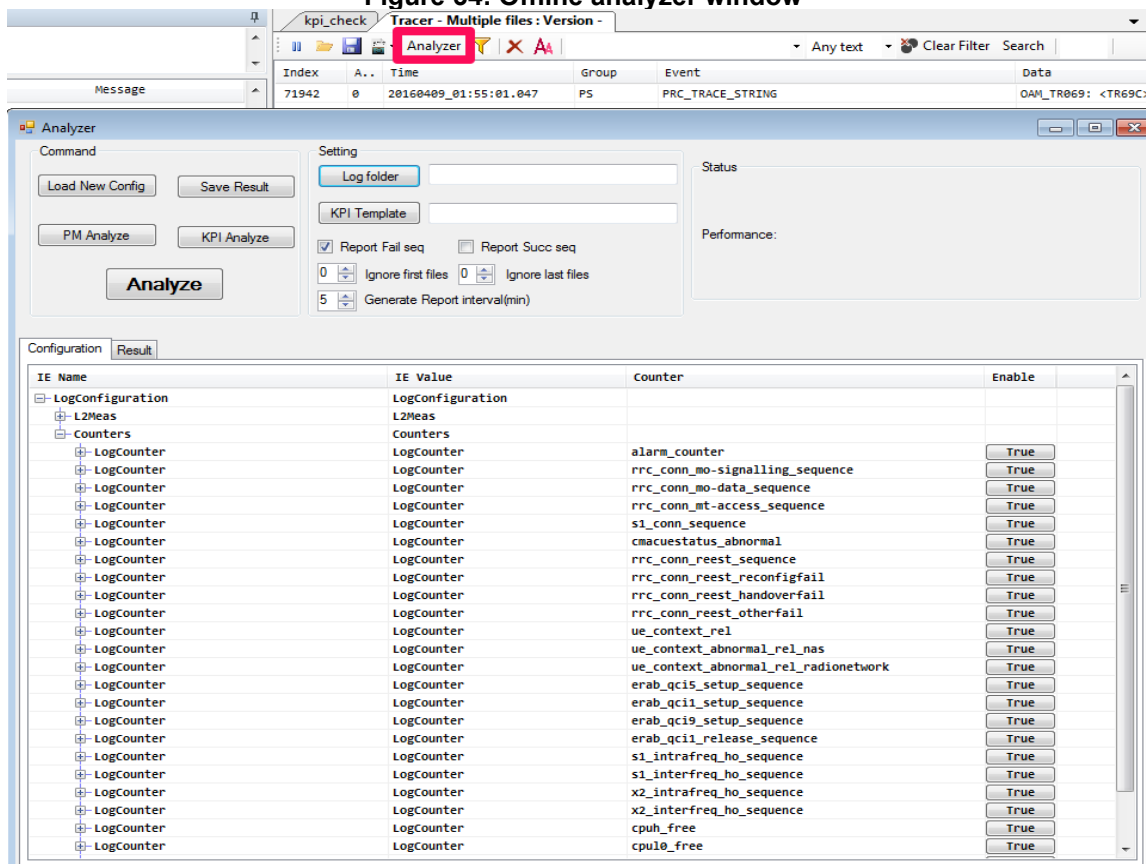
"Load New Config": load a specific configuration file to replace the default configuration.

The items are showed in the "Configuration" page and it is possible to enable/disable an item.

"Log folder": Set the log folder.

If a single folder is selected, the log files under the folder will be analyzed

If a batch folder (Figure 25: Log folder example for batch processis selected, the log files of all the case folders will be analyzed

If no folder selected, the displayed records will be analyzed

"Analyze ": Begin to analyze

"Save result": Save the result to a XML file

"PM Analyze": Open PM analyzer window to analyze the result

"KPI Template": Select the KPI template excel file, valid for batch process only

"KPI Analyze": Open KPI analyzer window to check the KPI, valid for batch process only

"Report succ seq"/"Report fail seq": Display the succ sequence and/or failed sequence in Result page

"Ignore first files"/"Ignore last files": Skip the first and/or last reports

"Generate report interval": The interval in minutes to generate the report.

Value "0" means to generate one report file only. This option is valid if a log folder is selected

If the report is generated with the displayed log records, then the index of the record will be displayed in the detailed report item. Double click the "Index" line, the Tool will jump to that log record.

Figure 35: Jump to the record